USDA FOREST SERVICE
ALASKA ROADLESS RULEMAKING PUBLIC MEETINGS, SEPT. 2018

To submit comments online, click here.
In addition, written comments can be submitted via hard-copy mail to:
Alaska Roadless Rule,
USDA Forest Service, Alaska Region, Ecosystem Planning and Budget Staff,
P.O. Box 21628,
Juneau, Alaska 99802-1628.

DATE	Meeting time and location
Thursday, September 13, 2018	**JUNEAU** Meeting Time: 5:30 – 8:00 PM Location: **Elizabeth Peratrovich Hall** 320 Willoughby Ave.
Monday, September 17, 2018	**KETCHIKAN** Meeting Time: 5:30 – 8:00 PM Location: **Southeast Alaska Discovery Center** 50 Main St. **HOONAH** Meeting Time: 5:30 – 8:00 PM Location: **Hoonah Ranger District** 430 Airport Way
Tuesday, September 18, 2018	**CRAIG** Meeting Time: 5:30 – 8:00 PM Location: **Craig Tribal Association Hall** 1330 Craig-Klawock Highway **ANGOON** Meeting Time: 5:30 – 8:00 PM Location: **Angoon Community Association**
Wednesday, September 19, 2018	**POINT BAKER** Meeting Time: 1:30 – 3:00 pm Location: **Point Baker Community Building** **TENAKEE SPRINGS** Meeting Time: 1:30 – 3:00 pm Location: **Community Center**
Thursday, September 20, 2018	**JUNEAU** Meeting Time: 5:30 – 8:00 pm Location: **Elizabeth Peratrovich Hall** 320 Willoughby Ave.

USDA FOREST SERVICE
ALASKA ROADLESS RULEMAKING PUBLIC MEETINGS, SEPT. 2018

DATE	Meeting time and location
Monday, September 24, 2018	**WRANGELL** Meeting Time: 5:30 – 8:00 PM Location: **Nolan Center** 296 Campbell Dr. **SITKA** Meeting Time: 5:30 – 8:00 PM Location: **Aspen Suites** 210 Lake St.
Tuesday, September 25, 2018	**PETERSBURG** Meeting Time: 5:30 – 8:00 PM Location: **Petersburg Borough, Assembly Chambers** 12 South Nordic Dr. **YAKUTAT** Meeting Time: 5:30 – 8:00 PM Location: **ANB Hall**
Wednesday, September 26, 2018	**KAKE** Meeting Time: 5:30 – 8:00 PM Location: **Senior Center** 251 Totem Way
Thursday, September 27, 2018	**ANCHORAGE** Meeting Time: 5:30 – 8:00 PM Location: **University of Alaska** Gorsuch Commons, Room #107 3211 Providence Dr.

To submit comments online, click here.
In addition, written comments can be submitted via hard-copy mail to:
Alaska Roadless Rule,
USDA Forest Service, Alaska Region, Ecosystem Planning and Budget Staff,
P.O. Box 21628,
Juneau, Alaska 99802-1628.

USDA Forest Service
Alaska Roadless Rulemaking Public Meetings
November 2019
(Locations and times are subject to change)
Visit the project webpage for the most up-to-date schedule (under the Analysis Tab)

Meeting Dates	Meeting Times and Locations
Monday, November 04, 2019	**JUNEAU** Public Meeting: 5 PM – 7 PM Location: **Elizabeth Peratrovich Hall** Room #1, 320 Willoughby Ave.
Tuesday, November 05, 2019	**KETCHIKAN** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Southeast Alaska Discovery Center** 50 Main St. **YAKUTAT** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9PM Location: **Yakutat School Auditorium** **TENAKEE SPRINGS** Public Meeting: 10 AM – 11:30 AM Subsistence Hearing: 12 PM – 2 PM Location: **Community Center**
Wednesday, November 06, 2019	**CRAIG** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Craig Tribal Association Hall** 1330 Craig-Klawock Highway **ANCHORAGE** Public Meeting: 6 PM – 8 PM Location: **University of Alaska** Gorsuch Commons, 3600 Sharon Gorgon Lane, Room #106 **WRANGELL** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Nolan Center** 296 Campbell Dr.

Meeting Dates	Meeting Times and Locations
Thursday, November 07, 2019	**PETERSBURG** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Petersburg Borough, Assembly Chambers**
Tuesday, November 12, 2019	**HYDABURG** Public Meeting: 9 AM – 10:30 AM Subsistence Hearing: 11 AM – 1 PM Location: **City Hall** **ANGOON** Public Meeting: 10 AM – 11:30 AM Subsistence Hearing: 12 PM – 2 PM Location: **Angoon Community Association** **SITKA** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Centennial Hall** King Salmon Room, 330 Harbor Dr. **KASAAN** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Totem Trail Café**
Wednesday, November 13, 2019	**THORNE BAY** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Thorne Bay Ranger District** 1312 Federal Way
Thursday, November 14, 2019	**HOONAH** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Hoonah Ranger District** 420 Airport Road **WASHINGTON, DC** Public Meeting: 4:30 PM – 6:30 PM Location: **Holiday Inn Washington Capitol** Congressional II Rm, 550 C St. SW
Tuesday, November 19, 2019	**POINT BAKER** Public Meeting: 10 AM – 11:30 AM Subsistence Hearing: 11:30 AM–1:30 PM Location: **Point Baker Community Building**

Wednesday, November 20, 2019	**GUSTAVUS** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Gustavus School, Commons**
Friday, November 22, 2019	**KAKE** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Senior Center** 251 Totem Way
Tuesday, November 26, 2019	**SKAGWAY** Public Meeting: 5 PM – 6:30 PM Subsistence Hearing: 7 PM – 9 PM Location: **Arctic Brotherhood Hall**, 245 Broadway St.

Public Meeting
Includes an overview of the Alaska Roadless Rulemaking process, the proposed Rule, and the Draft Environmental Impact Statement, followed by a question and answer session period. While information will be provided on submitting written comments, oral comments will not be taken during this event.

Subsistence Hearing
Follows the public meeting and Includes opportunities for recorded and transcribed public testimony, but no additional informational presentations.

Locations and times are subject to change. To submit comments online, click here. In addition, written comments can be submitted via hard-copy mail to: Alaska Roadless Rule, USDA Forest Service, Alaska Region, Ecosystem Planning and Budget Staff, P.O. Box 21628, Juneau, Alaska 99802-1628.

Alaska Roadless Rulemaking

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2001 Roadless Rule

- US Department of Agriculture issued a regulation to manage roadless areas nationally – the Roadless Area Conservation Rule (2001 Roadless Rule).
- Prohibits timber harvesting, road construction, and road reconstruction in inventoried roadless areas with limited exceptions.
- Inventoried Roadless Areas (IRAs) were established by the 2001 Roadless Rule.
- 58.5 million acres, nationwide, are inventoried roadless areas.
- Tongass National Forest (16.7 M Acres) comprises 80% of Southeast Alaska.
- Approximately 55% of the Tongass National Forest is inventoried roadless (9.2 M Acres, 110 IRAs)

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What is a Roadless Area?

- National Forest System lands
- Does not include designated Wilderness.
- 80% of IRAs exceed 5,000 acres and are normally without roads.
- 2001 Roadless Rule describes nine roadless characteristics.

2001 Roadless Rule – Alaska's Journey

- State of Alaska challenged inclusion of Chugach and Tongass National Forests.
- 2003 – USDA exempted the Tongass National Forest.
- 2011 – Federal District Court vacated Tongass National Forest exemption.
- 2015 – Ninth Circuit decision upheld the Federal District Court ruling to vacate the Tongass National Forest exemption.
- Today – 2001 Roadless Rule in effect across Alaska's national forests.
- Pending – State of Alaska lawsuit pending in District of Columbia Circuit Court of Appeals challenging the 2001 Roadless Rule's application in Alaska.

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Roadless Rulemaking

- This rulemaking process is about considering whether a state-specific approach to managing roadless areas is better than a one size fits all.

- A state-specific rule would replace the 2001 Roadless Area Conservation Rule to protect the social and ecological values and characteristics of inventoried roadless areas by prohibiting, with some exceptions, road construction, road reconstruction, and timber harvest on inventoried roadless areas on National Forest System lands nationwide.

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Why an Alaska Roadless Rule?

The Tongass National Forest is unique from other national forests.

- Size, percent inventoried roadless areas, dependency of local communities, and unique statutory considerations (Tongass Timber Reform Act, Alaska National Interest Lands Conservation Act)

State of Alaska petitioned US Department of Agriculture Secretary

- Desire to provide for rural economic development opportunities in local communities.

Forest Service desires a long-term and durable approach to addressing roadless issues in Alaska.

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Proposed Alaska Roadless Rule

- Specific to Alaska
- Chugach National Forest – currently outside area of focus.
- Tongass National Forest – consider changing roadless area management
- Could address activities that are allowed or not allowed.
- Inventoried Roadless Areas (IRAs) could be modified and designated as Alaska Roadless Areas (ARAs).

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Proposed Alaska Roadless Rule

- Does not amend or revise the 2016 Tongass Land Management Plan
- Does not authorize any ground disturbing activities

Colorado and Idaho Roadless Rules

- State-specific roadless rules.
- Idaho (2008) – zoned IRAs into 5 land categories; management-prohibitions and exceptions vary by category; specifically excluded some lands.
- Colorado (2012) – zoned IRAs into 2 tiers; included exceptions addressing state concerns, updated boundaries, and excluded some lands.

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Public Participation

- Early in the process of considering roadless rulemaking in Alaska.
- August 30, 2018 Notice of Intent – USDA is initiating an environmental impact statement (EIS) and public rulemaking process to address the management of inventoried roadless areas on the Tongass National Forest.
- Currently in 45-day scoping period.
- Additional opportunities for public participation.

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Government-to-Government

- Tribes have strong legal and cultural ties to aboriginal lands now managed as national forests.
- Federally-recognized tribes have been invited to become cooperating agencies as the Forest Service has federal trust responsibilities to tribal governments.
- Forest Service will honor government-to-government relationships with tribes throughout this process.

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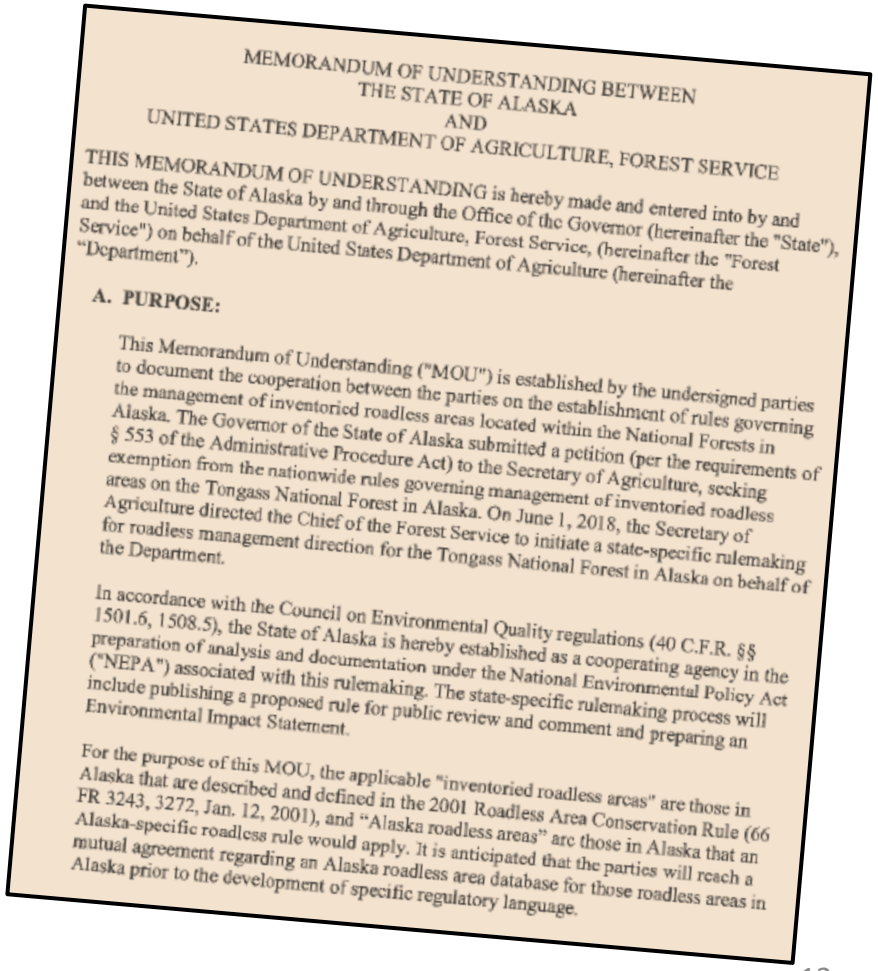
State-Federal Partnership

- Memorandum of Understanding signed establishing the State of Alaska as a cooperating agency (August 2018).
- State of Alaska will provide expertise and specific input regarding state interests.
- Secretary of US Department of Agriculture retains decision-making authority.



MEMORANDUM OF UNDERSTANDING BETWEEN
THE STATE OF ALASKA
AND
UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE

THIS MEMORANDUM OF UNDERSTANDING is hereby made and entered into by and between the State of Alaska by and through the Office of the Governor (hereinafter the "State"), and the United States Department of Agriculture, Forest Service, (hereinafter the "Forest Service") on behalf of the United States Department of Agriculture (hereinafter the "Department").

A. PURPOSE:

This Memorandum of Understanding ("MOU") is established by the undersigned parties to document the cooperation between the parties on the establishment of rules governing the management of inventoried roadless areas located within the National Forests in Alaska. The Governor of the State of Alaska submitted a petition (per the requirements of § 553 of the Administrative Procedure Act) to the Secretary of Agriculture, seeking exemption from the nationwide rules governing management of inventoried roadless areas on the Tongass National Forest in Alaska. On June 1, 2018, the Secretary of Agriculture directed the Chief of the Forest Service to initiate a state-specific rulemaking for roadless management direction for the Tongass National Forest in Alaska on behalf of the Department.

In accordance with the Council on Environmental Quality regulations (40 C.F.R. §§ 1501.6, 1508.5), the State of Alaska is hereby established as a cooperating agency in the preparation of analysis and documentation under the National Environmental Policy Act ("NEPA") associated with this rulemaking. The state-specific rulemaking process will include publishing a proposed rule for public review and comment and preparing an Environmental Impact Statement.

For the purpose of this MOU, the applicable "inventoried roadless areas" are those in Alaska that are described and defined in the 2001 Roadless Area Conservation Rule (66 FR 3243, 3272, Jan. 12, 2001), and "Alaska roadless areas" are those in Alaska that an Alaska-specific roadless rule would apply. It is anticipated that the parties will reach a mutual agreement regarding an Alaska roadless area database for those roadless areas in Alaska prior to the development of specific regulatory language.

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Next Steps

- Notice of Intent **comment period** closes October 15, 2018.
- Proposed Rule and Draft Environmental Impact Statement by Summer 2019 – Additional **comment period.**
- Final Environmental Impact Statement by Summer 2020.
- Secretary of Agriculture, or his designee, will make a decision on a final rule by Summer 2020.

How to Comment

Geography

- What areas are of concern to you?
- Should specific areas be included or excluded as an Alaska Roadless Area?

Activities

- What type of activities should be allowed in roadless areas?
- What types of activities should be prohibited in roadless areas?

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How to Comment

Comments must be submitted in writing by October 15, 2018.

- On the internet at: www.regulations.gov
- Project comment site at: www.fs.usda.gov/project/?project=54511
- Mail to: Forest Service, Attn: Alaska Roadless Rule, P.O. Box 21628, Juneau, Alaska 99802
- akroadlessrule@fs.fed.us

For More Information

https://www.fs.usda.gov/project/?project=54511

Alaska Roadless Rulemaking

Subscribe to this feed

Alaska specific roadless rule that will establish a land classification system designed to conserve roadless area characteristics on the Tongass National Forest.

Location Summary

Tongass National Forest

District: R10 - Alaska Region All Units

Project Documents

Pre-Scoping | Scoping

Pre-Scoping	Date Published
April 25 2018 response from Secy Perdue to Gov Walker Jan 19 letter and ... (PDF 70kb)	08-30-2018
MOU USFS AK State Roadless August 2 2018 (PDF 376kb)	08-30-2018
Jan 19 2018 letter and petition from Gov Walker to Secy Perdue (PDF 289kb)	08-30-2018
AKRR NOI News Release 30AUG2018 (PDF 260kb)	08-30-2018
Federal Register Notice of Intent Alaska Roadless Rule (PDF 217kb)	08-30-2018
09.06.18 AO 299 - Establishing the Alaska Roadless Rule Citizen Advisory Committee Signed (PDF 181kb)	09-07-2018
PR 18-111 Governor Walker issues A.O. 299 to establish the Alaska Roadless Rule Citizen Advisory Committee (PDF 165kb)	09-07-2018
Questions and Answers Sept 13 2018 (PDF 280kb)	09-13-2018

Project Navigation
- Project Overview
- Project Detail
- Project Location

Get Connected
- Request More Info
- Comment/Object on Project
- Public Comment/Objection Reading Room
- Subscribe to Email Updates

Forest Links
- SOPA Reports
- Appeal Responses
- Objection Responses

NEPA Resources
- FS NEPA Procedures and Guidance
- NEPA Links
- CEQ's NEPAnet
- CEQ's Guide to NEPA

https://www.fs.usda.gov/roadmain/roadless/alaskaroadlessrule

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USDA
United States Department of Agriculture

ALASKA ROADLESS RULE

Public engagement opportunity in Juneau, Alaska

As we move forward with developing an Alaska Roadless Rule, two themes emerge from Alaskans about the Tongass National Forest. Whether they support or oppose the current rule, I hear that 1) the forest is unique and requires unique regulation, 2) the forest offers an abundance of opportunities.

Imagine that we can do what is best for Alaska in terms of how we influence the ecological and economic health of the forest; are mindful of the demand for restoration and recreation; grow more jobs through timber, tourism, commercial fishing, and mining; and increase access for transportation and utility infrastructure. Now imagine we can do all this while we further protect the environment, fish and wildlife habitats, and subsistence activities.

The roadless rulemaking process provides an opportunity for everyone to be a part of this historic effort. I invite you to look for opportunities on the timeline offered in this bulletin and to participate during comment periods when announced; ask us to present a Roadless Rulemaking Overview for your organization or community; attend public meetings; or simply follow the process through this bulletin and the information resources that are available.

By working together—citizens, tribal governments, state and municipal governments, Alaska Native corporations, and other constituency groups—we can accomplish our combined goal to support the rural communities of Alaska, while conserving lands that are important to all Americans and to visitors from other countries.

David E. Schmid, Regional Forester

MARCH/APRIL 2019

This publication provides information to the public about the current status of the Alaska Roadless Rulemaking process. Subscribe to the bulletin here: Alaska Roadless Rule Bulletin

WHAT'S NEW
Written Public Comment Summary

The Written Public Comment Summary released in February contains an overview of perspectives received during the open comment period. However, the report does not contain an exhaustive list of all comments submitted. The summary and original letters may be found online at: https://www.fs.usda.gov/project/?project=54511. The overall objective of the summary is to aggregate and summarize public comments themes, identify input for developing the draft environmental impact statement, and identify other public concerns relevant to the Alaska Roadless Rulemaking. Following a public comment period between Aug. 20-Oct. 15, 2018, just over 144,000 were logged. This total quantity includes form letters (32,500), petitions (110,000 signatures), and unique submissions (1,400). Commenters provided support for and opposition to the three general alternatives for the proposed Alaska Roadless Rule identified in the Notice of Intent. The majority of comments received opposed changing the 2001 Roadless Rule.

Did You Know?

As part of the rulemaking process, the USDA Forest Service Alaska Region is working closely with cooperating agencies, which consists of the State of Alaska and six tribes. Memorandums of understanding were signed with each cooperating agency, establishing coordination and communication in these processes.

Alaska Roadless Rule Team
R10 - Alaska Region
PO Box 21628, Juneau, AK 99802-1628
akroadlessrule@fs.fed.us

Alaska Roadless Rule

Request A Speaker

The Forest Service's Alaska Region has speakers available to provide an overview on the Alaska Roadless Rulemaking process and answer your questions. Contact Dru Fenster at dfenster@fs.fed.us, 907-209-2094, or akroadlessrule@fs.fed.us to request a speaker.

Information Resources

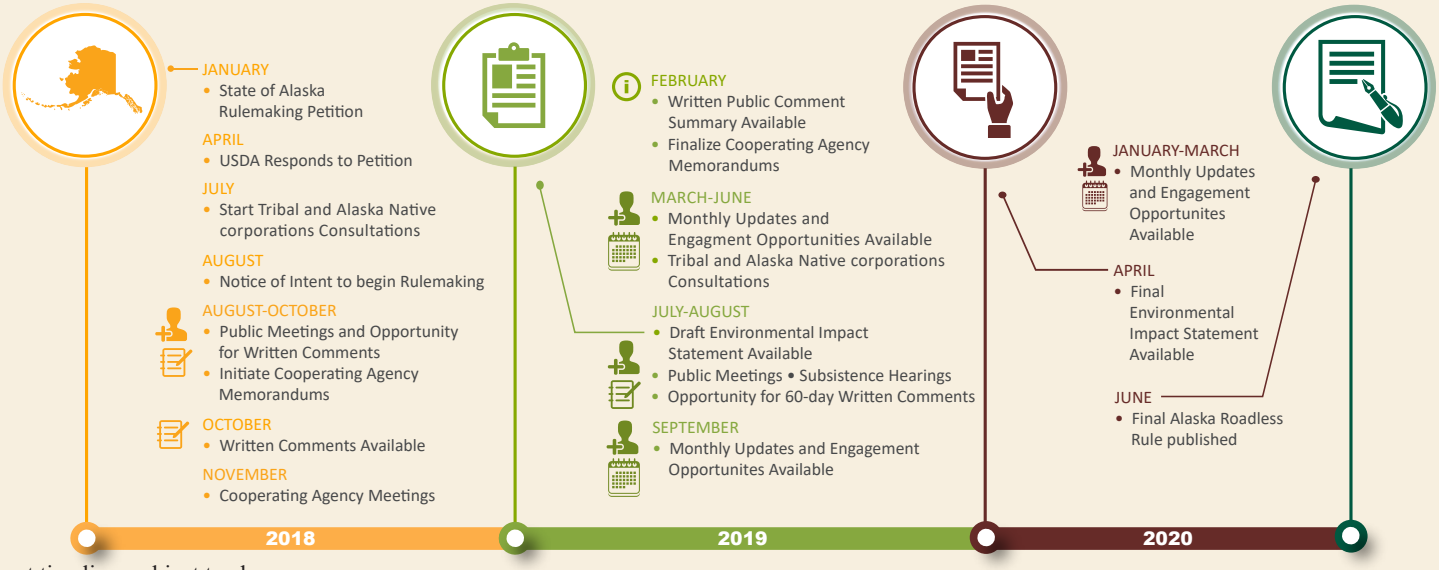
- **Websites:**
  - Alaska Region Roadless
  - Project Website
  - Roadless Area Conservation
  - Other FAQs
- **Phone #s:**
  - Request a speaker 907-209-2094
  - Project coordinator 907-586-9344
- **Email:**
  - akroadlessrule@fs.fed.us
  - rdale@fs.fed.us (project coordinator)
  - nicolergrewe@fs.fed.us (public engagement)
  - dfenster@fs.fed.us (speakers & media)

Frequently Asked Questions

Why is the USDA Forest Service initiating a rulemaking process now to establish an Alaska Roadless Rule for the Tongass National Forest? At the direction of USDA Secretary Sonny Perdue, the Forest Service is responding to the State of Alaska's petition for a full exemption of the Tongass National Forest from the 2001 Roadless Rule, which covers nearly all national forests and grasslands. The decision to pursue a state-specific rule seeks to address concerns raised over roadless area management and access. A state-specific roadless rule would determine which currently designated roadless areas in the Tongass National Forest require a unique management designation that could further Alaska's economic development or meet other needs while maintaining roadless areas and characteristics for future generations.

Will a new Alaska Roadless rule automatically authorize projects that would affect wildlife, subsistence resources or the building of roads? The Alaska Roadless Rule would not automatically authorize any specific projects. Any projects would still need to comply with the Tongass Land Management Plan and its impacts analyzed through a separate process under the National Environmental Policy Act (NEPA). The Alaska Roadless Rule would determine which currently designated roadless areas would have a different management designation that may allow for activity that is currently prohibited under the 2001 National Roadless Rule.

Alaska Roadless Rulemaking Timeline



Current timeline; subject to change

USDA FOREST SERVICE
ALASKA ROADLESS RULEMAKING

Questions and Answers
UPDATED Sept. 13, 2018

Q1: Why is USDA's Forest Service beginning to work on an Alaska Roadless Rule now?
The State of Alaska submitted a petition for rulemaking to the Secretary of Agriculture Sonny Perdue. The Secretary and Alaska Governor Walker have reached agreement to cooperatively undertake a state-specific roadless rule to address roadless management and access concerns on the national forests in Alaska. The USDA Forest Service is in the process of convening the resources and personnel to move forward in support of this agreement.

Q2: When and where was the Roadless Rule in effect in Alaska?
The Roadless Rule was adopted in January 2001, but due to litigation did not become effective and operational until April 2003. After three months of being in effect on the Chugach and Tongass National Forests, the Roadless Rule was again judicially enjoined on a nationwide basis and was not operational for the next three years. In September 2006, the Roadless Rule was judicially reinstated and became operational on the Chugach National Forest, but the Tongass National Forest remained exempt from the Rule because USDA had issued a temporary rule in 2003 exempting the Tongass National Forest from the Roadless Rule while it examined whether a state-wide exemption was appropriate. In 2011, the U.S. District Court for the District of Alaska set aside the 2003 Tongass Exemption and reinstated the Roadless Rule (with special instructions) on the Tongass National Forest. The District Court's ruling was upheld by the U.S. Court of Appeals for the Ninth Circuit and the Supreme Court declined further review.

Q3: What are the next steps the USDA Forest Service will be taking?
The USDA Forest Service is conducting a public rulemaking process pursuant to the Administrative Procedures Act (APA). In late August 2018, the Forest Service issued a Notice of Intent (NOI) in the Federal Register to initiate the rulemaking process. The NOI opened a scoping and public comment period. As part of the scoping period, the USDA Forest Service will host community meetings to provide information and answer questions about the rulemaking process. Public comments received during the scoping period will help inform the USDA Forest Service on the development of a range of alternatives to be analyzed in the Alaska roadless rule Environmental Impact Statement.

Q4: What is the timeframe for completion of the Alaska Roadless Rule?

- *Late August, 2018*–begin a scoping period on the proposed rulemaking.
- *July 2019*–publish a draft environmental impact statement (EIS), start a comment period on the draft.
- *April 2020*–publish a final EIS.
- *June 1, 2020*–publish a final Alaska Roadless Rule

Q5: What is happening next?

- The Forest Service has issued a Notice of Intent (NOI) announcing public engagement to inform the rulemaking.
- The deadline to comment is Oct. 15, 2018
- The Forest Service will host a series of public meetings to discuss the rulemaking process. Details can be found here: https://www.fs.usda.gov/roadmain/roadless/alaskaroadlessrule

Q6: How many public meetings will there be? When? Where?
Please see the schedule for public involvement here**:**
https://www.fs.usda.gov/roadmain/roadless/alaskaroadlessrule

Q7: How will the State of Alaska be involved in the rulemaking process?
The State of Alaska is a cooperating agency and will work closely with USDA Forest Service during all phases of the rulemaking process. The State will establish an advisory group that will report to the Governor and inform the State's input to the USDA Forest Service during the rulemaking process. Additionally, as a cooperating agency the State will work closely with the NEPA Interdisciplinary Team (IDT).

Q8: will the USDA Forest Service and the State of Alaska work together?
The USDA Forest Service and the State are committed to working cooperatively to resolve conflicts over roadless area management through increased communication, sharing of information, participation, cooperation, and coordination in implementing their respective missions as part of the rulemaking process. On August 2, 2018 the State and the USDA Forest Service signed a memorandum of understanding to establish the State as a cooperating agency and document cooperation between the parties on the development of the state-specific rule.

Q9: Is the State of Alaska the only cooperating agency?
The USDA Forest Service has also invited tribes to engage as cooperating agencies.

Q10: How can I provide input if I'm not able to attend a public meeting?
Comments may be submitted electronically at https://www.fs.usda.gov/project/?project=54511. In addition, written comments can be submitted via hard-copy mail to:
Alaska Roadless Rule,
USDA Forest Service, Alaska Region, Ecosystem Planning and Budget Staff,
P.O. Box 21628,
Juneau, Alaska 99802-1628.

All comments, including names and addresses, are placed in the record and are available for public inspection and copying.

Q11: Where can I find maps and information?
Maps and other information will be posted online at
https://www.fs.usda.gov/roadmain/roadless/alaskaroadlessrule

Q12: Is the rulemaking process focused only on opening roadless areas for road building and timber harvest?

No. It is about opening opportunities to support rural communities on the Tongass National Forest. A state-specific rule would replace the 2001 Roadless Area Conservation Rule which was adopted in January 2001 to protect the social and ecological values and characteristics of inventoried roadless areas by prohibiting, with some exceptions, road construction, road reconstruction, and timber harvest on inventoried roadless areas on National Forest System lands nationwide. A state-specific roadless rule will determine appropriate management direction for roadless areas within the State of Alaska, including appropriate exceptions to address essential infrastructure, timber, energy, mining, access, and transportation systems necessary to further Alaska's economic development interests, while at the same time conserving roadless areas in Alaska for future generations.

Q13: Will the Alaska Roadless Rule increase the amount of logging on the Tongass National Forest?

The Alaska Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not authorize any timber projects. Any timber projects would still need to comply with the 2016 Tongass Land Management Plan and be analyzed through a separate process under the National Environmental Policy Act (NEPA).

Q14: Will the Alaska Roadless Rule authorize projects that could harm Alexander Archipelago Wolf populations?

The Alaska Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not authorize any specific project. Any projects would still need to comply with the 2016 Tongass Land Management Plan and its impacts analyzed through a separate process under the National Environmental Policy Act (NEPA).

Q15: Will the Alaska Roadless Rule authorize projects which would affect the deer population?

The Alaska Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not authorize any specific project. Any projects would still need to comply with the 2016 Tongass Land Management Plan and its impacts analyzed through a separate process under the National Environmental Policy Act (NEPA).

Q16: Does this mean the Forest Service will be building more roads?

The Alaska Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not authorize any specific project. Any projects would still need to comply with the 2016 Tongass Land Management Plan and its impacts analyzed through a separate process under the National Environmental Policy Act (NEPA).

Q17: How will the Alaska Roadless Rule affect the implementation of the Tongass Land Management Plan and the transition from primarily old-growth harvest to a young growth timber program?

The Alaska Roadless Rule will not make any changes to the 2016 Tongass Land Management Plan or projects currently being implemented or proposed to implement the transition to a primarily young-growth timber program. Following a final decision on a state-specific roadless rule, the Tongass National Forest Land Management Plan could be amended or revised to reflect any management designations established by the state-specific rule.

Q18: What are the expected economic benefits of the Alaska Roadless Rule?

During the rulemaking process, the Forest Service will analyze and present the social and economic impacts of all proposed alternatives, including a no-action alternative. The range of alternatives will address how different management designations could facilitate rural prosperity and support sustainable communities and economies in southeast Alaska.

Q19: Are activities such as mining, cell tower construction, hydropower and geothermal power, transmission line, and infrastructure development prohibited under the 2001 Roadless Rule? If not, then why are they being discussed during the state-specific rulemaking process?

The 2001 Roadless Rule does not prohibit these activities. Under the current policy, most projects within inventoried roadless areas must be submitted to the Chief of the Forest Service for review and approval. In the Tongass National Forest, more than 57 projects have been approved. Some stakeholders with an interest in roadless areas, such as utility companies, mining interests, and local communities have raised concerns about how the 2001 Roadless Rule affects permits, contracts and other special uses involving access, road construction, and road maintenance in inventoried roadless areas. These issues are likely to remain part of the conversation.

Q20: Will important fish and wildlife habitat be protected?

The Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not supersede other laws, including the Tongass Timber Reform Act, which provide specific protections for fish and wildlife habitat. Also, a state-specific rule will not authorize any specific project. Any projects would still need to comply with the 2016 Tongass Land Management Plan standards for fish and wildlife habitat and its impacts analyzed through a separate process under the National Environmental Policy Act (NEPA). The USDA Forest Service will uphold our mission to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

Q21: How will the Alaska Roadless Rule affect subsistence resources?
The Roadless rulemaking process would determine whether currently designated roadless areas should have a different management designation that may allow for activity which is currently prohibited. It will not supersede other laws, including the Alaska National Interest Lands Conservation Act (ANILCA) rural subsistence preference. Also, a state-specific rule will not authorize any specific project. Any projects would still need to comply with the 2016 Tongass Land Management Plan and its impacts on subsistence resources analyzed through a separate process under the National Environmental Policy Act (NEPA). The USDA Forest Service will uphold our mission to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

Q22: With most logs from Tongass timber sales being exported, what are the economic benefits to the timber industry from a roadless rule revision? How many jobs will be added in that sector and what will the economic contribution of the wages be to the region?
We must first go through the public process to determine what alternatives will be considered before we know what possible economic benefits might be.

Q23: Is the state-specific roadless rulemaking connected to congressional action?
No. The USDA Forest Service rulemaking is administrative, and separate from any action Congress may take. The Forest Service has issued a Notice of Intent (NOI) initiating a public rulemaking process in response to a petition filed pursuant to the Administrative Procedure Act to develop a state-specific roadless rule focused on the Tongass National Forest. A state-specific roadless rule will determine appropriate management direction for roadless areas within the State of Alaska, including appropriate exceptions to address essential infrastructure, timber, energy, mining, access, and transportation systems necessary to further Alaska’s economic development interests, while at the same time conserving roadless areas in Alaska for future generations.

The NOI will open a 45-day scoping and public comment period. As part of the scoping period, the USDA Forest Service will host community meetings to provide information and answer questions about the rulemaking process. Public comments received during the scoping period will help inform the USDA Forest Service's development of a range of alternatives to be analyzed during the rulemaking process.

United States Department of Agriculture

Central Tongass Project

Draft Environmental Impact Statement

Volume I

Forest Service
Alaska Region

Tongass National Forest
Petersburg Ranger District and
Wrangell Ranger District

R10-MB-832a

July 2019

Cover Photo: Pats Creek Watershed Credit: Andrea Slusser

United States Department of Agriculture
Forest Service
Tongass National Forest
Alaska Region
648 Mission Street
Ketchikan, AK 99901
907-225-3101

File Code: 1950
Date: July 26, 2019

Dear Planning Participant,

The Tongass National Forest is seeking public comment on the Central Tongass Project Draft Environmental Impact Statement (DEIS). The project proposes, over a 15-year time period, to implement a variety of resource management actions on the Petersburg and Wrangell Ranger Districts. The actions include, but are not limited to, cabin construction, timber harvest, stream restoration, and road construction. The Forest Service analyzed two action alternatives and a no-action alternative. I have not chosen a preferred alternative at this time. All of the alternatives will be considered in my decision.

The DEIS and associated implementation plan and travel analysis are available for review online at: https://www.fs.usda.gov/detail/tongass/landmanagement/projects/?cid=fseprd568085. Also available at this website is the analysis for the *Northern Tongass Integrated Weed Management Environmental Assessment*, which the Central Tongass Project incorporates by reference. Paper copies of the DEIS are available for review at the Petersburg Ranger District, the Wrangell Ranger District, and the Forest Supervisor's Office in Ketchikan. If you require a paper copy or electronic media, or need additional information, please contact Carey Case, Project Leader, at 907-772-3871 or send your request to: carey.case@usda.gov.

Written comments on this proposed action will be accepted for 45 days following the date of publication of the Notice of Availability (NOA) of the DEIS in the *Federal Register* (https://www.federalregister.gov/). While public notices will also be placed in the *Ketchikan Daily News*, the *Petersburg Pilot* and the *Wrangell Sentinel*, the publication date in the *Federal Register* is the exclusive means for calculating the 45-day comment period. Those wishing to comment should not rely upon dates or timeframe information provided by any other source. If the comment period ends on a Saturday, Sunday, or federal holiday, comments will be accepted until the end of the next federal working day (11:59 p.m.).

The Central Tongass Project is subject to the objection process defined by 36 CFR 218, Subparts A and B. More information can be found at http://www.gpo.gov/fdsys/pkg/FR-2013-03-27/pdf/2013-06857.pdf. Only individuals or entities who submit timely and specific written comments about this proposed project or activity during this or another public comment period established by the responsible official will be eligible to file an objection. Persons submitting comments must provide the following information: name and address; title of the proposed project; specific written comments; and signature or other verification of identity upon request.

Other requirements to be eligible to submit an objection are listed at 36 CFR 218.25(a)(3). Individual members of an entity must submit their own comments to have eligibility to object as an individual. It is the responsibility of the sender to ensure timely receipt of any comments submitted. Names and contact information submitted with comments will become part of the public record and may be released under the Freedom of Information Act.

United States Department of Agriculture | Forest Service | Tongass National Forest Alaska Region | 648 Mission Street Ketchikan, AK 99901 907-225-3101

Comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the responsible official to consider. The responsible official for the Central Tongass Project is M. Earl Stewart, Forest Supervisor, Tongass National Forest.

Specific written comments may be submitted electronically at: https://cara.ecosystem-management.org/Public//CommentInput?Project=53098, or by fax to (907) 772- 5995. Please note the ability to comment at this online address is only activated during a public comment period. Comments may also be mailed to: Carey Case, Project Leader, Petersburg Ranger District, P.O. Box 1328, Petersburg, AK, 99833; or hand-delivered to Petersburg Ranger District, 12 North Nordic Drive, Petersburg, AK 99833 or Wrangell Ranger District, 525 Bennett Street, Wrangell, AK, 99929 during normal business hours, 8:00 a.m. to 4:30 p.m., Monday through Friday, excluding holidays.

Public meetings and subsistence hearings will be held in the communities of Kake, Petersburg and Wrangell, Alaska during the 45-day comment period.

Once dates and locations are finalized, we will advertise on the project webpage (https://www.fs.usda.gov/detail/tongass/landmanagement/projects/?cid=fseprd568085), in local newspapers and through public service announcements on local radio stations. Specific written comments on the Central Tongass Project will be accepted at these meetings.

Please read through the DEIS and its appendices and provide us your comments. We are committed to an open, transparent and inclusive process as we conduct the analysis for this project. Your input is valued and important to a successful outcome.

Sincerely,

TROY D. HEITHECKER
Acting Forest Supervisor, Tongass NF

CENTRAL TONGASS PROJECT

Draft Environmental Impact Statement
Petersburg and Wrangell Ranger Districts, Alaska

Lead Agency: USDA Forest Service
Tongass National Forest

Responsible Official: M. Earl Stewart, Forest Supervisor
Tongass National Forest
Federal Building
648 Mission Street
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Abstract

The Central Tongass Project is a large landscape-scale NEPA analysis that will result in a decision whether to authorize integrated resource management activities on the Petersburg and Wrangell Ranger Districts over the next 15 years. The Central Tongass Project is proposed to meet multiple objectives: contribute to jobs and labor income in local and regional communities in the timber and tourism sectors, contribute to improved terrestrial and aquatic conditions that support the viability of subsistence resources, and provide safe access to Forest users on the Petersburg and Wrangell Ranger Districts. These would be accomplished through a variety of activities and management strategies within four categories: watershed restoration and improvement, recreation management, vegetation management, and access management. Specific locations and implementation methods will be guided by conditions identified in the Selected Alternative and in conjunction with the framework provided by the Implementation Plan and Activity Guides in Appendix A. The Implementation Plan and Activity Guides are an integral part of this Environmental Impact Statement (EIS).

The Draft Environmental Impact Statement (DEIS) describes three alternatives: no action (Alternative 1), the proposed action (Alternative 2), and one other action alternative (Alternative 3). The alternatives represent different project designs intended to address issues raised by the public, while achieving to varying degrees the purpose and need for action. This DEIS describes the effects of implementing each alternative, and compares them in terms of meeting management objectives and estimated impacts to resources.

Tongass National Forest Supervisor Earl Stewart is the Responsible Official for this project. The Responsible Official will have the responsibility to ensure that activities are implemented within the bounds of the analysis and the decision made.

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Summary

Introduction

The Forest Service has prepared this Environmental Impact Statement (EIS) to disclose the direct, indirect, and cumulative environmental impacts that could result from the proposed action and alternatives proposed on the Petersburg and Wrangell Ranger Districts in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The project is located in the central area of the Tongass National Forest.

Geographic information system (GIS) data and product accuracy may vary. All numbers in this document calculated from the GIS should be considered as approximate. Map products in this document are also reproduced from the GIS and subsequently prepared for the use of visual representation by the Forest Service.

1 – What action is proposed?

The Central Tongass Project Analysis is a large landscape-scale NEPA analysis that will result in a decision whether to authorize a variety of integrated resource management activities on the Petersburg and Wrangell Ranger Districts, based on public input received during project scoping and other collaborative efforts, to be implemented over a 15 year period. The intent of this project is to contribute to jobs and labor income in local and regional communities in the timber and tourism sectors, contribute to improved terrestrial and aquatic conditions that support the viability of subsistence resources, and provide safe access to Forest users.

The environmental analysis focuses on a range of activities over the project area that maybe implemented when a need for change from the existing condition to the desired condition is identified. Specific locations and methods will be determined during implementation based on the conditions defined by the Selected Alternative in conjunction with the framework provided by the Implementation Plan and Activity Guide (Appendix A). The proposed action includes activities in four general categories, described below.

Watershed restoration and improvement, including stream, lake, and floodplain restoration, fish habitat and passage improvements, invasive plant management, and road-related activities that improve fish passage, water quality or watershed function (see Activity Guides 1, 2, 3 and 12 in Appendix A). These are proposed to maintain, improve, or restore the natural range of habitat conditions in the project area to support viable wildlife, fish and plant populations for subsistence, traditional and cultural uses, and to sustain diversity. In some watersheds this includes riparian ecosystem function improvements or enhancements, water quality maintenance and protection, fish habitat improvements, and native plant population protection.

Vegetation management, including old-growth and young-growth commercial harvest, and silvicultural intermediate treatments to achieve various management objectives such as promoting timber production, improving wildlife habitat, or improving riparian area functions (see Activity Guides 6, 7, and 8 in Appendix A). Old-growth and young-growth activities are proposed in ten timber analysis areas (TAAs) within the project area, located on Mitkof, Kupreanof, Kuiu, Wrangell, Zarembo and Etolin islands, and at Thomas Bay and Frosty Bay on the U.S. mainland (see alternative maps Figure 4, Figure 5, Figure 6 and Figure 7 in Chapter 2). These are proposed to provide a reliable and predictable flow of old and young-growth timber to support jobs and income in timber production and supporting industries during the transition

period to young-growth timber production occurring over the next 15 years. By supplying 150 million board feet (MMBF) of timber from the project area over 15 years the Forest Service can better maintain flexibility and stability in the timber sale program, manage young growth to sustain productive timber stands for future use, and improve habitat for wildlife and fish to support subsistence use.

As part of this analysis, the Forest Service is analyzing a project-specific Forest Plan Amendment1 that responds to Issue 1. The amendment would lower adopted Scenic Integrity Objectives (SIOs) (USDA Forest Service 2016a, p. 4-54) to allow more efficient even-aged management on a greater number of acres within selected portions of Timber Analysis Areas (see Figure 2). The amendment would apply only to this project, and may be applied to either action alternatives. The analysis for this amendment is located in Chapter 3.
Recreation management on National Forest System (NFS) and non-NFS lands including maintenance and improvements of existing recreation facilities and trails, construction of new recreation facilities and trails, and decommissioning existing recreation facilities. Recreation facilities include cabins, shelters, picnic areas, dispersed camping sites, outhouses, viewing areas and platforms (see Activity Guides 4 and 5 in Appendix A).

Access management including new NFS road construction, NFS road reconstruction, temporary road construction, aquatic organism passage and fish habitat connectivity, road storage and decommissioning, and construction, reconstruction, decommissioning and maintenance of marine access facilities, such as log transfer facilities, docks, mooring buoys, boat ramps and boat launches (see Activity Guides 9, 10, 11, and 12 in Appendix A). These activities are intended to maintain and manage a safe, cost-effective transportation system that supports management activities and provides Forest users access to subsistence, recreation and traditional use opportunities, and minimizes effects on wildlife and fish habitat, riparian habitat, and wetlands.

2 – Why is the project being proposed?

Existing conditions within the Central Tongass project area were compared with the desired conditions (desired long-term landscape attributes) defined in Chapter 2 of the 2016 Tongass National Forest Land and Resource Management Plan (Forest Plan), resulting in the identification of specific needs for the project area. In other words, where desired conditions are not being met, a need exists. The purpose of the Central Tongass Project is to meet the identified needs to attain Forest Plan goals and objectives, and land use designation (LUD) goals, objectives and desired conditions using an integrated land management approach. Forest-wide goals and objectives this project aims to address include, but are not limited to, Local and Regional Economies, Biodiversity, old-growth and young-growth Timber, Wildlife, Transportation, Fish, Recreation and Tourism, and Young Growth Direction (USDA Forest Service 2016a, pp. 2-2 to 2-6, 5-2 to 5-3, 5-6, 5-8, 5-13 and 5-14).

[1] Forest Plan amendments may be project-specific if a proposed project is not consistent with the Plan. In these instances, the Responsible Official has the option to propose a plan amendment that, if approved, would accommodate the project. If the plan amendment applies only to a single project, the amendment is subject to the project review process (FSH 1909.12 21.31).

3 – Alternatives: What other action would meet the same need?

The Central Tongass interdisciplinary team developed alternatives using information gathered from the public, state, tribes, and other federal agencies, as well as using agency information which helped identify where the current conditions within the project area either does not meet or will not be expected to meet desired conditions described in the 2016 Forest Plan during the life of this project. Chapter 2 describes the alternatives considered in detail, as well as alternatives considered but eliminated from detailed study. A summary of the alternatives is below.

Alternative 1 is the No-Action Alternative. Under this alternative, none of the proposed activities would take place in this project, unless they were authorized by a previous NEPA decision. A no-action alternative is required by the Council on Environmental Quality Regulations (40 CFR Section 1502.14(d)) to provide a baseline to measure and compare impacts of the various action alternatives, and represents the existing condition in the project area.

Alternative 2 is the proposed action. It seeks to address the needs identified within the purpose and need to balance commercial and non-commercial opportunities, and provide and maintain high-quality experiences for all Forest users over the long term, while maintaining or improving land and resource conditions by considering best-available science and public input. Activities included in the proposed action are described above (see "1 – What Action is Proposed?").

Alternative 3 addresses public comments related to the relationship between preserving deer winter range and providing travel corridors that connect high (summer habitat) and low (deer winter range) elevation habitat, and concerns about Pacific marten populations on Kuiu Island. This alternative is designed to reduce the effects to deer, and Pacific marten habitat, as well as provide additional connectivity for both species.

GIS queries were used to determine potential areas where some treatments/activities may occur based on existing conditions. This included but was not limited to existing vegetation, known invasive plant populations, stream reaches, existing recreation sites, and road barriers to fish passage (red crossings). This information enabled the Forest Service to develop alternative design features for both Alternative 2 and Alternative 3.

More detail on anticipated miles of stream work, invasive plant treatments, potential timber harvest areas and treatments, number and type of recreation improvements, and access management for both action alternatives is found in Chapter 2, Alternatives Considered in Detail, and Appendix A, Implementation Plan and Activity Guides.

4 – What would it mean to not meet the need for the project action?

Not meeting the purpose and need is represented by Alternative 1, the no-action alternative. Under Alternative 1, none of the specific management activities as proposed in the DEIS would be implemented to accomplish project goals and objectives. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as recreation maintenance and improvements, road and trail maintenance, stream restoration, invasive plant treatments and other routine forest management activities not associated with this decision would continue as authorized by previous decisions.

If the need for a continuous supply of timber for forest products is not met, then local and regional mills would need to obtain this timber supply elsewhere on the Tongass or from other non-NFS lands. Local mills that could not obtain their timber supply outside of the project area would close and the local community economies may be impacted.

Harvest from microsales (sales of approximately 50 MBF [thousand board feet] or less of dead or down timber) may continue to occur within the project area. However, that harvest would contribute a minimal amount of wood fiber to the local economies.

Although some restoration activities in the project area are authorized by previous decisions, delayed authorization of all likely restoration needs will result in continued degradation of aquatic resources and lost opportunities to efficiently integrate projects and leverage restoration funding in the near future. Impacts to water quality and fish habitat caused by other proposed actions would not occur.

The recreation program would continue to be focused on maintenance, and improvements for health and safety. Local residents and visitors would be able to continue using the existing recreation sites, but no new sites would be developed under this project. Local tourism may still increase, but Forest Service contribution to this growth or additional amenities could be constrained.

While these activities could continue to be proposed and analyzed as separate projects, they could be subject to longer timelines, availability of funds and personnel, and greater expense than the integrated approach that the Central Tongass Project proposes.

5 – How do the alternatives respond to issues identified during scoping?

The Forest Service identified two potentially significant issues from public comments received during scoping, following publication of the Notice of Intent (NOI) to publish an EIS, and during public meetings. See Issues Significant to the Proposed Action in Chapter 1. The Central Tongass Project interdisciplinary team (IDT) developed an alternative to the proposed action to address these issues. Chapter 2, Alternatives, presents the alternatives in full, describing how the alternatives respond to the issues, and compares proposed management options in the Comparison of Alternatives tables at the end of Chapter 2. Chapter 3, Environment and Effects, examines the existing condition and compares the potential effects of the alternatives to project area resources and the environment. The following summarizes these effects:

Issue 1: *Timber supply and the economics of future Central Tongass Project timber sales may affect the extent forest product operators contribute to the local and regional economy.*

Salability, predictability, and volume of timber offerings from the project area could directly impact timber operator contributions to local area employment and income. In addition, reliable raw material supply facilitates investment and facility upgrades to adapt to changing log characteristics as the young-growth transition progresses over time.

Alternative 2 provides the most potential volume, and makes more high-volume acres available than Alternative 3. Timber offered for purchase is expected to total a maximum of 150 MMBF of old-growth timber and 80 MMBF of young-growth timber for a total volume of 230 MMBF over 15 years over the entire project area. Alternative 2 would offer additional flexibility for the Forest Service to provide a range of available timber products and the size of potential timber

offers to meet industry demands, market conditions, and local needs identified through public involvement.

Issue 2: *Proposed timber harvest may decrease the quantity and quality of deer winter habitat and habitat for Pacific marten on Kuiu Island, as well as habitat connectivity for both.*

Timber harvest can affect wildlife species dependent on or associated with old-growth habitat. Commenters were concerned that additional harvest of habitat used by deer in winter and lack of elevational connectivity in areas of timber harvest could affect deer populations. Additionally, commenters expressed concern about impacts to marten and marten populations, and the Pacific marten population on Kuiu Island.

Alternative 3 provides greater connectivity by designating elevational corridors generally every ½ mile that connect summer and winter habitat utilized by deer, maintains more high-value deer winter habitat, and reduces timber harvest in Pacific marten habitat on Kuiu Island.

6 – What factors will be used when making the decision among alternatives?

Factors that will inform the decision include how the alternative components integrate to meet multiple resources objectives that will improve forest ecosystem health, support community resiliency, and provide economic development on Petersburg and Wrangell Ranger Districts; effects to subsistence resources and lifestyle, effects to local logging operators and their ability to contribute to regional and local economies, effects to water quality and fish habitat especially in watersheds that have been affected by past logging, and effects to wildlife habitat and connectivity. In addition, the decision will be informed by how the alternative components respond to the Forest Plan's multiple-use direction and how they move the project area toward desired conditions in the Forest Plan.

7 – Are there any ways to mitigate adverse effects?

All action alternatives are consistent with Forest Plan direction, and best management practices (BMP) designed for the protection and management of forest resources, as well as other relevant federal and state laws and regulations, and Forest Service Manual and Handbook direction. Possible effects may occur from implementing the actions proposed under each alternative. Measures have been formulated to mitigate or reduce adverse effects, guided by direction in the Forest Plan. Resource specialists from the IDT used on-the-ground inventories, computer (GIS) data, and aerial photographs to assess project area conditions. Activity guides prepared for the project (Appendix A) describe specific design features as well as BMPs and resource-specific guidelines related to affected resources for each activity proposed, to avoid or minimize potential adverse effects.

Resource specific design features may be refined further by specialists during final project design when specific activity locations are identified, and documented on Implementation Plan resource checklists, unit cards, road cards, or other activity cards, as applicable.

8 – What monitoring is necessary?

No project-specific monitoring requirements have been identified. The Forest Plan monitoring program, including BMP implementation and effectiveness evaluation using national protocols, may include sites in the project area. Forest Plan direction (page 5-4) is to conduct an internal

scientific review in collaboration with a forest collaborative and other stakeholders to determine likely effects to fish and wildlife habitat from young-growth timber projects that intersect with the high-value fish watersheds in the following project area VCUs: Irish Lakes (4290), Kadake Creek (4210), Mosman Inlet (4670), Bradfield River (5140), Port Camden (4200), Security Bay (4000), Thoms Lake (4790). The review would occur by the end of the 5-year period after the signing of the Forest Plan Record of Decision (June 2016).

Table of Contents

Abstract ii
Summary i
Introduction i
1 – What action is proposed? i
2 – Why is the project being proposed? ii
3 – Alternatives: What other action would meet the same need? iii
4 – What would it mean to not meet the need for the project action? iii
5 – How do the alternatives respond to issues identified during scoping? iv
6 – What factors will be used when making the decision among alternatives? v
7 – Are there any ways to mitigate adverse effects? v
8 – What monitoring is necessary? v
Chapter 1. Purpose of and Need for Action 1
Introduction 1
Project Area 1
Purpose of and Need for Action 5
Need 5
Purpose 5
Proposed Action 6
Project-specific Forest Plan Amendment 7
Decisions to be Made 7
Relationship to the Forest Plan 9
Public Involvement 13
Scoping 13
Issues Significant to the Proposed Action 14
Issue 1: Timber Supply and Economics 14
Issue 2: Wildlife Habitat – Deer Winter Range and Connectivity 14
Other Issues and Concerns 15
Federal and State Permits and Authorizations 15
Availability of the Project Record 16
Map and Data Disclaimers 16
Chapter 2. Alternatives, Including the Proposed Action 17
Introduction 17
Alternatives Considered in Detail 17
Alternative 1 - No Action 17
Alternatives 2 and 3 - Action Alternatives 17
Alternatives Considered but Eliminated from Detailed Study 25
Alternative that prioritizes outfitter and guide use over timber harvest 25
Alternative that excludes commercial old-growth timber harvest 25
Alternative that focuses supplying old- and young-growth timber through microsales or small sales only 26
Alternative that considers harvest in 2001 Roadless Area Conservation Rule Inventoried Roadless Areas (RACR IRAs) 26
Alternative that expands the project-specific Forest Plan amendment to all timber analysis areas 26
Apply Alternative 3 deer habitat design features in some, but not all, timber analysis areas 27
Comparison of Alternatives by Issue, Activity, and Resource 27
Chapter 3. Environment and Effects 43

Table of Contents

Introduction 43
Geographic Information System Database and Quantification for this EIS 43
Ecological and Administrative Land Divisions 43
Invasive Plant Analysis – Incorporating by Reference 45
Incomplete and Unavailable Information 45
Analyzing Effects 46
Direct, Indirect, and Cumulative Effects 46
Past, Present, and Reasonably Foreseeable Projects 46
Unavoidable Adverse Effects 47
Short-term Use and Long-term Productivity 47
Irreversible and Irretrievable Commitments of Resources 47
Resources Not Discussed in Detail 48
Air Quality and Climate Change 48
Roadless Area Conservation Rule Inventoried Roadless Areas 51
Land Status 52
Wild, Scenic, and Recreational Rivers 53
Environment and Effects by Significant Issue 55
Issue 1: Timber Supply and Economics 55
Units of Measure 55
Methodology 56
Affected Environment 57
Environmental Effects 59
Issue 2: Wildlife Habitat – Deer Winter Range, Marten Habitat and Connectivity 74
Methodology 74
Sitka Black-tailed Deer 76
American Marten and Pacific Marten 92
Other Wildlife 101
Summary 101
Methodology 107
Affected Environment 108
Environmental Effects 112
Environment and Effects for Other Resources 158
Aquatics 159
Summary 159
Regulatory Framework 160
Methodology 160
Affected Environment 162
Environmental Effects 170
Essential Fish Habitat Assessment 187
Botany 190
Summary 190
Regulatory Framework 190
Methodology 191
Affected Environment 191
Environmental Effects 195
Cultural Resources 202
Summary 202
Regulatory Framework 202
Methodology 202
Affected Environment 203
Environmental Effects 204

Forest Vegetation 207
Desired Conditions 207
Methodology 207
Affected Environment 208
Environmental Effects 219
Invasive Plants 237
Risk of Introduction or Spread of Invasive Plants 237
Human Health 249
Karst and Cave Resources 255
Summary 255
Regulatory Framework 255
Methodology 255
Affected Environment 257
Environmental Effects 259
Recreation 263
Summary 263
Regulatory Framework 263
Methodology 264
Affected Environment 265
Environmental Effects 277
Scenery 290
Summary 290
Methodology 290
Affected Environment 291
Environmental Effects 291
Socioeconomics 296
Summary 296
Regulatory Framework 297
Methodology 297
Affected Environment 299
Environmental Effects 315
Soils 321
Summary 321
Methodology 322
Affected Environment 323
Environmental Effects 325
Subsistence 333
Summary 333
Management Direction and Regulatory Framework 333
Methodology 334
Affected Environment 337
Effects Analysis 338
Subsistence Findings 350
Transportation 352
Regulatory Framework 352
Methodology 353
Affected Environment 353
Environmental Effects 360
Wetlands 368
Summary 368
Methodology 368

Table of Contents

Affected Environment....369
Environmental Effects....370
Wilderness....374
Regulatory Framework....374
Methodology....374
Affected Environment....375
Environmental Effects....375
Chapter 4. References and Lists....381
Preparers and Contributors....381
Interdisciplinary Team Members....381
Federal, State, and Local Agencies....386
Tribes and Native Corporations....386
Businesses, Organizations, and Individuals....386
References....387
Index....421

List of Tables

Table 1. Land use designation (LUD) acreages in the Central Tongass project area....9
Table 2. Comparison of Alternatives by Issue using units of measure for each Issue....27
Table 3. Comparison of Alternatives by Activity - Design features common to both action alternatives....28
Table 4. Comparison of Alternatives by Activity - Design features that vary between action alternatives....29
Table 5. Comparison of Alternatives by Resource based on Units of Measure for Resource....30
Table 6. Percent composition of old-growth species by volume for each TAA....60
Table 7. Total suitable acres and Alternative 2 gross unit pool old-growth (OG) acres and volume for each TAA....60
Table 8. Alternatives 2 and 3 project level old-growth estimated harvest acreage and volume for Alternative 3....60
Table 9. Percent composition of young-growth species by volume of the gross unit pool....61
Table 10. Project level young-growth acreage and volume by species for gross unit pool and near-term operable acres....62
Table 11. Comparison of the estimated near-term young-growth acreage and volume by alternative....62
Table 12. Transportation infrastructure costs per MBF by alternative[1]....64
Table 13. Transportation and camp costs per MBF for Alternatives 2 and 3....65
Table 14. Timber value from current Residual Value Appraisal Update Bulletin (May 20, 2019)....66
Table 15. Annualized timber industry and associated jobs supported by alternative for old growth....68
Table 16. Annualized timber industry and associated jobs supported by alternative for young growth....68
Table 17. Existing wildlife habitat types on Petersburg and Wrangell Ranger Districts based on the Size-Density Model using criteria important to various species (e.g., elevation, aspect) and by land ownership....77
Table 18. Existing winter and non-winter deer habitat on NFS lands....79
Table 19. Existing deer habitat capability by WAA for all land ownerships and NFS land only.82
Table 20. Direct and indirect effects to high and moderately high value deer winter habitat from Alternatives 2 and 3 (NFS land only) using the gross unit pool....85

Table 21. Young growth acres in the gross unit pool for Alternatives 2 and 3 by WAA and development LUD and non-development LUD 86
Table 22. Direct and indirect effects, by alternative, from proposed timber harvest on theoretical deer habitat capability, shown as theoretical number of deer on NFS land, as determined by the deer model 88
Table 23. Cumulative effects to high and moderately high value deer winter habitat. Acreages and percentage remaining are for NFS lands only..... 90
Table 24. Cumulative effects to deer habitat capability, NFS lands only..... 90
Table 25. Summary of effects determinations for Threatened and Endangered Species 101
Table 26. Summary of Effects Determinations for Alaska Region Sensitive Species and Other Species of Interest..... 102
Table 27. Summary of effects to management indicator species and migratory birds 104
Table 28. Summary of Effects Determinations for the action alternatives, Alternatives 2 and 3 105
Table 29. Size density map categories of habitat..... 108
Table 30. Existing wildlife habitat types based on the Size-Density Model on Petersburg and Wrangell Ranger Districts based on various criteria that are important to various species (e.g., elevation, aspect) and by ownership. It is assumed that all historic harvest was of high volume POG. 109
Table 31. Summary of timber harvest activity by year range within the project area, based on the Forest Service FACTS database 112
Table 32. Project activities and activity components that could cause effects to wildlife..... 112
Table 33. Summary of activity components, mechanisms of effects to wildlife, and species that could be affected..... 117
Table 34. Road Density below 1,200 feet elevation on NFS Lands – Existing and by Alternative (Miles and Density by WAA). All roads on NFS lands 140
Table 35. Road Density below 1,200 feet elevation on All Land Ownerships– Existing and by Alternative (Miles and Density by WAA)..... 141
Table 36. Direct and indirect effects of proposed timber harvest by Alternative on theoretical deer habitat capability, shown as theoretical deer density (deer per square mile) on NFS land, as determined by the deer model. Only the WAAs where the deer habitat capability would be affected by timber harvest are included in the table. 143
Table 37. Cumulative effects to deer density on NFS land. The calculations assume no current contributions to the deer habitat capability from non-NFS land. 147
Table 38. Summary of effects from timber harvest under Alternatives 2 and 3 to other Management Indicator Species. Acres displayed are for NFS lands only..... 151
Table 39. Road density and percent basin area as roads[1] in watersheds with the highest proposed timber and road-building activity 165
Table 40. Watersheds with the highest number of red culverts in the project area 168
Table 41. Watersheds with the greatest amount of total fish habitat inhibited by red culverts in the project area..... 169
Table 42. Cumulative harvest levels in watersheds with anticipated changes in detectable peak flows by alternative 171
Table 43. Proposed new crossings[1] on temporary and NFS roads by stream class 177
Table 44. R10 sensitive species suspected or known to occur within the Central Tongass project area, the general habitat where found, and the Land Use Designation (LUD)..... 192
Table 45. Rare plants known within the Central Tongass project area 192
Table 46. Comparison of alternatives..... 200
Table 47. Species composition of old growth by TAA (percent of volume/acre)..... 209
Table 48. Species composition of young growth by TAA for near-term operable volume (percent of volume/acre)..... 210

Table of Contents

Table 49. Old-growth acres (development and non-development LUDs) by volume strata and timber analysis area on NFS lands in the Central Tongass project area 210
Table 50. Alternative 2 potential old-growth harvest acres by timber analysis area (TAA) volume strata and percentage of total existing TAA volume strata acres 211
Table 51. Alternative 3 potential old-growth harvest acres by timber analysis area (TAA) volume strata and percentage of total existing TAA volume strata acres 211
Table 52. Young-growth acres by age classes and percent thinned in the Central Tongass project area 214
Table 53. Summary of direct/indirect effects on stand structure 222
Table 54. Summary of direct/indirect effects on species composition and regeneration.....224
Table 55. Summary of direct/indirect effects on species composition and regeneration.....226
Table 56. Summary of direct/indirect effects on stand productivity and forest health 231
Table 57. Summary of direct/indirect effects on wind-throw risk 233
Table 58. Acres of inventoried invasive plants by site type, with associated vulnerable habitat noted.....239
Table 59. Invasive plants within the Central Tongass project area ranked as moderately invasive or higher 241
Table 60. Summary of effects and risk of invasive plant introduction and spread for each category of activity in the Central Tongass Project 249
Table 61: Herbicides considered for use in the proposed action, including formulations and the range of application rates 250
Table 62. Rating of risk to human health and safety for each herbicide and adjuvants (in general) considered in all alternatives.....251
Table 63. Existing karst resource condition in the Central Tongass project area 258
Table 64. Potential acres of harvest and miles of road construction on karst by alternative and percent change from existing 259
Table 65. ROS designations for NFS lands in the Central Tongass project area.....266
Table 66. Project area dispersed camping sites.....272
Table 67. Etolin Timber Analysis Area 278
Table 68. Frosty Bay Timber Analysis Area 278
Table 69. Kuiu Timber Analysis Area 279
Table 70. Mitkof Island Timber Analysis Area 279
Table 71. Portage Bay Timber Analysis Area 279
Table 72. Thomas Bay Timber Analysis Area.....280
Table 73. Tonka Timber Analysis Area.....280
Table 74. West Kupreanof Timber Analysis Area.....280
Table 75. Wrangell Island Timber Analysis Area 280
Table 76. Zarembo Timber Analysis Area.....281
Table 77. Alternatives 2 and 3 - timber analysis area acres converted to Roaded Modified ROS class.....281
Table 78. SIOs for all land within the analysis area 290
Table 79. Percent of analysis area by ESI.....291
Table 80. Existing condition (ESI) compared to the desired condition (SIO) in the analysis area 292
Table 81: Existing condition (ESI) compared to the desired condition (SIO) in the gross unit pool 292
Table 82: Existing condition (ESI) compared to the desired condition (SIO) for lands within the gross unit pool available for even-aged management 293
Table 83: Existing condition (ESI) compared to the desired condition (SIO) for lands in gross unit pool affected by proposed 2016 Forest Plan amendment 294
Table 84. Southeast Alaska employment by sector, 2017 299

Table 85. Demographics of the project area communities 300
Table 86. Community employment and business license data 301
Table 87. Kake estimated subsistence harvest by weight 302
Table 88. Kake subsistence deer harvest by Wildlife Analysis Area 2000-2017 302
Table 89. Petersburg top ten subsistence harvest species 303
Table 90. Petersburg subsistence deer harvest by wildlife analysis area 2000-2017 304
Table 91. Wrangell top ten estimated subsistence harvest species by weight 305
Table 92. Wrangell subsistence deer harvest by wildlife analysis area 2000-2017 305
Table 93. Per capita subsistence harvest by community 306
Table 94. Wildlife analysis areas where over 75 percent of communities in project area harvest deer 306
Table 95. Timber industry employment in Southeast Alaska, 2002-2017 (number of workers) 307
Table 96. Southeast timber harvest (MMBF) by ownership, 2002 - 2017 308
Table 97. Comparison of southeast Alaska sawmill assessment results, calendar year 2000 through 2017 309
Table 98. Forest Service mill survey: Estimated mill capacity, production and utilization, 2017 310
Table 99. Additional sawmills[1] in Southeast Alaska based on a review of business licenses, 2018 310
Table 100. Southeast Alaska cruise passengers by community, 2007 - 2016 311
Table 101. Estimates of detrimental soil conditions for proposed activities that must meet soil quality standards 326
Table 102. Landslide frequency rates for harvested lands, unharvested lands, non-forested and low productivity areas, and roads and rock pits on the large landscape assessment areas 327
Table 103. Community of Petersburg Federal Subsistence Harvest 2016, Southeast Region. Permits issued were General Southeast Alaska subsistence fishing permits and Stikine River subsistence fishing permits. 341
Table 104. Community of Wrangell Federal Subsistence Harvest 2016, Southeast Region. Permits issued were General Southeast Alaska subsistence fishing permits and Stikine River subsistence fishing permits. 341
Table 105. Community of Petersburg State Subsistence Harvest 2016, Southeast Region 341
Table 106. Community of Wrangell State Subsistence Harvest 2016, Southeast Region 342
Table 107. Subsistence Harvest All Resources, Salmon, and Non-Salmon Fin Fish by Community (Most Representative Year) 342
Table 108. Road miles by operational maintenance level 357
Table 109. Road miles by objective maintenance level 357
Table 110. Open road on MVUM miles by current maintenance level and ATM designation 358
Table 111. Miles of estimated new construction to meet alternative design volume 361
Table 112. Road maintenance opening of OPML1 roads 361
Table 113. Number of potential new quarry development sites 362
Table 114. Project area log transfer facilities with expected use and required work for action alternatives[1] 363
Table 115. Estimated road development costs under each alternative 366
Table 116. Wetland acres and existing wetland disturbances in the Central Tongass project area 369

List of Figures

Figure 1. Vicinity map. Project area boundary encompasses Petersburg and Wrangell Ranger Districts 3

Table of Contents

Figure 2. Central Tongass timber analysis areas (TAAs) considered for a project-specific Forest Plan scenery integrity objectives amendment 8
Figure 3. Land use designations (LUDs) in the Central Tongass project area....11
Figure 4. Alternative 2 – Vegetation Management Gross Unit Pool (Petersburg Ranger District) 35
Figure 5. Alternative 2 – Vegetation Management Gross Unit Pool (Wrangell Ranger District) 37
Figure 6. Alternative 3 – Vegetation Management Gross Unit Pool (Petersburg Ranger District) 39
Figure 7. Alternative 3 – Vegetation Management Gross Unit Pool (Wrangell Ranger District) 41
Figure 8. Tongass National Forest timber harvest volume and proportion of harvest exported in log form, 2007-2018 67
Figure 9. Deep snow marten habitat (HPOG remaining below 800 feet elevation) 94
Figure 10. Average winter marten habitat (percent POG remaining below 1,500 feet elevation)95
Figure 11. Skanax and Rowan Creek, Kuiu Island, Alternative 2 gross unit pool and Pacific marten focal areas of use (based on Koch 2016) 98
Figure 12. Three Mile Arm, Kuiu Island, Alternative 2 gross unit pool and Pacific marten focal areas of use (based on Koch 2016) 99
Figure 13. Existing productive old-growth (POG) in the project area....109
Figure 14. Steller sea lion haulouts and rookeries 129
Figure 15. Canopy acres. 240
Figure 16. Range of invasive plant infestation in the Central Tongass project area....243
Figure 17. Recreation Opportunity Spectrum classes within the Central Tongass project area .269
Figure 18. NVUM Petersburg-Wrangell-Yakutat 2012 recreation activity participation....276
Figure 19. Existing recreation assets within the Central Tongass project area....283
Figure 20. Southeast Alaska small cruise vessel passenger capacity, 2005-2016 312
Figure 21. Tongass National Forest outfitter/guide use, 2008 to 2017....313

Chapter 1. Purpose of and Need for Action

Introduction

The Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that could result from the proposed action and alternatives.

The Central Tongass Project EIS is a large landscape-scale NEPA analysis that will result in a decision whether to authorize integrated resource management activities on the Petersburg and Wrangell Ranger Districts over the next 15 years. The intent of this project is to contribute to jobs and labor income in local and regional communities in the timber and tourism sectors, while also contributing to improved terrestrial and aquatic conditions that support the viability of subsistence resources and providing safe access to Forest users.

The effects analysis for each resource is contingent on adhering to the requirements, and processes outlined within the Implementation Plan and Activity Guides in Appendix A. The Implementation Plan is an integral part of this project for accountability, tracking, decision-making, and documentation purposes and include resource-specific constraints, guidelines, and requirements. The Responsible Official will have the responsibility to ensure that activities are implemented with the bounds of the analysis and the decision made.

The environmental analysis includes a range of activities that could be implemented when a need for change (from the existing condition to the desired condition) is identified. The upper limits of each action or activity are defined in the effects analysis for each activity. Specific locations and methods will be determined during implementation based on the conditions defined by the alternatives in conjunction with the framework provided by the Implementation Plan and Activity Guide (Appendix A).

This planning approach allows for integrated project design and implementation using an orderly out-year schedule. Additional benefits of this approach include more-effective cost sharing and logistical support of on-site resources (equipment, vehicles, seasonal workforce, mobilization costs, and contractors), which saves money and provides a more efficient flow of work, and long-term public involvement.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record available electronically from the Petersburg Ranger District.

Project Area

The Central Tongass Project area encompasses National Forest System (NFS) lands within the Petersburg and Wrangell Ranger Districts (3.7 million acres) on the Tongass National Forest. This includes Mitkof, Kupreanof, Kuiu, Wrangell, Zarembo and Etolin islands and the U.S. mainland (Figure 1). Non-NFS lands are included in the environmental analysis to facilitate integrated planning and implementation at the landscape level. However, implementation on non-NFS lands would only occur as authorized by the land owners. The only activity considered in congressionally designated Wilderness areas for this project is the treatment of invasive plants.

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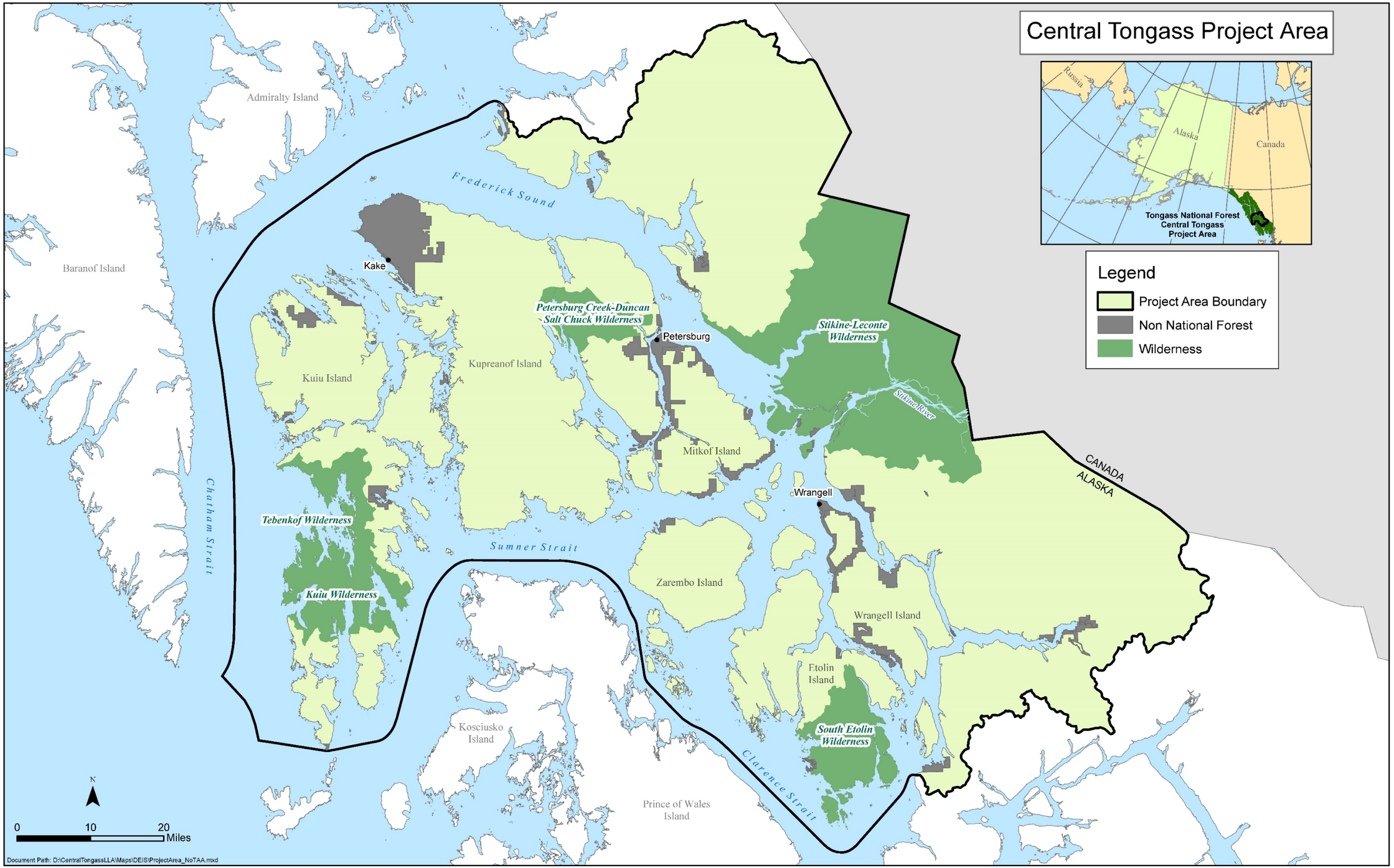

Figure 1. Vicinity map. Project area boundary encompasses Petersburg and Wrangell Ranger Districts.

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Purpose of and Need for Action

Need

Specific needs of the Central Tongass Project were identified by comparing the existing conditions within the project area with the desired conditions (desired long-term landscape attributes) defined in Chapter 2 of the 2016 Tongass National Forest Land and Resource Management Plan (Forest Plan). Where the current condition does not meeting the desired conditions identified in the Forest Plan, a need for management action exists.

For this project, four categories of needs were identified.

Watershed Restoration and Improvement

A need exists to improve watershed condition and maintain or restore habitat conditions in the project area to support wildlife, fish and plant populations for subsistence, traditional and cultural uses, and to sustain diversity. In some watersheds this need includes riparian ecosystem function improvements or enhancements, water quality maintenance and protection, fish habitat improvements, and native plant population protection.

Recreation Management

Within the project area, a need exists to maintain quality recreation opportunities for the public, and to support the recreation and tourism industry. Specifically, there is a need to 1) maintain existing recreation sites and facilities to provide for the health and safety of all users, 2) construct or reconstruct facilities in locations where the need for the facilities are supported by either known use, partnerships for long-term maintenance, or safety concerns, or 3) remove facilities that are no longer needed, or are not affordable (USDA Forest Service 2016a, p. 2-4).

Vegetation Management

A need exists for National Forest System lands to provide a reliable and predictable flow of old- and young-growth timber to support jobs and income in timber and supporting industries during the transition period to young-growth timber production occurring over 15 years. By supplying approximately 15 to 20 million board feet (MMBF) of timber annually from the project area over 15 years the Forest Service can better maintain flexibility and stability in the timber sale program, manage young growth to sustain productive timber stands for future use, to support subsistence use, and improve habitat for wildlife and fish.

Access Management

A need exists to design, construct, maintain and manage a safe, cost-effective transportation system that supports management activities and provides forest users access to subsistence, recreation and traditional use opportunities, and minimizes impacts to wildlife and fish habitat, riparian habitat, and wetlands.

Purpose

The purpose of the Central Tongass Project is to meet the identified needs to attain Forest Plan goals and objectives, and land use designation (LUD) goals, objectives and desired conditions using an integrated land management approach. Forest-wide goals and objectives this project aims to address include, but are not limited to, Local and Regional Economies, Biodiversity,

Timber, Wildlife, Transportation, Fish, Recreation and Tourism, and Young Growth Direction (USDA Forest Service 2016a, pp. 2-2 to 2-6, 5-2 to 5-3, 5-6, 5-8, 5-13 and 5-14).

Proposed Action

The proposed action is comprised of a variety of management activities to implement over 15 years and is designed to support community resilience within Southeast Alaska communities by providing and recreation opportunities, jobs and labor income in the tourism and wood products markets and provide opportunities that contribute to subsistence.

The proposed action seeks to balance commercial and non-commercial opportunities, and provide and maintain high-quality experiences for all forest users over the long-term while maintaining or improving land and resource conditions by considering best-available science and public input.

Proposed activities are described in the activity guides in Appendix A –Implementation Plan and Activity Guide. A summary is provided below. More information is found in Chapter 2.

Watershed restoration and improvement includes stream, lake, and floodplain restoration, fish habitat and passage improvements, invasive plant management, and road-related activities that improve fish passage, water quality or watershed function (see Activity Guides 1, 2, 3 and 12 in Appendix A). These are proposed to maintain, improve, or restore the natural range of habitat conditions in the project area to support viable wildlife, fish and plant populations for subsistence, traditional and cultural uses, and to sustain diversity. In some watersheds this includes riparian ecosystem function improvements or enhancements, water quality maintenance and protection, fish habitat improvements, and native plant population protection.

Vegetation management includes old-growth and young-growth commercial harvest, and silvicultural intermediate treatments to achieve various management objectives such as promoting timber production, improving wildlife habitat, or improving riparian area functions (see Activity Guides 6, 7, and 8 in Appendix A). Old-growth and young-growth activities are proposed in ten timber analysis areas (TAAs) within the project area, located on Mitkof, Kupreanof, Kuiu, Wrangell, Zarembo and Etolin islands, and at Thomas Bay and Frosty Bay on the U.S. mainland (see alternative maps Figure 4, Figure 5, Figure 6 and Figure 7 in Chapter 2). These are proposed to provide a reliable and predictable flow of old- and young-growth timber to support jobs and income in timber production and supporting industries during the transition period to young-growth timber production occurring over the next 15 years. By supplying up to 150 MMBF of timber from the project area over 15 years the Forest Service can better maintain flexibility and stability in the timber sale program, manage young growth to sustain productive timber stands for future use, and improve habitat for wildlife and fish to support subsistence use.

Recreation management on National Forest System (NFS) and non-NFS lands includes maintenance and improvements of existing recreation facilities and trails, construction of new recreation facilities and trails, and decommissioning existing recreation facilities. Recreation facilities include cabins, shelters, picnic areas, dispersed camping sites, outhouses, viewing areas and platforms (see Activity Guides 4 and 5 in Appendix A).

Access management includes new NFS road construction, NFS road reconstruction, temporary road construction, aquatic organism passage and fish habitat connectivity, road storage and decommissioning, and construction, reconstruction, decommissioning and maintenance of marine access facilities, such as log transfer facilities, docks, mooring buoys, boat ramps and

boat launches (see Activity Guides 9, 10, 11, and 12 in Appendix A). These activities are intended to maintain and manage a safe, cost-effective transportation system that supports management activities and provides Forest users access to subsistence, recreation and traditional use opportunities, and minimizes effects on wildlife and fish habitat, riparian habitat, and wetlands.

Project-specific Forest Plan Amendment

As part of this analysis, the Forest Service is analyzing a project-specific Forest Plan Amendment2 that responds to Issue 1. The amendment would lower adopted Scenic Integrity Objectives (SIOs) (USDA Forest Service 2016a, p. 4-54) to allow more efficient even-aged management on a greater number of acres within selected portions of Timber Analysis Areas (see Figure 2, below).

The amendment would apply only to this project, and may be applied to either action alternative. The analysis for this amendment is included in Chapter 3.

If the Responsible Official selects this Forest Plan amendment as part of the Selected Alternative, he will identify which substantive requirements of the 2012 Planning Rule are likely related to a proposed land management plan amendment, as required by the Rule (36 CFR § 219.13(b)(2)). At this time, he believes the following requirements of the Rule will apply: 36 CFR § 219.8(b)(2); 36 CFR § 219.10(a)(1); and 36 CFR § 219.10(b)(1)(i).

Decisions to be Made

The Responsible Official for this project is the Forest Supervisor for the Tongass National Forest. Given the purpose and need, the Forest Supervisor will review all the alternatives and their effects and consider public comments to decide:

- Whether to select the no-action alternative, an action alternative, or a modification of an action alternative;
- Design features;
- Whether to approve a project-specific Forest Plan amendment related to scenic integrity objectives;
- Whether to adopt Access and Travel Management updates to existing routes (see Appendix B, Travel Analysis); and
- Determine whether there may be a significant restriction of subsistence uses.

[2] Forest Plan amendments may be project-specific if a proposed project is not consistent with the Plan. In these instances, the Responsible Official has the option to propose a plan amendment that, if approved, would accommodate the project. If the plan amendment applies only to a single project, the amendment is subject to the project review process (FSH 1909.12 21.31).

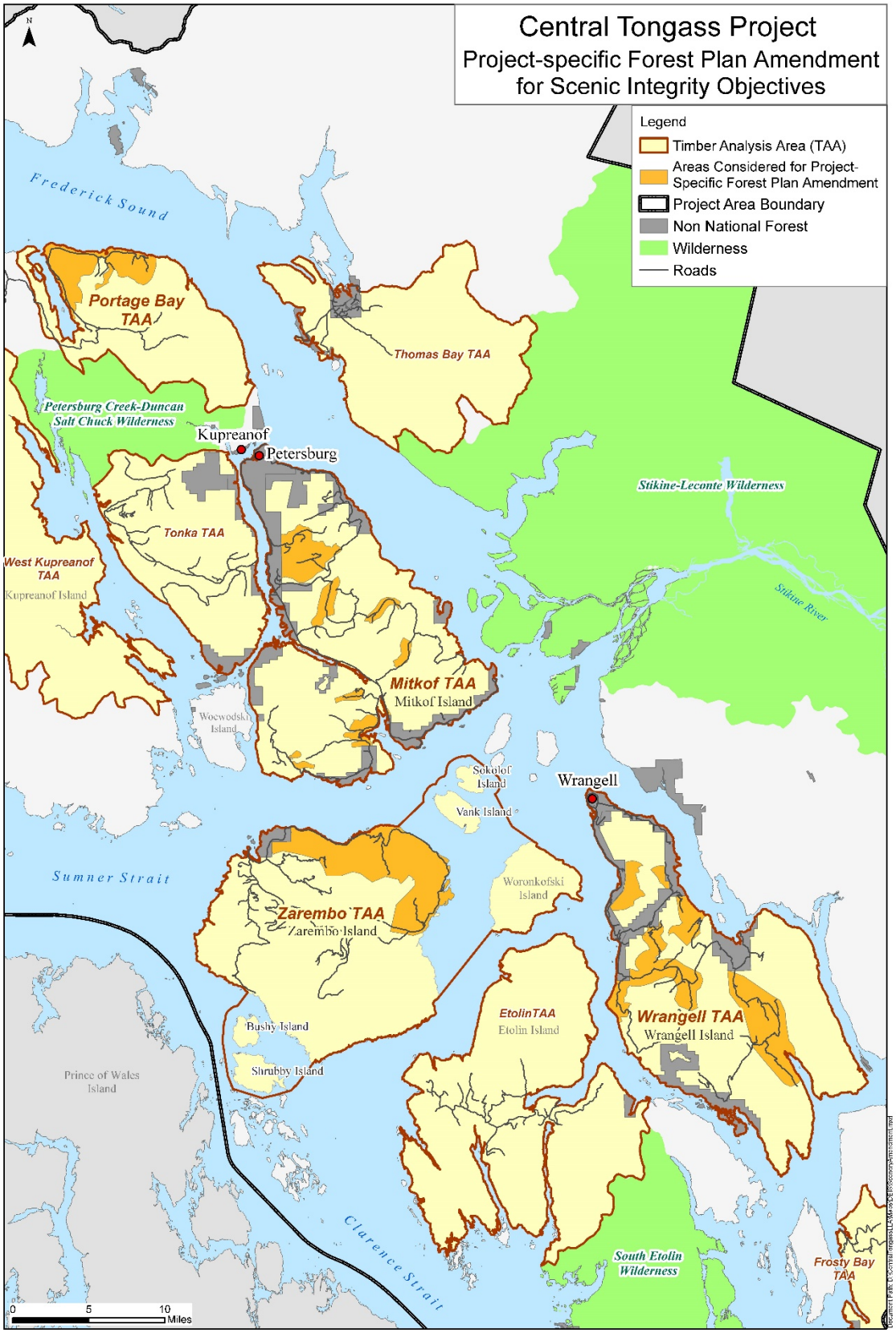

Figure 2. Central Tongass timber analysis areas (TAAs) considered for a project-specific Forest Plan scenery integrity objectives amendment

Relationship to the Forest Plan

Unless otherwise specified, all references to the Forest Plan are to the Tongass Land and Resource Management Plan, December 2016.

National Forest planning takes place at several levels: national, regional, forest, and project. The Forest Plan is a forest-level analysis that provides land and resource management direction for the Tongass National Forest.

The Central Tongass Project is a project-level analysis; its scope is confined to address the issues and environmental effects specifically related to this project. It does not attempt to address decisions made at higher levels. However, it does implement direction provided at those higher levels, and is designed to achieve the management direction of the Forest Plan as outlined in the purpose and need statement. Where appropriate, the Central Tongass Project Draft EIS tiers to the analysis done for the Forest Plan, the supplement, and subsequent amendments as encouraged by regulations at 40 CFR 1502.20.

The Forest Plan uses land use designations (LUDs), broad geographic zones that emphasize various resource values and outputs, to guide management of the Tongass National Forest. Each LUD provides direction on the types of activities, practices, and uses emphasized in specific areas. The Central Tongass project area includes 14 LUDs (Table 1). Project area land use designations, goals, objectives, and desired future conditions of all LUDs are described in detail in the Forest Plan, Chapter 3. The acreage of each LUD in the Central Tongass project area is shown in Table 1.

Table 1. Land use designation (LUD) acreages in the Central Tongass project area

LUD	Acres
Wilderness LUD Group	
Wilderness	691,069
Natural Setting LUD Group	
LUD II	96,025
Remote Recreation	93,953
Semi-Remote Recreation	1,021,859
Old-Growth Habitat	324,844
Municipal Watershed	5,988
Research Natural Area	2,204
Special Interest Area	20,174
Wild River	17,568
Scenic River	12,540
Recreational River	13,793
Development LUD Group	
Scenic Viewshed	147,302
Modified Landscape	278,924
Timber Production	815,785
Total	3,542,028

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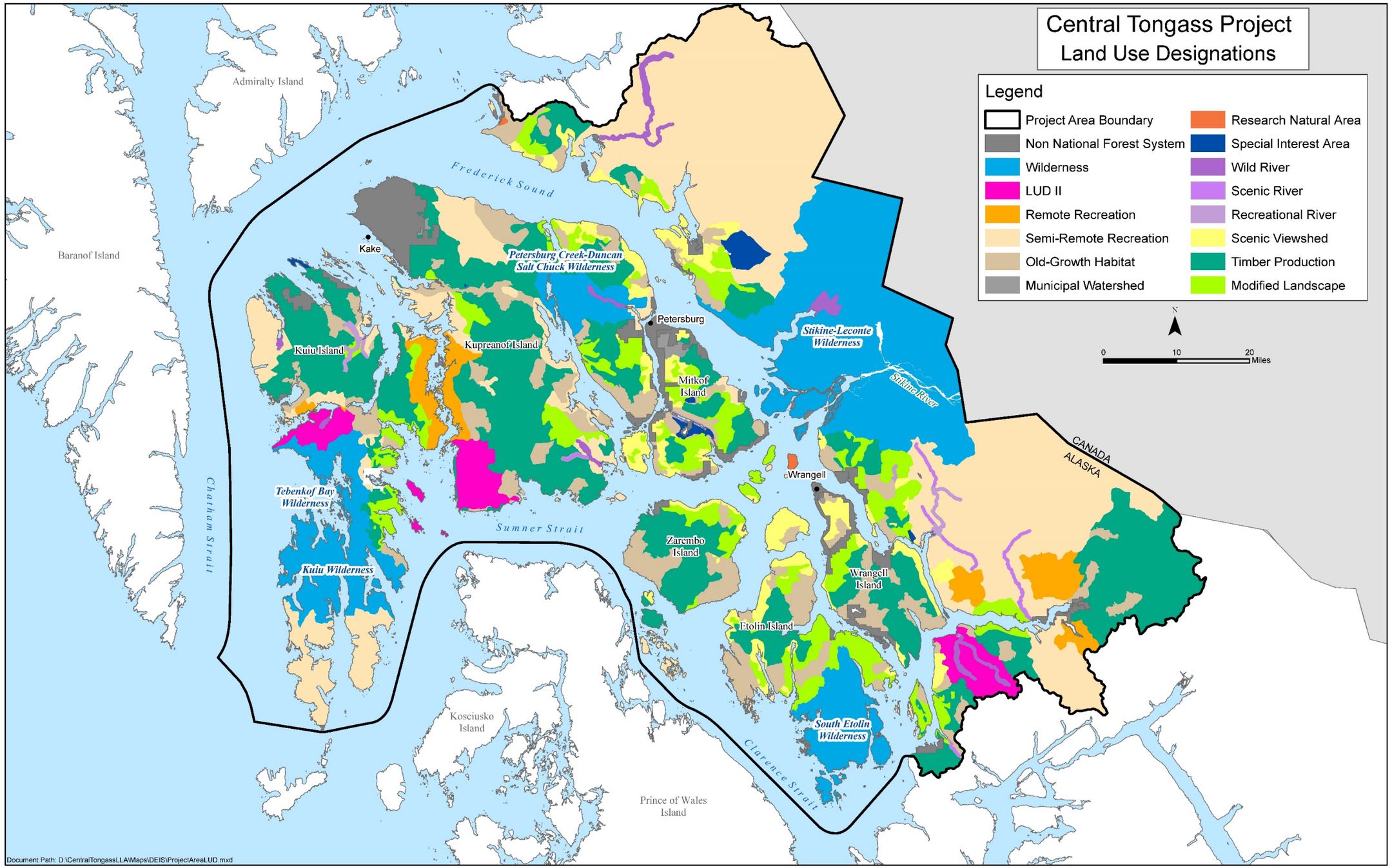

Figure 3. Land use designations (LUDs) in the Central Tongass project area

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Public Involvement

Scoping

The Council on Environmental Quality (CEQ) defines scoping as "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 Code of Federal Regulations [CFR] 1501.7). The scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process, continuing until a decision is made. The project was first listed in the Schedule of Proposed Actions (SOPA) in the 1st quarter of fiscal year 2019 (beginning October 1, 2018) for the Tongass National Forest.

During the winter and spring of 2018, the Forest used several methods to share the developing proposed action for the Central Tongass Project and gather input from the communities within the project area. In January, introductory letters were sent out to approximately 1,100 individuals, organizations and agencies with a questionnaire and map, and posted to a public project website on the Tongass homepage (https://www.fs.usda.gov/tongass/).

In February 2018, the Forest talked to local tribes, and visited elementary, middle and high school students in Kake, Petersburg and Wrangell, Alaska. In March, four pre-scoping public meetings were held: one in Kake (March 5), two in Petersburg (March 7), and one in Wrangell (March 8). Fifty people attended these meetings. The introductory letter, questionnaire and meetings were publicized in local newspapers (*Petersburg Pilot* and *Wrangell Sentinel*) and on public radio stations KFSK (Petersburg), KSTK (Wrangell) and KCAW (Sitka but within the broadcast area for Kake).

Following these efforts, input was received from five school classrooms within the project area and approximately 35 letters and questionnaires. The general themes gathered from the community input include:

♦ Provide more recreation opportunities closer to communities ♦ Provide a steady supply of old-growth timber for harvest ♦ Provide a greater variety of small timber sales ♦ Provide individual tree sales ♦ Tailor pre-commercial thinning prescriptions and contract provisions, such as slash removal, to promote berry production ♦ Incorporate traditional/Tlingit names on road signs throughout the project area ♦ Turn closed roads into pedestrian trails and ATV trails ♦ Build roadside cabins near communities ♦ Develop a system of dispersed campsites along a multi-island kayak "trail" ♦ Build more 3-sided shelters ♦ Improve or build docks to access road systems or fishing spots ♦ Improve fish passage ♦ Provide more areas for commercial firewood cutting ♦ Maintain roads that access important subsistence areas ♦ Implement more stream restoration projects ♦ Seek partnership opportunities

The notice of intent (NOI) to prepare an EIS was published in the Federal Register on August 9, 2018, and asked for public comment on the proposal from August 9 to September 24, 2018. In addition to the NOI, a scoping report, which included more information, was sent to approximately 1,200 individuals, organizations, and agencies on the project mailing list. Forty-five individuals, agencies, and organizations submitted comments, during the 45-day comment period. All the comments submitted are available for review in the Central Tongass Public Comment Reading Room.

Four public meetings were held in September 2018 during the scoping period: September 5 (Wrangell), September 11 (Kake), and two meetings on September 13 (Petersburg). Fifty-one people attended the meetings.

Using the comments from the individuals, agencies, and organizations (see Issues section), the interdisciplinary team developed two issues to address.

Issues Significant to the Proposed Action

The Forest Service identified the following significant issues through input received from comments during scoping (40 CFR 1501.7), following publication of the NOI to publish an EIS, and during public meetings. To describe and compare how the alternatives affect the resources related to the issue, units of measure are chosen that are quantitative where possible, predictable, responsive to the issue, and linked to cause-and-effect relationships. These issues, related resources, and how the alternatives address the issues are discussed in more detail in Chapter 3, Environment and Effects.

Issue 1: Timber Supply and Economics

Timber supply and the economics of future Central Tongass Project timber sales may affect the extent forest product operators contribute to the local and regional economy.

Salability, predictability, and volume of future timber offerings from the project area would directly impact timber operator contributions to local area employment and income. In addition, reliable raw material supply facilitates investment and facility upgrades to adapt to changing log characteristic as the young-growth transition progresses over time.

Units of Measure

- Timber volume (old growth and young growth) in million board feet (MMBF) for life of the project (15 years);
- Cost of harvest, including camp and transportation cost per thousand board feet (MBF) by timber analysis area;
- Number of annualized direct jobs supported for both domestic processing and Region 10 limited export policy for old growth and 100 percent export for young growth (15 years).

Issue 2: Wildlife Habitat – Deer Winter Range and Connectivity

Proposed timber harvest may decrease the quantity and quality of deer winter habitat and habitat for Pacific marten on Kuiu Island, as well as habitat connectivity for both.

Timber harvest can affect wildlife species dependent on or associated with old-growth habitat. Commenters were concerned that additional harvest of habitat used by deer in winter and lack of elevational connectivity in areas of timber harvest could affect deer populations. Additionally, commenters expressed concern about impacts to marten and marten populations, and the Pacific marten population on Kuiu Island.

Units of Measure

- Acres and percent reduction of high and moderately high value deer winter habitat (productive old growth (POG) less than 800 feet in elevation on south-facing slopes)

- Acres of average winter deer habitat (all productive old growth (POG) less than 1,500 feet in elevation
- Interagency Deer Model Habitat Capability outputs by WAA
- Elevational connectivity
- Deep snow marten winter habitat (High-Volume POG below 800 feet in elevation)
- Average winter marten habitat (POG below 1,500 feet in elevation)

Other Issues and Concerns

Each comment received during scoping was carefully considered to see if it was a potential issue that was not already addressed by the proposed action or Alternative 3. Where possible, suggestions about the project were incorporated into the design of the proposed action and alternatives (see Chapter 2: Alternatives Considered in Detail). However, concerns and suggestions that were already addressed in the Forest Plan, not alternative-driving issues, or their resolution was beyond the scope of this project were eliminated from detailed analysis for the reasons discussed in Chapter 2 (Alternatives Considered but Eliminated from Detailed Study).

Federal and State Permits and Authorizations

Prior to implementation of activities, the Forest Service would ensure all necessary permits or authorizations from other federal and state agencies are in place. These may include the following:

1. State of Alaska, Department of Environmental Conservation (DEC), Alaska Pollutant Discharge Elimination System (APDES):
   - General permit for Log Transfer Facilities in Alaska
   - Review Spill Prevention Control and Countermeasure Plan
   - Certification of Compliance with Alaska Water Quality Standards (401 Certification) Chapter 20
   - Storm Water Discharge Permit/ National Pollutant Discharge Elimination System review (Section 402 of the Clean Water Act)
   - Solid Waste Disposal Permit
2. U.S. Army Corps of Engineers:
   - Approval of discharge of dredged or fill material into the waters of the United States under Section 404 of the Clean Water Act
   - Approval of the construction of structures or work in navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899
3. State of Alaska, Division of Natural Resources (DNR):
   - Authorization for occupancy and use of tidelands and submerged lands
4. State of Alaska, Department of Fish and Game (ADF&G):
   - Fish Habitat Concurrence (Title 16)
5. State of Alaska, Division of Environmental Health:

- Pesticide-use permit and Alaska Pollution Discharge Elimination System (APDES) permit are required in response to the requirements of the Clean Water Action Section 402.

Availability of the Project Record

An important consideration in preparing this DEIS is reduction of paperwork specified in 40 CFR 1500.4. This DEIS provides the required hard look to demonstrate a reasoned consideration of the environmental impacts of the alternatives and ways to mitigate the impacts. The project record contains supporting material that documents the NEPA process and analysis from the beginning of the project through project implementation.

The project record is available electronically upon request from the Petersburg Ranger District office in Petersburg, Alaska and the Wrangell Ranger District office in Wrangell, Alaska. Reference documents, such as the Forest Plan, Alaska National Interest Lands Conservation Act of 1980 (ANILCA as amended) and the Tongass Timber Reform Act (TTRA), are available for review at public libraries and Forest Service offices throughout Southeast Alaska. The Forest Plan and its FEIS are available on CD-ROM and online (http://www.fs.usda.gov/goto/R10/Tongass/PlanAmend). The Forest Plan planning record is also available electronically.

Map and Data Disclaimers

All map products in this document are reproduced from geospatial information prepared by the Forest Service. Geographic information system (GIS) data and product accuracy may vary. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. For more information, contact the Petersburg Ranger District or the Wrangell Ranger District.

In addition, the accuracy of calculations made from GIS layers varies with the quality of the mapping itself. Numbers presented in tables in this document may not sum correctly due to rounding. Other slight anomalies due to rounding may also occur. Therefore, all numbers calculated from GIS should be considered as approximate. These numbers, however, are accurate enough to compare alternatives and make an informed decision.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Central Tongass Project. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options for the Responsible Official and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (for instance, helicopter yarding versus the use of ground-based equipment) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (the amount of erosion caused by helicopter versus ground-based yarding).

While the action alternatives comply with the required direction and regulations designed for the protection and management of forest resources[3], there are instances when project design features[4], are included as part of the alternative to alleviate potential adverse effects from natural or human-caused disturbances. Design features are provided in Appendix A - Implementation Plan and Activity Guides ("Implementation Plan") for each activity proposed.

Alternatives Considered in Detail

The Forest Service analyzed three alternatives, including the No-Action (Alternative 1), the Proposed Action (Alternative 2), and an additional action alternative (Alternative 3), in response to issues raised by the public. The following section describes the alternatives considered in detail.

Alternative 1 - No Action

Alternative 1, the No Action Alternative, is required by the CEQ Regulations (40 CFR Section 1502.14(d)) represents the existing condition in the project area and provides a baseline to measure and compare impacts of the various action alternatives against and represents the existing condition in the project area.

Under Alternative 1, management activities proposed would not be implemented. Natural disturbances current management and ongoing projects and activities would continue as before. Ongoing activities include recreation maintenance and improvements, road and trail maintenance, stream restoration, invasive plant treatments and other routine forest management activities not associated with this decision would continue as authorized by previous decisions.

Alternatives 2 and 3 - Action Alternatives

Alternatives 2 and 3 provide options for meeting the purpose and need of this project and represent different ways of addressing the issues (see Chapter 1). Features common to both action alternatives are described below followed by features specific to Alternatives 2 and 3.

---

[3] These include Forest Plan direction, land use designations (LUDs), best management practices (BMPs), relevant state and federal laws and regulations, and Forest Service manuals and handbooks.

[4] Design features—measures or procedures incorporated into the proposed action or an alternative, including measures or procedures which could reduce or avoid adverse impacts. Because these features are built into the proposed action or an alternative, design features are not considered mitigation.

2 – Alternatives

Tables 2 through 5 at the end of this chapter provide a comparison of alternatives by activity and resource, including activities common to all action alternatives.

The activity guides in Appendix A - Implementation Plan and Activity Guides defines the proposed activities and guides their implementation over the life of the project. Information provided in the guides include activity descriptions, conditions that may trigger implementation, implementation methods, equipment used, integration opportunities to maximize shared resources, and resource-specific design features. Activities in the Selected Alternative will be implemented as funding and personnel become available.

Features Common to Both Action Alternatives

The alternatives were designed by describing the conditions where a need for change had been identified. Limits on the intensity of specific activities were also identified where needed for resource protection. GIS queries were used to determine potential areas where treatments/activities may occur based on existing conditions. This included but was not limited to existing vegetation, known invasive plant populations, stream reaches, existing recreation sites, and road barriers to fish passage (red pipes). This information enabled the Forest Service to develop alternative design features for the action alternatives. The design features common to both action alternatives are described below.

Watershed Restoration and Improvement

All proposed watershed restoration and improvement activities within the project area are common to both action alternatives. They include: stream and floodplain restoration, fish habitat and passage improvements, and invasive plant management. Maps of proposed sites are include on the project webpage at https://www.fs.usda.gov/detail/tongass/landmanagement/projects/?cid=fseprd568085.

The Forest Service's Watershed Condition Framework (USDA Forest Service 2011) guides watershed restoration on the forest. Watershed condition classification at the forest scale provides the first iteration of priorities. Watershed resource values, field assessments, and stakeholder input inform the selection of a small subset of Priority Watersheds where Watershed Restoration Action Plans are developed to integrate restoration activities at a watershed scale. There are currently 12 priority watersheds located in the project area.

To sustain the diversity and production of fish and other freshwater organisms, and to restore proper stream and floodplain functioning conditions, the Central Tongass Project proposes restoration on up to 49 miles of stream channel types conducive to restoring with heavy equipment and/or helicopter. Similarly, instream wood placements are proposed on up to 64 miles of streams using hand tool restoration methods.

To sustain and improve aquatic habitat complexity and flood resilience of lake ecosystems, the Central Tongass Project proposes the addition of large wood on up to 15 freshwater bodies – either along lake shores or within shallow ponds.

To sustain the diversity and production of fish and other freshwater organisms, the Central Tongass Project proposes up to 25 fisheries improvements such as new fish pass construction and natural instream barrier modifications. Fish stocking is proposed to "seed" newly opened habitat upstream of instream barrier modifications on up to 15 sites and no more than 25 stream miles. Fertilization is proposed on up to two lakes in lake ecosystems with natural subsistence sockeye runs with low levels of nitrogen and phosphorus.

Invasive plant treatments currently occur under the *Wrangell-Petersburg Weed Management Environmental Assessment* (USDA 2013). To increase the ability to complete effective treatments there are four additional components included in the Central Tongass Project. 1) The first includes lands of other ownership. Invasive plants know no political boundary; therefore efforts to treat across boundary lines will improve control and eradication efforts. Additionally, this "all lands, all hands" approach will increase the ability to form partnerships and increase the capacity to treat an estimated 5,811 gross acres on both NFS and lands of other ownership. 2) The second removes the 200-acre annual treatment cap as both the Wrangell and Petersburg Ranger Districts together are approaching 200 gross acres of treatment annually. 3) The third adds foliar spot treatment of emergent vegetation (plants rooted in water) to allow treatment of infestations in aquatic settings. 4) The fourth adds broadcast spray as a treatment option. Manual methods such as hand-pulling or tarping, mechanical methods such as mowing, and herbicide application including wicking/wiping, stem injection or foliar spot spray are treatment tools presently used that will continue to be utilized. The herbicides proposed in the Central Tongass Project are no different – aminopyralid, and aquatic formulations of imazapyr and glyphosate. The early detection – rapid response management strategy remains as a tool that provides the flexibility to treat new invasive plant infestations.

When deciding whether or not to treat an invasive plant, the Forest Service will consider the following factors: the management objective for the location, the target species' Alaska Center for Conservation Science invasiveness ranking, the size of the infestation, and the proximity of the infestation to specific areas such as wilderness or research natural areas, or to habitat where ecological function may be impaired. Subsurface aquatic plant treatment is not proposed.

Vegetation Management

Vegetation management activities include old-growth and young-growth commercial harvest, and silvicultural intermediate treatments, such as thinning in young growth stands to achieve various management objectives - promoting timber production, improving wildlife habitat, improving riparian area health.

Old-growth and Young-growth Commercial Harvest

Commercial Timber Harvest Methods

Timber harvest methods include even-aged and two-aged management prescriptions (conventional ground-based logging methods), and uneven-aged management prescriptions (conventional and helicopter yarding). Commercial harvest of old-growth and young-growth timber includes large, small, microsale and salvage sale opportunities.

The number of acres and estimated volume for both old-growth harvest and young-growth harvest differ by alternative and are discussed in Alternative 2 and Alternative 3 sections.

Specifically related to old-growth commercial harvest, a project-specific Forest Plan amendment is proposed and analyzed in both action alternatives to allow less restrictive Scenic Integrity Objectives (SIOs) in selected portions of four of ten timber analysis areas (TAAs) (Figure 2).

Young-growth harvest needs to generally occur in stands that have not reached 95 percent of culmination of mean annual increment[5] as granted, with limitations, by Public Law 113-291,

[5] The age in the growth cycle of a stand at which the mean annual increment for height, diameter, basal area, or volume is at a maximum is defined as the Culmination of Mean Annual Increment (CMAI). This

§3002 (e)(4)(A) because of the age of the stands. However, stands proposed for rotational harvest (even-aged and two-aged management) will generally be at a level of growth where at least 50 percent of the merchantable volume occurs in trees with a merchantable height suitable to produce two 34-foot logs.

Silviculture Intermediate Treatments

The Forest Service also proposes non-commercial young-growth management activities. These silvicultural intermediate treatments aim to achieve various management objectives, such as promoting young-growth timber production, improving wildlife habitat, or improving riparian areas in concert with watershed restoration. The Central Tongass Project proposes to treat up to 3,000 acres of young-growth stands annually, or 45,000 acres over the next 15 years. Activities include various treatment combinations in young-growth stands that have reached or are approaching the stem-exclusion stage of stand development: pre-commercial thinning; creating or maintaining wildlife gaps, clumps or movement corridors; creating wildlife trees; girdling; pruning; or slash treatment. See Vegetation Management Activity Guides 6 through 8 in Appendix A, Implementation Plan.

Intermediate Treatments to Enhance/Maintain Deer Habitat

Treatments from the Interagency Wolf Habitat Management Program: Recommendations for Game Management Unit 2 for deer habitat (R10-MB-822) have been incorporated into both action alternatives. These recommendations correspond to Forest plan direction (Forest Plan, WILD1, WILD2, TIM3, TM8 and Chapter 5). These are described in Appendix A, Implementation Plan, Activity Guides 7 and 8.

- Young-aged Young Growth Stands (16 to 25 years) in All Areas
- Older Non-Commercial Young Growth stands (26 to 60 years) in All Areas:
- Commercial-Aged Young Growth in Areas where Succession towards Old-Growth Conditions is identified as a Dual Objective (that is, Old-Growth Habitat LUD, and Beach and Estuary Fringe and Riparian Management Areas outside of Tongass Timber Reform Act buffers that are within development and Old-Growth Habitat LUDs)

Access Management

Access management activities related to this project include new National Forest System road construction and reconstruction, temporary road construction, and up to 80 new rock quarries (Alternative 2). Access management also includes aquatic organism passage and marine facility construction, reconstruction, and maintenance of marine access facilities, such as log transfer facilities, docks, mooring buoys, boat ramps and boat launches.

The Central Tongass DEIS incorporates by reference the decisions of the Access and Travel Management Plan (ATM) Environmental Assessments for Wrangell and Petersburg signed in 2007 and 2009, respectively. These decisions guide the travel management of existing designated routes within the project area. Designated routes and areas, in addition to authorized use (class of

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Age varies based on stand productivity and past management of the stand, and is the legal requirement under the National Forest Management Act (NFMA) for determining the youngest age a stand may be considered for even-aged harvest. This translates to a range of rotation ages from about 100 to 110 years old for most stands considered for treatment using even-aged management in the Central Tongass project area. Old-growth stands in nearly all instances have already exceeded CMAI.

vehicle and time of year), are reviewed and updated annually. When changes are approved, they are displayed on the current calendar year's Motor Vehicle Use Map (MVUM).

Existing Road System – Proposed Travel Management Changes

In addition to the access management identified for the Selected Alternative, the Forest reviewed the existing use and conditions, and planned future use of roads on the Petersburg and Wrangell Ranger Districts. Based on this review, the Forest proposes changes of designated use to about 176 miles (19 percent) of the existing road system within the project area (see Figure 1 in Appendix B). Proposed changes include:

- Designate 128 miles of existing NFS road as Motorized Trails open to OHV < 50 inches wide (such as ATVs or motorcycles). These roads would follow criteria outlined in 36 CFR 212.55, and be displayed on the district's annual Motor Use Vehicle Map. The roads are currently closed, or are already planned for future closure.
- Change the designation of 19 miles of NFS roads currently Closed to Public Use to Open to High-Clearance Vehicle. This would meet future Central Tongass resource management objectives and access for subsistence, recreation, firewood, and free use timber.
- Change the designation of 29 miles of road from Open to High-Clearance Vehicles to Open to Standard Passenger Cars. These roads are located on road systems where a variety of vehicle use is already occurring by the public for recreation, subsistence, free use timber, timber management, and firewood.

Proposed National Forest System Roads - Travel Analysis

The travel analysis also evaluated the potential future use needs for proposed National Forest System (NFS) roads. These are the roads proposed to be constructed for timber harvest but are either needed for long-term administration and resource needs or need to be designed to a certain standard. The IDT identified the risks and benefits associated with the proposed roads to inform management recommendations for each new road segment. Interdisciplinary recommendations for route specific road management are in Appendix B.

Upon completion of commercial harvest activities, proposed NFS roads designated for storage (Maintenance Level 1), decommissioning, or conversion to uses other than motorized access will be reviewed for access to firewood, and microsales. If there are no significant resource concerns or risk to public safety, the road may remain open (Maintenance Level 2) for 3 to 5 years. After this 3 to 5 year period, the road will be stored to reduce maintenance costs, or designated as a motorized or pedestrian trail where identified in travel analysis.

To improve aquatic organism passage (AOP) and fish habitat connectivity, alternatives 2 and 3 propose replacing, removing, or improving stream crossing structures where fish passage is currently inhibited. Heavy equipment, hand tools or explosives would be used to maintain or restore fish and aquatic organism passage at stream crossings to applicable BMPs and design standards and provide effective flood resiliency.

To facilitate log transfer to saltwater for commercial timber harvest within the Central Tongass project area, the Forest Service proposes to maintain or improve 15 existing log transfer facilities (LTFs) and construct up to three new LTFs located on Shrubby Island, Vank Island, and Three Mile Arm on Kuiu Island (see Figure 4 and Figure 5).

Additionally, up to 69 marine access facilities, such as docks, boat ramps and floats, may be maintained, constructed or improved for public access. These sites are typically not associated with a road system, but used for access to shoreline or inland water facilities such as a cabin, shelter, or trailhead.

Recreation Management

All proposed recreation activities are common to both action alternatives and include maintenance and improvements of existing recreation facilities, construction of new recreation facilities, and decommissioning of existing recreation facilities. Recreation facilities include cabins, shelters, picnic areas, dispersed camping sites, outhouses, viewing areas and platforms. The conditions and decision tree in Appendix A (Figure 5) will be used to determine when a proposed recreation activity would be considered for implementation and potential locations.

Trail construction, reconstruction, decommissioning, and maintenance is also proposed and includes pedestrian trails, motorized trails, snow trails, canoe and kayak portages and the conversion of existing boardwalk trail to gravel.

Alternatives 2 and 3 propose constructing up to 6 new cabins, 30 day use/picnic areas, 6 platforms for interpretative or wildlife viewing use, and 10 dispersed camp sites (including tent platforms); decommissioning up to 15 cabins; constructing up to 10 new shelters and/or converting cabins to shelters; and constructing or replacing up to 75 outhouses. Both alternatives also include constructing up to 300 miles of pedestrian trail (this includes new construction, and/or converting existing boardwalk trail to gravel trail), 60 miles of new motorized trails and 105 miles of winter trails.

Disturbance estimates based on the type of proposed site and their ground coverage:

- Single facility (shelter) with no ancillary buildings or infrastructure: less than 900 square feet (0.02 acre).
- Facilities (cabins and shelters) with ancillary buildings and infrastructure: typically less than 10,000 square feet (0.23 acre).
- Dispersed campsites, day-use/picnic areas, and interpretative sites: variable acreage but based on existing facilities the average size is approximately 40,000 square feet (0.92 acre).

Ground coverage for trails (linear sites) is measured by the length of the route and the width of the trail plus immediately adjacent (within 10 feet of trail centerline) ground. For this analysis, trail coverage is 2.4 acres per mile. This measure accounts for variability of trail widths, potential activity adjacent to the trail, and other features such as trail head parking and viewpoints.

Recreation management activities, including trail building, would be prioritized during implementation based on the following conditions 1) health and safety concerns for users, 2) availability of internal or external funding sources, 3) current and projected use levels, 4) degraded resource conditions from human use such as vegetation trampling, site hardening, soil erosion, and 5) feasibility due to topography.

Supporting Actions

In addition to the four broad categories of activities proposed above, the Central Tongass interdisciplinary team identified two supporting actions which would occur only as needed and

in conjunction with a primary activity. These actions are soil restoration and timber stand establishment – planting and inter-planting tree seedlings., Soil restoration, such as grass seeding, tree planting and fertilization on exposed soil, adding sediment traps, returning topsoil to displaced areas like skid trails, decommissioning or removing rock fills from temporary roads or decommissioned roads, and possibly scarification or ripping of compacted soils, may accompany stream and floodplain restoration where detrimental soil conditions approach or exceed 15 percent of the activity area, or timber stand establishment (planting or inter-planting tree seedlings) may occur in harvested stands where reforestation is required to meet desired future conditions.

Features Specific to Alternative 2 – Proposed Action

Alternative 2 seeks to address the needs identified within the purpose and need, balance commercial and non-commercial opportunities, and provide and maintain high-quality experiences for all Forest users over the long-term while maintaining or improving land and resource conditions by considering best-available science and public input.

Vegetation Management

Alternative 2 could offer up to 150 MMBF of commercial old-growth timber from 9,500 acres. An average of approximately 20 MMBF of harvest from suitable timber lands is proposed annually during the first 5 years of implementation. During the next 5-year period, the average annual old-growth harvest is proposed to drop to 7 MMBF and drop again for the last 5-year period (4 MMBF of annual old-growth harvest).

Of the 80 MMBF of commercial young-growth timber proposed for harvest, approximately 2 MMBF of young-growth harvest are proposed annually over the first 5-year period of implementation and increase to an average of 4 MMBF during the second 5-year period. By the last 5-year period young-growth harvest would increase to a yearly average of 10 MMBF. Young-growth harvest would need to occur in stands that generally have not reached 95 percent of culmination of mean annual increment due to the age of the stands. However, stands proposed for rotational harvest (even-aged and two-aged management) will have generally reached a level of growth where at least 50 percent of the merchantable volume occurs in trees with a merchantable height suitable to produce two 34-foot logs.

Access Management

To support harvest and other activities, approximately 25 miles of NFS road construction, 93 miles of temporary road construction, and up to 80 rock quarries are proposed. An estimated 82 miles of closed NFS roads could be improved for haul. These access improvements may include up to 128 new fish stream crossing structures, such as culverts and bridges.

Features Specific to Alternative 3

Alternative 3 was designed in response to Issue 2. It provides greater connectivity by designating elevational corridors generally every ½ mile that connect summer and winter habitat utilized by deer, maintains more high value deer winter habitat, and lessens timber harvest in Pacific marten habitat on Kuiu Island.

Vegetation Management

Alternative 3 could offer up to 127 MMBF of old-growth timber from 8,075 acres, and 74 MMBF of young-growth from 3,650 acres over a 15-year period.

Under this alternative, high-value deer winter habitat and elevational connectivity would be used to influence the location of commercial old and young-growth timber a primary criteria when designing vegetation treatments. Alternative 3 also includes design features specific to the Pacific marten population on Kuiu Island.

High-value deer winter habitat is prioritized over timber harvest by modifying timber unit boundaries to exclude this habitat, modifying harvest prescriptions to maintain the existing habitat structure, or deferring the harvest unit.

This alternative proposes to designate at least one corridor within each deer home range (average of approximately 200 acres) to provide habitat connectivity, and facilitate seasonal movement of deer and other wildlife species. Proposed corridors would be approximately 330 feet wide, and are intended to be windfirm, allow for snow intercept, and to minimize side-lighting (which increases understory growth, and can impede movement) (Suring et al. 1993).

- Corridors may be designated in young-growth stands (SDM Class 4 and above), provided they are managed as corridors for the life of the Central Tongass Project. For example, a corridor could be moved in cases of blowdown or where a comparable location is found to allow timber harvest or better access.
- Where possible corridors should be located in areas where wildlife use is occurring, such as existing game trails, and ideally serve multiple resource benefits (for example, part of or an extension of a stream buffer, or extension of a nest buffer) but must be positioned to facilitate movement (for instance, cannot be restricted to a deeply incised v-notch which could impede movement).
- If necessary to ensure windfirmness, feathering of corridor edges may be needed. Feathering can extend into the interior of the corridor, but may not compromise corridor objectives.
- High-value deer winter habitat may be included as part of a designated elevational corridor.

Elevational corridors would be designated generally every ½ mile. The ½ mile spacing correlates to an average deer home range area of approximately 200 acres (80 hectares) (Schoen and Kirchoff 1985, Yeo and Peek 1992, Farmer et al. 2006).

The following design features are proposed for old-growth and young-growth timber harvest units on Kuiu Island only:

- Defer harvest of old growth in High and Very High focal areas of use[6] by marten as determined by the resource selection function model developed by Koch (2016).
- Design young-growth harvest in High and Very High focal areas of use by marten, as determined with the resource selection function model developed by Koch (2016), to provide commercial timber byproducts while providing habitat and connectivity for wildlife and opportunities for accelerating old-growth characteristics. The maximum size of any created opening for commercial timber harvest must not exceed 10 acres and a

[6] Footnote: "Koch (2016) mapped focal areas of use by marten on Kuiu Island using a resource selection function (RSF) model. Habitats were binned into five categories based on RSF scores, which are proportional to the probability of marten occurrence on the landscape. Five categories were used to map the scores on the RSF map as follows: very high (most important for marten), high, medium, low, and very low (least important)."

maximum removal of up to 35 percent of the acres of the original harvested stand is allowed. Thinning is limited to 33 percent of the stand's basal area. A combination of the two treatments may be used, with no more than 35 percent of the total stand removed in either basal area and/or acres. TTRA and other administratively withdrawn areas do not count towards the stand's total acreage.

Of the 127 MMBF of commercial old-growth timber proposed for harvest, approximately 17.5 MMBF of harvest from suitable timber lands is proposed annually, on average, during the first 5 years of implementation. An average of 8 MMBF of annual old-growth timber harvest is proposed during the next 5-year period, and 0.1 MMBF on average in the last 5 years.

The proposed harvest of young-growth would average 3 MMBF annually over the first 5-year period and increase to an average of 4 MMBF during the second 5-year period. By the last 5-year period, young-growth harvest would advance to a yearly average of 8 MMBF.

Access Management

To support harvest and other activities, approximately 22 miles of NFS road construction, 82 miles of temporary road construction, and up to 70 rock quarries are proposed. An estimated 71 miles of closed NFS roads could be improved for haul. These access improvements may include up to 37 new stream crossing structures, such as culverts and bridges.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to "rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods to achieve the purpose and need. Some of these alternatives were outside the scope of the project (did not meet the purpose and need), duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Alternative that prioritizes outfitter and guide use over timber harvest

To guide the management of the Tongass National Forest, the Forest Plan uses LUDs, which are broad geographic zones that emphasize various resource values, outputs, practices and use (see Figure 3 in Chapter 1). Goals, objectives and desired future conditions of all LUDs are described in detail in the 2016 Forest Plan (Chapters 2 and 3).

The Central Tongass Project purpose and need includes Forest Plan goals and objectives that address timber, local and regional resource-based economies, fish, biodiversity, recreation and tourism, subsistence, and wildlife.

While permitted outfitter guiding is an appropriate use of development LUDs, prohibiting timber harvest within these LUDs would not meet Forest Plan goals and objectives (see discussion below, Alternative that excludes commercial old-growth timber harvest).

Alternative that excludes commercial old-growth timber harvest

Commercial old-growth harvest is part of the purpose and need because the Tongass National Forest managers are obligated to seek to meet demand for timber from the forest to comply with

the Tongass Timber Reform Act (TTRA Section 101). In addition, the Forest Plan authorizes old-growth harvest as a means to help the forest industry and other stakeholders remain financially viable during the transition to predominantly young-growth timber harvest. After the transition, the Forest Plan allows the Tongass to offer an average of 5 MMBF of old-growth timber annually. Without commercial old growth, the Central Tongass Project would not fulfill the project purpose and need as defined by the Responsible Official. Since the Central Tongass Project contains areas where the allocated LUD allows commercial old-growth timber harvest, the Responsible Official proposes both old- and young-growth harvest activities for this project.

Alternative that focuses supplying old- and young-growth timber through microsales or small sales only

The timber volume provided only through small sales and microsales would not meet the requirement of TTRA to seek to provide a supply of timber which meets the annual demand even in conjunction with other Tongass timber projects. The calculated annual demand for FY19 is 52 MMBF. Additionally, the volume of this project is expected to contribute to the long -term market demand over the planning cycle (Daniels et al. 2016). As such, microsale and small sale volume could not meet the purpose and need for the Central Tongass Project,

Alternative that considers harvest in 2001 Roadless Area Conservation Rule Inventoried Roadless Areas (RACR IRAs)

An alternative was considered to maximize the timber stands available for harvest by expanding potential harvest into 2001 Inventoried Roadless Areas (IRAs) even though lands within 2001 IRAs are not suitable for commercial harvest under the Forest Plan. The Alaska Roadless rulemaking process will determine whether currently prohibited activities should be allowed in designated roadless areas. This project complies with the 2016 Tongass Land and Resource Management Plan (Forest Plan).

The proposed action can meet the purpose and need by providing up to 230 MMBF of old-growth and young-growth timber from suitable timber lands within the existing Forest Plan direction.

Alternative that expands the project-specific Forest Plan amendment to all timber analysis areas

An alternative was considered to allow less-restrictive scenic integrity objectives (SIOs) in portions of all ten timber analysis areas for old-growth harvest. Meeting SIOs has impacted timber economics on past Tongass timber sale contracts by restricting harvest areas to less-economic, uneven-aged management prescriptions and higher cost helicopter logging systems, sometimes to the extent they could not be offered due to a deficit appraisal. To address this, areas were chosen within each timber analysis area (TAA) where lowering SIOs would have the greatest potential to improve timber economics.

The Responsible Official decided to propose less-restrictive SIOs in portions of four of the TAAs for old-growth harvest to reduce the impact to the scenery resource less but still provide old-growth timber to forest product industries while the transition to young-growth management occurs.

Apply Alternative 3 deer habitat design features in some, but not all, timber analysis areas

This alternative was not analyzed in detail since it would fall within the range of the alternatives. The Responsible Official may include this design feature to all or some of the TAAs in the decision.

Comments were received about subsistence use related to the effects to deer populations due to the loss of habitat through timber harvest. Alternative 3 was designed to mitigate some of these effects through the maintenance of elevational corridors between summer and winter habitat and by deferring old-growth stands identified as high-value deer winter range. This was applied to all TAAs in the project area to analyze the most effect of these measures since subsistence use occurs in the entire project area to varying extents. The Wildlife section in Chapter 3 displays the effects by TAA.

Comparison of Alternatives by Issue, Activity, and Resource

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. Table 2 below compares effects of the alternatives by Issue, using the units of measure identified in Chapter 1.

Table 2. Comparison of Alternatives by Issue using units of measure for each Issue

Issue 1 – Timber Supply and Economics			
Unit of Measure	**Alt 1**	**Alt 2**	**Alt 3**
Old-growth timber harvest volume over 15 years (MMBF)	0	150	127
Young-growth timber harvest volume over 15 years (MMBF)	0	80	74
Road/LTF construction/reconstruction/maintenance costs per MBF ($)	0	$123	$128
Employment (annualized direct jobs supported for maximum Alaska manufacturing)	0	582	493
Employment (annualized direct jobs supported under the Alaska Region limited export policy)	0	543	459
Issue 2 – Wildlife Habitat - Deer Winter Range, Marten Habitat and Connectivity			
Unit of Measure	**Alt 1**	**Alt 2**	**Alt 3**
High-value deer winter habitat (high productive old growth (HPOG) below 800 feet elevation on south-facing slopes	162,483 (existing acres)	5,417 (harvest acres)	3,275 (harvest acres)
All productive old growth (POG) below 800 feet elevation on south-facing slopes	1,045,746 (existing acres)	38,160 (harvest acres)	35,402 (harvest acres)

Unit of Measure	Alt 1	Alt 2	Alt 3
Deer habitat capability[1] and percent remaining from the historic condition on NFS lands only (Year=2045) by WAA			
1605	1,208 78%	1,137 73%	1,156 74%
1816	520 90%	482 83%	493 85%
1901	3,290 90%	3,202 87%	3,213 87%
1903	2,221 83%	2,129 79%	2,139 80%
1904	629 66%	629 66%	629 66%
1905	2,637 71%	2,273 61%	2,345 63%
2007	2,508 75%	2,225 67%	2,272 68%
5012	4,781 74%	4,474 70%	4,602 72%
5018	1,538 93%	1,466 88%	1,499 90%
5131	1,923 89%	1,805 83%	1,818 84%
5132	892 70%	841 66%	849 67%
5136	1,244 81%	1,030 67%	1,086 71%
5138	1,467 75%	1,396 72%	1,430 74%

[1] Interagency Deer Model Habitat Capability outputs

Table 3 and Table 4 below provide a summary of action alternative components by activity. Different levels of effects or outputs can be distinguished quantitatively or qualitatively between alternatives. Many activities share design features common to both action alternatives (Table 3). Other activities such as timber harvest and related actions differ somewhat between alternatives, as shown in Table 4. Alternative 2 would generate 29 MMBF more timber volume than Alternative 3, harvest 1,875 more acres, build 11 more miles of temporary road, build 3 more miles of NFS road, and install 35 more stream crossing (AOP) structures.

Table 3. Comparison of Alternatives by Activity - Design features common to both action alternatives

Activity	Design features common to Alternative 2 and 3
Stream, lake shore, and floodplain restoration	Instream wood placement on up to 49 miles of stream using heavy equipment and/or a helicopter, and instream wood placement on up 67 miles of stream using hand tool methods. Lake shore restoration on up to 15 lakes or ponds using the methods above. Up to 900 acres of potential riparian thinning for floodplain improvement.

Activity	Design features common to Alternative 2 and 3
Fish improvements	Fisheries improvements such as fish pass construction and natural instream barrier modifications on up to 25 sites. Stocking on up to 15 sites and no more than 25 stream miles. Lake fertilization in up to 2 lakes.
Invasive plant treatments	Treat invasive plant infestations on NFS and non-NFS lands using an integrated pest management strategy. There is no annual limit on controlling the estimated 5,811 gross infestation acres. Treatments include all current methods with the addition of broadcast spray. Herbicides are the currently approved aminopyralid or aquatic formulations of glyphosate and imazapyr. Herbicide treatment areas add emergent (plants rooted in water with foliage above the water surface) vegetation to current terrestrial treatments. Subsurface aquatic plant treatment is not proposed. The early detection-rapid response management strategy will continue.
Silvicultural intermediate treatments	Treat up to 3,000 acres of young-growth stands annually, or 45,000 acres total over the next 15 years. Activities would include various combinations of the following in young-growth stands approaching, have reached, or are in the stem-exclusion stage of stand development: pre-commercial thinning; creating or maintaining wildlife gaps or clumps; creating or maintaining wildlife movement corridors; creating wildlife trees; girdling; pruning; or slash treatment.
Aquatic organism passage	Replace, remove, or improve up to 452 stream crossing structures where fish passage is inhibited.
Marine access facilities	Maintain or improve 15 existing Log Transfer Facilities (LTFs), and construct up to 3 LTF sites located on Shrubby Island, Vank Island, and Three Mile Arm on Kuiu Island to facilitate log transfer for commercial timber harvest and public access. Up to 69 access points not related to log transfer, such as docks, boat ramps and floats may be maintained, constructed or improved for public access to sites such as shoreline trails, cabins, and existing roads.
Recreation facilities	Construct up to 6 new cabins, 30 day use/picnic areas, 6 platforms for interpretative or wildlife viewing use, and 10 dispersed camp sites (including tent platforms); decommission up to 15 cabins; construct up to 10 new shelters and/or convert cabins to shelters; and construct or replace up to 75 outhouses.
Trails	Construct up to 300 miles of pedestrian trail (this includes new construction, and/or convert existing boardwalk trail to gravel trail), 60 miles of new motorized trails and 105 miles of winter trails.

Table 4. Comparison of Alternatives by Activity - Design features that vary between action alternatives

Activity	Alt 1	Alt 2	Alt 3
Timber Harvest			
Old-growth timber harvest volume over 15 years (MMBF)	0	150 MMBF	127 MMBF
Young-growth timber harvest volume over 15 years (MMBF)	0	80 MMBF	74 MMBF
Total timber volume harvest over 15-year life of project (MMBF)	0	230 MMBF	201 MMBF
Old-growth timber harvest over 15 years (acres)	0	9,500 acres	8,075 acres
Young-growth timber harvest over 15 years (acres)	0	4,000 acres	3,650 acres
Total acres of timber harvest over 15-year life of project (acres)	0	13,500 acres	11,725 acres
Road Construction			
New NFS road construction to support harvest activities (miles)	0	25 miles	22 miles
Temporary road construction for short-term access to support harvest activities (miles)	0	93 miles	82 miles

Activity	Alt 1	Alt 2	Alt 3
Estimated NFS Road Construction Costs	0	$5,000,000	$369,565
Estimated Temporary Road Construction Costs	0	$13,987,500	$2,285,326
Estimated Road Maintenance Costs[1]	0	$2,852,771	$2,488,251
Stream Crossings			
New aquatic organism passage (AOP) structures (stream crossings) to support transportation corridor development	0	128	101

[1] Road maintenance is the estimated cost to improve closed NFS roads suitable for log haul.

Table 5 below provides a summary of alternative design features and effects by resource. Different levels of effects or outputs can be distinguished quantitatively or qualitatively between alternatives, as shown by units of measure. Many activities share design features common to both action alternatives while other activities differ somewhat between alternatives.

Table 5. Comparison of Alternatives by Resource based on Units of Measure for Resource

Resource	Effect	Effect		Effect
Botany[1] species	**Alt 1**	**Alt 2**		**Alt 3**
Edible thistle (*Cirsium edule*)	least	3 = 2		3 = 2
Mountain lady's slipper (*Cypripedium montanum*)	least	3 = 2		3 = 2
Calder's loveage (*Ligusticum calderi*)	least	3 = 2		3 = 2
Alaska rein orchid (*Platanthera unalascensis*)	least	3 < 2		3 < 2
Lesser round-leaved orchid (*Platanthera orbiculata*)	least	3 < 2		3 < 2
Lichen *Ricasolina amplissima* ssp. *sheiyi*	least	2 = 3		2 = 3
Kruckeberg's sword fern (*Polystichum kruckebergii*)	least	3 = 2		3 = 2
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	least	3 < 2		3 < 2
Henderson's checkermallow (*Sidalcea hendersonii*)	least	2 = 3		2 = 3
Karst	**Alt 1**	**Alt 2**		**Alt 3**
Acres of proposed old-growth harvest on karst (percent of gross unit pool)	0	572 (1.3)		358 (1)
Acres of proposed young-growth harvest on karst (percent of gross unit pool)	0	2,898 (10.3)		2,747 (10.5)
Estimated miles of proposed NFS and temporary road construction on karst (percent change)	0	13.5 (34)		13.5 (31.5)
Scenery[2]	**Alt 1**	**Alt 2**		**Alt 3**
Acres of young-growth harvest compared to 4,584 acres of gross unit pool with ESI greater than or	0 acres of harvest	4,000 acres of harvest		3,650 acres of harvest

Resource	Effect	Effect		Effect
equal to SIO ("4,584 acres of young-growth capacity")				
Acres of old-growth harvest compared to acres of gross unit pool with ESI greater than or equal to SIO ("22,603 acres of old-growth capacity")	0 acres of harvest	9,500 acres of harvest		8,075 acres of harvest
Acres of GUP that may change SIO as a result of the proposed 2016 Forest Plan amendment	0	12,084		12,084
Socioeconomics	**Alt 1**	**Alt 2**		**Alt 3**
Cash Income:				
Timber volume (old and young growth) in million board feet for the life of the project (15 years).	0 MMBF	230 MMBF		201 MMBF
Employment (annualized direct jobs supported for maximum Alaska manufacturing)	0 Jobs	582 Jobs		493 Jobs
Employment (annualized direct jobs supported for maximum Alaska manufacturing)	0 Jobs	542 Jobs		459 Jobs
Risk to freshwater salmon	No change	Reduce existing risks to salmon habitat - removal of salmon barriers on streams - Flood plain improvement Increase risk to salmon habitat - 712 new road crossings - 7 watersheds with increased likelihood of peak flow events.		Reduce existing risks to salmon habitat - removal of salmon barriers on streams - Flood plain improvement Increase risk to salmon habitat - 625 new road crossings - 5 watersheds with increased likelihood of peak flow events
Number of cabins accessible by road	No change	Up to 6 cabins		Up to 6 cabins
Acres of foreground and middleground views with high Scenic Integrity Objectives modified at popular tourist destinations and along high profile excursion routes on the Tongass with the project area.	No change	0 Acres of Foreground Views 304 Acres of Middleground Views Avg patch size between 2-12 acres.		0 Acres of Foreground Views 268 Acres of Middleground Views Avg patch size between 2-11 acres
Subsistence Income:				
Risk to freshwater salmon (existing)	No change	Existing risks to salmon habitat - Reduced through		Reduce existing risks to salmon habitat - removal of

Resource	Effect	Effect		Effect
		removal of salmon barriers on streams - Flood plain improvement Increase risk to salmon habitat - 712 new road crossings - 7 watersheds with increased risk of peak flow events.		salmon barriers on streams - Flood plain improvement Increase risk to salmon habitat - 624 new road crossings - 5 watersheds with increased risk of peak flow events.
Percent change in existing high-value deer winter habitat that communities in project area secured over 75 percent of deer harvest by area. Overall change described here.	0 percent	8.5 percent		2.1 percent
Aquatics[3, 4]	**Alt 1**	**Alt 2**		**Alt 3**
Watershed Name	Existing 30-year cumulative harvest (%)	30-year cumulative harvest (%)		30-year cumulative harvest (%)
Skanax Creek	3.4	42.0		37.2
Detectable peak flow increase (percent)	-	16%		15%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
Saint John Harbor	7.1	41.6		37.8
Detectable peak flow increase (percent)	-	16%		15%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	yes		yes
Baht Harbor-Frontal Sumner Strait	4.9	35.5		32.7
Detectable peak flow increase (percent)	-	13%		12%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	yes		yes
190102100702-Browns Creek	5.8	25.7		22.9
Detectable peak flow increase (percent)	-	11%		11%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
Falls Creek - PRD	1.7	23.0		21.8
Detectable peak flow increase (percent)	-	11%		11%

Resource	Effect	Effect		Effect
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
Frosty Creek	10.3	21.0		20.1
Detectable peak flow increase (percent)	-	11%		10%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
190102100101-Big Creek	2.0	20.9		19.6
Detectable peak flow increase (percent)	-	10%		10%
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
Chipp Peak -Frontal Frederick Sound	1.8	19.9		18.0
Detectable peak flow increase (percent)	-	10%		Not detectable
Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)	-	no		no
New Stream Crossings by stream class:	**Alt 1**	**Alt 2**		**Alt 3**
Class I – temporary road crossings	-	15		15
Class I – NFS road crossings	-	33		33
Class II – temporary road crossings	-	37		37
Class I – NFS road crossings	-	43		43
Class III – temporary road crossings	-	117		116
Class III – NFS road crossings	-	119		119
Class IV – temporary road crossings	-	178		177
Class IV – NFS road crossings	-	173		173
Total new temporary road crossings	-	347		345
Total new NFS road crossings	-	368		368
Soils	**Alt 1**	**Alt 2**		**Alt 3**
Detrimental soil conditions (acres)	0	1,019		897
Management-related landslides over a 20-year time period (acres)	4	7		5
Proposed old-growth and young-growth harvest on slopes over 72 percent gradient (acres)	0	366 old-growth 247 young-growth		233 old-growth 243 young-growth
Wetlands	**Alt 1**	**Alt 2**		**Alt 3**
Wetlands impacted by roads, trails, recreation sites, mines, and other developments (acres)	0	204		181

Resource	Effect	Effect		Effect
Wetlands impacted by timber harvest (acres)	0	1,968		1,811

[1] Botany: Units of measure are indicators used to make an effects determination on the viability of R10 sensitive plants or rare botanical resources suspected in the project area. The maximum potential disturbance footprint is based on acreage and/or miles impacted by proposed activities to make an effects determination. All effects determinations are "May Affect".
[2] Scenery: Units of Measure include 1) acres of gross unit pool with ESI greater or equal to SIO, compared to acres of harvest, for both young-growth and old-growth harvest and 2) acres of the gross unit pool that may change SIO as a result of the proposed 2016 Forest Plan amendment.
[3] Aquatics – Watershed: Estimates of 30 year cumulative harvest for all alternatives assume implementation in 2020 and that all proposed acres are harvested. Cumulative harvest estimates assume even-aged management prescriptions except within previously-harvested beach buffers and RMAs, which are adjusted to partial harvest treatment prescriptions defined by Forest Plan (see the *Forest Vegetation* section of this DEIS). Cumulative harvest estimates include Forest Service and non-Forest Service lands and, roads, and estimated acreage for recreation and restoration activities. Detectable peak flow increase values are estimated from Grant et al. 2008, "Figure 10. Peak flow response in the transient snow zone".
[4] Aquatics – Proposed New Stream Crossings: Number of proposed crossings is based entirely from a GIS exercise documenting where the proposed road locations cross currently known stream segments. The NFS road crossings includes proposed crossings for all proposed NFS road work including both new construction and reconstruction on an existing prism.

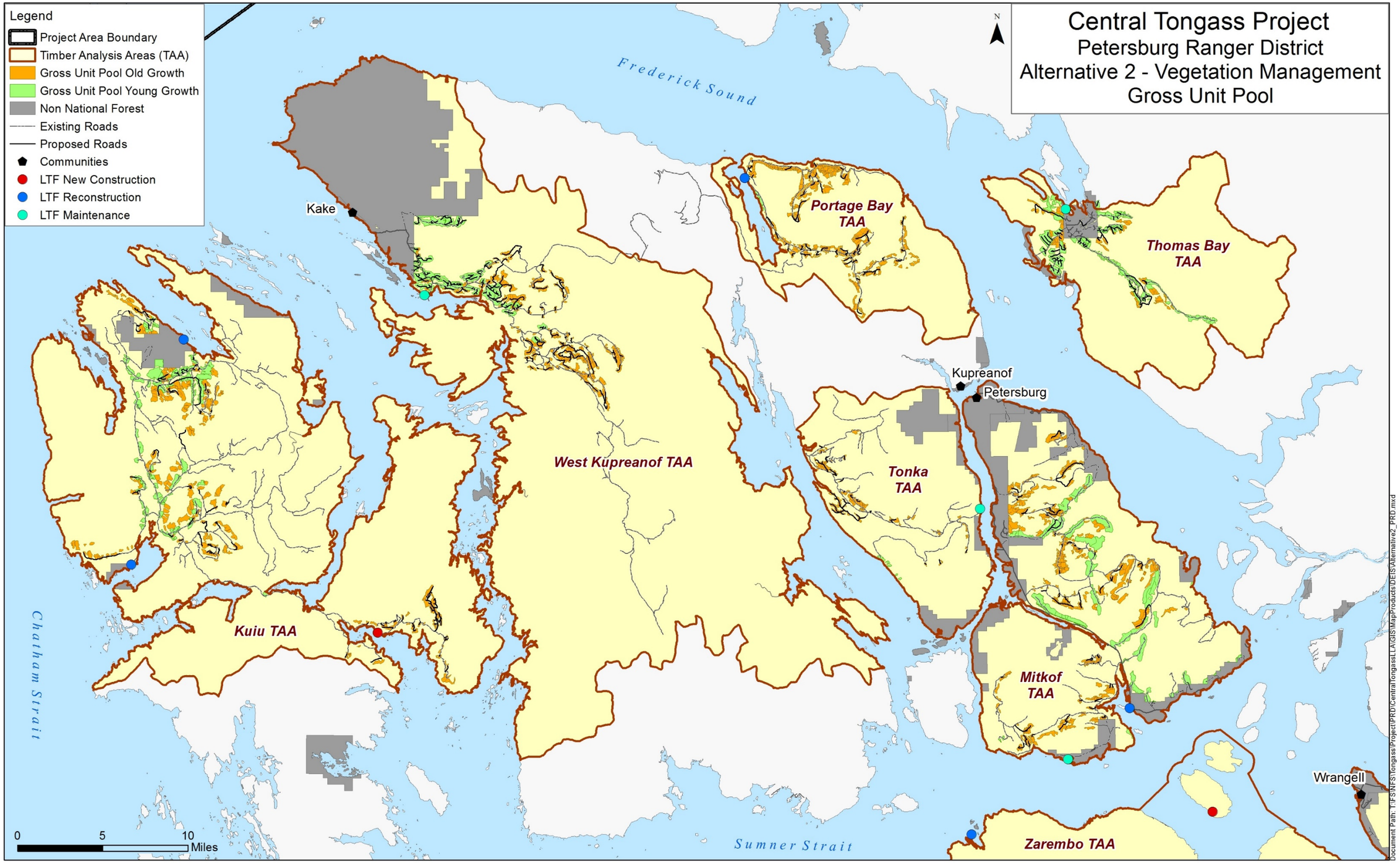

Figure 4. Alternative 2 – Vegetation Management Gross Unit Pool (Petersburg Ranger District)

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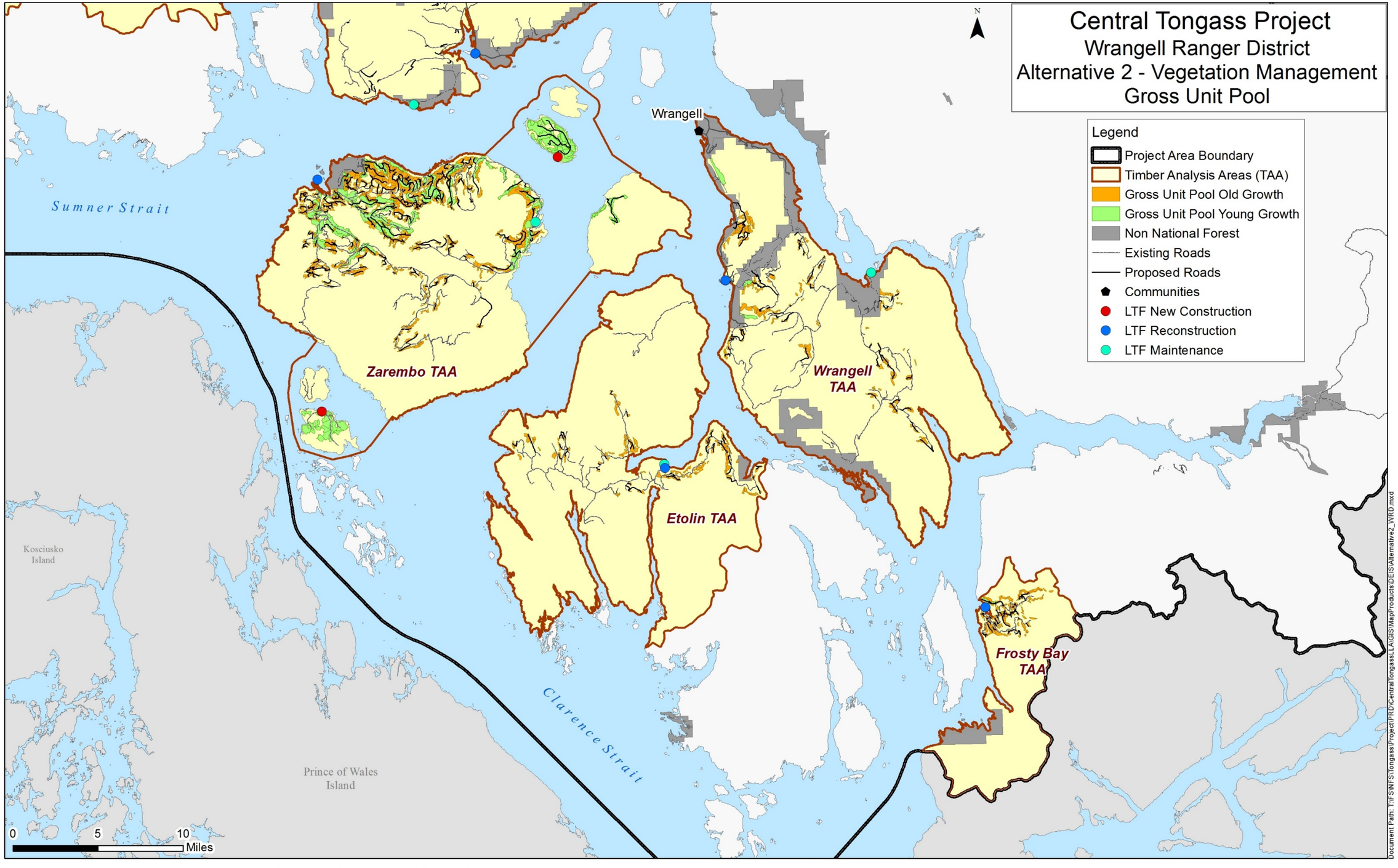

Figure 5. Alternative 2 – Vegetation Management Gross Unit Pool (Wrangell Ranger District)

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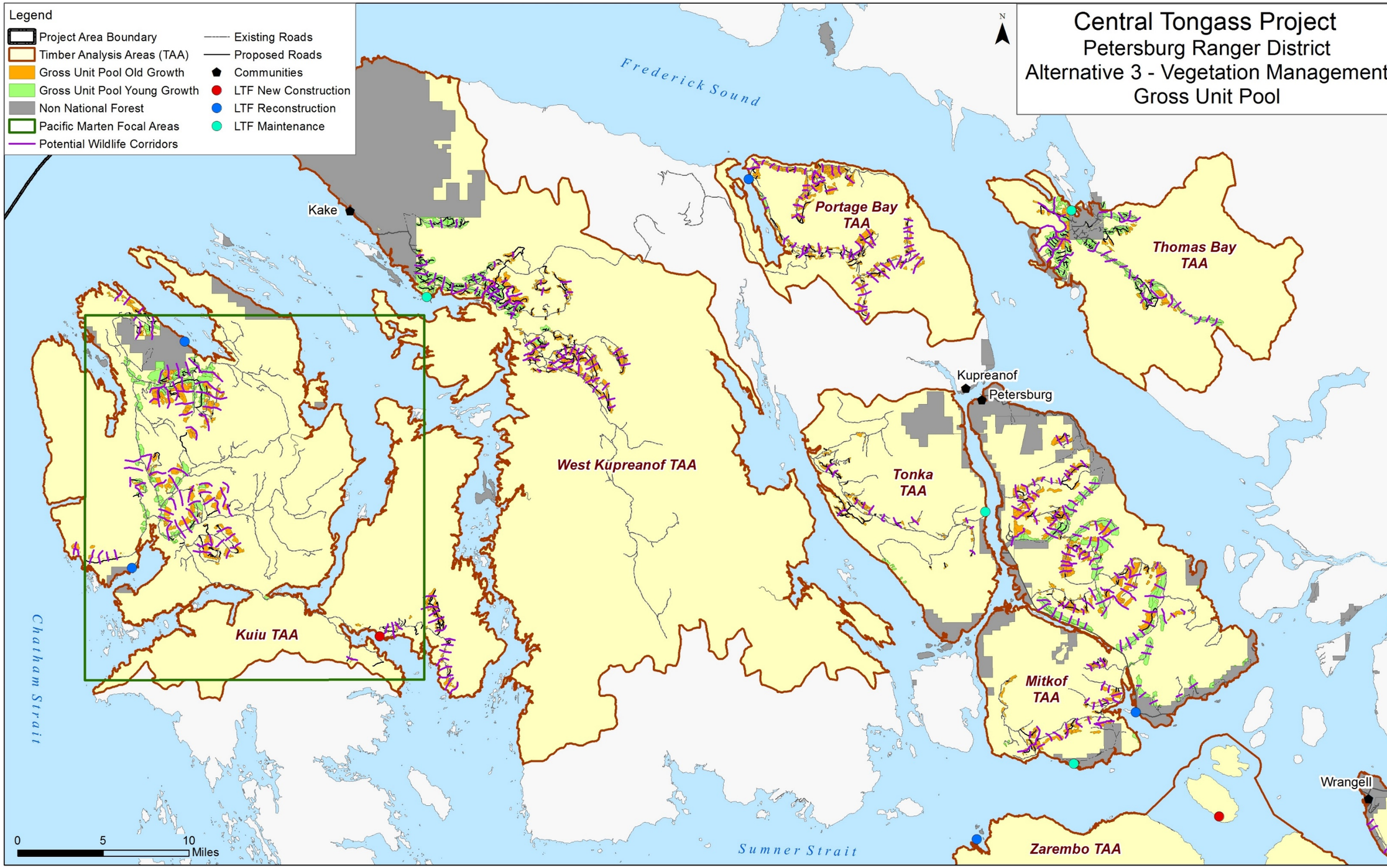

Figure 6. Alternative 3 – Vegetation Management Gross Unit Pool (Petersburg Ranger District)

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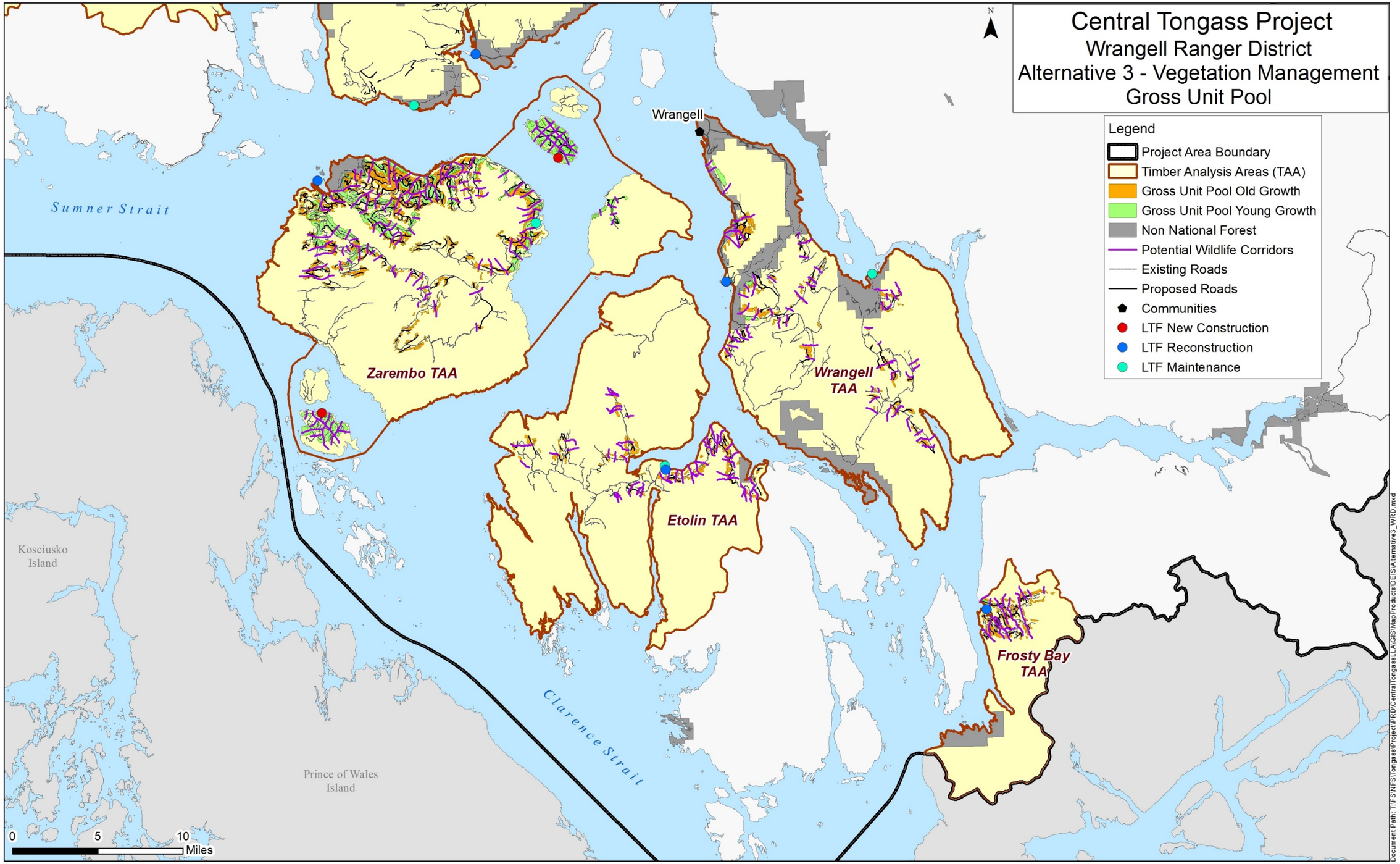

Figure 7. Alternative 3 – Vegetation Management Gross Unit Pool (Wrangell Ranger District)

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Chapter 3. Environment and Effects

Introduction

This chapter describes the affected environment within the project area and the environmental impacts of the alternatives. The 2016 Forest Plan FEIS provides background information and analyses not included here.

Geographic Information System Database and Quantification for this EIS

The Forest Service uses its computerized geographic information system (GIS) database to conduct spatial analysis of alternatives and effects, and to display resource information in map format. Much of the GIS data consist of map "layers," each representing a particular resource or attribute (such as forest type, soil type, or recreation places). These GIS data layers originated from aerial imagery interpretation and are updated from field inventories using standard data collection procedures. GIS layers allow the consistency of using the same base data for individual resource effects analysis. GIS data and product accuracy may vary.

This analysis used the best available information and included habitat variables such as vegetation, slope, and elevation. Potential habitat is based on the presence of habitat characteristics as described in available scientific literature, previous habitat surveys, recorded observations, and from other credible sources of natural biotic information. This project was analyzed and assessed with consideration of the best available science, 2016 Forest Plan components, research and life history literature, approved survey protocols, and professional judgment. The assumptions about the proposed treatments that were used to make the determination of effects for the resources are found in the individual resource sections below.

The baseline numbers used to describe the existing condition may depend on overlaying of multiple layers which may not always line up (for example, along property boundaries, saltwater shorelines, lake edges). This may produce variation in acreage estimates. These differences can amount to hundreds of acres or more, especially when the calculations are for a large project area. The slivers of area creating these discrepancies, on a percentage basis, are insignificant.

Numbers presented are generally rounded to the nearest whole acre, whole mile, or whole percent, except for road densities. No attempt has been made to adjust the numbers to force the sums of rounded numbers to equal the totals. Therefore, the sum of rounded individual numbers may be different than the expected sum, and all numbers calculated from GIS should be considered as approximate.

GIS data are always changing due to the input of on-going field surveys and inventories plus changes that occur naturally. GIS data generated for analysis represent the most-current information available for what is on the ground at the time the analysis is conducted.

Ecological and Administrative Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe resources and allow analysis of how they may be affected by 2016 Forest Plan and project-level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. The allocations of 2016 Forest Plan land use

designations (LUD), discussed in Chapter 1, are one such division. Other divisions important to describe the affected environment and perform analyses are described briefly here.

Biogeographic Province (BP)

A biogeographic province designation refers to 21 ecological subdivisions of Southeast Alaska that are identified by generally distinct ecological, physiogeographic, and biogeographic features (see map in the 2016 Forest Plan Amendment FEIS, p. 3-186). Four biogeographic provinces: 10, 11, 12, and 13 overlay the Central Tongass Project area, along with a small northernmost portion of a fifth province, 15, on the mainland in the southeastern portion of the project area (USDA Forest Service 2016c, p. 3-186).

Game Management Unit (GMU)

Game management units are geographical areas defined by the Alaska Department of Fish and Game (ADF&G) to manage wildlife populations. There are two GMUs in the project area. Game Management Unit 3 includes all the islands in the project area: Kuiu, Kupreanof, Mitkof, Zarembo, Etolin, and Wrangell Islands, as well as the smaller islands. Game Management Unit 1B includes the mainland portion of the project area.

2001 Roadless Area Conservation Rule Inventoried Roadless Areas (IRA)

Inventoried roadless areas are undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the *Wilderness Act* and were originally inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process (1979). Many of these areas have been modified since that review due to land transfer and development, road construction, and timber harvest that occurred before the 2001 Roadless Area Conservation Rule or while the Tongass National Forest was exempt from the 2001 Rule. The Forest Service Roadless Area Conservation, Final Environmental Impact Statement Volume 2 dated November 2000 contains maps that display the inventoried roadless areas analyzed for this project. The Central Tongass Project area includes 43 roadless areas.

Value Comparison Units (VCU)

Value comparison units are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The project area includes 147 VCUs.

Watershed

Activities for this project were analyzed at the 6th level Hydrologic Unit Code (HUC). HUCs are unique identifiers used in a standardized watershed classification system, the Watershed Boundary Dataset, developed by the USGS. Hydrologic units are watershed boundaries organized size and location, and can be viewed as the "address" of a particular watershed. Watersheds defined as HUCs are uniformly mapped for the entire United States. The project boundary contains 225 watersheds with at least a portion of their drainage areas within it.

Wildlife Analysis Areas (WAA)

Wildlife analysis areas are land divisions used by the ADF&G for wildlife analysis and regulating wildlife populations. The project area includes 40 WAAs. The wildlife and subsistence analyses uses information by WAA for estimating effects.

Invasive Plant Analysis – Incorporating by Reference

When incorporating by reference, other available documents are referenced that cover similar issues, effects and/or resources considered in the NEPA analysis at hand. The relevant portions of the referenced documents are cited and briefly summarized rather than repeating the analysis.

The Central Tongass Project incorporates by reference the analysis completed for the *Northern Tongass Integrated Weed Management EA*[7] draft, which was recently completed and released for public review. Both project areas are ecologically similar as are their treatment objectives and proposals. Incorporation by reference is consistent with the Council on Environmental Quality (CEQ) (40 CFR 1502.21) and Forest Service regulations that encourage reducing redundant analysis during the NEPA process.

The Central Tongass and Northern Tongass Integrated Weed Management projects are similar in that both propose the following: 1) no annual or long-term treatment limit, 2) the same suite of treatment methods analyzed (herbicide, manual and mechanical), 3) cover large overall project areas on both NFS (including wilderness) and non-NFS lands, 4) treatment of emergent vegetation, 5) the use of aminopyralid and the aquatic formulations of glyphosate and imazapyr[8] and 6) the Early Detection and Rapid Response (EDRR) management strategy.

Incomplete and Unavailable Information

There is incomplete knowledge about many of the relationships and conditions of wildlife, fish, forests, climate change, jobs, and communities. The ecology, inventory, and management of a large forest area is a complex and continually developing science. The biology of fish and wildlife species prompts questions about population dynamics and habitat relationships; and the interaction of resource supply, the economy, and communities is the subject of an inexact science. However, the basic data and central relationships are sufficiently well-established in the respective sciences for the Responsible Official to make a choice between the alternatives, and to adequately assess and disclose the possible adverse environmental effects.

Comprehensive stream, rare and sensitive plant, invasive plant, geology, soil, landslide, wetlands, wildlife and cultural surveys have not been conducted within the entirety of the project area, but are ongoing throughout the project planning process. In addition, as more resources or technology become available, they will also contribute to the process of gathering more information on the project area and continuing to refine existing condition information. For example, Tongass National Forest is anticipating extensive coverage of this project area in the near future from a type of remote sensing called LiDAR (Light Detection and Ranging), which will help inform decision making on the project. It is likely that additional streams, plant populations, karst features, unsuitable soils, landslides, wetlands, nests, dens and cultural sites may be found prior to implementation in currently un-surveyed areas, though knowledge of these additional occurrences is not essential for a choice among alternatives. Any newly discovered sites would receive the appropriate protections under the 2016 Forest Plan and relevant laws or regulations. Additional field surveys prior to implementing activities may be required as described in Appendix A - Implementation Plan and Activity Guides.

Information on past, present, and foreseeable projects on non-NFS lands is not always complete and readily available. Available information was used, or assumptions documented, to support

[7] https://www.fs.usda.gov/nfs/11558/www/nepa/104874_FSPLT3_4641842.pdf
[8] The Northern Tongass Integrated Weed Management project includes one additional herbicide - Metsulfuron methyl.

sufficient direct, indirect, and cumulative effects analysis. See Appendix C and supporting materials in the project record.

Analyzing Effects

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the *National Environmental Policy Act* (NEPA) include the following specific categories for the analysis of environmental consequences.

Direct, Indirect, and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable actions, regardless of what agency or person undertakes such actions.

In the Environmental Effects sections, the direct and indirect effects are presented first, followed by cumulative effects. For all resources private lands and other public lands outside the jurisdiction of the Forest Service (such as tribal and state land and private property) are included in the direct and indirect effects analysis because some activities may extend into other land ownerships for continuity and integration of planning and implementation. Any such project must be supported and authorized by the other landowners, usually through formal agreements. For evaluating cumulative effects, the interdisciplinary team (IDT) considered all lands in the project area. For some resources, an expanded boundary was evaluated. The direct, indirect, and cumulative analysis area for each resource is described in the appropriate section later in this chapter.

Past, Present, and Reasonably Foreseeable Projects

Past Projects

Past projects considered in cumulative effects analysis generally are physically located on the landscape, such as roads. The past projects combined with the natural environment, represent the affected environment described for each resource in this chapter. These projects include timber harvest, thinning of harvested stands, recreation developments, road construction and log transfer and marine access facility construction; stream restoration and enhancement, and road construction.

To understand the contribution of past actions to the cumulative effects of alternatives, this analysis assumes that current environmental conditions are a result of effects from past actions. This is because existing conditions reflect the aggregate effect of all preceding human actions and natural events that have affected the environment and might contribute to cumulative effects. Therefore, cumulative effects discussions contained in the Central Tongass Project do not attempt to quantify the effects of past actions by adding up all previous actions on an action-by-action basis. The reasons for not taking this approach are as follows:

Present and Reasonably Foreseeable Projects

Present and reasonably foreseeable projects are cataloged in the *Catalog of Present and Reasonably Foreseeable Activities* tables (Appendix C). Present actions considered are within or

adjacent to the project area and include Forest Service projects, special use authorizations, and other agency activities. These are actions that are either already occurring or scheduled to begin in 2019, as shown in Tables 1 through 3 of Appendix C.

Reasonably foreseeable projects are those with either a developed proposed action or a GIS layer or map displaying a spatial location. These are various multi-year actions with a timeframe of "2019 and beyond" or "ongoing" and including Forest Service projects, tourism, special use authorizations, pre-commercial thinning, stream restoration, partnerships, and actions by other agencies, as shown in Tables 4 through 6 of Appendix C.

Unavoidable Adverse Effects

Implementation of any action alternative could cause adverse environmental effects that cannot be effectively mitigated. Unavoidable adverse effects often result from managing the land for multiple resources. The activity guides included in Appendix A describe proposed activities; the interdisciplinary process used for making these guides incorporated design criteria that could eliminate or lessen adverse effects. The application of 2016 Forest Plan direction, best management practices (BMP), and activity-specific design features are all intended to limit the extent, severity, and duration of potential effects. Alternatives and their actions are designed to reduce or avoid adverse environmental effects; however, some adverse impacts to the environment that cannot be completely mitigated could occur. This chapter discloses these effects in the issues discussions and resource sections.

Short-term Use and Long-term Productivity

Short-term uses and their effects are those that occur annually or within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the *Multiple-Use Sustained Yield Act* and the *National Forest Management Act*, all renewable resources are to be managed so they are available for future generations. By meeting 2016 Forest Plan direction, this project meets the requirements of the *Multiple-Use Sustained-Yield Act* and the *National Forest Management Act*.

Irreversible and Irretrievable Commitments of Resources

Irreversible Commitments is a term that describes the loss of future options. It applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors such as soil productivity, that are renewable only over long periods of time (USDA Forest Service 2016, p. 7-27).

Loss of soil due to erosion and mass failures is an irreversible commitment of resources. The loss of soil resources would be minimized to the extent feasible for all activities by following Region 10 Soil Quality Standards, incorporating BMPs and applying design features specified in this document.

Road construction is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. The development or expansion of rock quarries for roadbuilding or other uses is also an irreversible commitment. See also the Transportation section in this chapter.

Soils and wetlands displaced by road construction activities are irreversible commitments of project resources, due to the long-term loss of soil productivity. It is irreversible because the soils and wetland resources have deteriorated to the point that renewal can occur only over a long

period of time or at a great expense, or because the wetland soils have been destroyed or removed. In road construction, wetland soils are either scraped away or are buried beneath road fill, greatly limiting their pre-disturbance productivity. See also the Soils section and the Wetlands section in this chapter.

Loss of heritage resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. 2016 Forest Plan Standards and Guidelines, surveys prior to activities, and design features specified in this document provide reasonable assurance that no irreversible loss of heritage resources would occur. See also the *Cultural Resources* section in this chapter.

Irretrievable Commitments applies to the loss of production, harvest, or use of natural resources. These decisions are reversible, but the production opportunities foregone are irretrievable (see USDA Forest Service 2016a, p. 7-27). Old-growth forest structure converted to even-aged forest structure by timber harvest can be considered an irretrievable commitment of the old-growth structure, especially if the land is continually managed for timber production. It is not expected that old-growth characteristics would naturally reoccur within harvest areas for 150 years or more; however, old-growth forest structure would eventually return to the landscape. Foregoing timber harvest opportunities in certain areas at this time, due to resource concerns or economics, may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible because future entries could harvest those areas if they are still classified as part of the suitable timber base.

The reduction in the visual quality of an area due to timber harvesting would be an irretrievable commitment of resources. The commitment is irretrievable because viewsheds will typically heal from a visual quality standpoint after about 40 years. Young-growth trees will have the color and height needed to be unnoticeable to the casual observer after this time.

Resources Not Discussed in Detail

Resources likely to remain unaffected by this project, or those that do not have measureable effects are discussed briefly here.

Air Quality and Climate Change

The affected environments for Climate, Climate Change and Air Quality are described in detail in the 2016 Forest Plan Amendment FEIS (pp. 3-11 to 3-19).

Air quality and climate change are related issues that are often separated in politics and research. Both issues are addressed for the Tongass National Forest in the 2016 Forest Plan (USDA Forest Service 2016c). This section describes climatic change and air quality specifically for the Central Tongass Project. The spatial scale for this project is the project area, for which the conditions are considered similar to the Tongass National Forest. How carbon storage, carbon sequestration, timber harvest, vegetative regrowth and carbon emissions interact over time is very complex, making it unrealistic to define a temporal scope of analysis.

Affected Environment

Air Quality

Air quality in the project area is regarded as generally very good. Considering the prevailing winds off of the Pacific Ocean, the small size of the human population in the project area, the low levels of industrial development, and the lack of large-scale wildland fire smoke emissions,

there are not many long-term or large-scale air pollutant sources in the project area. However, temporary localized air pollution does occur in the form of marine vessel emissions, vehicle and diesel power emissions, wood smoke, incinerators or refuse burning, and dust from vehicle traffic on unpaved roads.

To determine if national and state ambient air quality standards are being met, an annual review of Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) reports are conducted at the Forest level. Currently there are no non-attainment areas[9] in the project area. Air quality is monitored in the four wildernesses in the project area. Lichens are monitored as sensitive indicators of air quality every 10 years for 26 air pollutants including sulfur, nitrogen and heavy metals (K. Dillman 2016a).

Climate Change

Climate is important to local ecosystems as well as human health and infrastructure, since temperature, precipitation, wind speed, and metrological events (for example, timing of the first and last frosts, or severe storms causing flooding) all influence the distribution of water, soil, plants, and wildlife across the project area. Significant, lasting change to existing and historical weather patterns is commonly called "climate change". Impacts of climate change include increases in prolonged periods of high temperatures, heavier precipitation, increases in wildfire frequency and size, increase in severity of drought, ocean rise, and ocean acidification. The term "greenhouse gases" (GHG) refers to a variety of gases in the Earth's atmosphere that react with sunlight in a way that influences global air temperature. GHGs are a function of air quality and include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EO 13514).

Long-term climate trends and decadal climate cycles have always occurred in Southeast Alaska (Neal et al. 2002). There is a growing body of literature on the topic of climate change and the likely effects on aquatic and terrestrial ecosystems of the Tongass National Forest (see the 2016 Forest Plan FEIS for detailed discussion). Melting glaciers and shifts from snow-dominated to more rain-dominated hydrology will impact terrestrial and aquatic resources in both adverse and beneficial ways (Littell, McAffee and Hayward 2018; Schoen et al. 2017).

Climate change is also discussed briefly in the Issue 2: Wildlife Habitat, Aquatics, Botany, Forest Vegetation, Invasive Plants, Socioeconomics and Soils sections of this DEIS.

Carbon Sequestration

Atmospheric carbon, as well as other gases (for example, methane, nitrous oxide, and water molecules) trap the sun's heat to create the natural "greenhouse effect" which makes life possible on Earth (McPherson and Simpson 1999). The balance of carbon dioxide in the atmosphere is regulated by complex interactions between the atmosphere, terrestrial environment, marine environment, and geologic processes. Forest ecosystems, such as those managed on the Tongass National Forest, represent a large terrestrial sink for carbon, such that the United Nations Framework Convention on Climate Change has recognized forest management as an effective strategy for off-setting GHG emissions (Wilson et al. 2013). A widely recognized ecosystem service provided by the Tongass is carbon flux regulation.

[9] In United States environmental law, a non-attainment area is an area considered to have air quality worse than the National Ambient Air Quality Standards as defined in the Clean Air Act Amendments of 1970 (P.L. 91-604, Sec. 109).

The relationship between timber harvests, reforestation, wood building materials, and the net storage of carbon is complicated. For example: carbon is stored in building materials, but the storage value does not last as long as a living old-growth tree, as carbon stored in buildings generally outlives its usefulness or is replaced within decades (Law et al. 2018). When considering land management practices that mitigate the loss of carbon, reforestation contributes the most to carbon sequestered, followed by reduced timber harvest practices (Law et al. 2018). For more details on carbon sequestration see the 2016 Forest Plan FEIS (USDA Forest Service 2016c, pp. 3-13 to 16).

Environmental Effects

Analysis of the effects of climate and air resources was qualitatively evaluated by comparing differences in the amount of old- and young-growth timber harvest as well as road building activities between alternatives. A qualitative discussion of air pollution sources, GHG emissions, and carbon sequestration was taken for disclosing air pollution and climate change implications. This qualitative discussion includes an evaluation of how climate change may modify conditions in the project area and how the proposed actions may influence levels of GHG and therefore, climate change. Although most Forest Service projects are considered very small in terms of global carbon flux, this qualitative comparison of alternatives provides insight into how proposed actions for each alternative could impact the carbon flux.

Air Quality

Both of the action alternatives considered for the Central Tongass Project DEIS would involve harvesting of wood products over a period of time, as described in Chapter 2. For the Central Tongass Project, the action Alternatives 2 and 3, as well as the no action Alternative 1, all result in a net release of air pollution into the atmosphere through varying amounts of road maintenance and construction, timber harvest, use of vehicles of all kinds, recreation development and use, and other land management actions. Some proposed activities involve removing vegetation, grading and contouring the ground, hardening roads, extraction of materials such as gravel, soil, rock, and minerals, and constructing bridges, all of which require fuel-burning construction machinery and an increase in construction related vehicle traffic for the next 15-year period. All these construction activities would increase GHG and other fossil fuel combustion emissions, airborne dust, and particulate matter from wood burning.

The expected direct effects on air quality from forest management and other activities would be minimal (temporary and limited in location). Effects may be dust and vehicular emissions as described above from logging operations, administrative, and recreational use of Forest roads. However, due to the short-lived nature of these activities coupled with the dynamic weather patterns throughout Southeast Alaska continually circulating airsheds within the project area (wind and rain throughout the year), no significant adverse effects on air quality are anticipated from these activities under any of the alternatives considered.

Indirect effects on air quality conditions could result from the use of the harvested trees for operating industrial processing sites, firewood burning, as well as emissions and dust from the private vehicles using unpaved roads. These indirect effects can be aesthetically displeasing, or have potential health risks to both humans and sensitive ecosystems of the Forest. The periodic monitoring of lichens in sensitive ecosystems in Wilderness help determine if non-Wilderness pollution emissions are impacting wilderness air quality. Additionally the EPA and the ADEC have regulatory responsibility under the *Clean Air Act* to manage emissions from permanent point sources. The enforcement of the applicable regulations by these agencies is anticipated to keep any potential adverse effects within the standards for air quality; therefore, no significant

indirect effects are expected to occur in either Central Tongass Project action alternative from activities such as timber harvesting.

Climate Change

Both of the action alternatives involve old-growth and young-growth timber harvest along with road construction which would result in a net release of GHG and other pollutants into the atmosphere through varying amounts of road construction, timber harvest, use of administrative vehicles of all kinds, mining, recreation development and use, and other land management actions. Some proposed activities involve removing vegetation, grading and contouring the ground, hardening roads, extraction of materials such as gravel, soil, and rock, and the construction of bridges, all of which require fossil fuel-burning machinery and an increase in construction vehicle traffic for the next 15-year period. All these construction activities would increase GHG and other fossil fuel combustion emissions.

Effects of timber harvest and roads in Alternatives 2 and 3 combined with effects of climate change could exacerbate adverse effects of peak streamflow increases on aquatic resources.

Restoration actions in Alternatives 2 and 3 that improve watershed condition also increase resiliency to climate change effects by restoring stream, floodplain, and riparian function and reducing aquatic habitat fragmentation. Under Alternative 1, restoration actions would continue as authorized through past NEPA decisions, and into the future at a slower pace through individual project NEPA decisions.

Roadless Area Conservation Rule Inventoried Roadless Areas

The USDA's Roadless Area Conservation Rule (2001 Roadless Rule) identified undeveloped areas, typically exceeding 5,000 acres, which met the minimum criteria for wilderness consideration under the *Wilderness Act* and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or forest planning.

The 2001 Roadless Rule establishes prohibitions on road construction, road reconstruction, and timber harvesting on 58.5 million acres of inventoried roadless areas on NFS lands. The intent of the 2001 Roadless Rule is to provide lasting protection for inventoried roadless areas within the NFS in the context of multiple-use management.

The Tongass completed a Supplemental Environmental Impact Statement (2003) for the 1997 Forest Plan revision to consider whether inventoried roadless areas (IRA) should be recommended for Wilderness designation. The assessment looked at potential impacts to the unique or outstanding biological, physical, or social values of the IRAs. Some of the IRAs identified on the November 2001 map have been modified pursuant to the enactment of multiple pieces of legislation in recent years. Several land adjustments have also occurred changing the land ownership patterns and the IRAs.

The Tongass National Forest, and therefore the Central Tongass Project, currently recognizes the IRAs identified in a set of maps associated with the USDA Roadless Area Conservation Rule, Final EIS, Volume 2, dated November 2000. These maps identify 43 IRAs within the project area.

None of the alternatives propose old-growth or young-growth harvest, new roads, or road construction or reconstruction within IRAs. No direct impacts to IRAs are expected from timber harvest or road construction for any of the alternatives.

There are recreation activities, such as winter trail designations, that could occur in, or near, inventoried roadless areas. The activities would be limited and largely adjacent to existing road systems, and would allow travel into the IRAs by foot, skis, snowshoes, snowmobiles, or other off-highway vehicles. These impacts would be limited because no roads or timber harvest are planned for these areas. The 2001 Roadless Rule recognizes this type of "dispersed recreation opportunities such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing," and does not prohibit these activities.

The action alternatives include dispersed recreation activities, three-sided shelters and beach access, which could occur in IRAs and are not prohibited under the 2001 Roadless Rule. This dispersed recreation is limited to small beach accessible areas on the edges of the IRAs. These activities fall within the Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation activities discussed in the Roadless Rule.

Watershed improvement activities which may include some timber harvest are also included in the action alternatives. The 2001 Roadless Rule provides for ecosystem health, including wildlife and fisheries habitat improvement, and includes an exception to the prohibition on timber harvest if it is designed to maintain or help restore ecosystem composition or structure to conditions within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period. This will allow the agency to manage for the full range of habitat types needed to support the diversity of native and desired nonnative species (Federal Register /Vol. 66, No. 9 / Friday, January 12, 2001 /Rules and Regulations page 3257).

None of the indirect or incremental cumulative effects associated with the alternatives should adversely affect the values of the IRAs within the project area. None of the alternatives would change how the IRAs meet the minimum criteria for Wilderness consideration.

Land Status

Land ownership within the Tongass National Forest is complex, and land ownership has been shaped by multiple public land laws including the *Alaska Native Claims Settlement Act* (ANCSA), ANILCA, *Alaska Native Allotment Act*, *Alaska Statehood Act*, and the *National Defense Authorization Act for Fiscal Year 2015* (*Sealaska Finalization Act*). Within the project area, cultural and historic site selection applications remain to be adjudicated by the Bureau of Land Management under the *Sealaska Finalization Act*. Over the past few years, multiple pieces of legislation have been introduced that, if enacted, may result in additional transfer of lands out of federal ownership in the project area.

The federal land within the project area is administered as National Forest System (NFS) land as part of the Tongass National Forest. In addition to the NFS lands in the project area, approximately 134,436 non-NFS acres are owned by a variety of landowners, including the State of Alaska, Alaska Native Village Corporations and Regional Corporations, local communities, and private landowners.

None of the action alternatives propose to acquire or dispose of any property, therefore, there would be no effect on the surface or subsurface lands, which includes minerals.

Property boundaries may need to be surveyed if an activity is proposed within one-quarter mile of non-NFS lands. This would be accomplished prior to implementation.

On May 5, 2017, the *Consolidated Appropriations Act*, 2017, Public Law 115-31, Div. G, Section 431(a)(2) (*Alaska Mental Health Trust Land Exchange Act of 2017* or "the Act") was enacted and authorized an equal value land exchange between the Alaska Mental Health Trust Authority (AMHTA) and the Forest Service. Since this law has been passed, but the final transfer of lands has not been completed, the Forest Service must determine if this project has any direct, indirect, or cumulative effects that may affect the equal value of the land exchange. The land exchange is comprised of about 18,000 acres of AMHTA land and 21,000 federal acres across nine areas in Southeast Alaska (including the project area.) The Act established a framework to facilitate and expedite the land exchange over a 2-year period in two separate phases. Phase I of the land exchange was completed and closed in January of 2019 for lands outside the project area. Phase 2 of the land exchange includes the remaining approximate 18,600 acres of NFS lands in exchange for 15,500 acres of AMHTA land adjacent to communities across the Tongass National Forest.

Within the project area, the non-federal, AMHTA-owned lands to be exchanged to the Forest Service total approximately 4,942 acres in Petersburg and Wrangell. In Petersburg, the acreage is 3,871 acres, of which 42 acres is under a designated administrative site as denoted in the Act. In Wrangell, the acreage is 1,071 acres. As part of the Tongass National Forest, the lands will be managed consistent with the 2016 Forest Plan and managed pursuant to the provisions in the Act including being managed to preserve the undeveloped natural character, wildlife, watershed and scenic values of these lands and provide for recreational opportunities.

Since this land exchange is not final, it is considered a "present" activity in Table 3 of Appendix C – Catalog of Events. However, all alternatives were designed as if the land exchange was final and proposed activities within these lands were limited to stream restoration, fish habitat improvement, and invasive plant management activities only through an agreement with AMHTA. None of the direct, indirect, or cumulative effects associated with the alternatives would affect the value of the land exchange and no alternative would interfere with the land exchange. For these reasons, no effects to the land exchange between AMHTA and the Forest Service are expected and no further analysis is necessary.

The cumulative effects analysis on the effect that the land exchange may have on the individual resources are below in their respective sections.

Wild, Scenic, and Recreational Rivers

The 1997 Tongass Land and Resource Management Plan recommended certain segments of rivers in the project area to Congress for inclusion in the National Wild and Scenic Rivers System. The recommended rivers and associated mileage are listed in Appendix J of the 2016 Forest Plan. Within the project area, the recommended designations include 70.5 miles of wild, 46.5 miles of scenic, and 53 miles of recreational rivers. The 2016 Forest Plan describes desired conditions for wild, scenic, and recreational rivers and management prescriptions to achieve 2016 Forest Plan goals and objectives (USDA Forest Service 2016a, pp. 3-76 to 3-96) to ensure free-flowing condition, water quality, river classifications, and outstandingly remarkable values will be maintained until Congress makes a decision about these rivers. No appreciable effect is expected with the implementation of this project that would cause these river segments to deviate from the desired condition or preclude them from eventual inclusion by Congress in the National Wild and Scenic Rivers System. Recreation and tourism use and activities will continue to be

managed consistent with the *Wild and Scenic Rivers Act* and the *Alaska National Interest Lands Conservation Act of 1980* (ANILCA). For these reasons, effects to river segments managed under the wild, scenic, or recreational river classifications are expected to be negligible and no further analysis is necessary.

Environment and Effects by Significant Issue

The Council on Environmental Quality (CEQ) issues guidance to federal agencies to determine the significant issues concerning any proposal and to eliminate those issues that are not significant or that are outside the scope of this document. With the help of the public and other agencies, the Forest Service has identified two issues (see Chapter 1) to examine in detail for the proposed project. The following sections describe the environmental effects of each alternative by issue. Where appropriate, effects to other resources are discussed in this chapter as well (see section Environment and Effects for Other Resources).

Issue 1: Timber Supply and Economics

Issue statement: Timber supply and the economics of future Central Tongass Project timber sales may affect the extent forest product operators contribute to the local and regional economy.

Background: Salability and volume of future timber sales from the project area would directly impact the potential for timber operators to contribute more fully to employment and revenues locally and regionally.

The Central Tongass Project proposes commercial old-growth and young-growth timber volume to be made available for future harvest to result in a supply of timber to purchasers for the next 15 years. The amount of timber volume made available for old growth and young-growth varies by alternative, giving a range of volume that would be available for commercial timber offerings.

Management objectives identified by the interdisciplinary team (IDT) include:

- Provide a predictable level of forest products for the next 15 years that supports a variety of mill sizes and operators, including small and micro sales, consistent with the 2016 Forest Plan.
- Provide an estimate of the cost of timber harvest in various areas of the project area.
- Meet the 2016 Forest Plan direction for other resources, including soils, watershed and aquatics, wildlife habitat, sensitive plants and scenery characteristics.

Further detailed reconnaissance, logging plan development, and an appraisal would be completed prior to offering timber for bid during the implementation phase of this project.

Units of Measure

Measures used to compare the amount of timber supply and direct employment from potential timber harvest by alternative:

- Timber volume (old growth and young growth) in million board feet (MMBF) for life of the project (15 years);
- Cost of harvest, including camp and transportation cost per thousand board feet (MBF) by timber analysis area;
- Number of annualized direct jobs supported for both domestic processing and Region 10 limited export policy for old growth and 100 percent export for young growth (15 years).

Methodology

Spatial and Temporal Context for Analysis

The spatial boundary for the direct and indirect effects analysis for timber supply and economics is the timber analysis areas (TAA). To allow for more site-specific analysis, the project area was subdivided into ten TAAs. These analysis areas have developed road systems and encompass the majority of the suitable lands for timber harvest, as defined under the 2016 Forest Plan. These TAAs collectively encompass all proposed timber harvest for the Central Tongass Project. Timber analysis areas for the project area are shown on the alternative maps at the end of Chapter 2.

The spatial boundary for analyzing the cumulative effects to timber supply includes all forested lands within the project area since the timber demand analysis for the 2016 Forest Plan included timber from lands other than National Forest System (NFS) lands.

The temporal boundary for direct, indirect, and cumulative effects is 15 years to align with the timeline of the project.

Suitability and Gross Unit Pool Development

The suitability for timber production from Tongass National Forest lands is determined at the Forest Plan level using a two-step process described in the 2016 Forest Plan, Appendix A. This process considers legal and technical factors and the compatibility of timber production. Following this process, a Logging System and Transportation Analysis (LSTA) plan was developed for all lands estimated to be suitable for timber production. With the LSTA as a general starting point, suitable lands for both old growth and young growth and their associated road systems were further refined for each TAA into what is referred to as the “gross unit pool”. This process includes information and local knowledge from past planning efforts, the Forest GIS library, aerial photos, the Forest Service Activity Tracking System database (FACTS) and young-growth inventories. No alternative would harvest all potential stands identified within the gross unit pool. Only the acreage needed to meet the harvest level for the Selected Alternative would be harvested. Not all roads associated with the gross unit pool would be constructed, only those needed to harvest the selected stands. See Chapter 2 for harvest levels by alternative. Timber volume and costs were analyzed and estimated using the gross unit pool for each TAA. While all TAAs have stands associated with the gross unit pool and are analyzed for timber harvest, not all TAAs may provide for offerings of forest products over the next 15 years if sales appraise negative as timber markets can fluctuate. For example, on Mitkof Island there has been a reduction of around 75 percent from the mapped old-growth which defined the gross unit pool for Alternative 2 to the potential harvest units as identified through recent field surveys. For Alternative 3, there would be an estimated additional reduction of around 10 percent for the elevational corridors and deferral of high-volume, low-elevation old-growth on Mitkof Island. In addition, of the 24,335 acres of young growth in the gross unit pool, only 4,000 acres or approximately 16 percent are estimated to be associated with stands that are considered near-term operable and suitable based on the 2016 Forest Service Standards and Guidelines and could be harvested in the next 15 years. Near-term operable young-growth stands represent those stands expected to be of sufficient tree size and volume during the project timeline to be commercially harvested.

Inventory

Young-growth inventory data in stands 40 years in age or older have been collected through two different inventories in the project area over the past several years. A portion of the stands considered for commercial harvest or potentially "near-term operable" which equates to roughly 55 years and older, were inventoried under the Challenge Cost Share Agreement with a plot intensity of one plot for every 2.5 acres. A sample of younger stands roughly 40-54 years old were inventoried under the Common Stand Exam protocol with a plot intensity of one plot for every 5 acres. This young-growth data is incorporated into the Forest Planning and Projection System database (FPS). The FPS program allows data from inventoried stands to be extrapolated into non-inventoried stands with similar species composition, stocking levels and volume classes. FPS also allows stands to be "grown forward" using a Tongass calibrated growth and yield model. Future inventory efforts are expected to improve yield estimates during the life of the project. This information may help predict near-term harvest opportunities later on in the life of this project, from within the project's gross unit pool. For more information see the Young Growth Inventory Portal at: https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=e748ce92139c4100a65ad8b12510d620#.

Information on the vegetation in old-growth stands has been collected in the project area from the 1980s to 2016 through the Common Stand Exam protocol. Areas that do not have plot data use data from, walk-through assessments, Tongass National Forest GIS library, aerial photos, and extrapolation of plot data collected within the related Timber Analysis Area.

Until the actual units for a timber sale offering are defined, located, and field-reviewed, reductions in acreage and volume cannot be accurately quantified. As described in the Implementation Plan (Appendix A), further refinement of the gross unit pool would be made and a logging plan developed at the time a commercial timber offer is planned. A logging plan includes all units (selected from the gross unit pool), proposed and existing roads, silviculture prescriptions that meet 2016 Forest Plan direction and all design features described in the Implementation Plan.

Affected Environment

Central Tongass Project and the Tongass Timber Program

The Tongass uses a 5-year timber sale plan for planning and scheduling purposes, which is consistent with direction in Forest Service Manual 2430. This 5-year plan is based on completed and ongoing environmental analyses, and provides a plan that can be adjusted in response to changing market conditions and the NEPA public involvement process. Volume on outyear timber sales are estimates and may be adjusted considerably over time. The Tongass National Forest posts the 5-year plan on the public website at: https://www.fs.usda.gov/tongass/.

The project area, which includes the Petersburg and Wrangell Ranger Districts, offers many reasons for proposing potential timber harvest within the project area at this time. Some of these include: the project area's existing road systems, which could be used to access timber stands; existing log transfer facilities, which could be used to transport timber to the mill or export facility; and other timber harvest infrastructure. The project area has also proven practical for transporting logs to the remaining medium-sized mill in Southeast Alaska, outside the project area, which could process larger timber sales. Additionally, there are at least six smaller operators and mills within the project area.

Annual Market Demand

The annual market demand forecast is based on a methodology used to set the short-term goals for the Tongass Timber Program and the volume the Tongass National Forest plans to offer in the current year, pending sufficient funding and sufficient NEPA-cleared volume. The planning cycle demand for the 2016 Forest Plan analysis has already been determined for 2015 to 2030 (Daniels 2016).

The formulas and procedures used in forecasting annual market demand are described in a Forest Service report titled *Responding to the Market Demand for Tongass Timber* (Morse 2000) and updated with Grewe (2017). These procedures, which are known as the "Morse Methodology," are based on the premise that:

- Forest product markets are volatile, especially in the short-term.
- Timber purchasers in Southeast Alaska have few alternative suppliers of timber if they cannot obtain it from the Tongass National Forest. Oversupplying this market has relatively few adverse economic effects; undersupplying it can have much greater negative economic consequences.
- It takes years to prepare NFS timber for sale, including completion of environmental impact statements.
- It is difficult to estimate demand for timber from the Tongass National Forest, even a year or two in advance.
- Industry must be able to respond to rapidly changing market conditions to remain competitive.

For fiscal year 2019, the annual demand for timber volume on the Tongass to be offered is 52 MMBF. This volume does not represent actual timber purchases. Rather, it reflects the estimated volume of timber the Forest Service needs to offer to replace the expected harvest volume and to help build a 3-year supply of timber under contract. This allows the industry to respond to market fluctuations. However, the actual volume of timber offered in any given year reflects a combination of factors including final budget appropriations, completing the NEPA process, the statutory requirement that timber sales offered in the Alaska Region appraise positive, and volume affected by litigation. Due to these factors, the actual amount of timber offered and sold may be substantially less than the predicted timber purchases in the annual demand calculations. Daniels (2019) displays the most recent annual demand calculation and the factors used in these calculations. Notably, the planned annual timber volume offer could include a combination of new, previously offered, and reconfigured timber sales. Both old- and young-growth green timber and salvage sales are components of this program.

Timber Supply

The estimated timber supply planned from the project area tiers to outputs from the 2016 Forest Plan Amendment FEIS. The 2016 Forest Plan estimates approximately 150 MMBF of old-growth timber and 80 MMBF of young-growth timber harvest during the first 15 years, from lands suitable for timber production within the Petersburg and Wrangell Ranger Districts (see project record). During the development and analysis of project alternatives, every reasonable effort is made to make the best estimate of potential economic timber sale harvest volume and acreage. This includes evaluating past projects and utilizing that knowledge to refine future estimates. During project planning and as the project moves into implementation, harvest areas continue to be refined through field reconnaissance. These efforts identify operability, economic

considerations, and resource concerns, including those that require protections according to 2016 Forest Plan direction.

Because it is unknown which acres from the gross unit pool will be harvested, an estimated average volume of 15.8 MBF per acre is assumed for all old-growth harvest acres for this analysis. This estimate assumes an average of 20 MBF per acre for stands harvested using ground-based or cable logging and 5 MBF per acre for stands harvested by helicopter. Across the project area, approximately 70 percent of the gross unit pool acres are assumed suitable for conventional logging and 30 percent helicopter due to the difficulty and expense of road construction.

Young-growth stands within the gross unit pool that are: 1) estimated to reach a minimum volume of 25 MBF per acre within the next 15 years, which is a rough estimate of stands that meet the two-log rule, and 2) in areas with existing road systems or in areas of high concentrations of stands with this minimum volume, are considered "near term operable". For young-growth harvest an estimated average of 25 MBF per acre will be used. This gives an estimate on the volume per acre needed to reach an economical offering. Based on an analysis of net verses gross suitable acreage conducted on recently inventoried young-growth stands, it is estimated that approximately 20 percent of the potential near-term young-growth acres will be infeasible for harvest due to operability constraints or unsuitable based on the 2016 Forest Plan (Sheets 2018).

2016 Forest Plan direction that would affect potential harvest within the gross unit pool include: created opening size restrictions, soil stability concerns, identification of unknown Class I, II or III streams and their associated buffers, the implementation of the Legacy standard and guideline (old-growth only), and old-growth buffers around goshawk and other raptors nests, great blue heron nests, and wolf dens. Since animals move around and establish new nest or den sites, the actual acreage and volume that could be impacted would not be known until implementation. Other standards and guidelines affect only young-growth harvest such as those that allow young-growth harvest in the Old-Growth Habitat LUD, harvest within RMAs outside the TTRA buffers, and harvest within the 1,000-foot beach buffer.

Environmental Effects

The amount of timber volume that could be offered within the next 15 years varies for each of the action alternatives. Each alternative proposes different criteria that would affect the availability of some potential timber stands to be considered for harvest during any given time. See Chapter 2, Comparison of Alternatives.

Timber offered for sale does not necessarily represent the projected actual timber harvest during that time period. When timber harvest occurs depends partly on the length of the contract, the purchasers' operation plan, and weather conditions.

The volume, acreage, species composition, and potential harvest stands for old-growth and near term operable young-growth were determined using the methodology and assumptions stated above in the *Affected Environment* section, and further documented in the project record. Old-growth and young-growth acreage includes only those stands contained in the project gross unit pool. Table 8 through Table 13 describe the estimated acreage volume, and species composition for old-growth and young-growth from within the project's gross unit pool. Acreages and volumes displayed in the tables depict potential reductions in harvestable acreage. The volume is reflected for those factors quantified, as noted in the tables.

Table 6. Percent composition of old-growth species by volume for each TAA

Timber Analysis Area		Sitka spruce	Hemlock	Alaska yellow-cedar	Western redcedar
Etolin Island		15	54	14	15
Frosty Bay		22	46	17	16
Kuiu Island		16	81	3	0
Mitkof Island		25	66	9	0
Portage Bay		24	71	4	0
Thomas Bay		8	84	9	0
Tonka		24	66	10	0
West Kupreanof		15	67	17	1
Wrangell Island		21	65	12	4
Zarembo Area		22	56	16	6

Table 7. Total suitable acres and Alternative 2 gross unit pool old-growth (OG) acres and volume for each TAA

Timber Analysis Area	Suitable acres[1]	OG gross unit pool[2] (acres)	Sitka spruce (MBF)	Hemlock (MBF)	Alaska yellow-cedar (MBF)	Western redcedar (MBF)	Estimated total OG potential stands (MBF)
Etolin Island	3,497	2,030	4,811	17,320	4,490	5,453	32,074
Frosty Bay	1,592	1,470	5,110	10,684	3,948	3,716	23,458
Kuiu Island	15,698	6,732	17,019	86,156	3,191	0	106,366
Mitkof Island	15,988	7,251	28,642	75,614	10,311	0	114,566
Portage Bay	5,624	4,739	17,970	53,162	2,995	0	74,127
Thomas Bay	2,729	1,292	1,633	17,148	1,837	0	20,618
Tonka	4,213	1,223	4,638	12,753	1,932	0	19,323
West Kupreanof	8,670	4,524	10,722	47,891	12,151	715	71,479
Wrangell Island	8,413	2,711	8,995	27,414	5,140	1,713	43,262
Zarembo Area	15,751	10,807	37,565	95,621	27,320	10,245	170,751
Total	82,177	42,779	137,104	443,762	73,317	21,842	676,025

[1] Estimated acreage suitable for timber harvest determined at the 2016 Forest Plan level using a two-step process described in the 2016 Forest Plan, Appendix A.
[2] Estimated potential gross unit pool acres; see methodology and environmental effects in the sections above.

Table 8. Alternatives 2 and 3 project level old-growth estimated harvest acreage and volume for Alternative 3

Timber Analysis Area	Alternative 2 total OG acres gross unit pool	Alternative 3 total OG acres gross unit pool	Acres of OG deferred to meet Alt. 3 design features[1]	Alternative 2 total OG estimated volume (MBF)	Alternative 3 total OG estimated volume (MBF)	Volume (MBF)[1] deferred to meet Alt 3. design features
Etolin Island	2,030	1,800	230	32,074	28,440	3,634

Timber Analysis Area	Alternative 2 total OG acres gross unit pool	Alternative 3 total OG acres gross unit pool	Acres of OG deferred to meet Alt. 3 design features[1]	Alternative 2 total OG estimated volume (MBF)	Alternative 3 total OG estimated volume (MBF)	Volume (MBF)[1] deferred to meet Alt 3. design features
Frosty Bay	1,470	1,282	187	23,226	20,256	2,970
Kuiu Island	6,732	4,906	1,825*	106,366	77,515	28,851
Mitkof Island	7,251	6,431	821	114,566	101,610	12,956
Portage Bay	4,739	4,001	738	74,876	63,216	11,660
Thomas Bay	1,292	1,048	243	20,414	16,558	3,855
Tonka	1,223	926	297	19,323	14,631	4,693
West Kuprean of	4,524	4,057	466	71,479	64,101	7,379
Wrangell Island	2,711	2,493	218	42,834	39,389	3,444
Zarembo Area	10,807	9,370	1,438	170,751	148,046	22,705
Total	**42,779**	**36,779**	**5,999**	**675,908**	**581,108**	**94,800**

[1] Wildlife design criteria reductions are estimated for the gross unit pool acreage and volume available for timber harvest. These design criteria are the designation of elevational corridors and deferral of high-volume, low elevation old-growth for deer winter range.
* An estimated 464 acres and 7,331 MBF impacted to meet design features specific to Kuiu Island for Pacific marten.
[3] Estimated maximum available volume at 15.8 MBF per acre. For further information see the volume discussion under methodology section above. Differences between tables 9 and 10 are due to rounding.

Table 9. Percent composition of young-growth species by volume of the gross unit pool

Timber Analysis Area	Sitka spruce	Hemlock	Red alder[1]	Western redcedar
Etolin Island	N/A	N/A	N/A	N/A
Frosty Bay	67	30	0	3
Kuiu Island	56	43	2	0
Mitkof Island	65	30	5	0
Portage Bay	65	35	0	0
Thomas Bay	78	19	3	0
Tonka	69	25	6	0
West Kupreanof	60	38	2	0
Wrangell Island	N/A	N/A	N/A	N/A
Zarembo Area	76	15	8	1

[1] Red alder is not considered a commercial species on the Tongass National Forest because no market has been established and consequently no regional end-product selling values are currently in place.

Table 10. Project level young-growth acreage and volume by species for gross unit pool and near-term operable acres.

Timber Analysis Area	Total gross unit pool YG[1] (acres)	Total YG estimated near-term operable[2] (acres)	Sitka spruce (MBF)[3]	Hemlock volume (MBF)[3]	Red alder (MBF)[3]	Western redcedar (MBF)[3]	Total YG estimated near-term available volume (MBF)[3]
Etolin Island	NA	NA	NA	NA	NA	NA	NA
Frosty Bay	50	0	0	0	0	0	0
Kuiu Island	4,077	318	3,534	2,704	121	0	6,359
Mitkof Island	4,748	1,167	15,067	7,022	1,221	5	23,315
Portage Bay	75	75	903	572	24	0	1,499
Thomas Bay	3,302	1,455	22,208	4,451	2,187	210	29,055
West Kupreanof	3,518	703	10,906	2,738	374	0	14,019
Zarembo Area	8,680	951	12,279	6,680	60	0	19,020
Total	**24,335**	**4,669**	**64,898**	**24,167**	**3,987**	**215**	**93,267**

[1] Total YG acres identified in the gross unit pool. For further information see the young-growth operability volume discussion under methodology section above.
[2] Total acres in project gross unit pool estimated to be "near-term" operable during project. Acreage does not include projected "falldown".
[3] Estimated maximum available volume at 20 MBF per acre. This volume per acre assumes an average volume of 25 MBF for even-aged management acres (70% of suitable YG acres) and 8.25 MBF per acre from partial harvest acres (30% of suitable YG acres). For further information see the young-growth operability volume discussion under *Methodology* section above.

Table 11. Comparison of the estimated near-term young-growth acreage and volume by alternative

Timber Analysis Area	Alternative 2 total YG acres near-term operable[1]	Alternative 3 total YG acres near-term operable[1]	Acres impacted to meet Alt. design wildlife concerns[2]	Alternative 2 total YG estimated volume (MBF)	Alternative 3 total YG estimated volume (MBF)	Volume (MBF)[3] impacted to meet wildlife concerns[2]
Frosty Bay	0	0	0	0	0	0
Kuiu Island	318	270	48	6,360	5,400	960
Mitkof Island	1,167	992	175	23,340	19,840	3,500
Portage Bay	75	63	12	1,500	1,260	240
Thomas Bay	1,455	1237	218	29,100	24,740	4,360
Tonka	0	0	0	0	0	0
West Kupreanof	703	598	105	14,060	11,960	2,100
Wrangell Island	0	0	0	0	0	0
Zarembo Area	951	808	143	19,020	16,160	2,860

Timber Analysis Area	Alternative 2 total YG acres near-term operable[1]	Alternative 3 total YG acres near-term operable[1]	Acres impacted to meet Alt. design wildlife concerns[2]	Alternative 2 total YG estimated volume (MBF)	Alternative 3 total YG estimated volume (MBF)	Volume (MBF)[3] impacted to meet wildlife concerns[2]
Total	4,669	3,969	700	93,380	79,380	14,000

[1] Total acres in project gross unit pool estimated to be 'near-term' operable during project. Acreage does not include projected "falldown".
[2] Reductions associated with wildlife habitat design criteria.
[3] This volume estimate accounts for expected fall down due to 2016 Forest Plan and operability constraints. For further information see the young-growth operability volume discussion under *Methodology* section above.

Factors Affecting the Economics of Timber Offers

Specific timber sale units will be developed during implementation and no specific sale design is being analyzed. No attempt was made to determine the total value of the alternatives or for each TAAs. Such analysis could only be based on current costs and value information using the gross unit pool since actual harvest units have not been determined. The Selling Values (Table 14) are particularly volatile and could fluctuate greatly during the next 15 years. Also since the volume for these two alternatives is relatively similar, the results would be also be similar. For the purpose of this analysis, the Timber Analysis Areas were developed to establish a relative comparison between alternatives in relation to harvest costs and the volume of timber available in each area. For this analysis the project gross unit pool was used to determine the potential timber harvest stands and any needed infrastructure improvements. This provides a means to estimate the potential transportation and logging systems that may be utilized at the landscape level. More detailed information that supports this analysis is in the project record. An appraisal using the latest Residual Value (RV) Appraisal bulletin or the current appraisal method will be done during implementation. Past projects involving timber sales within the project area that have appraised positive include, but are not limited to, larger sales such as the Tonka Stewardship, Mitkof Heli Stewardship, Frenchie Stewardship Project, Skipping Cow Timber Sale, Wrangell Island Timber Sale, North Kuiu Timber Sale, and various small sales.

Many factors can influence the cost of timber harvest, adding economic risks for potential purchasers and affecting the ability of the Forest Service to offer timber sales. Road construction, helicopter yarding, complex silvicultural prescriptions, setting size and other factors may increase costs, which would then decrease the timber value for the offering. The value of the timber offered must be sufficient to cover costs and offer a percent of profit to purchasers. Because markets fluctuate, volume made available with the Central Tongass Project should allow the Forest Service to better respond to these conditions when preparing to offer timber sales. Also, the larger the timber sale volume, the greater the ability an operator has to respond to market conditions with the volume they have under contract.

Analysis of Harvest Costs

Under the *Consolidated Appropriations Act*, 2018, timber sales that do not appraise positive using the current Region 10 Residual Value appraisal cannot be offered. This project is needed at this time because it is anticipated that positive timber contracts can be created from the alternatives analyzed.

This analysis compares estimated costs between alternatives for infrastructure, transportation and camp costs. Because the estimated logging systems do not change across alternatives, costs are anticipated to remain the same by alternative for felling, limbing, bucking, yarding, decking, and

loading trucks. Of the potential logging systems proposed, helicopter logging is the most expensive. A recent analysis for the nearby Prince of Wales project area estimated an average helicopter logging cost of $376 per MBF for old growth. It is assumed no helicopter yarding would occur in young growth. Shovel and cable logging are both considered conventional logging systems for even-aged management. An average cost of $314 per MBF is predicted for cable systems in old growth. An average cost of $172 per MBF was estimated for ground-based systems in old growth. In young growth, the costs for cable and shovel yarding are estimated to be $203 per MBF for cable and $155 per MBF for ground-based systems.

The increased cost of applying partial harvest silvicultural systems was considered to avoid damaging the residual trees from logging activity. While some uneven-aged management can be done with shovel logging and even with uphill cable logging, to compare the alternatives prior to identifying harvest units, all uneven-aged management units for old growth were considered logged by helicopter, and therefore, the increased costs of doing partial harvest is factored into the cost of helicopter logging old growth.

For young growth all harvest is assumed even-aged because the amount of partial harvest will not be known until implementation of a young-growth timber offering and silvicultural prescriptions are determined. However it is estimated that partial-harvest prescriptions in young growth will increase logging costs by $5 per MBF for two-aged openings 20 acres in size or less, and by $15 per MBF for uneven-aged management with openings of 2 acres or less. If young-growth partial harvest is not adjacent to a haul road, it is estimated logging costs will increase an additional $5 per MBF to $15 per MBF per acre, increasing with distance. These estimates from the recent Prince of Wales project generated numbers using the official R10 Logging Cost Calculator. More details on the methodology and assumptions used in the cost determinations is in the project record.

Infrastructure Costs – The estimated cost for transportation infrastructure across the alternatives is described in the table below. In some years, appropriated funds are available to pay for all or a portion of NFS road costs for roads used for a timber sale, as well, as the long-term administration of the national forest. See the *Transportation* section for additional information.

Table 12. Transportation infrastructure costs per MBF by alternative[1]

Alternative 2	Alternative 3
$121	$125

[1] Includes road construction, road reconstruction, and maintenance and LTF development

Transportation Costs – These include all costs of transporting the logs from the landing to a mill or export yard capable of handling that amount of timber. This may differ depending on the size of the sale. In order to compare haul costs by alternative for this analysis, the sawmill and adjacent export yard in Klawock, Alaska was chosen as the single point of delivery for all TAAs, even though some smaller sales could be handled by other mills located on Wrangell, Mitkof or Kupreanof islands and may be closer to the proposed Timber Analysis Area. Other export sites at Tolstoi on the east side of Prince of Wales Island and Coon Cove near Ketchikan are also possibilities as points of delivery. There is also the possibility that during the life of this project additional export sites could be approved by the Regional Forester. For example, the marine access facility in Kake which approved as an appraisal point for the North Kuiu Timber Sale in 2016.

For this analysis, transportation costs are estimated at the TAA level and include truck haul, marine transport via barge or log raft, or a combination of the two. An added cost is assumed for transporting rafts of logs from the northern TAAs (Kuiu Island, West Kupreanof, Portage Bay, Thomas Bay and Tonka) due to delayed times associated with towing through the Wrangell Narrows using single rafts transported from the TAAs and stored in Alexander Bay (the Pothole). Once four rafts are transported to Alexander Bay, they would be transported together the remainder of the distance to Klawock. The haul costs are predicted to range from $16 per MBF to $43 per MBF across the TAAs. Tow costs range from $41 per MBF to $107 per MBF. More information describing the methods used for this determination, and additional assumptions is included in the transportation cost calculation spreadsheets in the project record.

Camp Costs – Camp costs were predicted for each TAA with harvest for either full or partial camp, or a combination of both based on volume and location. All helicopter harvest is considered to require a full camp due to the infrastructure needed for these operations. Camp costs are predicted to range between $5 per MBF and $53 per MBF across the TAAs. More information describing the methods used for this determination and additional assumptions is included in the log cost and camp cost spreadsheets in the project record.

Combined, from a financial standpoint, camp costs and transportation costs show the greatest variability between TAAs. Together these range from $97 per MBF to $203 per MBF.

Table 13. Transportation and camp costs per MBF for Alternatives 2 and 3

Timber Analysis Area	Haul to LTF per net MBF	Tow to Klawock per net MBF	Camp costs per net MBF	Combined haul, tow and camp costs per MBF
Etolin Island	$30	$41	$42	$113
Frosty Bay	$26	$87	$42	$155
Kuiu Island	$43	$107	$53	$203
Mitkof Island	$35	$77	$5	$117
Portage Bay	$28	$102	$31	$161
Thomas Bay	$16	$93	$31	$140
Tonka	$35	$99	$5	$139
West Kupreanof	$41	$105	$22	$168
Wrangell Island.	$36	$54	$7	$97
Zarembo Area	$18	$60	$22	$100

Note: Logging costs are anticipated to remain roughly the same across all the action alternatives. Those costs are $128.90 per MBF for shovel and $168.90 for cable.

Logging costs do not include profit and risk factors which would be included at implementation and time of appraisal. Numbers were derived from cost calculations for past projects within the respective TAAs. This data is located in the project record.

Manufacturing Costs – Average manufacturing costs by species are from the Official Residual Value Update Bulletin, May 20, 2019. An average foreign market (export) manufacturing cost of $72.14 per MBF is assumed for all young growth. An average foreign market manufacturing cost of $93.42 per MBF is assumed for Alaska yellow-cedar and 50 percent of the old-growth spruce and hemlock. Average domestic (sawn) manufacturing costs by species is assumed for western redcedar and the remaining 50 percent of old-growth spruce and hemlock.

End Product Selling Value –The average end product selling values ($ per MBF) from the current Residual Value Update Bulletin are shown in Table 14. The end product selling values represent a value comparison between species and whether it is expected to be processed in Alaska or exported (foreign market).

Table 14. Timber value from current Residual Value Appraisal Update Bulletin (May 20, 2019)

Species product	Tongass End-Product Selling Value ($/MBF)	Tongass NF Manufacturing Costs ($/MBF)
Sitka spruce old-growth domestic sawn	$1,322.43	$257.11
Western hemlock old-growth domestic sawn	$506.13	$339.73
Western redcedar old-growth domestic sawn[1]	$1,330.69	$406.15
Sitka spruce old-growth foreign market log sales	$592.24	$93.42
Western hemlock old-growth foreign market log sales	$569.16	$93.42
Alaska yellow-cedar foreign market log sales[2]	$678.92	$93.42
Sitka spruce young-growth foreign market log sales	$592.24	$72.14
Western hemlock young-growth foreign market log sales	$569.16	$72.14

[1] All western redcedar is assumed to be processed in Alaska.
[2] All Alaska yellow-cedar is assumed surplus and exported.

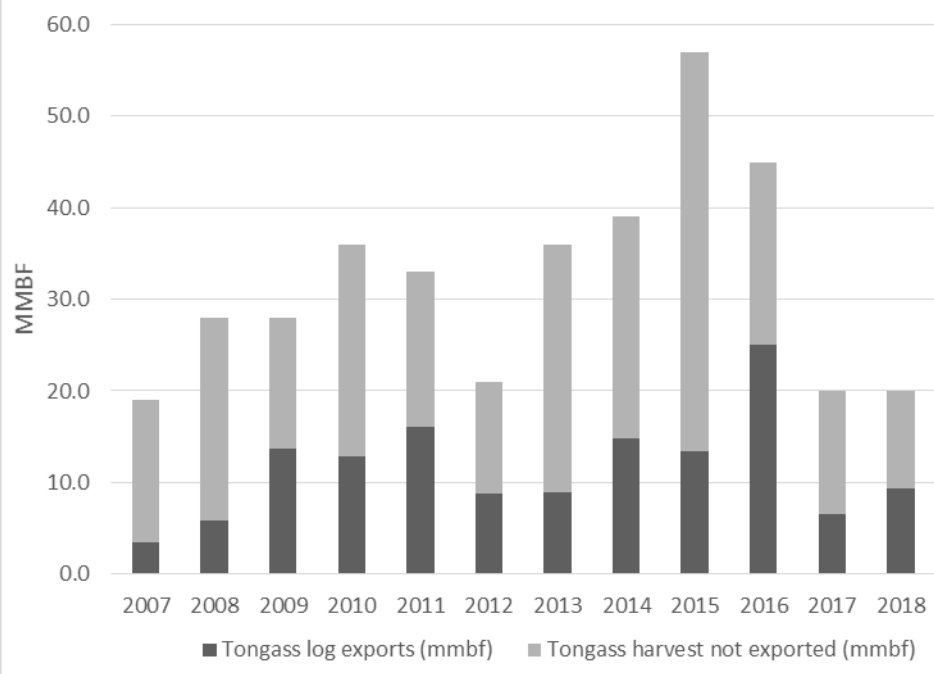
Projected Employment and Income

Direct employment and income likely to result from timber harvest is estimated by converting board feet to jobs and income. The amount of timber volume and type of timber volume (old growth verses young growth) would have an effect on employment as shown in Table 17, which displays the estimated direct employment that would result from volume if timber sales were offered from this project. The direct employment and income displayed assume the total maximum design criteria of potential volume for each alternative would be harvested, thus reflecting the totals for the 15-year timeline of the Central Tongass Project.

Table 18 displays estimated direct logging, transportation, and sawmilling-related employment and income based on old-growth volume. The number of jobs supported and related income shown in Table 17 and Table 18 reflect the difference in domestic processing as compared to differing export percentages for a relative comparison of the alternatives. The scenarios used for the Limited Export policy are based partly on cost collection data and an analysis of the current trends from 2014 through 2017 (Petaisto 2019). No analysis for 100 percent manufacture except for western redcedar was completed since this does not currently occur for the smaller lower value hemlock and Sitka spruce. The analysis of number of jobs supported used the jobs per MBF coefficients from the Daniels 2019 report and does not represent actual jobs and will probably change over time. Table 17 is based solely on old-growth volume.

Young-growth volume is assumed to be 100 percent export because there is currently no established market for domestically sawn young growth (see Table 18). This was assumed true for the life of this project since the estimated amount of young-growth available would not be enough to warrant the construction of a mill especially designed to handle young-growth logs. Recent young-growth contracts with domestic processing have not been fully successful for the purchasers due to a lack of local markets for sawn young-growth. Contracts where export of young-growth was allowed have been more successful for purchasers. Past log export and interstate shipments are reported annually on the public website: http://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785.

The figure below (Figure 8) shows the total volume of timber harvested from the Tongass and the volume exported as logs to demonstrate the variation in the proportion of exports over time. This includes both international and domestic exports to the lower 48. With the exception of 2016, the majority of timber harvested from the Tongass has not been exported in log form and remained in-state for processing. Timber harvest data were collected from the cut and sold reports that are also available on the Forest Management Reports and Accomplishments page on the Alaska Region website. While this shows past export volume, it gives no indication or trend in the amount of volume that may be exported in the future.



Year	Tongass log export volume (%)	Tongass harvest not exported (%)
2007	18	82
2008	21	79
2009	49	51
2010	36	64
2011	49	51
2012	42	58
2013	25	75
2014	38	62
2015	24	76
2016	56	44
2017	33	67
2018	47	53

Figure 8. Tongass National Forest timber harvest volume and proportion of harvest exported in log form, 2007-2018

The jobs per MBF used for this estimate are based on annualized employment data from sawmill surveys and the Alaska Department of Labor. Annualized jobs are considered all the Alaska jobs (excluding indirect jobs) supported by offered timber volume. Actual annualized jobs may vary by timber sale purchaser and specific business practices. Total jobs generated depends on the amount of volume offered from sales that appraise positive at time of advertisement. In other words, deficit value timber sales cannot be offered under current law and would support “zero jobs”.

Alternative 1 would not support timber harvest-related jobs since no timber would be offered. The action alternatives would have indirect impacts to the economies of the local communities. See the Socioeconomics section for additional information. Both Alternatives 2 and 3 could offer a mix of timber sale sizes and material to help support the regional industry. This possibility may change as less old-growth is offered over the next 15-year period and limited young-growth markets make it difficult to appraise positive. This reduction in the amount of old-growth offered under both action alternatives may cause the last remaining mid-sized sawmill in the region to reduce its number of employees or the length of time of operation, such as closing for part of the year. This may cause some employees to seek work elsewhere.

Predicted jobs from young-growth harvest increases over the 15 years as young-growth timber grows larger and is more likely to provide economic timber sales. Assuming young-growth timber is exported, offered volume must be sufficient (greater than 4 MMBF) to warrant an export ship to come to a port for the wood. Although log export does not provide sawmilling jobs, it does result in other jobs supported such as stevedoring for export ships which helps provide a diversity of employment opportunities.

Table 15. Annualized timber industry and associated jobs supported by alternative for old growth

Projected Alaskan employment income	Alt 1	Alternative 2		Alternative 3	
	No action	Maximum Alaska manufacturing[1]	100% hemlock export[2]	Maximum Alaska manufacturing[1]	100% hemlock export[2]
Local jobs related to logging	0	345	345	292	292
Local jobs related to sawmill and export mfg.	0	106	56	90	47
Transportation and other services related to Alaska domestic manufacturing	0	31	16	26	14
Transportation and other services related to export	0	100	126	85	107
Total jobs	0	582	543	493	459
Direct income[3]	0	$34,243,540	$32,981,354	$28,977,939	$27,909,871

[1] Represents a high market condition with Alaska manufacturing of larger old-growth hemlock 20+ inches at small end diameter, old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar. All Alaska yellow-cedar is exported outside Alaska.
[2] Represents a lower market condition with 100% of old-growth hemlock and all Alaska yellow-cedar exported. Alaska manufacturing of old-growth Sitka spruce 18+ inches at small end diameter and all western redcedar.
[3] Direct income figures are based on Daniels 2018.

Table 16. Annualized timber industry and associated jobs supported by alternative for young growth

Projected Alaskan employment income	Alternative 1 (No Action)	Alternative 2 (100% export)	Alternative 3 (100% export)
Local jobs related to logging	0	173	158
Transportation and other services related to export	0	77	71
Total jobs	0	250	229

Alternative 1 – No Action Alternative

Direct and Indirect Effects

No timber would be offered under the Central Tongass Project under this alternative. This would affect the amount of timber available for purchasers involved in timber industry within the project area and other parts of Southeast Alaska. These effects may indirectly affect the communities on Prince of Wales and Ketchikan, Kake, Wrangell and Petersburg that benefit from timber industry employment. If their livelihood decreases this may result in less expenditures on community goods and resources. However, at this scale, these expenditures cannot be estimated (Alexander 2012).

Cumulative Effects

Under this alternative, no timber would be offered from this project to add to the supply of timber for offer in southeast Alaska, and therefore less volume available to offer. Potential purchasers would have to rely on timber from other landowners or from other Forest Service projects.

Effects Common to All Action Alternatives

Direct and Indirect Effects

The largest distinguishing factor determining timber harvest costs for a TAA is distance from mills and export sites. All TAAs have extensive road systems but are not directly tied to a mid-sized mill capable of processing potential timber sales. All TAAs require truck, water haul and truck haul again. All TAAs except Mitkof, Wrangell and Tonka require full camp costs due to their distance from nearby towns. The TAAs with the best opportunities for economically positive timber offers are those with enough timber of higher value and those closer to a mill, export site and a town.

The TAAs with the most economic opportunities for proposing old-growth timber sales based on their relative costs, available volume, species composition and local knowledge of the areas are Zarembo Island and Mitkof Island. Both of these areas have relatively lower costs and higher available volumes according to their gross unit pools. Wrangell and Etolin islands appear to have some of the lowest costs, but rank sixth and seventh respectively out of ten in available old-growth volume. Portage Bay and western Kupreanof have relatively high costs given their distance from a mill, but rank fourth and fifth, respectively, in available volume. The road networks for Mitkof, Wrangell and western Kupreanof are all connected to communities which reduces the need for logging camp costs. Conversely, the areas that appear to have the least likely prospects to produce an economic old-growth offering are Frosty Bay, Tonka, Kuiu Island and Thomas Bay. This is due to their available volumes, distance from a mill, haul costs that includes truck haul and marine transport via barge or log raft, and overall increased costs of operations due to the distance to communities and other services. While Kuiu Island has some of the highest available volume, this volume consists primarily of lower value hemlock (81 percent of the TAA old-growth volume) with very little cedar and a moderate amount of spruce. It is also the TAA with the highest estimated costs. The approval of Kake as an appraisal point for material approved for export would lower the tow costs for logs transported from Kuiu Island, western Kupreanof, Portage Bay, and the Thomas Bay TAAs.

The TAAs with the best opportunities for positive-appraising young-growth timber sales are Thomas Bay, Mitkof Island, Zarembo and western Kupreanof. These areas were identified based on inventory, past harvest and local knowledge. They also have a concentration of suitable young-growth timber, require less infrastructure, and have areas of favorable ground-based logging systems. Conversely, the TAAs with the least-likely prospects for economical young-growth offers are Frosty Bay, Tonka, Etolin Island, Wrangell Island, Portage Bay and Tonka due to their higher haul costs and lack of concentrated available young-growth volume.

As part of this project, the Forest Service is analyzing a project-specific 2016 Forest Plan Amendment to use less-restrictive scenic integrity objectives (SIOs) (USDA Forest Service 2016a, p. 4-54) within portions of four out of ten timber analysis areas (TAAs) - Mitkof, Zarembo and Wrangell islands and Portage Bay located on Kupreanof Island. The gross unit pool would not change; however, more timber volume may be available from the gross unit pool with the 2016 Forest Plan Amendment adopted SIOs. Approximately 13,892 acres of the gross unit

pool fall within these areas considered for a project-specific 2016 Forest Plan Amendment. With the amendment, an additional 12,084 acres, or 95 percent of gross unit pool within the four TAAs, would then meet 2016 Forest Plan direction for even-aged management. Assuming 20 MBF per acre for even-aged management, this equates to approximately 241 MMBF. Without the amendment, partial harvest would usually be required for these acres to meet the adopted 2016 Forest Plan SIOs and only an estimated 60 MMBF could be harvested given the assumptions for partial harvest. This partial harvest would be more costly especially where helicopter logging is necessary. The size of both old-growth and young-growth timber offerings would be determined during implementation. It is anticipated that potential timber offerings from this project would be offered in variety of sizes to meet market conditions and industry demand for the 15-year project timeline. Individual sales offered may be exclusively old-growth or young-growth timber, or a combination of the two. The proposed timber salvage activities associated with this project would provide greater opportunities for salvaging dead, dying, and damaged timber through small sales than can be harvested from under current decisions, such as the *Wrangell Roadside EA*, the *Central Kupreanof EIS* and the *Mitkof Island Commercial Firewood and Individual Tree Sales CE*. For more information see Activity Guides 06 and 07 (Appendix A).

Cumulative Effects

Past timber sales have contributed to the development of the existing roaded infrastructure that would be used for both action alternatives. Timber harvest has occurred in the project area for more than 70 years. Industrial-scale logging activity began in the mid-1950s. These stands have regenerated into young-growth stands now form the young-growth timber component.

While there are other sources of timber volume currently available both On NFS and non-NFS lands, the Central Tongass Project is one part of the Forest Service's plan to meet the goals of the 2016 Forest Plan and provide an orderly flow of timber to the local and regional industry. Sawmill employment in Southeast Alaska has historically been supported by Forest Service timber sales, with a smaller contribution from state timber harvest (USDA Forest Service 2012b). Much of the timber from non-NFS lands is exported. Since most sawmills within the project area rely on old-growth timber, the timber from this project is considered necessary to maintain these mills and the jobs skills needed to transition to a young-growth management program.

Present projects for this analysis are the timber sales currently under contract, which as of May 31, 2019 is 65.6 MMBF. This information is at https://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785

Reasonably foreseeable timber management projects within the project area, identified for the cumulative effects analysis, are summarized in Appendix C of this document. Future projects include 7.4 MMBF of old-growth timber from the Wrangell Island EIS project, 23 MMBF for Kuiu Timber Area Project, 25 MMBF from the Central Kupreanof Timber Harvest EIS and 3 MMBF of remaining old-growth timber from the Navy EIS. Small sales, generally less than 1 MMBF, as well as micro-sales, which consist of dead or down and limited to 50 MBF or less, from the decisions on Wrangell Roadside EA, the Central Kupreanof EIS, Mitkof Microsale CE or Mitkof Island Commercial Firewood and Individual Tree Sales CE are expected to harvest less than 4 MMBF of old-growth from the project area over the next 15 years.

Other Forest Service projects on the Tongass that may provide timber are sales associated with the Prince of Wales Landscape Level Analysis project signed March 19, 2019. This project could

result in a harvest of up to 235 MMBF of old-growth timber and 421 MMBF of young-growth timber for a total volume of up to 656 MMBF over 15 years. The South Revillagigedo Integrated Resource Project revised Notice of Intent was published in the Federal Register on July 1, 2019 and proposes 46 MMBF of timber volume with a decision planned for December 2020.

The current estimate for Alaska Native lands in Southeast Alaska is 304 MMBF of old-growth timber and 10 MMBF of young-growth timber for the next 5 years. Volume from native lands is generally exported overseas and does not contribute to local sawmilling-related employment. The volume from the State may be less given their budget uncertainties but an estimated 9 MMBF of old-growth and 15 MMBF of young-growth harvest may occur based on their predictions for the next 5 years. The University of Alaska Trust plans to harvest 0.9 MMBF of old growth on its lands within the project area.

All of these future sources may contribute to meeting the planning cycle demand for Southeast Alaska. However, not all of these sources may happen due to the availability of funds, personnel, litigation or other reasons. Therefore, the Central Tongass Project contributes to the certainty of meeting the market demand as described in the decision for the 2016 Forest Plan.

In the absence of a multiple-year stable supply of economic timber of the desired type and species from the Central Tongass Project or elsewhere, the future of existing mill operators could be negatively affected. Closure of one or more mills could result in a further reduction in jobs in the logging and sawmilling industries and could also affect regional businesses that provide goods and services to these industries.

While there is proposed legislation for additional land adjustments (including potential future land exchanges), the amount of old-growth timber offered from various landowners is not expected to drastically increase in the next 15 years. Young-growth timber harvest is anticipated to increase when harvesting and utilization techniques improve economically.

Additional transportation options for hauling logs on Kupreanof Island may occur if under Public Law 109-59, (SAFETEA–LU) Section 4407, as amended by Public Law 114-94 (FAST Act) , which granted the State of Alaska transportation and utility easements crossing Tongass NFS lands to connect communities of Southeast Alaska. If the State of Alaska constructs a road (Kake Access road) connecting the Kake road system to the Portage Bay road system and log transfer facility. Making this connection may lower the transportation costs of transporting logs from either the Portage Bay or West Kupreanof TAA, to a mill or export yard. For example, if Klawock was a destination for logs from these TAAs, an operator could choose to haul logs from the West Kupreanof area to the Portage Bay LTF which would shorten the tow distance to Klawock. Other potential roads or developments associated with this law are not expected to lower costs associated with tow but could reduce haul costs if haul distance or time is reduced through road improvements.

The Kake to Petersburg Transmission Line Intertie Project would potentially disturb 135 acres, removing 1.5 MMBF of timber from suitable lands. Where the potential power line would cross flight routes for potential helicopter yarding, access may have to be adjusted to avoid yarding logs over powerlines.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Timber offered for purchase is expected to total a maximum of 150 MMBF of old-growth timber and 80 MMBF of young-growth timber for a total volume of 230 MMBF over 15 years over the entire project area. The location of specific harvest units and configuration of economic sale offerings will be determined using the process outlined in the Implementation Plan. This alternative will provide the most timber proposed for harvest.

Alternative 2 would offer more flexibility than Alternative 3 for the Forest Service to provide a range of available timber products and the size of potential timber offers to meet industry demands, market conditions, and local needs identified through public involvement. This is because it provides the most potential volume and makes more high volume acres available for harvest (see Table 8).

Overall, this alternative appears to best respond to the issue of timber supply and economics for a variety of reasons. First, it has the potential to supply the highest amount of timber volume, which may have the greatest positive economic effect. Second, Alternative 2 includes harvest of more high-volume areas since these are not deferred as in Alternative 3. This increases the likelihood that more large Sitka spruce and western hemlock trees will be harvested which contributes volume for domestic manufacturing. It also offers the highest direct income. The larger old-growth volume associated with Alternative 2 would also support the most current local manufacturing and milling jobs when compared to Alternative 3. It also offers the highest direct income.

This larger old-growth volume would allow local manufacturing, milling, and logging operations the most time under their current old-growth business practices to expand into young-growth. This move towards young-growth operations, and local manufacturing would be necessary to fully utilize the project area's growing young-growth timber resource. This alternative also gives industry the most time under current practices to develop markets for the project area's extensive young-growth which should become commercial during the late 2030s (USDA Forest Service 2016c, p. 3-515).

Alternative 2 would provide enough young-growth volume for potential larger offerings that may prove an incentive for industry to invest in young-growth businesses other than export and better aligns with the 2016 Forest Plan's focus on accelerating the transition to young-growth management. Alternative 2 has the best opportunity to supply the current industry with the old-growth timber it needs to supply the existing mills. It also has the highest chance at successfully allowing the timber industry to begin to develop a young-growth industry by supplying enough timber to maintain the industry.

Cumulative Effects

Under this alternative, this project is expected to contribute 230 MMBF of timber over the next 15 years from NFS lands within the project area. See the *Effects Common to All Action Alternatives, Cumulative Effects* in this section.

Alternative 3

Direct and Indirect Effects

Timber offered for purchase is expected to total 127 MMBF of old-growth timber and 74 MMBF of young-growth timber for a total volume of 201 MMBF over 15 years. This alternative would

provide less total volume of young-growth and old-growth compared to Alternative 2 (230 MMBF) due to required wildlife corridors and reserve areas that are proposed for harvest under Alternative 2.

Because it restricts harvest on some high-volume areas to reduce effects to wildlife, Alternative 3 would reduce the available economic opportunity within all TAAs and provide fewer opportunities than Alternative 2 to develop economic timber sales. This ultimately reduces the Forest Service's flexibility to provide a range of timber products and reduces the size of potential timber offers to meet industry demands, market conditions, and local needs identified through public involvement.

Overall, Alternative 3 is less responsive to the issue of timber supply and economics for a variety of reasons. First, Alternative 3 would provide fewer local manufacturing and milling job opportunities and less direct income when compared to Alternative 2. Then, by applying the wildlife constraints, the timber offerings may be less economic since more partial harvest would be applied more often and the timber harvest units may be reduced in size or spread out over a wider area, requiring more-expensive transportation, potentially increasing harvest costs.

While the ability of the Forest Service to offer economic timber sales from the project area is less under Alternative 3, this alternative has a reasonable opportunity to supply the current industry with the old-growth timber it needs to supply the existing mills while moving towards young-growth management.

Cumulative Effects

With the exception of less volume (201 MMBF instead of 230 MMBF) and the likelihood of fewer large-diameter trees that can be used for domestic manufacture with the reduction of high-volume acres for wildlife design criteria, the cumulative effects for this alternative are expected to be the same as for Alternative 2. See the *Effects Common to All Action Alternatives, Cumulative Effects* in this section.

Issue 2: Wildlife Habitat – Deer Winter Range, Marten Habitat and Connectivity

Issue statement: Proposed timber harvest may decrease the quantity and quality of deer winter habitat and habitat for Pacific marten (on Kuiu Island), as well as habitat connectivity, and the elevational movement of deer and other wildlife.

Background: Timber harvest can affect wildlife species dependent on or associated with old-growth habitat. Commenters are concerned that additional harvest of habitat used by deer in winter and lack of elevational connectivity in areas of timber harvest could affect deer populations. Additionally, commenters expressed concern about impacts to marten and marten populations, and the marten population on Kuiu Island is amongst the lowest documented in Southeast Alaska.

Methodology

Units of Measure

Effects are analyzed using the following Units of Measure and are further discussed as they pertain to each species in the *Environmental Effects* section of this document.

- Acres and percent reduction of high and moderately high value deer winter habitat (productive old growth (POG) less than 800 feet in elevation on south-facing slopes)
- Acres of average winter deer habitat (all productive old growth (POG) less than 1,500 feet in elevation
- Interagency Deer Model Habitat Capability outputs by WAA
- Elevational connectivity
- Deep snow marten winter habitat (High-Volume POG below 800 feet in elevation) on Kuiu Island
- Average winter marten habitat (POG below 1,500 feet in elevation) on Kuiu Island

Design Features Specific to Alternative 3

Measures to address the concern about wildlife habitat were incorporated into a separate alternative (Alternative 3). Additionally, Alternative 3 incorporates additional protections of important areas of use by Pacific marten on Kuiu Island. For Alternative 3, the following Design Features would be applied to the gross unit pool:

- **Elevational corridors:** Provide unharvested corridors for deer movement adjacent to or through timber harvest units, generally approximately 330 feet wide through old growth where possible, roughly every ½ mile in Development LUDs. [*The ½ mile distance is correlated to the diameter of an average deer home range size of approximately 200 acres. This would allow there to be at least one corridor area within every 200 acre circular*].
- **High value deer winter habitat:** If the gross unit pool intersects with mapped existing high value deer winter habitat (defined as: High POG (SDM classes 5N, 5S, and 67) that is less than 800 feet in elevation on a southern aspect), maintain existing habitat quality and quantity of connected moderate to high value deer winter habitat.

- **Gross unit pool, old growth:** On Kuiu Island, defer harvest of old growth in areas of High or Very High focal areas of use by marten. Koch (2016) mapped focal areas of use by marten on Kuiu Island using a resource selection function (RSF) model. Habitats were binned into five categories based on RSF scores, which are proportional to the probability of marten occurrence on the landscape. Five categories were used to map the scores on the RSF map as follows: very high (most important for marten), high, medium, low, and very low (least important).
- **Gross unit pool, young growth:** On Kuiu Island, in areas of High or Very High focal areas of use by marten, the maximum size of any created young-growth opening for commercial timber harvest must not exceed 10 acres and a maximum removal of up to 35 percent of the acres of the original harvested stand is allowed. Commercial thinning is limited to 33 percent of the stand's basal area. A combination of the two treatments may be used, with no more than 35 percent of the total stand removed in either basal area and/or acres. TTRA and other administratively withdrawn areas do not count towards the stand's total acreage.

Spatial and Temporal Scales

The Units of Measure are addressed at one or more of the following spatial scale(s) that are relevant to the species:

- Bioregional Province
- Game Management Unit
- Wildlife Analysis Area

For habitat change, and particularly for large scale change due to timber harvest, effects will be discussed at varied temporal scales as necessary, such as:

- Immediately post-implementation
- Stem exclusion (assumed to be at age 25)
- Development of old-growth conditions (160 to 200 years or more)

For the project-related indirect effects analysis, deer habitat capability by WAA (including only NFS lands) is divided by the total square miles of NFS lands (all elevations included, but with acres above 1,500 feet elevation receiving a zero value) in the WAA.

For the cumulative effects analysis, deer habitat capability on NFS lands was divided by the total square miles of NFS lands (all elevations included, but habitats on non-NFS land and land above 1,500 feet elevation receiving a zero value) in the WAA. No value was given to non-NFS lands.

Assumptions

See wildlife report for the description of assumptions used in this analysis.

Limitations of the Analysis

See wildlife report for the complete description.

Sitka Black-tailed Deer

Summary

Because of further reductions of important winter habitat from timber harvest in certain WAAs but overall high levels of retention of important habitat in the project area overall, the overall determination is that the effects to deer (management indicator species) would be moderate.

The most important habitat for deer is high and moderately high value deer winter habitat (all POG less than 800 feet elevation on south facing slopes). Severe winters will likely continue infrequently into the future, because while there may be a general warming trend expected with climate change extreme weather events will likely continue to occur. Some WAAs have undergone substantial reductions in high and moderately high value deer winter habitat from past and present timber harvest, and would undergo further reductions under Alternatives 2 and 3. Though there are no known thresholds for the amount of deer winter habitat required, reductions in this important deer winter habitat (high and moderately high value deer winter habitat) increase the risk of severe winters in not sustaining a healthy deer population in the long term, and may result in periodic declines from infrequent severe winters.

Wildlife habitat connectivity has already been reduced in some areas, and young-growth may impede deer and other wildlife movement. Harvest of old-growth located between previously harvested stands could further impede deer and other wildlife movement. This is of particular concern if harvest occurs linearly along hillsides creating a long band of young-growth between lower and higher elevations. Alternative 3 would lessen the additional effects from proposed timber harvest to wildlife and deer movement by maintaining windfirm corridors spaced every half mile, as compared to Alternative 2.

High and moderately high value deer winter habitat would be most reduced by Alternative 2 in WAA 5136 (Portage Bay). Under Alternative 2 there would be a 35 percent reduction from the existing condition in this WAA, resulting in 49 percent of this habitat remaining compared to the historic (1954) condition in this WAA. Based on professional opinion, a removal of 35 percent of the existing amount of high and moderately high deer winter habitat in any particular WAA would be a substantial change in a WAA's ability to sustain a healthy deer population through a severe winter. The high and moderately high value deer winter habitat remaining from the historic condition would also reach 49 percent in WAA 5132 (West Kupreanof) under Alternative 2.

In WAAs which have experienced long-lasting declines in the deer population in the past, such as WAA 2007 (Mitkof) and WAA 5138 (Tonka), high and moderately high value deer winter habitat would also be further reduced. In WAA 2007, the percentage remaining (from historic) would go from 70 percent currently remaining to 62 percent under Alternative 2. In WAA 5138, the percentage remaining would go from 71 percent currently remaining to 63 percent under Alternative 2. As noted there are no thresholds for what percentage of important deer winter habitat is required to prevent declines during severe winters, though it is known that the risk of severe winters would be increased, particularly under Alternative 2.

Theoretical deer habitat capability calculated by the deer model shows slightly different cumulative effects than the assessment of important deer habitat (that is, high and moderately high value deer winter habitat) acres affected, with WAA 1905 (Zarembo) reaching the least percent remaining from the historic condition at 61 percent remaining at stem exclusion (Year 2045; under Alternative 2). The deer model outputs for WAAs where timber harvest is proposed

would remain between 61 to 88 percent remaining from the historic condition under Alternative 2 (Table 26). Under Alternative 3, the range of remaining deer habitat capability remaining from the historic condition in these WAAs would be slightly higher, at 63 to 90 percent.

Overall, there would be a 2 to 3 percent reduction in the acres of high and moderately high value deer winter habitat when calculated for the whole project area, when using the gross unit pool which substantially over-represents the amount of actual timber harvest. However, in certain WA As it is our determination there would be moderate effects to deer, considering some WAAs would potentially fall to below or near 50 percent of high and moderately high value deer winter habitat remaining from the historic condition under Alternative 2. Alternative 3 moderates this risk of severe winters causing deer declines to some degree, particularly by providing for enhanced elevational movement of wildlife by maintaining corridors through areas proposed for timber harvest and maintaining more high value deer winter habitat.

Affected Environment

On NFS lands in the project area, there is currently 92 percent of historic POG remaining, and considering all lands there is 90 percent remaining (Table 17). Within all WAAs on NFS lands between 73 to 100 percent of POG is remaining, and within all WAAs considering all lands the amount of POG remaining ranges from 37 to 100 percent. The WAA impacted most on NFS lands and all lands is WAA 5132.

Table 17. Existing wildlife habitat types on Petersburg and Wrangell Ranger Districts based on the Size-Density Model using criteria important to various species (e.g., elevation, aspect) and by land ownership

	Historic NFS Lands [1]	Existing NFS Lands[1]	Percent Remaining	Historic, all ownerships[2]	Existing, all ownerships[2]	Percent Remaining
All POG	1,298,666	1,189,898	92	1,358,758	1,223,388	90
High Volume POG*	608,330	499,631	82	646,835	512,757	79
POG ≤800 ft elevation	804,525	718,482	89	852,728	746,251	88
High-POG ≤800 ft elevation	395,370	309,395	78	424,667	319,174	75
High-POG ≤1,500 ft elevation	566,865	459,378	81	603,921	471,571	78
POG ≤1,500 ft elevation	1,157,124	1,049,569	91	1,215,106	1,081,508	89
Young Growth[3]		131,221			158,902	

[1] NFS land only
[2] Includes all ownership
[3] SDM Vegcode (HS1-3 & S1-3)
* It is assumed that the majority of all historic harvest was high volume POG. So we don't have historic: large tree, medium, or low POG nor do we have unproductive forest, forested muskeg, and non-forest.

Existing Condition

The Sitka black-tailed deer was chosen as an Management Indicator Species because it is the wildlife species that receives the highest hunting and subsistence use of all terrestrial species in Southeast Alaska, and it represents those species that use lower elevation POG habitat (below

800 feet) during the winter period (USDA Forest Service 1997a, p. 3-353). They are also an important prey species for the Alexander Archipelago wolf, which is also a Management Indicator Species. The predator-prey relationship between wolves and deer is discussed in more detail within the Alexander Archipelago Wolf section of this document. Standards and guidelines for Sitka black-tailed deer are on pages 4-88 of the Forest Plan (USDA Forest Service 2016a).

Table 18 shows the historic and existing deer habitat on NFS land in different categories within the project area by WAA.

Deer Population

The project area consists of Game Management Unit (GMU) 1B and GMU 3 (except for Coronation Island). Most of GMUs 1B and 3 are National Forest System (NFS) lands. The Alaska Department of Fish and Game (ADF&G) has traditionally used deer pellet-group count transects along with deer hunter harvest data to indicate population trends. There are no reliable population estimates for deer in the project area. Additional methods to establish population indices that have undergone testing and development by ADF&G include aerial counts in alpine areas, using fecal DNA as a capture-recapture approach to estimate abundance (Brinkman et al. 2011), and combining information from game cameras and fecal DNA to estimate age structure, abundance, and density of deer (Eacker 2018, pers. comm.). Deer populations in Southeast Alaska have historically fluctuated with high and low extremes.

Table 18. Existing winter and non-winter deer habitat on NFS lands

WAA	Locality	High and moderately high value deer winter habitat (acres)[1]			Average winter deer habitat (acres)			Non-winter (acres)[2]		
		Historic (1954)	Existing	% rem	Historic (1954)	Existing	% rem	Historic (1954)	Existing	% rem
1601	Farragut Bay	5,224	5,199	99.5	23,240	23,207	99.9	43,447	43,414	99.9
1602	Farragut Bay	3,669	3,667	99.9	28,041	27,862	99.4	135,881	135,702	99.9
1603	Thomas Bay	2,911	2,815	96.7	14,176	13,475	95.1	76,082	75,370	99.1
1604	Thomas Bay	7	7	100.0	18	18	100.0	225,045	225,045	100.0
1605	Thomas Bay	3,426	2,173	63.4	25,728	20,882	81.2	147,909	143,036	96.7
1706	LeConte	2,276	2,276	100.0	9,934	9,934	100.0	98,580	98,580	100.0
1707	Leconte/ Stikine	4,154	4,154	100.0	20,280	20,280	100.0	73,985	73,985	100.0
1708	Stikine	3,525	3,525	100.0	33,319	33,319	100.0	226,809	226,809	100.0
1809	Icefield	497	497	100.0	7,355	7,355	100.0	127,711	127,711	100.0
1810	Virginia Lake	2,483	2,483	100.0	17,329	17,329	100.0	53,781	53,781	100.0
1811	Berg Bay	3,535	3,490	98.7	21,439	21,303	99.4	91,137	91,001	99.9
1812	Bradfield Canal	3,967	3,729	94.0	25,299	24,744	97.8	97,549	97,465	99.9
1813	Bradfield Canal	2,558	1,552	60.7	25,500	20,688	81.1	230,465	225,656	97.9
1814	Bradfield Canal	1,562	1,553	99.4	20,309	20,142	99.2	67,287	67,110	99.7
1815	Anan	1,245	1,237	99.3	14,045	14,020	99.8	41,601	41,138	98.9
1816	Frosty Bay	1,089	943	86.6	11,439	10,253	89.6	32,155	30,898	96.1
1901	Etolin	7,107	6,467	91.0	56,767	51,771	91.2	128,445	124,842	97.2
1902	Deer Island	480	400	83.4	5,841	5,399	92.4	9,129	8,687	95.2
1903	Wrangell	5,471	4,578	83.7	48,035	41,008	85.4	112,918	107,046	94.8
1904	Vank/Sokolof	2,288	1,529	66.8	13,764	9,992	72.6	21,943	17,236	78.5
1905	Zarembo	9,743	7,518	77.2	59,743	44,367	74.3	113,997	100,649	88.3
1906	Bushy/Shrubby	1,922	1,435	74.7	8,763	5,958	68.0	10,508	7,713	73.4
1910	Etolin	7,128	7,093	99.5	38,886	38,675	99.5	97,618	96,880	99.2
2007	Mitkof	7,706	5,395	70.0	59,712	47,657	79.8	111,336	99,360	89.2

WAA	Locality	High and moderately high value deer winter habitat (acres)[1]			Average winter deer habitat (acres)			Non-winter (acres)[2]		
		Historic (1954)	Existing	% rem	Historic (1954)	Existing	% rem	Historic (1954)	Existing	% rem
2008	Woewodski	1,345	1,345	100.0	5,615	5,615	100.0	9,977	9,943	99.7
5012	Kuiu	14,175	10,552	74.4	99,936	79,435	79.5	137,305	118,201	86.1
5013	Kuiu	7,526	7,215	95.9	38,051	36,456	95.8	61,603	59,740	97.0
5014	Kuiu	5,583	5,300	94.9	27,142	26,369	97.2	38,470	37,691	98.0
5016	Kuiu	7,851	7,658	97.5	45,397	45,079	99.3	67,154	66,729	99.4
5017	Kuiu	12,622	12,605	99.9	71,979	71,830	99.8	119,533	118,756	99.3
5018	Kuiu	4,176	3,836	91.9	22,084	20,640	93.5	47,755	46,278	96.9
5130	W. Kupreanof	8,363	8,224	98.3	42,054	40,952	97.4	90,950	90,400	99.4
5131	W. Kupreanof	6,100	5,414	88.8	26,993	23,943	88.7	68,996	65,955	95.6
5132	W. Kupreanof	4,773	2,964	62.1	14,527	10,338	71.2	36,008	31,818	88.4
5133	W. Kupreanof	7,010	6,787	96.8	43,871	42,937	97.9	106,573	106,142	99.6
5134	S. Kupreanof	8,519	7,382	86.6	36,181	33,501	92.6	97,984	95,176	97.1
5135	W. Kupreanof	604	587	97.3	10,807	10,138	93.8	55,023	54,983	99.9
5136	Portage Bay	3,030	2,256	74.4	26,653	22,613	84.8	58,872	55,374	94.1
5137	Duncan Salt Chuck	2,834	2,834	100.0	21,362	21,347	99.9	49,601	49,516	99.8
5138	Tonka/ Lindenberg	5,264	3,719	70.6	28,183	22,277	79.0	61,564	58,108	94.4
Total	Project Area	183,749	162,393	88.4	1,149,797	1,043,105	90.7	3,482,683	3,383,923	97.2

[1] High and moderately high value deer winter habitat (deep snow habitat) is defined as all POG (SD classes 4H, 4N, 4S, 5H, 5S, 5N, & 6/7) below 800 feet elevation on south aspect; average winter deer habitat is defined as all POG at or below 1,500 feet elevation.
[2] Non-winter deer habitat is all habitats except stands in stem exclusion stage (assumed to be over 25 years since harvest) at all elevations.

Between 1974 and 2004, the Petersburg area experienced well below average to average snowfall, during which time deer likely did well despite habitat change resulting from forest management and road construction activities. This 30-year period of predominantly mild winters was immediately followed by a series of deep snow winters, including record snowfall during the winter of 2006–2007. The relatively high pellet-group densities documented in spring 2007 and 2008 are likely the result of low numbers of deer concentrating on winter range during those severe winters. High deer mortality due to both malnutrition and predation by wolves and black bears may have occurred in spring of those years, resulting in considerably lower counts in subsequent years. The combined effect of multiple severe winters and predation likely delayed recovery of deer populations in these VCUs. The last three winters (2013–2014, 2014–2015, 2015–2016), however, have been mild with well below average snowfall. Harvest data as well as anecdotal observations by ADF&G staff and hunters indicate that populations may now be rebounding (McCoy 2017).

Deer Habitat Capability

Deer habitat capability is assessed using the interagency deer habitat capability model. The theoretical deer density output is better thought of as a representation of the resiliency of the habitat to support deer during severe deep snow winters, and therefore indirectly represents the long-term resiliency and function of the predator-prey system dynamic. The quantity, quality, and to some extent distribution and arrangement of winter habitat are considered important limiting factors for Sitka black-tailed deer in Southeast Alaska.

Table 19 shows the output of the deer model by WAA within the project area, and comparisons for the historic (1954) to the existing condition, showing the deer model outputs for all land ownerships and for NFS lands only. The deer habitat capability output reflects the long term carrying capacity of the WAA, represented as the theoretical number of deer each WAA could support on a sustained basis. Carrying capacity of winter range projected by the deer model are related to the availability and quality of forage; availability of forage to deer is related to production of forage in the habitat and how much forage is covered by snow (Suring et al. 1992).

Threats

Although deer will utilize a wide range of habitat from shoreline to alpine, depending on the season, they are associated with old-growth forests and represent species that use lower elevation POG habitats during the winter. Historically, severe winters with high snow amounts in the project area have caused substantially deer declines in certain areas. Declines in deer populations can be exacerbated by wolf predation and human harvest, resulting in slow deer population recovery that can persist for many years after these infrequent severe winter events.

Table 19. Existing deer habitat capability by WAA for all land ownerships and NFS land only

WAA	Locality	Square Miles NFS only	Square miles All Owner	Avg annual deer harvest, 1997 to 2017	All land ownerships			NFS land only		
					Historic (1954) deer habitat capability	Existing deer habitat capability	Percent remaining	Historic (1954) deer habitat capability	Existing deer habitat capability	Percent remaining
1601	Farragut Bay	68.0	68.0	0.0	1385	1382	99.7	1385	1382	99.7
1602	Farragut Bay	217.1	218.2	3.3	1177	1162	98.7	1162	1147	98.7
1603	Thomas Bay	122.5	122.5	30.7	782	734	93.8	782	734	93.8
1604	Thomas Bay	382.0	382.0	3.0	40	40	100.0	40	40	100.0
1605	Thomas Bay	232.5	237.5	34.3	1687	1260	74.7	1559	1208	77.5
1706	LeConte	154.5	154.5	13.5	527	527	100.0	527	527	100.0
1707	Leconte/ Stikine	117.5	118.9	5.1	1122	1122	100.0	1104	1104	100.0
1708	Stikine	361.2	370.8	1.8	1496	1496	100.0	1495	1495	100.0
1809	Icefield	200.1	200.2	0.0	242	242	100.0	242	242	100.0
1810	Virginia Lake	85.7	92.8	5.7	820	820	100.0	714	714	100.0
1811	Berg Bay	144.1	144.3	0.0	941	932	99.1	940	931	99.1
1812	Bradfield Canal	154.3	155.3	0.0	1052	1011	96.1	1030	993	96.4
1813	Bradfield Canal	362.3	369.8	3.0	929	638	68.7	839	577	68.8
1814	Bradfield Canal	108.1	108.4	0.0	651	642	98.7	651	642	98.7
1815	Anan	68.3	68.3	0.0	604	592	98.1	603	592	98.1
1816	Frosty Bay	52.7	56.7	3.0	646	585	90.6	580	520	89.5
1901	Etolin	206.1	208.0	45.0	3685	3329	90.3	3673	3319	90.3
1902	Deer Island	14.4	14.6	6.3	280	233	83.0	280	233	83.0
1903	Wrangell	177.0	211.0	70.7	3385	2729	80.6	2681	2243	83.7
1904	Vank/Sokolof	35.7	36.1	12.2	947	633	66.9	947	633	66.9
1905	Zarembo	181.1	183.9	202.3	3820	2705	70.8	3736	2669	71.4
1906	Bushy/Shrubby	17.3	17.8	7.8	693	394	56.8	693	394	56.8

WAA	Locality	Square Miles NFS only	Square miles All Owner	Avg annual deer harvest, 1997 to 2017	All land ownerships			NFS land only		
					Historic (1954) deer habitat capability	Existing deer habitat capability	Percent remaining	Historic (1954) deer habitat capability	Existing deer habitat capability	Percent remaining
1910	Etolin	157.2	159.5	18.4	2807	2770	98.7	2780	2743	98.7
2007	Mitkof	170.2	210.0	63.2	4481	3327	74.3	3346	2514	75.1
2008	Woewodski	16.5	16.9	3.0	474	470	99.2	462	459	99.2
5012	Kuiu	217.1	231.0	9.8	6709	5050	75.3	6423	4809	74.9
5013	Kuiu	98.3	99.0	1.0	2586	2466	95.4	2585	2466	95.4
5014	Kuiu	56.6	62.6	5.7	1983	1915	96.5	1827	1778	97.3
5016	Kuiu	106.7	108.5	0.0	3278	3239	98.8	3272	3233	98.8
5017	Kuiu	191.3	193.4	4.0	5198	5146	99.0	5186	5134	99.0
5018	Kuiu	75.8	76.2	4.4	1658	1538	92.7	1658	1538	92.7
5130	W. Kupreanof	144.0	145.4	6.3	2983	2907	97.4	2949	2873	97.4
5131	W. Kupreanof	109.3	109.8	11.9	2163	1925	89.0	2162	1923	89.0
5132	W. Kupreanof	57.5	137.7	15.6	3186	1523	47.8	1270	892	70.2
5133	W. Kupreanof	168.0	168.3	11.3	2989	2918	97.6	2989	2917	97.6
5134	S. Kupreanof	158.2	158.8	18.0	3503	3107	88.7	3503	3107	88.7
5135	W. Kupreanof	86.6	86.6	6.6	1164	1136	97.6	1164	1136	97.6
5136	Portage Bay	93.6	93.7	14.8	1539	1266	82.2	1538	1265	82.2
5137	Duncan Salt Chuck	78.9	79.0	6.4	1274	1269	99.6	1271	1266	99.6
5138	Tonka/ Lindenberg	96.1	109.2	48.5	2156	1723	79.9	1944	1514	77.9

Environmental Effects

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

The limiting factor for deer in the project area is winter habitat which is particularly important to deer during severe winters with high snow amounts. POG captures snow in the canopy of large trees and provides understory forage, and High POG maximizes these beneficial attributes. As snow depth increases, selection of high-volume old-growth on south facing slopes increases (Gilbert et al. 2017). Effects to POG habitat would extend for 160 to 200 years or more into the future, until old-growth conditions redevelop where clearcut harvest occurs. Non-winter habitat is also important to deer for improving body condition throughout the spring, summer, and fall, particularly leading into winter when forage can become limited.

Because low elevation POG habitat on south facing slopes is the most important deer winter habitat, reduction in the amount of this habitat carries the most potential for effects to deer population in the long term. Therefore, alternatives that harvest the most deer winter habitat would be expected to have the greatest effect on deer populations in the long term. Potential effects to deer winter habitat were assessed by determining how many acres would be affected by timber harvest under each alternative. For this assessment, winter habitat was assessed in two categories, high and moderately high deer winter habitat (Table 20), and average winter habitat. For this analysis, high and moderately high deer winter habitat was defined as all POG below 800 feet elevation on south aspect, and average winter habitat was defined as all POG (SD 4H, 4N, 4S, 5H, 5S, 5N, and 6/7) at or below 1,500 feet elevation on all aspects.

High and moderately high value deer winter habitat

The total amount of high and moderately high value deer winter habitat (all POG below 800 feet elevation on south facing slopes) existing in the whole project area on NFS lands is 162,483 acres (Table 20). Based on the mapped gross unit pool, Alternative 2 would harvest a maximum of 5,417 acres (3 percent of the amount existing on NFS lands in the whole project area, when rounded to the nearest whole number) while Alternative 3 would harvest a maximum of 3,275 acres (2 percent when rounded to the nearest whole number). Under Alternative 2 the percentage reduction from the existing condition in individual WAAs ranges from 2 to 35 percent. Under Alternative 3 the percentage reduction from the existing condition ranges from 2 to 18 percent. However, it is important to note that the mapped gross unit pool on which these percentages are based substantially overestimate the amount of actual timber harvest that would occur under either action alternative (the mapped gross unit pool encompasses a total of 42,779 acres of old growth while the maximum that could be harvested is 9,500 acres based on the Alternative 2 limits for old growth harvest (22.2 percent of the gross unit pool). How these potential effects add to past, present, and reasonably foreseeable impacts are discussed in the *Cumulative Effects* section below.

Table 20. Direct and indirect effects to high and moderately high value deer winter habitat from Alternatives 2 and 3 (NFS land only) using the gross unit pool

WAA[2]	Locality	High and Moderately High Value Deer Winter Habitat[1]				
		Existing (acres)	Alternative 2 harvest (acres)	Alternative 2 % reduction from existing	Alternative 3 harvest (acres)	Alternative 3 % reduction from existing
1605	Thomas Bay	2,173	196	9	104	5
1816	Frosty Bay	943	186	20	98	10
1901	Etolin	6,467	126	2	112	2
1903	Wrangell	4,578	98	2	73	2
1905	Zarembo	7,518	1,127	15	835	11
2007	Mitkof	5,395	632	12	416	8
5012	Kuiu	10,552	693	7	132	1
5018	Kuiu	3,836	277	7	112	3
5131	W. Kupreanof	5,414	317	6	284	5
5132	W. Kupreanof	2,964	602	20	547	18
5136	Portage Bay	2,256	778	35	399	18
5138	Tonka/ Lindenberg	3,719	384	10	165	4
Project Area Grand Total[3]		162,483	5,417	3	3,275	2

[1] Defined as all POG below 800 feet elevation on south aspect
[2] Only showing WAAs where old growth is mapped in the gross unit pool
[3] The Grand Total includes all WAAs in the project area.

Commercial harvest of young-growth

Commercial harvest of young-growth stands would result in an increase in deer forage in the short term due to the conversion of stands currently in the stem exclusion stage (that currently provide limited habitat) back into the stand initiation stage (that provides forage habitat at least during summer and mild winters) assuming all harvest would be even-aged management. This forage may not be available to deer during winter if it covered by snow. In the long term, commercial harvest of young growth would preclude these stands progressing toward old growth habitat conditions that would again provide snow interception and forage within the stand. The forage created by clearcutting young-growth would last only for the short-term until the stand again reaches stem exclusion stage (around 25 years).

In Alternatives 2 and 3, based on 2016 Forest Plan direction, commercial young growth harvest that would occur within non-development LUDs (such as in the Old Growth Habitat LUD and a portion of the 1000-foot beach buffer) will provide merchantable wood products while promoting old growth conditions. The acres of young growth in the gross unit pool by WAA are shown in Table 21 (refer to 2016 Forest Plan Chapter 5). Treatments within these designated areas would be designed to improve the development and diversity of understory plants for wildlife including deer, create more structural diversity, and enhance snow intercept by promoting tree crown development. Created openings in the stand's canopy would necessarily be small, usually less than 2 acres, and would not compromise the overall ability of the stand to both provide understory forage and capture snow in the canopy. Commercial harvest is not allowed within the first 200 feet of the beach buffer closest to the shoreline.

Table 21. Young growth acres in the gross unit pool for Alternatives 2 and 3 by WAA and development LUD and non-development LUD

WAA	Development LUD		Non-development LUD	
	Alternative 2	Alternative 3	Alternative 2	Alternative 3
1603	341		287	
1605	3,692	3,295	45	42
1816	90	80		
1903	295	278		
1904	2,536	2,096		
1905	6,401	6,077	1	1
1906	1,335	1,335		
2007	5,197	4,653	1,051	709
5012	4,104	3,862	6	5
5013			43	30
5014	196			
5018	71			
5131	294	214	1	
5132	3,540	3,283		
5134	145		78	
5136	121	116		
5138			115	115
Grand Total	28,358	25,290	1,626	902

Corridors

Alternative 3 would provide more habitat connectivity and less impediment to wildlife movement than Alternative 2 by maintaining elevational corridors through areas which would undergo timber harvest.

Silvicultural Intermediate Treatments

Silvicultural intermediate activities (for example, pre-commercial thinning, riparian thinning, etc.) enhance tree growth by reducing competition between trees and shorten the time to achieve old-growth conditions. The slash generated by thinning can impede wildlife movement in the short term, which is a known detriment for deer being able to access the forage within portions of these thinned stands. Parker et al. (1994) demonstrated that when debris (such as that accumulated after thinning) exceeds fifty percent of brisket height (approximately ten inches for Sitka black-tailed deer; Hanley 1984) the effort that deer must make to move through it increases dramatically. Additional measures such as bucking, or girdling (to kill trees while they stand instead of dropping them on the forest floor, thus slowing the pulse of slash onto the forest floor) can be used to mitigate effects to wildlife movement. Thinning conducted when the trees are smaller (less than 12 centimeters diameter at breast height) allows for faster decay of the slash and extends the duration of time that deer will use a thinned stand (Martin and Brinkman 2018, preliminary results).

Deer habitat capability

The theoretical deer habitat capability would be most reduced under Alternative 2 in WAAs where old growth timber harvest is proposed. The WAAs which would experience the highest reduction would be WAA 5136 (Portage Bay) where at stem exclusion (Year 2045) the deer habitat capability would be reduced by 18.6 percent under Alternative 2, and 14.1 percent under

Alternative 3, from the existing condition; WAA 1905 (Zarembo) where at stem exclusion (Year 2045) the deer habitat capability would be reduced by 18.6 percent under Alternative 2, and 14.1 percent under Alternative 3, from the existing condition; and WAA 2007 (Mitkof) where at stem exclusion (Year 2045) the deer habitat capability would be reduced by 11.5 percent under Alternative 2, and 9.6 percent under Alternative 3, from the existing condition (Table 22).

Table 22. Direct and indirect effects, by alternative, from proposed timber harvest on theoretical deer habitat capability, shown as theoretical number of deer on NFS land, as determined by the deer model

WAA[1]	Locality	Square Miles NFS only	Deer habitat capability (NFS only), shown as theoretical number of deer			Percent reduction in deer habitat capability on NFS land from the existing condition by Alternative and Year					
			Historic (1954)	Existing	Reduction from historic on NFS land only	Alternative 1		Alternative 2		Alternative 3	
						2020	2045	2020	2045	2020	2045
1605	Thomas Bay	233	1559	1208	22.5%	0.0%	0.0%	4.4%	5.9%	3.2%	4.3%
1816	Frosty Bay	53	580	520	10.5%	0.0%	0.0%	6.1%	7.2%	4.2%	5.2%
1901	Etolin	206	3673	3319	9.7%	0.3%	0.9%	1.9%	3.5%	1.7%	3.2%
1903	Wrangell	177	2681	2243	16.3%	0.2%	1.0%	2.8%	5.1%	2.5%	4.7%
1904	Vank/Sokolof	36	947	633	33.1%	0.0%	0.6%	0.0%	0.7%	0.0%	0.6%
1905	Zarembo	181	3736	2669	28.6%	0.2%	1.2%	8.4%	14.8%	6.6%	12.2%
2007	Mitkof	170	3346	2514	24.9%	0.0%	0.2%	7.5%	11.5%	6.3%	9.6%
5012	Kuiu	217	6423	4809	25.1%	0.2%	0.6%	4.2%	7.0%	2.5%	4.3%
5018	Kuiu	76	1658	1538	7.3%	0.0%	0.0%	3.0%	4.7%	1.6%	2.5%
5131	W. Kupreanof	109	2162	1923	11.0%	0.0%	0.0%	3.8%	6.2%	3.3%	5.4%
5132	W. Kupreanof	58	1270	892	29.8%	0.0%	0.0%	2.2%	5.7%	1.7%	4.8%
5136	Portage Bay	94	1538	1265	17.8%	0.0%	1.7%	8.7%	18.6%	5.9%	14.1%
5138	Tonka/ Lindenberg	96	1944	1514	22.1%	0.0%	3.1%	1.8%	7.8%	0.6%	5.5%

[1] Only the WAAs where the deer habitat capability would be affected by timber harvest are included in the table.

Cumulative Effects

Alternative 1 – No Action Alternative

The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternatives 2 and 3

Because there would be direct/indirect effects to deer or their habitat from all action alternatives there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. The existing condition reflects the past and present reductions in deer winter habitat. The reasonably foreseeable future utility and road easements would cause minor additional reductions in POG and deer habitat capability in some WAAs but is not expected to cause a decline in the deer population over the long term.

High and moderately high value deer winter habitat

The percent of the high and moderately high value deer winter habitat (defined as all POG less than 800 feet on south facing slopes) currently remaining, compared to the historic (1954) condition, currently ranges from 62 to 92 percent in the WAAs where timber harvest is proposed under Alternatives 2 and 3 (Table 23). Alternatives 2 and 3 would result in further reductions of high and moderately high value deer winter habitat in these WAAs. The reduction of this important deer habitat under Alternative 2 would result in 49 to 89 percent remaining while the reduction under Alternative 3 would result in 51 to 89 percent remaining (Table 23). Under Alternative 2, WAAs where the percentage of moderately high value deer winter habitat is currently above 50 percent but would fall below 50 percent are WAA 5132 (Western Kupreanof) and WAA 5136 (Portage Bay). Under Alternative 3, no WAAs would fall below 50 percent. These overall reductions in high and moderately high value deer winter habitat remaining compared to the historic (1954) condition further increase the risk of certain WAAs in not providing habitat conditions that would sustain healthy and productive deer populations through a severe winter or series of severe winters with high persistent snow amounts. Overall in the whole project area, Alternatives 2 and 3 would leave between 85 and 87 percent of the historic high and moderately high value deer winter habitat remaining (Table 23).

Deer Habitat Capability

In WAAs where timber harvest is proposed under Alternative 2 or Alternative 3, the theoretical deer habitat capability has been most reduced already in WAA 1904 (Vank/Sokoloff; a reduction of 33 percent from the historic condition on NFS lands) (Table 24). Additional old-growth harvest is not proposed in WAA 1904 and the deer habitat capability would not differ between alternatives.

The next highest reduction has occurred in WAA 5132 (reduction of 30 percent from historical on NFS lands), which has also undergone a substantial amount of timber harvest on private lands adjacent to Kake. Alternative 2 would cause an additional 4 percent reduction from the existing condition in this WAA (at stem exclusion in Year 2045) whereas Alternative 3 would cause an additional 3 percent reduction from the existing condition, resulting in an overall reduction from the historical condition by 66 to 67 percent).

Table 23. Cumulative effects to high and moderately high value deer winter habitat. Acreages and percentage remaining are for NFS lands only

WAA	Historic (1954) (acres)	Existing (acres)	Existing (Alt 1) percent remaining	Alt 2 harvest (acres)	Alt 2 % remaining	Alt 3 harvest (acres)	Alt 3 % remaining
1605	3,426	2,173	63	196	58	104	60
1816	1,089	943	87	186	69	98	78
1901	7,107	6,467	91	126	89	112	89
1903	5,471	4,578	84	98	82	73	82
1904	2,288	1,529	67	0	67	0	67
1905	9,743	7,518	77	1,127	66	835	69
2007	7,706	5,395	70	632	62	416	65
5012	14,175	10,552	74	693	70	132	74
5018	4,176	3,836	92	277	85	112	89
5131	6,100	5,414	89	317	84	284	84
5132	4,773	2,964	62	602	49	547	51
5136	3,030	2,256	74	778	49	399	61
5138	5,264	3,719	71	384	63	165	68
Project Area Grand Total[1]	**183,839**	**162,483**	**88**	**5,417**	**85**	**3,275**	**87**

[1] The Grand Total shown is for the whole project area, not just the WAAs shown in the table, where timber harvest would have effects on habitat.

Table 24. Cumulative effects to deer habitat capability, NFS lands only

WAA	Locality	Square Miles, NFS land	Deer habitat capability, NFS lands			Deer habitat capability and percent remaining from the historic condition on NFS lands only by Alternative and Year					
						Alternative 1		Alternative 2		Alternative 3	
			Historic (1954)	Existing	Reduction	2020	2045	2020	2045	2020	2045
1605	Thomas Bay	233	1559	1208	22%	1208 78%	1208 78%	1155 74%	1137 73%	1170 75%	1156 74%
1816	Frosty Bay	53	580	520	10%	520 90%	520 90%	488 84%	482 83%	498 86%	493 85%

WAA	Locality	Square Miles, NFS land	Deer habitat capability, NFS lands			Deer habitat capability and percent remaining from the historic condition on NFS lands only by Alternative and Year					
			Historic (1954)	Existing	Reduction	Alternative 1		Alternative 2		Alternative 3	
						2020	2045	2020	2045	2020	2045
1901	Etolin	206	3673	3319	10%	3309 90%	3290 90%	3254 89%	3202 87%	3261 89%	3213 87%
1903	Wrangell	177	2681	2243	16%	2239 84%	2221 83%	2181 81%	2129 79%	2186 82%	2139 80%
1904	Vank/ Sokolof	36	947	633	33%	633 67%	629 66%	633 67%	629 66%	633 67%	629 66%
1905	Zarembo	181	3736	2669	29%	2663 71%	2637 71%	2445 65%	2273 61%	2492 67%	2345 63%
2007	Mitkof	170	3346	2514	25%	2514 75%	2508 75%	2325 70%	2225 67%	2357 70%	2272 68%
5012	Kuiu	217	6423	4809	25%	4799 75%	4781 74%	4607 72%	4474 70%	4689 73%	4602 72%
5018	Kuiu	76	1658	1538	7%	1538 93%	1538 93%	1492 90%	1466 88%	1514 91%	1499 90%
5131	W. Kupreanof	109	2162	1923	11%	1923 89%	1923 89%	1851 86%	1805 83%	1859 86%	1818 84%
5132	W. Kupreanof	58	1270	892	30%	892 70%	892 70%	873 69%	841 66%	877 69%	849 67%
5136	Portage Bay	94	1538	1265	18%	1265 82%	1244 81%	1155 75%	1030 67%	1191 77%	1086 71%
5138	Tonka/ Lindenberg	96	1944	1514	22%	1514 78%	1467 75%	1486 76%	1396 72%	1505 70%	1430 74%

Under Alternative 2, the WAA which would have the least amount of deer habitat capability remaining from the historic condition, when stem exclusion is reached at Year 2045, would be WAA 1905 (Zarembo; 61 percent remaining). There are several WAAs that would have between 66 and 73 percent of their historical deer habitat capability remaining at stem exclusion; these are WAA 1605 (Thomas Bay; 73 percent), WAA 1904 (Vank/Sokoloff; 66 percent), WAA 2007 (Mitkof; 67 percent), WAA 5012 (Kuiu; 70 percent), WAA 5132 (West Kupreanof; 66 percent), WAA 5136 (Portage Bay; 67 percent), and WAA 5138 (Tonka Lindenberg; 72 percent) (Table 24).

American Marten and Pacific Marten

Summary

The proposed activities under the action alternatives are likely to affect the abundance and availability of marten either indirectly from forest treatments of habitat or directly from harvest.

Marten habitat in certain VCUs has already undergone reductions that meet the habitat retention threshold identified by research (70 percent remaining) where populations may decline, therefore marten populations may already be reduced in localized areas. Alternatives 2 and 3 would further reduce the habitat quantity and/or quality in these VCUs, and would cause other VCUs to fall below the threshold which could cause declines in marten populations in certain areas. There would be more potential for declines particularly where VCUs below habitat thresholds adjoin each other, particularly on northern Zarembo but also in various other parts of the project area.

Historically in the whole project are there were a total of 804,525 acres of average winter marten habitat (considered as POG habitat below 1,500 feet elevation) and there are currently 718,482 acres or 89 percent remaining. Under Alternative 2 or Alternative 3 the percent remaining in the project area overall would be 85 percent, when calculating based on the gross unit pool. There would be 76 percent of deep snow winter habitat (high POG below 800 feet elevation) in the project area overall. While certain VCUs have already experienced reductions in marten habitat from the historic condition they would be further affected by Alternatives 2 and 3. This will put them at greater risk in not providing sufficient marten habitat and marten declines could occur in certain areas.

Alternative 3 provides additional protections for marten habitat, particularly on Kuiu Island where the Pacific marten occurs. Elevational corridors through the gross unit pool in Alternative 3 would also provide more habitat connectivity for marten as compared to Alternative 2. Alternative 3 protects more habitat especially the most important marten habitat on Kuiu Island. On Kuiu Island, most VCUs will remain above 70 percent marten habitat remaining from the existing condition under both Alternatives 2 and 3, though Alternative 3 would have less effects than Alternative 2 especially in the most important marten habitat. Therefore, for Pacific marten the determination is that Alternatives 2 and 3 may impact individuals but not likely to cause a trend to federal listing or a loss of viability.

While in the project area overall the amount of remaining marten habitat would remain at a relatively high percentage, and many VCUs would not be affected by the project, the relatively low amount of important marten habitat that could remain in certain VCUs would have the potential to cause localized declines in marten populations. Therefore, Alternatives 2 and 3 would have major effects to American marten as a Management Indicator Species.

Affected Environment

Existing Condition

Two species of marten occur in the Tongass, Pacific marten (*Martes caurina*) and American marten (*Martes americana*). Both species are important furbearers and are associated with old growth forests. Kuiu Island is an area of sympatry between the two species where hybridization occurs. The American marten is an MIS on the Tongass because of its close association with old-growth forests and its susceptibility to habitat fragmentation from forest management practices. Pacific marten are a species of interest for this analysis because they are known to occur on only Admiralty Island and Kuiu Island on the Tongass, and the marten population on Kuiu Island has been found to be amongst the lowest in Southeast Alaska (Flynn et al. 2004). American marten expanded westward across the interior after the glacial retreat through the large river valleys and eventually naturally occupied the mainland coast and the islands in the project area. The discussion below applies generally to both species (grouping them together as "marten" in this section of the analysis) which have similar ecological needs. Where there is a distinction between the species it is noted.

Marten numbers fluctuate over time in response to food availability, habitat conditions, and trapping pressure. ADF&G does not have population data for marten within the project area, but according to trapping data, populations appear to fluctuate yearly.

Studies of eight marten populations in Southeast Alaska conducted between 2001 and 2003 show that marten selected POG but also used some young-growth 26 to 40 years of age (Flynn et al. 2004). On the Tongass, lower elevations have been shown to have higher value for marten. Coastal habitats (beach fringe) and riparian areas have the highest value, followed by upland High-Volume POG habitats below 1,500 feet in elevation (USDA Forest Service 2016c, p. 3-235). During severe winters with deep snow, High-Volume POG habitat below 800 feet may be the most crucial element to marten survival.

Legacy standards and guidelines were developed in part to address marten on the Tongass (USDA Forest Service 2016a WILD1.IV.D, pp. 4-86 and 4-87). For more information on legacy see Appendix D in 2008 FEIS. Two legacy VCUs are identified in the 2016 Forest Plan that are in the project area, VCU 4550 and VCU 4570.

The Etolin Island Biogeographic Province is considered a high-risk province for marten habitat because of the amount of past timber harvest (1997 Forest Plan FEIS, p. 4-118).

When compared to the existing condition (1954) there are several VCUs that have between 55 and 70 percent of POG remaining and many VCUs that have between 21 and 70 percent HPOG remaining on NFS lands below 800 feet (for a summary of marten habitat by VCU refer to the Wildlife report, Figure 9). On NFS lands below 1,500 feet fewer VCUs have POG and HPOG that fall below 70 percent habitat remaining (Figure 10).

The number of relatively smaller habitat patches in the project area, particularly those less than 50 acres in size, has increased from the historic condition to the existing condition, which is a measure of fragmentation.

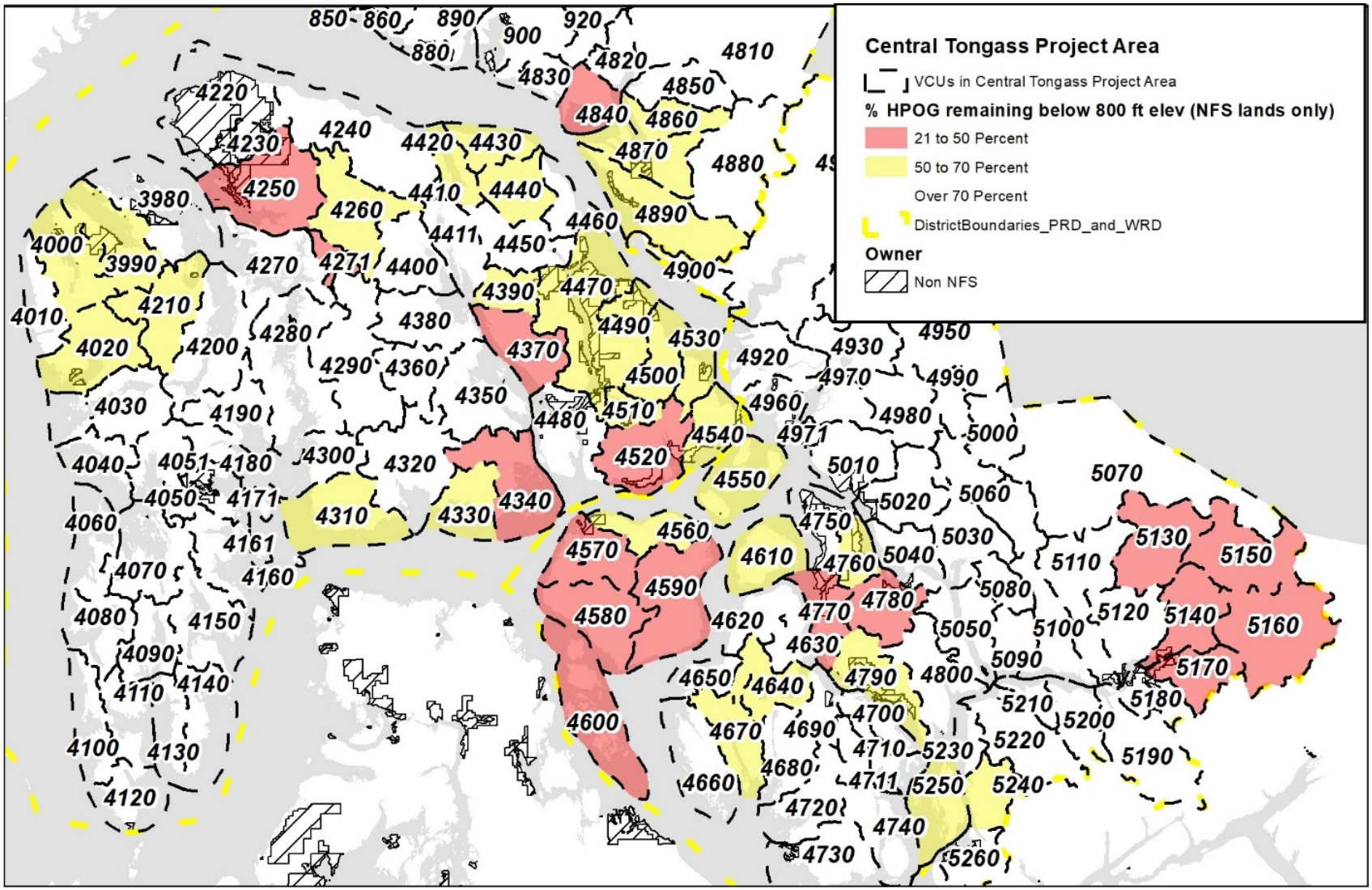


Figure 9. Deep snow marten habitat (HPOG remaining below 800 feet elevation)

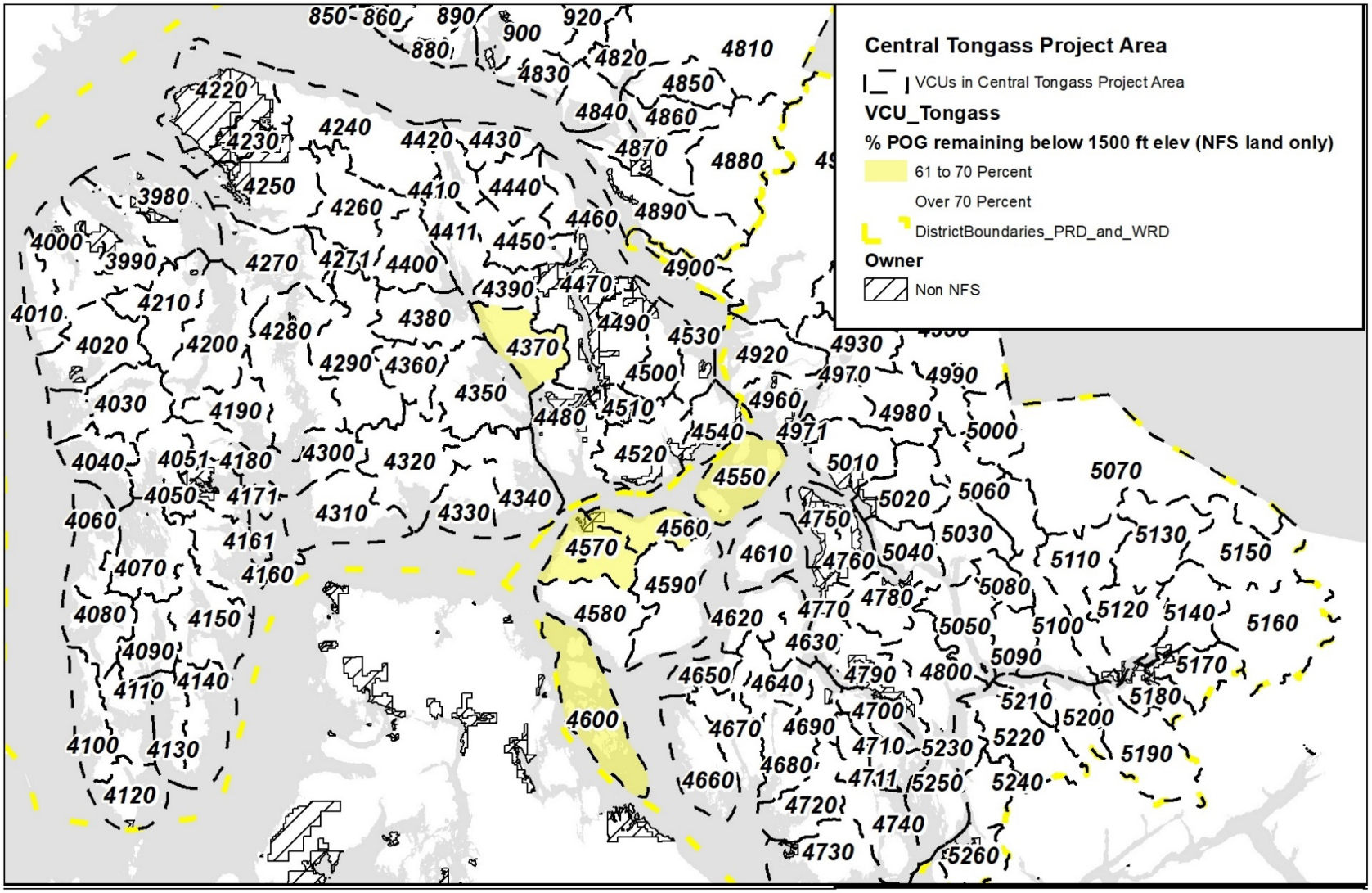


Figure 10. Average winter marten habitat (percent POG remaining below 1,500 feet elevation)

Indicators

Alternatives that result in the greatest reduction in POG and High-Volume POG habitat would be expected to have the greatest effects to marten. On the Tongass marten are generally associated with POG in lower elevations. The availability of good quality marten habitat is important and is defined as POG (SD classes 4H, 4N, 4S, 5H, 5N, 5S and 6/7), high POG (SD classes 5N, 5S and 6/7) below 1,500 feet and below 800 feet in elevation.

Environmental Effects

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

Both action alternatives would have direct and indirect effects to martens and/or habitat because of the removal of potential habitat and increased motorized access. Two primary activities in Alternatives 2 and 3 would affect marten: timber harvest below 800 feet and increases in open motorized access. Since the most important marten habitat on the Tongass has been found to be lower elevation old-growth, alternatives that result in the greatest reduction in POG and High-Volume POG habitat at low elevations would be expected to have the greatest effects to marten.

Research has shown a negative linear relationship between clearcut logging and marten densities. Clearcut logging directly affects marten habitat and can reduce the connectivity of POG across the project area. Clearcut harvest would also reduce canopy cover, the amount of coarse woody debris (in the long term since snags would not continue to fall to the forest floor), the availability of denning and resting sites, habitat for prey species, and marten hunting efficiency. It would also create a relatively fine-grained, highly fragmented landscape pattern that includes increases in forest-opening edge and decreases patch size (Thomas et al. 1988). Clearcutting differs from natural disturbances in that it represents a large-scale change rather than small dispersed patches where trees remain standing or partially standing (Hansen et al. 1991). Clear-cuts and forest openings also reduce forest cover exposing martens to much higher snow accumulations and predation risks (Schoen et.al. 2007). Marten are thought to avoid both young and older clear-cuts in the winter (Flynn and Schumacher 2001).

Under the current Forest Plan, effects to marten populations from timber harvest are mitigated by the Forest Plan Conservation Strategy which provide old growth reserves and Forest wide Standards and Guidelines for timber harvest in development LUDs. TTRA and beach buffers, provide old growth forest cover and coarse woody debris in timber harvest areas within TTRA and beach buffers. Unharvested buffers provide a measure of structure important to marten. The beach and estuary fringe and RMA's provide travel corridors for marten, old growth reserves and other non-development LUDs provide refugia from trapping particularly when far removed from road systems. Pre-commercial would promote the development of stand conditions that provide habitat structure for marten, though if these stands are harvested when they reach merchantable age any primary benefits to marten would not be realized.

Lower elevation POG is considered the most important habitat for marten. For this analysis average winter marten habitat is considered as all POG below 1,500 feet elevation, and deep

snow marten winter habitat is considered as high POG below 800 feet elevation. Effects to marten habitat are assessed by VCU because marten populations can be sensitive to fragmentation. Based on the gross unit pool, Alternative 2 would affect the existing average winter marten habitat from 0 to 46 percent in individual VCUs, and 5 percent in the project area overall. Alternative 2 would remove the existing deep snow winter marten habitat from 0 to 48 percent in individual VCUs, and 3 percent in the project area overall.

Young growth that is commercially viable for timber harvest would likely be providing some value to marten, particularly if the stands have begun to develop some characteristics of old-growth such as large snags and logs. Harvest of young-growth would preclude the continued progression of young-growth stands toward old-growth conditions in development LUDs. A total of 28,358 acres of young-growth are in the gross unit pool and could potentially be harvested under Alternative 2 within development LUDs, and 25,290 acres under Alternative 3. In Old Growth LUD, any young-growth harvest would be required to promote progression toward old-growth conditions and would therefore benefit marten in the long term. There are 1,626 acres of young-growth within the gross unit pool in non-development LUDs under Alternative 2 and 902 acres under Alternative 3.

Koch (2016) identified high and very high marten focal use areas on Kuiu Island (Figure 11 and Figure 12). Alternative 3 was designed to manage young-growth harvest in this most important marten habitat to provide both merchantable timber and promote old-growth habitat conditions (refer to 2016 Forest Plan, Chapter 5). In addition, Alternative 3 would preclude old-growth timber harvest in the high and very high focal areas of use. Therefore, Alternative 3 would have less effect to the most important habitat for marten on Kuiu Island by maintaining the ecological function of the existing old-growth in the high and very high marten focal areas of use and perpetuating movement of existing young-growth towards old-growth conditions in these specific areas. Additional fragmentation of the most important marten habitat (categorized as very high and high areas of marten use by Koch) would be lessened on Kuiu Island under Alternative 3.

Both action alternatives involve road construction which can increase the risk of marten trapping mortality through increased human access. There are no known definitive thresholds for road density related to potentially unsustainable levels of marten trapping mortality, though it is assumed the potential for effects from increases in road density to marten would be similar as for wolves.

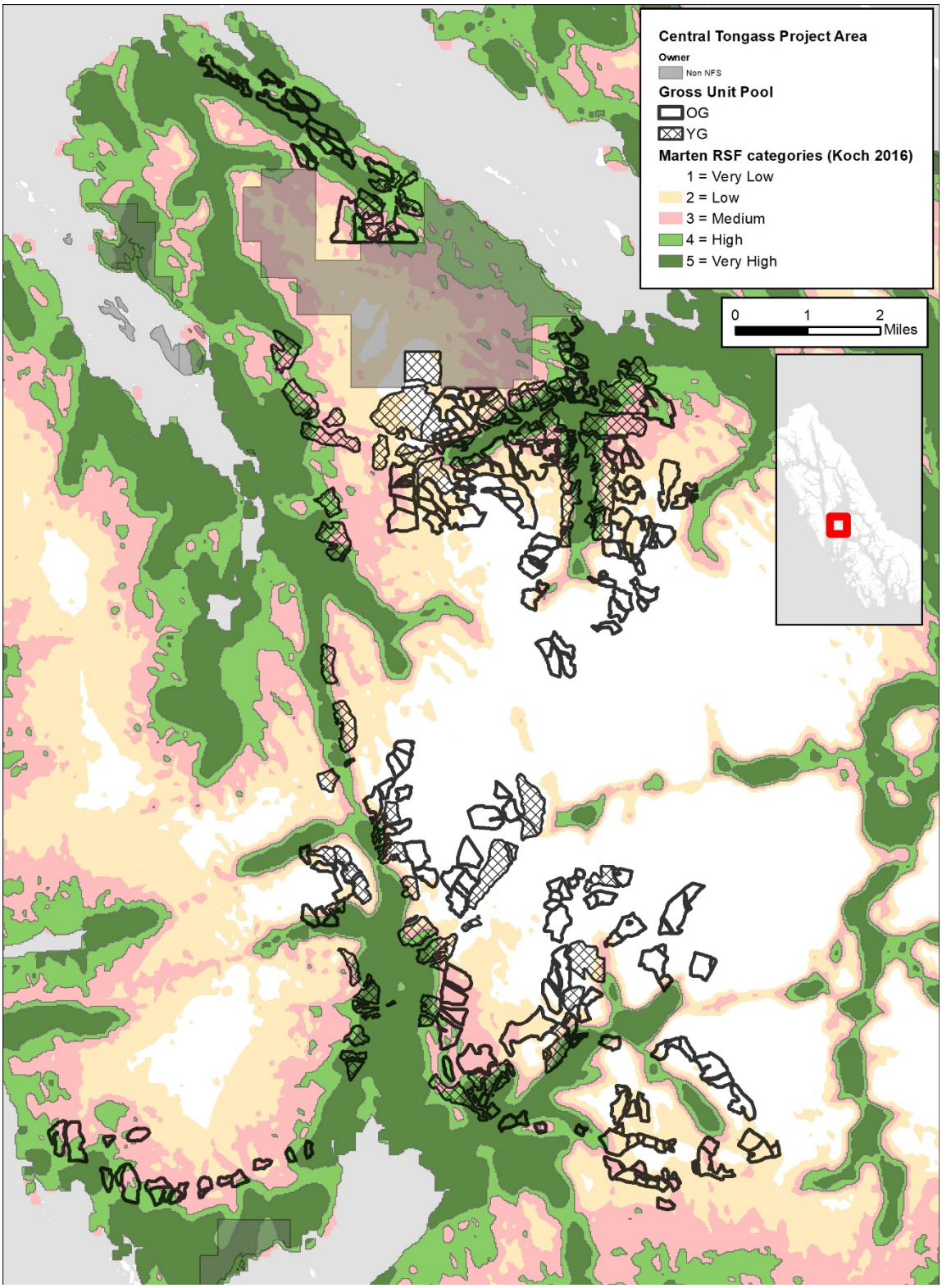


Figure 11. Skanax and Rowan Creek, Kuiu Island, Alternative 2 gross unit pool and Pacific marten focal areas of use (based on Koch 2016)

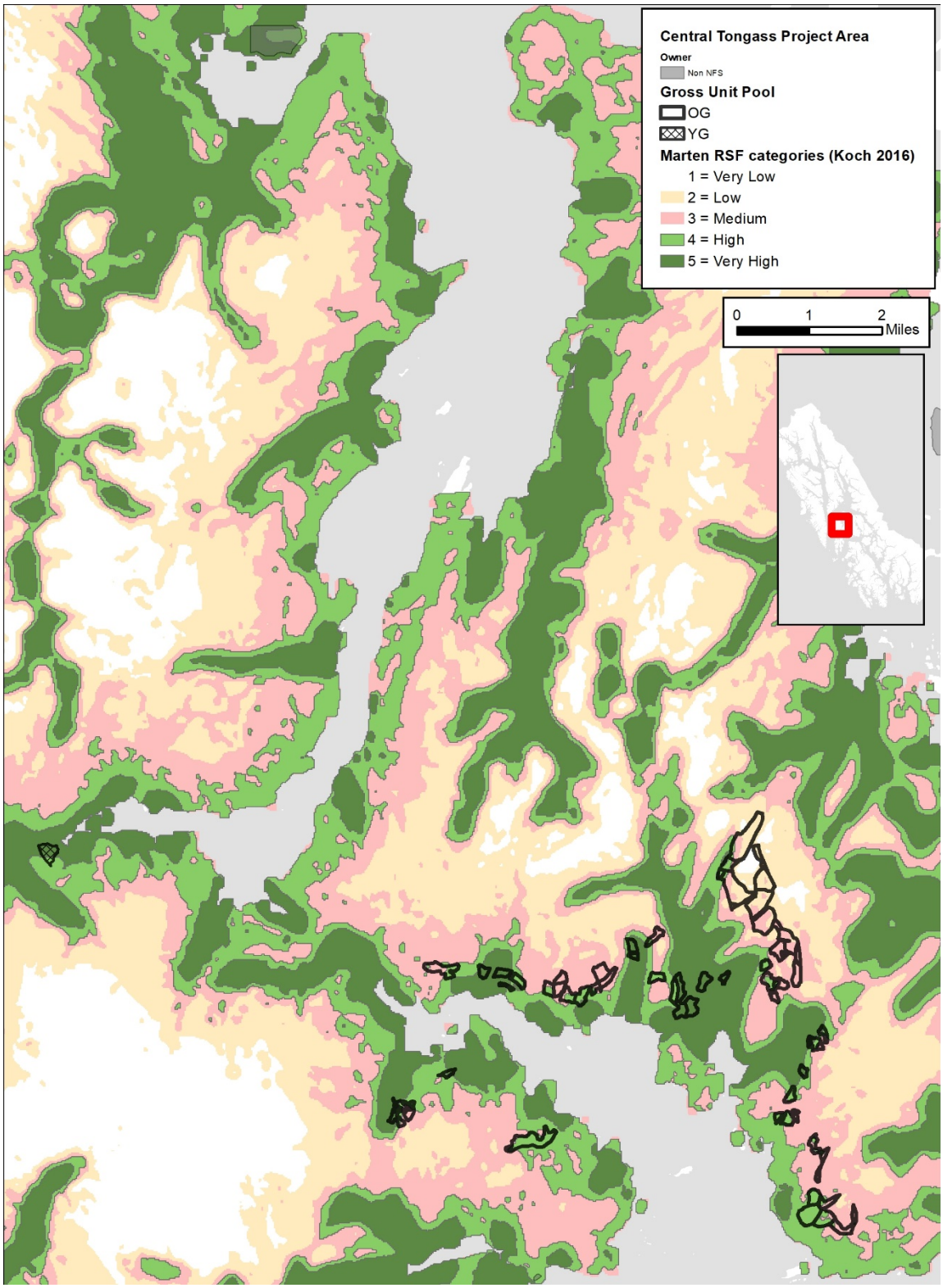


Figure 12. Three Mile Arm, Kuiu Island, Alternative 2 gross unit pool and Pacific marten focal areas of use (based on Koch 2016)

Cumulative Effects

Alternative 1 – No Action Alternative

The past, present, and reasonably foreseeable future activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternatives 2 and 3

Because there would be direct/indirect effects from all action alternatives to martens and their habitat, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities with the implementation of this project. Past and present activities have resulted in the existing condition. The reasonably foreseeable future utility and road easements would cause additional minor reductions of deep snow marten habitat in some WAAs but given the small amount of reduction and narrow linear nature it is not expected to result in a reduction of marten populations or substantive fragmentation of marten habitat. However, roads would further increase the road density and add to the potential for increased trapping pressure.

Additional reduction in the quantity and quality of marten habitat, particularly at lower elevations, could increase the risk of declines in the marten population in certain VCUs in the project area, particularly since past and present activities have already reduced marten habitat below the potential threshold of 70 percent identified through various research efforts. Alternatives 2 and 3 would add to these reductions. Martens are extremely sensitive to the loss and fragmentation of mature forest habitat and rarely occupy landscapes after more than 30 percent of the mature forest has been harvested (Chapin et al. 1998, Hargis et al. 1999, Potvin et al. 2000, Moriarty et al. 2016a). Martens can inhabit younger or managed forests as long as some of the structural elements found in older forests remain, particularly those required for resting and denning (Baker 1992, Porter et al. 2005).

With the proposed old-growth timber harvest under Alternatives 2 and 3, the remaining percentage of average winter marten habitat (POG below 1,500 feet elevation) would fall below 70 percent in the following VCUs where the percentage is currently above 70 percent: VCUs 3990 and 4020 (Kuiu), VCUs 4250, 4260, and 4271 (West Kupreanof), VCUs 4430 and 4440 (Portage Bay), VCUs 4490, 4500, 4520, and 4530 (Mitkof Island), VCU 4640 (Etolin), VCUs 4630, 4770, and 4780 (Wrangell Island), and VCU 5240 (Frosty Bay); and VCUs 4560 and 4570 (Zarembo) which currently are between 50 and 70 percent remaining would fall below 50 percent remaining (refer to Wildlife Resource Report).

When assessing deep snow marten habitat (high POG below 800 feet elevation) there are some differences compared to the average winter habitat in some VCUs though the general results are the same (Refer to Wildlife Resource Report).In VCUs where the percentage of historic average winter and deep snow marten habitat remaining would be below 70 percent under either alternative there would be an increased potential for marten population declines. The potential would be even more elevated where the percentages of habitat that would remain would be low in adjoining VCUs. This situation is particularly evident on north Zarembo where both VCUs would be below 50 percent of the historic average winter and deep snow marten habitat; and one of these VCUs is already below 50 percent deep snow marten habitat remaining.

On Mitkof Island four adjoining VCUs would all fall below 70 percent remaining of average winter marten habitat, and deep snow habitat would be below 50 percent remaining. West Kupreanof is similar to Mitkof Island. Wrangell Island would also have some VCUs that adjoin each other that would be below 70 percent average winter marten habitat and 50 percent deep

snow marten habitat. Two VCUs on Kuiu Island would also fall below 70 percent of average winter habitat though they are not immediately adjacent to each other and there are several VCUs adjoining each other that are currently below 70 percent deep snow marten habitat and one of these would fall below 50 percent remaining.

When calculating the existing road density on all land ownerships below 1,200 feet, Zarembo (WAA 1905) has the highest road density on NFS lands at 1.55 mi/mi^2 and would increase to 2.00 mi/mi^2 with Alternatives 2 and 3. Under Alternatives 2 and 3, the road density on all land ownerships would not exceed 1.5 mi/mi^2 in any other WAAs but it would approach 1.5 mi/mi^2 in several. As discussed with wolves, when road densities approach a certain level (for example, 1.5 mi/mi^2 with wolves), harvest risk could plateau to a point where an increase in road density may have little additional effect. Whether this would result in an unsustainable level of marten harvest is unknown.

Other Wildlife

In addition to direct, indirect, and cumulative effects to deer and marten, effects to other wildlife resources in the project area were also assessed. These include effects to Threatened, Endangered, and Sensitive (TES) species (Table 25), Alaska Region Sensitive Species (Table 26), and Management Indicator Species (MIS), and other species of interest such as endemic species, and migratory birds (Table 27).

Summary

Species considered in this analysis are listed in Table 40 along with a basic summary of status, distribution, habitat association, and potential occurrence in the project area. For some species, the project would have no effects individuals or habitat, therefore these species are not considered any further in this analysis. The species are the short-tailed albatross, fin whale, sperm whale, Aleutian tern, Kittlitz's murrelet, and dusky Canada goose.

For federally-listed Threatened and Endangered Species, the determination was made as to whether the project may affect these listed species or their designated critical habitat, and if so, whether or not the project was likely to adversely affect these species or adversely modify critical habitat (Table 25). This determination is required as a first step in meeting *Endangered Species Act* Section 7 requirements. For a "may affect" determination, consultation with the appropriate *Endangered Species Act* regulatory agency (depending on the species either the U.S. Fish and Wildlife Service or National Marine Fisheries Service) is required.

Table 25. Summary of effects determinations for Threatened and Endangered Species

Threatened and Endangered Species	Determination		
	No Effect	May affect, not likely to adversely affect	May affect, likely to adversely affect
Short-tailed Albatross	All activities under all alternatives		

Threatened and Endangered Species	Determination		
	No Effect	May affect, not likely to adversely affect	May affect, likely to adversely affect
Humpback Whale	Most activities would have No Effect under any Alternative	Activities associated with marine access facilities, particularly construction and reconstruction, proposed under Alternatives 2 and 3 could cause insignificant effects (undetectable, not measurable, or so minor that they cannot be meaningfully evaluated). There would also be a discountable (plausible but extremely unlikely to occur) potential for ship strike or marine mammal entanglement with activities involving use of marine waters.	
Fin Whale	All activities under all alternatives would have No Effect		
Sperm Whale	All activities under all alternatives would have No Effect		
Steller Sea Lion – Western DPS; and designated Critical Habitat	Most activities would have No Effect under any Alternative. All activities would have No Effect to designated Critical Habitat.	Activities that include use of marine waters may affect Steller sea lion western DPS individuals. The level of effect would be insignificant (undetectable, not measurable, or so minor that they cannot be meaningfully evaluated).	

For Forest Service Alaska Region Sensitive Species, and other species of interest, a determination of whether the Forest Service's obligation would be met in managing wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area and ensure that its actions do not contribute to trends toward federal listing of species (FSM 2620.1, 36 CFR 219.19; Table 26).

Table 26. Summary of Effects Determinations for Alaska Region Sensitive Species and Other Species of Interest

Alaska Region Sensitive Species	Determination			
	No Impact	Beneficial impacts	May impact, not likely to cause a trend to federal listing or a loss of viability	May impact, likely to result in a trend to federal listing or a loss of viability
Aleutian Tern	All activities under all alternatives			

Alaska Region Sensitive Species	Determination			
	No Impact	Beneficial impacts	May impact, not likely to cause a trend to federal listing or a loss of viability	May impact, likely to result in a trend to federal listing or a loss of viability
Black Oystercatcher			There is a potential for disturbance to black oystercatchers along the shoreline from project activities, though any disturbance would most likely be very rare and localized if it were to occur. Shoreline activities may impact individuals but not likely to cause a trend to federal listing or a loss of viability.	
Dusky Canada Goose	All activities under all alternatives			
Kittlitz's Murrelet	All activities under all alternatives			
Queen Charlotte Goshawk			There could be effects from disturbance from many of the activities though it would likely be temporary and insignificant (the level of the effect would not be measurable or would not have consequence). Timber harvest would cause habitat reductions which may impact individuals but would not lead to a trend toward federal listing or a loss of viability. Surveys are conducted for habitat altering activities and Forest Plan Standards and Guidelines provide nest buffer protection.	
Other Species of Interest				
Pacific Marten			Distribution in the project area is only Kuiu Island. Timber harvest would cause habitat reductions which may impact individuals but would not lead to a trend toward federal listing or a loss of viability. Alternative 3 protects more marten habitat especially areas identified as high and very high focal areas of use on Kuiu Island.	
Southern Red-backed Vole			Endemic small mammal on Wrangell Island and nearby Sergief Islands. Timber harvest would cause habitat reductions which may impact individuals but would not lead to a trend toward federal listing or a loss of viability.	

For Management Indicator Species and migratory birds, effects to habitat were assessed and categorized as either: no effect, negligible, minor, moderate, or major (Table 27).

Table 27. Summary of effects to management indicator species and migratory birds

Resource	Degree of effect from all activities				
	No Effect	Negligible	Minor	Moderate	Major
Management Indicator Species					
Alexander Archipelago Wolf				X	
American Marten				X	
Bald Eagle		X			
Black Bear			X		
Brown Bear			X		
Brown Creeper				X	
Hairy Woodpecker				X	
Mountain Goat			X		
Red-breasted Sapsucker		X			
Red Squirrel			X		
River Otter			X		
Sitka Black-tailed Deer				X	
Vancouver Canada Goose		X			
Migratory Birds					
Migratory Birds			X		

Table 28 summarizes determinations for species considered in this analysis, by activity type and supporting actions. The overall effects determinations are largely the same for both action alternatives (Alternatives 2 and 3). However, Alternative 3 lessens the effects to wildlife by providing for 1) wildlife movement corridors through areas with mapped gross unit pool, 2) maintaining high value deer winter habitat, and 3) maintaining more Pacific marten habitat on Kuiu Island.

Table 28. Summary of Effects Determinations for the action alternatives, Alternatives 2 and 3

If there is a difference in the level of effect between action alternatives, the difference is denoted.
For Threatened and Endangered: Blank cell = No Effect, NLAA = May Affect Not Likely to Adversely Affect, LAA = May Affect Likely to Adversely Affect
For Sensitive Species and Other Species of Interest: Blank cell = No Impact, MINL = May Impact Individuals Not Likely to Lead to Trend toward Listing, MITL = May Impact Likely to Lead to Trend toward Listing
For Management Indicator Species: N = Negligible, M = Minor, MO = Moderate, MJ = Major

	Activity[1]												Supporting Actions[2]	
Resource	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**A**	**B**
Short-tailed Albatross														
Humpback Whale						NLAA	NLAA					NLAA		
Fin Whale														
Sperm Whale														
Steller Sea Lion – Western DPS						NLAA	NLAA					NLAA		
Aleutian Tern														
Black Oystercatcher						MINL	MINL					MINL		
Dusky Canada Goose														
Kittlitz's Murrelet														
Queen Charlotte Goshawk	MINL		MINL	MINL	MINL	MINL	MINL		MINL	MINL			MINL	
Pacific Marten	MINL	MINL	MINL	MINL	MINL	MINL	MINL		MINL	MINL	MINL		MINL	MINL
Southern Red-backed Vole			MINL	MINL	MINL	MINL	MINL	MINL	MINL	MINL				MINL
Alexander Archipelago Wolf	N			N	N	MO	MO		MO	MO	N	MO		
American Marten	N	N	N	N	N	MJ	MJ		N	N	N		N	N
Bald Eagle				N	N	N	N	N	N	N				
Black Bear	N	N		N	N	M	N	N	N	N	N			N

	Activity[1]												Supporting Actions[2]	
Resource	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**A**	**B**
Brown Bear	N	N		N	N	M	N	N	N	N	N			N
Brown Creeper				N	N	MJ	N		N	N	N			
Hairy Woodpecker				N	N	MJ	N		N	N	N			
Mountain Goat						M	M							
Red-breasted Sapsucker				N	N	N	N		N	N	N			
Red Squirrel						M	N							
River Otter	N	N				M	N				N			
Sitka Black-tailed Deer				N	N	MO	MO		N	N	N			
Vancouver Canada Goose				N	N	N	N							
Migratory Birds						M	M							

[1] Activity
01: Stream and Floodplain Restoration
02: Fisheries Improvements
03: Invasive Treatments
04: Recreation Facility Construction, Reconstruction, Improvement, Decommissioning, and Maintenance
05: Trail Construction, Reconstruction, Improvement, Decommissioning, and Maintenance
06: Old-Growth Timber Harvest (Commercial)
07: Young-Growth Timber Harvest (Commercial)
08: Silviculture Intermediate Treatments (Pre-commercial)
09: NFS Road Construction and Reconstruction
10: Temporary Road Construction
11: Aquatic Organism Passage
12: Marine Access Facility Construction, Reconstruction, Decommissioning, and Maintenance
[2] Supporting Action
A: Soil Restoration
B: Timber Stand Establishment – Planting and Interplanting

Methodology

This analysis compares effects of the three alternatives being considered in the Central Tongass Draft Environmental Impact Statement. Effects are analyzed for the following different categories of wildlife:

- Threatened and Endangered Species
- Forest Service Alaska Region Sensitive Species
- Other Species of Interest (for example, endemics or other species that may have viability concerns)
- Management Indicator Species
- Migratory Birds

Units of Measure

Effects are analyzed using the following units of measure and are further discussed as they pertain to each species in the *Environmental Effects* section of this document.

- Habitat change based on criteria that are pertinent to the species
  - For Sitka black-tailed deer/Alexander Archipelago Wolf this includes outputs from the Interagency Deer Model
- Disturbance factors
- Road density
- Other types of effects

Spatial and Temporal Scales

The units of measure are addressed at one or more of the following spatial scale(s) that are relevant to the species:

- Bioregional Province
- Game Management Unit
- Wildlife Analysis Area
- Value Comparison Unit

For habitat change, and particularly for large scale change due to timber harvest, effects will be discussed at varied temporal scales as necessary, such as:

- Immediately post-implementation
- Stem exclusion (assumed to be at age 25)
- Development of old-growth conditions (160 to 200 years or more)

3 – Environment and Effects

Affected Environment

General Wildlife Information

There are approximately 73 migratory bird species that either breed or overwinter in the project area or in the surrounding marine waters and approximately 27 terrestrial mammal species. Marine mammals include humpback whales, fin whales, minke whales, killer whales, Dall's porpoise, harbor porpoise, Pacific white-sided dolphins, Steller sea lions, harbor seals, and sea otters.

Old Growth Habitat

Old-growth forests are divided on the basis of their productivity, defined in terms of their ability to produce a minimum volume of wood. The relative productivity of a stand is based on site quality. Site quality is defined as the ability of a forest site to grow trees (USDA Forest Service 2008c, p. 3-137), and is based on the physiography, climate, soil, and other factors of the environment that are not easily altered. Site productivity is the capacity of a tree species to thrive and successfully compete on a particular site and is influenced by the physiological makeup of the tree species and environmental factors. A higher site quality generally translates into taller trees and higher volume per acre (USDA Forest Service 2008c, p. 3-137). The oldest harvests on the Tongass tended to be on the higher productivity sites at lower elevations, adjacent to the beach and within floodplain riparian areas where large Sitka spruce were available and abundant. POG forest stands, particularly low elevation stands, have been affected the most by human modification through timber harvest (USDA Forest Service 2008c, p. 3-138). The Size-Density Model (SDM), which uses a combination of tree sizes and tree densities to classify forest structure (Caouette and DeGayner 2005), is used by Forest Service managers and planners to map POG and assess impacts to wildlife and habitats. Evaluation of the SDM by Caouette and DeGayner (2008) found mapping accuracy estimates between 60 and 80 percent. This classification system builds on the timber volume-based classification system (volume strata) for POG used prior to the 2008 Forest Plan (low-, medium-, and high-volume), which used only hydric soils and steep slopes as measures of productivity and growth. By incorporating the characterization of forest structure, the SDM is more applicable in assessing biodiversity, estimating timber values, and describing wildlife habitat than using timber volume alone. The following seven POG types have been defined which illustrate the progression between the volume strata approach and the SDM (USDA Forest Service 2016c, p. 3-190):

Size density map (SDM) categories are described in detail in the USDA Forest Service 2016 Forest Plan FEIS (pp. 3-189 and 3-190). For analyzing habitat for species in this document, size density classes are categorized as shown in Table 29. They are grouped this way to represent habitat utilized by species discussed in this document.

Table 29. Size density map categories of habitat

Habitat	Size Density Map Categories
POG	SD4H, SD4N, SD4S, SD5H, SD5N, SD5S, SD67
High-POG	SD5N, SD5S, SD67
Medium POG	SD4N, SD4S, SD5H
Low-POG	SD4H
Forested muskeg	FM
Non-forested	NF
All young growth	HS1, HS2, HS3,S1, S2, S3

Figure 13 shows the existing productive old growth in the project area.

On NFS lands in the project area, there is currently 92 percent of historic POG remaining, and considering all lands there is 90 percent remaining (Table 30). Within all WAAs on NFS lands there are between 73 to 100 percent of POG remaining, and within all WAAs considering all lands the amount of POG remaining ranges from 37 to 100 percent. The WAA that has been impacted the most on NFS and all lands is WAA 5132.

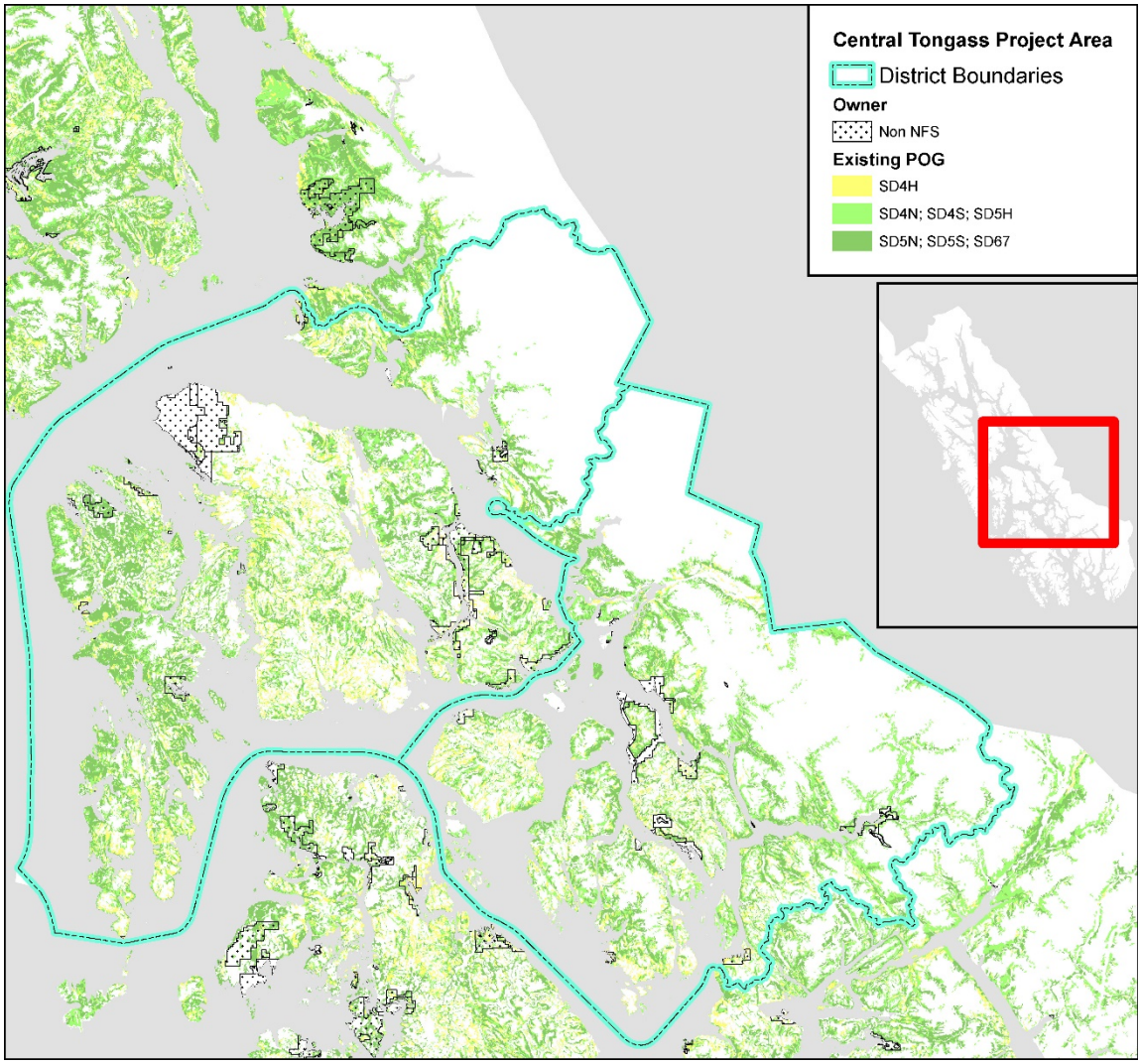


Figure 13. Existing productive old-growth (POG) in the project area

Table 30. Existing wildlife habitat types based on the Size-Density Model on Petersburg and Wrangell Ranger Districts based on various criteria that are important to various species (e.g., elevation, aspect) and by ownership. It is assumed that all historic harvest was of high volume POG.

	Historic NFS Lands [1]	Existing NFS Lands[1]	% Remaining	Historic, all ownerships[2]	Existing, all ownerships[2]	% Remaining
All POG	1,298,666	1,189,898	92%	1,358,758	1,223,388	90%
High Volume POG*	608,330	499,631	82%	646,835	512,757	79%

	Historic NFS Lands [1]	Existing NFS Lands[1]	% Remaining	Historic, all ownerships[2]	Existing, all ownerships[2]	% Remaining
POG ≤800' elevation	804,525	718,482	89%	852,728	746,251	88%
High-POG ≤800' elevation	395,370	309,395	78%	424,667	319,174	75%
High-POG ≤1,500' elevation	566,865	459,378	81%	603,921	471,571	78%
POG ≤1,500' elevation	1,157,124	1,049,569	91%	1,215,106	1,081,508	89%
Medium Volume POG		471,800			483,717	
Low Volume POG		218,466			226,914	
Large Tree POG-SD67		88,691			92,952	
Unproductive Forest		625,761			641,286	
Forested muskeg		424,573			432,478	
Non-forest		1,132,451			1,158,809	
Young Growth[3]		131,221			158,902	

[1] NFS land only
[2] Includes all ownership
[3] SDM Vegcode (HS1-3 & S1-3)
* It is assumed that the majority of all historic harvest was high volume POG. So we don't have historic: large tree, medium, or low POG nor do we have unproductive forest, forested muskeg, and non-forest.

Old Growth Reserves

During development of the 2008 Forest Plan, many of the small Old Growth Reserves (OGRs) in the project area were assessed by an interagency biologist team and recommendations of changes were proposed to the Forest Supervisor. Some of the changes were adopted and some were not. When the proposed interagency biologist team OGR was not adopted, reasons were provided as to why.

During project development, all of the OGRs in the project area were examined using GIS to determine whether the recommended acreage minimums were met, and summary notes from the interagency OGR review for the 2008 Forest Plan were reviewed, as well as projects and decisions since the 2008 Forest Service that involved OGR review and proposed OGR amendments. It was decided that an interagency OGR review was not needed for this project.

Landscape Connectivity

A common element of conservation planning has been to ensure that adequate connectivity between habitat reserves is maintained to facilitate movement across the landscape and thus genetic exchange between populations (USDA 1997 FP FEIS, Appendix D, p. D-21), which promotes health and resiliency of wildlife populations. Landscape connectivity is defined as the degree to which the structure of a landscape helps or hinders the movement of wildlife species (Taylor et al. 1993). A landscape with a high degree of connectivity is one in which wildlife

move readily between habitat patches over the long-term (USDA Forest Service 2016c p.198). Connectivity between areas of similar habitats (that is, old-growth forest) or between high and low elevation habitats is important to maintaining well-distributed, viable wildlife populations. The Tongass National Forest is characterized as naturally fragmented because it's a largely oceanic archipelago which is unsurpassed by any other National Forest (Kiester and Eckhardt 1994).

Roads and Access

Portions of the project area contain extensive road systems, while other areas do not. Shorelines also provide access by boat. The road systems connected to the permanent communities receive the most use. Many of the road systems are snowed in during winter and may or may not receive over-the-snow vehicle (for example, snowmobile) during this time period. The larger permanent communities are connected to road systems, including Petersburg on Mitkof Island, Wrangell on Wrangell Island, and Kake in the northwestern part of Kupreanof Island. Another road system where there are some permanent residents includes the Point Agassiz/Thomas Bay road system on the mainland. Road systems where there is no permanent human habitation include Tonka, north Kuiu, Zarembo Island, north Etolin Island, Portage Bay on Kupreanof Island, and Frosty Bay on the Cleveland Peninsula. There are no roads connected to the City of Kupreanof. There are some differences in how much these road systems are used. For instance, the Tonka road system is very close to Petersburg, and some people have vehicles permanently there for occasional use, whereas Kuiu Island is further removed from any community and overall receives very little road use, with a majority of the use for hunting during only parts of the year.

Marine Access Facilities

The Central Tongass Project would utilize existing Marine Access Facilities (MAFs) and associated Log Transfer Facilities (LTFs). Log transfer facilities include the site and structures used for moving logs and timber products from land-based transportation forms to water-based transportation forms (or vice versa). LTFs may include log raft, storage areas, and adjoining collateral facilities in various configurations. Guidelines for planning and permitting of LTFs are located in the Forest Plan, Appendix G. Through the permitting process, the regulatory agencies may approve or disapprove permits with stipulations which govern the construction and operation of LTFs. Discharge of bark and wood debris into the coastal water may be authorized, with stipulations.

There are 15 existing Log Transfer Facilities that are proposed for use in the Central Tongass Project. There are 3 new LTFs proposed (Three Mile Arm on Kuiu Island, Vank Island, and Shrubby Island). The 15 existing LTFs are at Thomas Bay on the mainland; Portage Bay on northeast Kupreanof Island; Hamilton Bay on northwest Kupreanof Island; Skanax Bay and Rowan Bay on north Kuiu Island; Tonka on Lindenberg Peninsula of Kupreanof Island; South Blind Slough (Olson's) and Woodpecker Cove on Mitkof Island; St. John's Harbor and Deep Bay on Zarembo Island; Venus (Earl West) Cove and Pats Creek on Wrangell Island; Anita Bay North and Anita Bay South on Etolin Island; and Frosty Bay on the Cleveland Peninsula of the mainland. Of the existing LTFs, those requiring some form of reconstruction in order to be used are Anita Bay South, Rowan Bay, Skanax Bay, Portage Bay, Frosty Bay, South Blind Slough, Pats Creek, and St. John's. The required reconstruction at these sites varies, but examples include improvements to a drive down ramp and/or bulkhead for loading and unloading logs and machinery, increasing upland log storage capacity, or improvements to floats, boat launch, mooring buoys, and docks.

Past Activities

The existing habitat conditions include past activities. The largest effect to wildlife habitat has come from old-growth timber harvest. Sixty-eight percent of the past timber harvest was clearcut timber harvest that occurred from 1964 to 1993 (Table 31). The young-growth stands from this era are now around 25 to 55 years old.

Table 31. Summary of timber harvest activity by year range within the project area, based on the Forest Service FACTS database

Year Range	FACTS database timber harvest activity type			
	Clearcut		Other harvest type	
	Acres	% of Grand Total	Acres	% of Grand Total
pre-1954	3,749	2.83%	4,377	3.31%
1954-1963	8,559	6.46%	800	0.60%
1964-1974	31,152	23.53%	385	0.29%
1974-1983	32,511	24.56%	1,760	1.33%
1984-1993	26,184	19.78%	1,168	0.88%
1994-2003	8,306	6.27%	3,692	2.79%
2004-2013	3,867	2.92%	1,701	1.28%
2014-current	2,728	2.06%	1,194	0.90%
Total	**117,055**	**88.42%**	**15,077**	**11.39%**

Environmental Effects

There are twelve project activity types and two supporting action types that are part of both action alternatives (Alternatives 2 and 3). To compartmentalize the analysis of effects to wildlife, the Project Activities and Supporting Actions were first broken down into the components that could cause effects to wildlife (Table 32). Many of the Project Activities and Supporting Actions consist of the same or similar activity components. For example, many Project Activities include the use of heavy equipment, a few may involve the use of helicopters, a few involve the use of explosives, and vegetation management would involve habitat alteration on a measurable scale. The analysis is structured based on these specific components that could cause effects to wildlife. Alternatives 2 and 3 are the same for most activity types, differing only in commercial harvest of old-growth or young-growth.

Table 32. Project activities and activity components that could cause effects to wildlife

Project Activity	Activity components that could affect wildlife
Stream and Floodplain Restoration Maximum: Heavy equipment: 49 miles of stream Hand crew: 64 miles of stream	Use of heavy equipment and hand tools
	Use of helicopter
	Harvest of trees including root wad for instream placement
	Stream habitat improvement
Fisheries Improvements Maximum: 25 sites; including up to 25 stream miles and 2 lakes	Fish pass construction or instream barrier modification
	Fish stocking
	Lake fertilization

Project Activity	Activity components that could affect wildlife
Invasive Treatments Maximum: 5,811 acres For herbicide treatments, application would be by either hand/selective, foliar spot spray treatment or broadcast spray	Manual or mechanical removal (by hand, tools, power equipment, or barriers (e.g., tarps)
	Use of aquatic formulated herbicide containing Glyphosate
	Use of herbicide containing Aminopyralid
	Use of aquatic formulated herbicide containing Imazapyr
Recreation Facility Construction, Reconstruction, Improvement, Decommissioning, and Maintenance Maximum: 6 new cabins 10 new shelters and/or convert cabins to shelters 75 new outhouses 30 new day use/picnic areas 6 new platforms for interpretative or wildlife viewing 10 new dispersed camp site (including tent platforms) Decommission up to 15 cabins	Construction of new facility including cabin, shelter, outhouse, picnic area, viewing platform, campground, or dispersed campsite (includes select tree removal, establishment of permanent structure). Use of heavy equipment, small scale earth moving equipment, chainsaws, or other equipment.
	Decommissioning cabins and associated structures
Trail Construction, Reconstruction, Improvement, Decommissioning, and Maintenance Maximum: 300 miles of trail construction (includes new or conversion from boardwalk to gravel) 60 miles of new motorized trail 105 miles of winter trail	Use of heavy equipment, small scale earth moving equipment, chainsaws, or other equipment
	Use of explosives
Old-Growth Timber Harvest (Commercial) Maximum: 9,500 acres	Use of heavy equipment and yarding systems, including cable, tracked shovel, and helicopter
	Timber harvest resulting in a change in habitat type
	Loading of logs at marine access facilities, and transportation of logs on marine waters and NFS roads.
Young-Growth Timber Harvest (Commercial) Maximum: 4,000 acres	Use of heavy equipment and yarding systems, including cable, tracked shovel, and helicopter
	Timber harvest resulting in a change in habitat type on a measurable scale
	Loading of logs at marine access facilities, and transportation of logs on marine waters and NFS roads.
Silvicultural Intermediate Treatments (Pre-commercial) Maximum: 45,000 acres	Use of chainsaws and other mechanical equipment by hand crews
	Thinning of forest stand (may include other treatments such as pruning, leave strips, gaps, etc.)
	Creation of slash on the forest floor
	Use of heavy equipment

Project Activity	Activity components that could affect wildlife
NFS Road Construction and Reconstruction Maximum Construction: 25 miles	Permanent increase in road density and public access
Temporary Road Construction Maximum: 93 miles	Use of heavy equipment
	Temporary increase in road density and public access (without physical closure, may provide longer term access)
Aquatic Organism Passage Maximum: 128 new structures 452 replace, remove, or improve stream crossing structures	Use of heavy equipment
	Use of explosives
	Improvement in aquatic ecosystem function
Marine Access Facility Construction, Reconstruction, Decommissioning, and Maintenance Maximum: Maintain or improve up to 15 existing marine access facilities that have log transfer facilities 3 new sites for log transfer and public access Maintain 69 other marine access points used for public access	Use of heavy equipment during construction and log transfer operations
	Construction of bulkheads and ramps
	Conversion of habitat (including log raft make-up areas, log storage areas, sort yards, and seafloor where logs are rafted)
	Increase in public access on land and use of boats in marine area
Soil Restoration	Use of heavy equipment, hand tools including chainsaws, or other machinery
	Use of helicopter
	Ground-level modifications (placement of slash, moving topsoil, altering drainage, etc.)
Timber Stand Establishment – Planting and Interplanting	Use of hand tools
	Increase stocking level, alter tree species diversity

Direct and Indirect Effects

Proposed Activities and Effects on Wildlife

When proposed activities are identified, consideration of effects specific to that location will be documented according to procedures outlined in the Implementation Plan and applicable design features will be applied. The general effects associated with this project on wildlife in terms of disturbance, habitat alteration (small-scale), habitat or stream management activities, access, and herbicide application are summarized in Table 33. The main effects of vegetation treatments will be discussed in more detail.

Disturbance

Most activity components which would cause noise and/or human presence on land (such as use of ground-based heavy equipment or machinery, use of hand tools, management activities,

human use of recreational developments, building or decommissioning roads, use of helicopter, use of explosives, construction activities, quarry development, use of log transfer facilities, etc.) could cause localized disturbance to varying degrees. Some species are more susceptible to disturbance, and especially during certain periods of the year such as during breeding, fawning, nesting, or denning. Raptors including goshawks and bald eagles can be especially prone to disturbance near their nests, especially during certain periods (nesting season) and when activities occur near active nests sites and if the individuals are not accustomed too or routinely exposed to disturbance factors. Some mammals such as bears and wolves may avoid areas entirely if humans are present. The largest potential for detrimental effects would occur during critical periods of the year within a species' preferred habitat, or where nesting is most likely to occur. For many species such as various smaller birds and some mammals, unless the activity was located in the immediate vicinity of active nesting, denning, or other critical time periods (for example, fawning), it would not be likely to cause consequential impacts, though individual behavior would likely be altered. The most likely behavior for many species would be avoidance of the immediate area for the period of time the disturbance factor is present. At some locations, such as at developed recreation sites, or in association with marine access facilities, a small level of disturbance would likely become a normal periodic occurrence throughout the life of the developed site. Depending on how often it occurs, and the timing (for example, during nesting or during winter) and magnitude (for example, relatively high or low numbers of people or noise) of the disturbance, it could cause some measure of long term avoidance of the immediate area. However, because of how far these types of disturbances would be spread across the project area, localized disturbances would not be consequential to the overall species' use or population in the project area.

Habitat Alteration

"Small-scale" alteration of habitat (for example, which would occur with recreation site construction, removal or conversion of a developed facility, construction associated with a marine access facility that does not contain log transfer facilities, construction associated with trails, soil restoration, and sign installation), could slightly change the use of the habitat in the immediate area by various species, though it would be very unlikely to be consequential to individuals unless it occurred immediately where nesting, denning, or other important activity (for example, fawning, roosting) occurs. Single tree selection or small group selection (generally less than 2 acres), or construction associated with a log transfer facility, would have similar effects to small-scale alteration of habitat, though the magnitude and likelihood of effects to nesting or denning would be greater. Regardless, because of the size and distance between these small habitat alterations, localized changes would not be consequential to overall species' use or populations in the project area.

"Large-scale" alteration of habitat (for example, commercial old-growth and young-growth timber harvest) will be analyzed under the individual species. Because the species analyzed in this report utilize habitat in different ways, large scale alteration of habitat focuses on the effects to each species' preferred habitat. For more information see the species sections below.

Habitat and Stream Management Activities

Silvicultural intermediate treatments (for example, pre-commercial thinning, riparian thinning, etc.) would promote tree growth, and therefore in the long term would improve habitat conditions for these species that prefer older forest types. A caveat, however, is that if the thinned stands reach merchantable age and occur within a development LUD they may be harvested again before any substantive benefits to these species is realized. Silvicultural intermediate

treatments in Old Growth LUD or other areas where the intent is to promote old-growth conditions would in the long term benefit these species that prefer POG. Where thinning treatments occur, the slash generated can impede wildlife movement, which is a known detriment for deer being able to access the forage within these areas. Additional measures such as bucking, or girdling (to kill trees while they stand instead of dropping them on the forest floor, thus slowing the pulse of slash on the forest floor) can be used to mitigate effects to wildlife movement, though these measures are expensive and are therefore not routinely used.

Increase in sapling density and/or diversity by planting or interplanting would only affect wildlife in the very long term, particularly when the stands begin exhibiting old-growth characteristics.

Reducing impediments of man-made features to aquatic organism passage (for example, road crossings), instream habitat improvement, facilitation of unnatural aquatic organism passage (fish pass construction or natural instream barrier modification), fish stocking, or lake fertilization would improve prey species availability for species that use aquatic resources, such as eagles, bears, marten, and river otters.

Access

Changes in access (permanent or temporary road construction, road storage, road decommissioning increase in access to shoreline, change in use of marine waters, etc.) would not be likely to cause effects to most species, except for species that avoid human presence such as bears and wolves, and species that are hunted or trapped by humans.

Where roads are a unit of measure for individual species they are discussed in that section. Existing and proposed roads are summarized in the Wolf section (Table 36 and Table 37).

Changes in marine habitats (for example, any marine habitat changes associated with LTFs) would not cause effects to terrestrial wildlife species.

Invasive Plant Treatments

The effects of invasive plant treatments from mechanical, manual, or the use of herbicides containing glyphosate, aminopyralid, or imazapyr will be similar to the effects discussed in the *Biological Evaluation and Wildlife Resource Report* (Oehlers 2018, amended by Dunn 2019). This analysis for the *Northern Tongass Integrated Weed Management Plan EA* draft is hereby incorporated by reference.

With regard to herbicide use, the proposed application methods will minimize potential for herbicide delivery to surface waters and wetlands. However, the risk that some chemicals may reach surface waters cannot be eliminated. Wildlife consuming non-target vegetation, direct contact with herbicides rubbing off on an animals skin/fur, or drinking water that has inadvertently been treated with herbicides is unlikely. Treatment extent, rate and method of application, and the properties of the chemicals proposed influence the degree of risk. All treatment methods have the potential to disturb, temporarily displace, or directly harm various wildlife species. However, impacts from treatments tend to be short term, whereas successful control of invasive plant infestations provides long-term benefits to wildlife by restoring native habitats. The effects of invasive plant treatments on wildlife are relative to the size and locations of existing and future invasive plant infestations, the type of treatment used, and the timing and duration of the treatments. Treatments of infestations along disturbed roadsides, which are common, are not likely to substantially affect terrestrial wildlife populations, since this

vegetation type does not generally provide essential habitat for native wildlife species, and it consists of long, narrow areas spread over large distances.

Science-based evaluations conducted by regulatory bodies and other scientific institutions have concluded that aminopyralid and imazapyr have low toxicity for animal species, and that glyphosate usage does not pose any unreasonable risks to wildlife when used according to label directions. Glyphosate is readily degraded by soil microbes to aminomethylphosphonic acid (AMPA) and carbon dioxide and, therefore, generally dissipates rapidly from agricultural environments as well as from more complex ecosystems such as forests and wetlands. In addition, glyphosate adsorbs strongly in the soil which limits its ability to run off fields and enter water bodies and limits the exposure of any organisms outside the site of application.

Invasive plant treatments are not expected to alter native habitat structure or composition for terrestrial wildlife species or birds. Incidental damage or removal of native vegetation immediately adjacent to invasive plants or within the infested site may occur during treatments, but would be very limited in distribution and magnitude. In some cases, removal of invasive plants could cause a localized and temporary decrease in the amount of vegetative cover provided. However, due to the patchy nature of invasive plant infestations, the amount of cover lost would be very small compared to the amount of habitat available, and natural or facilitated revegetation would facilitate recovery and eventual improved value of the habitat. In general, there is low risk from this project to wildlife, because; 1) infestations are currently small and scattered across a large area, 2) invasive plants are concentrated on roads and other disturbed areas that do not provide optimum wildlife habitat, and 3) the expected level of change to high value wildlife habitat is very low. The herbicides proposed for use are not likely to adversely affect any wildlife species. Additional discussion of effects to wildlife can be found in the Northern Tongass Integrated Weed Management BE and Wildlife Report (Oehlers and Dunn 2019).

Table 33. Summary of activity components, mechanisms of effects to wildlife, and species that could be affected

Activity component that could affect wildlife	Mechanism of effect	Species considered in this analysis that could be affected and general effects discussion
DISTURBANCE FACTORS		

Activity component that could affect wildlife	Mechanism of effect	Species considered in this analysis that could be affected and general effects discussion
Use of ground-based heavy equipment or machinery (e.g., excavator, bulldozer, earth moving equipment)	Noise and human presence	Most notably could affect goshawk, wolf, bald eagle, black bear and brown bear, migratory birds. Many wildlife species may avoid the immediate area of noise and human activity, but the disturbance is not likely to hinder many species' daily activities to a measurable and consequential degree. Species considered in this analysis that are more susceptible to substantive effects of disturbance by heavy equipment include goshawk (nesting), bald eagle (nesting) wolf (denning, and may avoid a larger area when humans are present), black bear and brown bear (denning, and foraging activities may be disrupted during critical feeding periods at certain sites (e.g., salmon streams)), and some migratory birds (nesting). Forest Service Standards and Guidelines contain various measures to minimize disturbance to goshawk, falcon, osprey, other raptors, heron, marbled murrelet, swan, waterfowl, shorebirds, oystercatcher, seabirds, marine mammals, and wolf. National Bald Eagle Guidelines minimize potential disturbance to eagles.
Use of hand tools, including small power tools (e.g., chainsaw, pole saws, trimmers, generators, etc.)	Noise and human presence	Species and potential effects would be similar but at a lesser potential and scale than disturbance from ground-based heavy equipment.
Use of helicopter	Noise	Most notably could affect mountain goat, seabird colonies, bald eagle. Many wildlife species may react to helicopter use if nearby, but the disturbance is not likely to hinder many species' daily activities to a measurable and consequential degree. Mountain goats are susceptible to disturbance from helicopters correlated with distance (Cote 1996, Goldstein et al. 2005, Cote et al. 2013). Forest Service Standards and Guidelines reduce the potential impacts of helicopter use to mountain goats and seabird colonies. National Bald Eagle Guidelines minimize potential disturbance to eagles.
Use of explosives	Noise	Many species would be susceptible to disturbance from explosives. Substantive effects would be more likely if recurrent at a certain location in proximity to a nest or den. National Bald Eagle Guidelines address use of explosives in relation to bald eagle nests, foraging areas, and communal roost sites.
Recreation developments (e.g., cabin, shelter, campground, etc.)	Noise and human presence	Species and potential effects would be largely the similar to disturbance from ground-based heavy equipment. A difference is that disturbance from a recreation development would continue through time (albeit periodically, at times when humans are present). Forest Plan Standards reduce the potential for disturbance to mountain goat wintering and kidding habitat (location of facilities and concentrated human activities).

Activity component that could affect wildlife	Mechanism of effect	Species considered in this analysis that could be affected and general effects discussion
Construction of bulkheads and ramps at marine access facilities	Noise, including in marine waters	Also see heavy equipment section. Pounding of pilings and other loud noise in marine waters has the potential to affect marine mammals including federally-listed listed whales and Steller sea lion Western DPS.
Use of log transfer facilities for processing and packaging logs at marine access facilities	Noise, including in marine waters	Also see heavy equipment section. Loud noise in marine waters has the potential to affect marine mammals including federally-listed listed whales and Steller sea lion Western DPS, and shoreline associated species such as bald eagles and black oystercatcher.
Transportation of logs on marine waters	Noise in marine waters, potential for ship strike with marine mammals	Marine mammals including listed whales and Steller sea lion Western DPS
Use of boats on marine waters	Noise in marine waters, potential for ship strike with marine mammals	Marine mammals including listed whales and Steller sea lion Western DPS
HABITAT ALTERATION		
Reducing impediments of man-made features to aquatic organism passage (e.g., road crossings)	Improved aquatic ecosystem	Wolf, American marten, Pacific marten, bald eagle, black bear, brown bear, river otter
Instream habitat improvement	Improved aquatic ecosystem	Beneficial indirect effects (e.g., prey populations) to wolf, American marten, Pacific marten, bald eagle, black bear, brown bear, river otter
Small scale alteration of ground vegetation or soil (e.g., applying barriers (e.g., tarps) over invasive plants, application of slash for soil restoration)	Localized change in habitat	Small localized changes in habitat would not cause substantive effects to most wildlife. Individuals could be affected particularly if they nest in the immediate area.
Construction of developed facility (e.g., cabin, campground, shelter, etc.)	Localized change in habitat	Small localized changes in habitat would not cause substantive effects to most wildlife. Individuals could be affected if they nest in or use the immediate area.
Removal of developed facility	Localized change in habitat	Small localized changes in habitat would not cause substantive effects to most wildlife. Removal of a developed facility would allow the habitat to return to a more natural condition and allow more wildlife use.
Sediment and debris from use of log transfer facilities for processing and packaging logs at marine access facilities. Changes in the seafloor in localized areas associated with LTFs.	Localized change in habitat	Permit specifies allowable discharge. Potential to affect marine mammals including listed whales and Steller sea lion Western DPS, including localized effects to foraging habitat and prey populations.

Activity component that could affect wildlife	Mechanism of effect	Species considered in this analysis that could be affected and general effects discussion
Single tree selection or small group selection (generally less than 2 acres)	Localized change in habitat	Small localized changes in habitat would not cause substantive effects to most wildlife. Individuals could be affected if they nest in or use the immediate area.
Old growth habitat removal or alteration, creating early seral forest conditions on relatively large scale (e.g., various prescriptions including partial cut to clearcut).	Change or removal of habitat	Old growth habitat removal is addressed in the individual species sections
Young growth removal or alteration, creating early seral forest conditions on relatively large scale (e.g., various prescriptions including partial cut to clearcut).	Change or removal of habitat	Young growth habitat removal is addressed in the individual species sections
Precommercial thinning of forest stand (may include other treatments such as pruning, leave strips, gaps, etc.)	Localized change in habitat	Thinning would promote tree growth therefore promoting stand movement toward old-growth conditions, and allows more forage productivity for wildlife, however, the slash generated by thinning can be an impediment to wildlife movement.
Increase sapling stocking level, alter tree species diversity	Localized change in habitat	Tree planting would in the long term benefit species that prefer tree cover.
CHANGES IN ACCESS		
Permanent increase in road density	Increase in public access	Could increase harvest of species that are susceptible to overharvest by humans, particularly wolf and marten.
Temporary increase in road density and public access (without physical closure, might provide longer term access)	Increase in public access	Could increase harvest of species that are susceptible to overharvest by humans, particularly wolf and marten. Temporary roads may become permanent access points for the long term.
Development of marine access facilities,	Increase in public access to shoreline and related increase in use of boats in marine area	Could increase harvest of species that are susceptible to overharvest by humans, particularly wolf and marten. Increased amount of disturbance along the shoreline could affect shoreline associated species such as bald eagle and black oystercatcher.
OTHER TYPES OF EFFECTS		
Facilitation of unnatural aquatic organism passage (Fish pass construction or natural instream barrier modification)	Increase in fish and other aquatic organism productivity	Would benefit species that use fish or aquatic organisms in their diet. Could have unknown consequences for the long term with certain species such as amphibians.
Fish stocking	Increase in fish and other aquatic organism productivity	Would benefit species that use fish or aquatic organisms in their diet. Could have unknown consequences for the long term with certain species such as amphibians.

Activity component that could affect wildlife	Mechanism of effect	Species considered in this analysis that could be affected and general effects discussion
Lake fertilization	Increase in fish and other aquatic organism productivity	Would benefit species that use fish or aquatic organisms in their diet. Could have unknown consequences for the long term with certain species such as amphibians.
Use of herbicide containing Glyphosate	Chemical toxicity	Refer to discussion of herbicide use
Use of herbicide containing Aminopyralid	Chemical toxicity	Refer to discussion of herbicide use
Use of herbicide containing Imazapyr	Chemical toxicity	Refer to discussion of herbicide use

Landscape Connectivity

Fragmentation, from harvest and road building reduces landscape connectivity due to the breaking apart of larger contiguous blocks of habitat into smaller patches. The value of residual habitat patches may decline if they become too small to support species with minimum area requirements or to support a subpopulation of a particular organism (that is, the functional unit of a metapopulation, or population made up of spatially separated local populations that interact with each other). In the latter case, interaction occurs via dispersal as individuals move among patches. Populations may become isolated, and therefore at greater risk of local extirpation, if fragmentation hinders movement of individuals between subpopulations (Wilcove et al. 1986). The degree to which this occurs depends on species-specific dispersal capabilities, the distance between habitat patches, and conditions within the matrix between habitat patches. For large animals such as bear and wolves which have good dispersal capability, the fragmentation simply presents a series of dispersal obstacles to be overcome. Small species on the other hand can be completely prevented from dispersing (Kiester and Eckhardt 1994).

Fragmentation is often accompanied by a decline in native biodiversity because ecological changes along the habitat edge (edge effects) favor some species over others. Edge effects may include changes in vegetation structure, species composition (both plants and animals), predation rates, and disturbance (Murcia 1995; As 1999). Although the number of species may be higher along edges (favoring invasive species), the number of habitat specialists (that is, those associated with interior forest conditions or structural components of old-growth forest), which tend to be more sensitive or at-risk, decreases (As 1999; Kissling and Garton 2008).

Alternative 3 proposes elevational corridors every ½ mile where timber harvest, where feasible, in each Timber Analysis Area to facilitate movement for species, especially deer between habitat patches. This will offset some of the impacts of fragmentation due to timber harvest but not road building.

Overall effect to landscape connectivity is minor because areas affected are in LUDs that allow for timber harvest, and where young-growth harvest occurs in old-growth LUDs will be done in a way to provide for greater connectivity as this LUD only allows harvest that contributes to improving old-growth conditions. Also, the 2008 Forest Plan Conservation Strategy has been designed to make sure species remain viable across the forest and most landscapes are connected to each other based off that design.

General Cumulative Effects to Wildlife

Activities that occur on non-NFS lands have the potential to affect the overall context within which effects to wildlife are considered in cumulative effects. Activities on non-NFS lands include, but are not limited to, timber harvest, residential development, mining, recreation and tourism, and road construction. Prediction of the future extent and intensity of such activities has a high degree of uncertainty, therefore non-NFS lands were considered not to contribute to wildlife habitat.

However, there are portions of the Tongass where cumulative effects become more important due to the level of past harvest that has occurred. One biogeographic province within the project area, the Kupreanof/Mitkof Islands biogeographic province, has experienced some of the highest reductions in original (1954) POG forest on the Tongass and are also where much of the young-growth suitable for commercial timber production is located. Additional timber harvest (young-growth and POG forest), particularly when located adjacent to previously harvested areas, has a greater potential to result in localized reductions in landscape connectivity and gaps in species distributions in these more heavily harvested areas compared to portions of the Tongass that have less cumulative past timber harvest. These cumulative effects would be most likely to occur for species with very limited ranges or with limited dispersal capabilities or dispersal capabilities that are dependent on certain mature forest structural characteristics. Natural fragmentation of habitats can also affect the level of additional fragmentation that can be supported.

Both action alternatives would result in vessel traffic and marine activity associated with LTF use and log transport, which would occur irregularly in association with individual old-growth and young-growth timber harvest projects as they are implemented. Use of vessels in marine waters would make a minor contribution to the existing noise levels and potential for oil or fuel spills associated with existing vessel activity, and additional bark accumulations on the sea floor near the LTFs to which marine and shoreline-associated species such as shorebirds, humpback whales, and Steller's sea lions would be exposed. All activities at the project level would be conducted in accordance with Alaska Water Quality Standards under Section 401 of the *Clean Water Act* for log transfer facilities (ADEC 2011). These standards place restrictions on the types, quantities, and extent of discharges (including bark) to the marine environment and would limit the effects of the project on water quality. Therefore, very minor contributions to cumulative effects in the marine environment are anticipated under all of the alternatives.

Climate change may also contribute to cumulative effects. Predicted warming trends and decreased precipitation are anticipated to result in changes to vegetation and the suitability and use of wildlife habitat. Many species may benefit (for example, potential greater overwinter survival of deer, and thus a greater prey base for wolves) though extreme weather events are likely to continue to occur. Conversely habitat changes resulting from a longer growing season, wind, fires, increased insect infestations, and disease may have variable effects on others. The greatest concerns for wildlife populations in relation to climate change, however, there are the weather extremes that can be expected to occur periodically, such as severe winter snowfalls. These stochastic events would be of greatest concern for populations that are limited in number or distribution. The Tongass Old-Growth Habitat Conservation Strategy was designed to maintain a resilient old-growth forest ecosystem in the face of this uncertainty.

Threatened and Endangered Species

Listed Threatened or Endangered Species in the project area are one open-ocean associated bird and several marine mammals. There are two primary mechanisms of effects to marine species in the project area, the construction, reconstruction, and use of marine access facilities (MAFs) and

log transfer facilities (LTFs), and transportation on marine waters by administrative, recreational, or commercial vessels through activities that are interrelated and interdependent to Central Tongass Project proposed activities. Consultation has not been initiated for this project but will be required for "May affect" determinations for federally-listed Threatened or Endangered Species. Consultation will be initiated with the appropriate regulatory agency (USFWS and/or NMFS) once a preferred alternative is settled upon.

The Central Tongass has the potential to affect federally-listed marine species that occur in the area. Project design features were developed to minimize the potential for effects to marine mammals. The below assessment addresses all federally-listed species and critical habitat under either USFWS or NMFS jurisdiction potentially found in the action area. There are no species in or near the action area that are proposed or candidates for federal listing.

Summary of Determinations for Threatened or Endangered Species

Preliminarily, the determination for federally listed species is that **Alternative 2 and Alternative 3 may affect but would not adversely affect: humpback whale (Mexico Distinct Population Segment) and Steller sea lion (Western DPS)**; and that both action alternatives would have **no effect to: short-tailed albatross, fin whale, or sperm whale.** Alternative 1, the no action alternative, would have no effect to any threatened or endangered species.

Humpback Whale (Megaptera novaeangliae) – Mexico DPS

Existing Condition

Based on information provided by the NMFS the Hawaii DPS and Mexico DPS may occur in waters surrounding the proposed project location (NMFS 2016; 81 FR 62260). No critical habitat has been designated for humpback whales within the project area.

They generally inhabit waters over continental shelves and in summer are relatively close to shore. Dahlheim et al. (2009) list them as feeding in Southeast Alaska panhandle waters from about May through December, although some have been seen every month of the year.

Estimates of the humpback population have increased as the species has recovered; the current rate of increase is estimated at 5 percent to 6 percent annually (Allen and Angliss 2010).

Threats

Potential threats include entanglement in fishing gear, ship strikes, acoustic disturbance, habitat degradation from oil and other contaminants, and vessel-based harassment (NMFS 1991). Entanglements in unknown marine debris/gear reported to the NMFS Alaska Region account for an estimated average annual mortality and serious injury rate of 2.6 Central North Pacific humpbacks in 2009 to 2013 (Muto et al. 2016). Forest management activities that could affect humpback whales generally fall into categories of acoustic disturbance, habitat degradation, and ship strikes. Acoustic disturbance sources include all types of marine vessels and low-flying aircraft. Habitat could be degraded by development and use of Log Transfer Facilities (LTFs) and their associated camps, movement of log rafts from LTFs to mills, and potential development of other docks and associated facilities for mining, recreation, or other Forest uses and activities. The potential for effects in Alaska will likely be mitigated by vessel approach regulations (USFWS 2001; 66 FR 29502).

Indicators

The indicator to determine whether the project may affect the species is whether the project would contribute to existing threats.

Direct and Indirect Effects

Alternative 1 – No Action Alternative
With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3
Of the existing threats to the species, project activities have the potential to contribute to ship strike potential, entanglement in fixed lines in the water, acoustic disturbance, and habitat degradation from oil and other contaminants. Project design features were developed to minimize the potential for effects.

The potential for ship strike, entanglement in marine gear (e.g. mooring lines associated with marine facilities), and acoustic disturbance to humpback whales from vessel use of marine waters or the use of MAFs and LTFs is expected to be undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. While disturbance of humpback whales is plausible and may be expected from project activities or actions that are interrelated and interdependent, these effects would be so small in intensity and inconsequential that they would be insignificant. These sorts of potential effects would add to but be indistinguishable from other vessel traffic using the marine waters within the proposed project area.

While it is plausible there could be minor leakages of oil or other contaminants into the marine environment from vessels and equipment, consequential habitat degradation from oil and other contaminants would be very unlikely to occur. Therefore these potential effects would be discountable.

Forest Service authorized or permitted activities are required to comply with all prohibitions and regulations to minimize the potential for effects to marine mammals including humpback whales. Therefore there would be no potential for harassment of individuals from authorized or permitted Forest Service activities.

Likely marine haul routes from log transfer facilities proposed for use have been identified. The slow vessel speed for towing or barging logs would make the likelihood of collisions with humpback whales so minimal that it would be discountable.

There are three LTFs that are proposed for new construction in the project area, and eight which would require reconstruction. The required reconstruction necessary at LTFs varies, but examples include improvements to a drive down ramp and/or bulkhead for loading and unloading logs and machinery, increasing upland log storage capacity, or improvements to floats, boat launch, mooring buoys, and docks. It is plausible that noise generated by marine access facility and log transfer facility construction (for example, pounding pilings) and operations could expose humpback whales to a noise level that might affect their communication and foraging activities.

LTF construction or reconstruction activities that occur above mean high tide would not be expected to have effects to humpback whales. It is anticipated that additional analysis would be required to adequately assess potential effects to humpback whales, and consultation with NMFS would occur, if engineering designs for log transfer facility construction or reconstruction activities would occur below mean high tide.

Cumulative Effects

Alternative 1 – No Action Alternative
The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternative 2 and Alterantive 3
Except for construction or reconstruction activities associated with LTFs below mean high tide which cannot be meaningfully evaluated without engineering designs, either of the action alternatives could cause discountable or insignificant effects to humpback whales. By definition, these sorts of effects would be either very unlikely to occur or would not be measurable. Therefore there would be no measurable cumulative effects.

Conclusion

The No Action Alternative (Alternative 1) would have No Effect to the humpback whale Mexico DPS. For Alternatives 2 and 3, it is anticipated additional analysis and consultation with NMFS would be required for construction or reconstruction activities associated with LTFs below mean high tide. With the project design features that minimize the potential for effects to humpback whales, other activities proposed in both action alternatives (Alternatives 2 and 3), "may effect but would not likely adversely affect" humpback whale Mexico DPS individuals.

Disturbance of humpback whales is plausible and may be expected from actions that are interrelated and interdependent of project activities, but these effects would be so small in intensity and inconsequential that they would not be measurable and would therefore be insignificant.

Recommendation: conduct LTF construction activities during the winter and spring months to minimize potential noise disturbance.

Steller Sea Lion (Eumetopias jubatus) – Western DPS

Existing Condition

The Steller sea lion was emergency-listed as threatened under the ESA in April 1990 by NMFS due to rapid population declines in the western portion of its range (55 FR 12645). In 1997 the NMFS designated two Distinct Population Segments (DPS; occurring west and east of 144 degrees west longitude, respectively). Due to persistent decline, the western DPS was reclassified as endangered. In November of 2013 the eastern DPS was delisted and is no longer on the threatened and endangered list, because they have been increasing at an average rate of approximately 3 percent per year, and was estimated to have reached 70,174 animals as of 2010. Steller sea lions are also protected by the *Marine Mammal Protection Act* under which they are designated as "depleted" (which means all protections and requirements would remain in effect) (NMFS 2013a, b). A revised recovery plan for the species was published in March 2008 (NMFS 2008). Because of Forest Service policy change in 2016, recently delisted species are no longer automatically added to the R10 sensitive species list, therefore the eastern DPS of the Steller sea lion will not be analyzed in this project analysis.

Critical habitat was designated in August 1993 (NMFS 1993; 58 FR 45269) consisting of breeding rookeries (sites where pups are born) and haulouts (sites where adults emerge from the water to rest) throughout the State, as well as marine waters within a 3,000-foot radius of those sites (Figure 14). In Southeast Alaska, three major rookeries on the outer coast—White Sisters, Hazy Island, and the Forrester Island complex, the largest rookeries for the eastern population stock—and 13 major haulout sites were designated as critical habitat (NMFS 1993; 58 FR

45269). Two of the haulout sites designated in northern Southeast Alaska—Biali Rocks and Graves Rock—have since become rookeries (DeMaster 2009). DeMaster (2009) also listed 38 other haulouts sites that have been surveyed in recent years by NMFS. Sea lions can be found using various locations in the project area as haulouts and are found in various locales throughout the project area in all seasons.

Most Steller sea lions in southern Southeast Alaska are part of the eastern DPS which is not federally-listed, but western DPS have occasionally been sighted moving through the area. Individuals disperse widely outside of the breeding season and potentially intermix with animals from other areas (ADF&G website).

Currently, the eastern population stock of Steller sea lions in Southeast Alaska is recovering and growing despite the effects of increased disturbance and habitat destruction, increases in commercial and recreational fisheries, and environmental changes in marine habitats (NMFS 2008). NMFS is in the process of developing a post-delisting monitoring plan which would include, among other criteria, monitoring the frequency and severity of Steller sea lion-human interactions in ports and harbors and the impacts of recreational and commercial viewing operations. If current protection measures are maintained, NMFS expects that the eastern DPS would remain at low risk of extinction.

Threats

Steller sea lions are sensitive to disturbance and harassment and displacement of sea lions from haulout and rookeries by human activities such as boating, recreation, aircraft, log transfer facilities (LTFs), and log raft towing are concerns related to the long-term conservation of the sea lion in Southeast Alaska. Isolated disturbances and the cumulative effects of repeated disturbances can affect their behavior, distribution, stress levels, energy expenditure, and the ability to forage or raise young (NMFS 2008). NMFS (2008) lists threats affecting or having the potential to affect the dynamics of the population as follows: environmental variability, competition with fisheries, killer whale predation, toxic substance contamination, incidental take associated with commercial fisheries, subsistence harvest by coastal Alaska Natives, illegal shooting, entanglement in marine debris, parasitism and disease, disturbance from vessel traffic, tourism and research.

Indicators

The indicator to determine whether the project may affect the species is whether the project would contribute to existing threats.

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

Of the existing threats to the species, project activities have the potential to contribute to toxic substance contamination, and disturbance from vessel traffic.

Project activities that include authorized and approved facilities and concentrated human activities would be located away from any known marine mammal haul outs, rookeries, and known concentration areas, in accordance with Forest Plan Standards and Guidelines (2016 Forest Plan, p. 4-89). Project activities would not affect designated Critical Habitat.

The potential for disturbance from vessel use of marine waters or the use of MAFs and LTFs is expected to be undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. While disturbance of sea lion Western DPS individuals is plausible, and may be expected from project activities or actions that are interrelated and interdependent, these effects would be so small in intensity and inconsequential that they would be insignificant. These sorts of potential effects would indistinguishable from other vessel traffic using the marine waters within the proposed project area.

While it is plausible there could be minor leakages of oil or other contaminants into the marine environment from vessels and equipment, consequential habitat degradation from oil and other contaminants would be very unlikely to occur. Therefore these potential effects would be discountable.

Forest Service authorized or permitted activities are required to comply with all prohibitions and regulations to minimize the potential for effects to marine mammals including Steller sea lions. Therefore there would be no potential for harassment of individuals from authorized or permitted Forest Service activities as long as these regulations are followed.

Cumulative Effects

Alternative 1 – No Action Alternative
The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternatives 2 and 3
Either of the action alternatives could cause discountable or insignificant effects to Steller sea lions. By definition, these sorts of effects would be either very unlikely to occur or would not be measurable. Therefore there would be no measurable cumulative effects.

Conclusion

The No Action Alternative (Alternative 1) would have No Effect to the Steller sea lion Western DPS. Both action alternatives (Alternatives 2 and 3) “may effect but would not likely adversely affect” Steller sea lion Western DPS individuals.

The project would have “No effect” on designated Critical Habitat since project activities would be designed to avoid these areas in accordance with Forest Plan Standards and Guidelines (2016 Forest Plan, p. 4-89).

Forest Service authorized or permitted activities are required to comply with all prohibitions and regulations to minimize the potential for effects to marine mammals including Steller sea lions.

Disturbance of Steller sea lions is plausible and may be expected from actions that are interrelated and interdependent of project activities, but these effects would be so small in intensity and inconsequential that they would not be measurable and would therefore be insignificant. Therefore, any effects would not be likely to adversely affect Steller sea lion Western DPS individuals.

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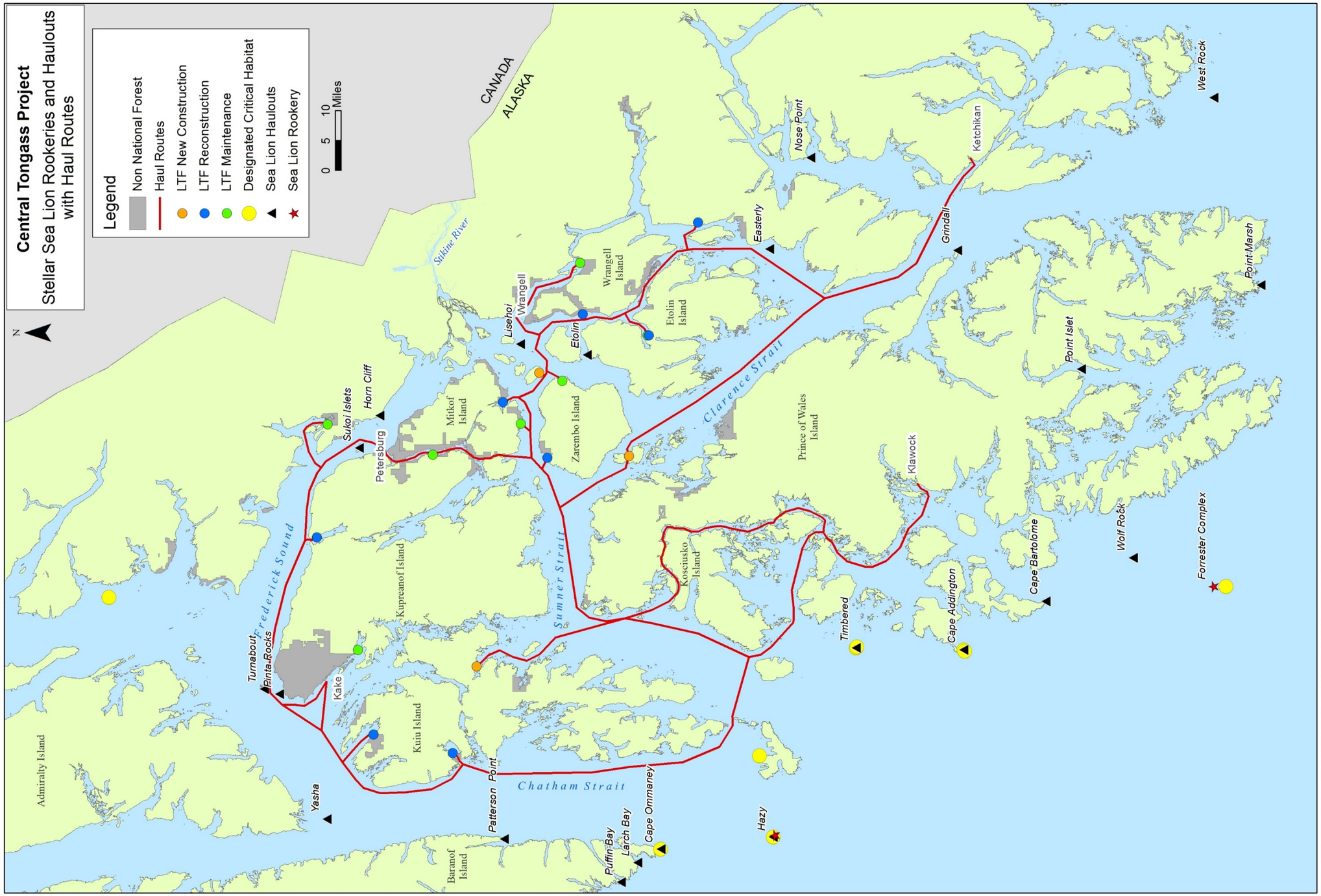

Figure 14. Steller sea lion haulouts and rookeries

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Forest Service Alaska Region Sensitive Species

Forest Service Alaska Region Sensitive Species that do not occur in or near the project area, except potentially while migrating through the area, are the Dusky Canada Goose and Aleutian Tern. Because these species do not occupy or rely on habitats in the project area, our determination is that there would be No Impact to these species. As for the species analyzed in this report there would be "no impact" for Kittlitz's murrelets, and a "may impact, but not likely to cause a trend towards federal listing or a loss of viability" for the black oystercatcher and Queen Charlotte Northern Goshawk.

Black Oystercatcher

Existing Condition

Forest Service personnel have reported observations of black oystercatchers in the project area in Tebenkof Bay and Port Beauclerc on Kuiu Island, and in Totem Bay on Kupreanof Island. There are numerous public observations reported in various locations throughout the project area, predominantly around northern Frederick Sound (Global Biodiversity Information Facility, https://www.gbif.org/; accessed May 21, 2019).

Threats

The Black Oystercatcher's small population size and complete dependence upon a narrow coastal band throughout their life cycle places this species at risk to human and other mammalian disturbance. Threats include predation, recreational disturbances, flooding, vessel wakes, and shoreline contamination (Tessler et al. 2010). The 1989 Exxon Valdez oil spill in Prince William Sound, Alaska, directly killed 20 percent of the population in the spill area, disrupted breeding activity in 39 percent of oystercatcher pairs attempting to nest on the heavily oiled shorelines, and reduced chick survival (Gotthardt and Coray 2005). Black oystercatcher populations appear to be regulated by the availability of quality foraging and nesting habitat. Because they are confined to specific shoreline habitat and congregate during the winter, they are vulnerable to natural and human disturbances. Human-induced disturbance is most important limiting factor for population growth in some parts of the species range; human-induced habitat alteration is suspected of causing local extirpations from islands around Sitka, AK (Andres and Falxa 1995).

Indicators

Disturbance to individuals and loss of shoreline habitat.

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the Existing Condition section.

Alternatives 2 and 3

Short-term disturbance of black oystercatcher is possible along the shoreline, which could occur with young-growth harvest or other management activities in the beach fringe under Alternatives 2 and 3. Any effects would likely be of short term duration during harvest activities.

Black oystercatchers could be affected by oil or fuel spills associated with vessels in the vicinity of the LTFs and the transport of logs from harvested areas under all of the alternatives.

The Forest Plan Standard and Guideline to provide a minimum distance of 330 feet from human activities on the ground and waterfowl or shorebird intertidal concentration or nesting areas would minimize the potential for substantive effects (2016 Forest Plan, p. 5-15, Standard S-WILD-04).

Cumulative Effects

Alternative 1 – No Action Alternative

The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternative 2 and Alterantive 3

Past, present, and reasonably foreseeable future activities in the project area include use of shorelines that support black oystercatchers, predominantly recreational use, and it is assumed occasion disturbance to black oystercatcher may occur. Such activities are not likely to have substantive effects to oystercatchers particularly since the known locations of black oystercatchers are in remote areas far from communities. The reasonably foreseeable future utility and road easements would not be expected to affect black oystercatcher. The additional potential for disturbance from project activities under Alternatives 2 and 3 along the shorelines could add slightly too ongoing levels of disturbance. Additional potential effects from oil or fuel spills from project activities would likewise add slightly too potential similar effects from past, present, and reasonably foreseeable actions, though he potential for such effects to black oystercatchers is slight considering the rarity of oil and fuel spills of substantive size.

Conclusion

There is a potential for disturbance to black oystercatchers along the shoreline from project activities, though any disturbance would most likely be very rare and localized if it were to occur. The Forest Plan Standard to provide a minimum distance of 330 feet from human activities on the ground and waterfowl or shorebird intertidal concentration or nesting areas would minimize the potential for substantive effects. Any disturbance would be to individuals and inconsequential to the species' population or distribution. Likewise, the potential for effects associated with vessels in the vicinity of the LTFs and the transport of logs from harvested areas is also slight. Therefore, the determination is that Alternatives 2 and 3 may impact individuals but not likely to cause a trend to federal listing or a loss of viability.

Queen Charlotte Goshawk (Accipiter gentilis laingi)

Existing Condition

The Queen Charlotte goshawk (*Accipiter gentilis laingi*) is recognized as a distinct subspecies of the northern goshawk that occurs only in coastal areas of British Columbia and in Southeast Alaska, and is a sensitive species by the Forest Service, Alaska Region (Goldstein et al. 2009). In 2007, the USFWS updated a 1997 status review for the Queen Charlotte goshawk, and concluded that Alaska supports a DPS of this species, but the listing of this DPS was not warranted (USFWS 2007; 72 FR 63123)

In Southeast Alaska, the northern goshawks inhabit forested lands but favor old-growth for nesting and foraging habitat. Goshawks have been found to not be continuously distributed across the landscape, but rather exhibit a patch distribution based on the presence and availability of suitable habitat (Sonsthangen et al. 2012). Research specific to Southeast Alaska concluded that goshawks are uncommon in this region and nesting densities are lower than other

areas (USFWS 2007; 72 FR 63123). The major threat to goshawks is the loss of old growth habitat due to logging which decreases nesting sites, foraging areas and prey availability. Goshawks are also susceptible to human disturbance during nesting period.

Based on existing knowledge, there are 33 confirmed and 1 probable goshawk nesting territories on Petersburg Ranger District, and 11 confirmed nesting territories on Wrangell Ranger District. These territories were identified during surveys generally for previous timber harvest projects and research projects.

Research from the Queen Charlotte Islands and elsewhere in western North America suggests that landscapes consisting of 40 to 60 percent mature or old forest are favored by goshawks for foraging and nesting (Reynolds et al. 1992, Doyle 2005). Research conducted by Doyle (2005) on Haida Gwaii, found that territories that consisted of at least 40 to 60 percent old-growth forest successfully fledged young. Within the project area VCUs on NFS lands, the remaining percentage of POG compared to the historic condition ranges from 61 to 100 percent, and the remaining HPOG ranges from 28 to 100 percent; and within WAAs the remaining POG ranges from 68 to 100 percent, and HPOG from 33 to 100 percent.

Threats

The major threat to goshawks is the loss of old-growth habitat due to logging. Timber harvest may locally limit the availability of nest sites through the removal of suitable nest trees. Timber harvest may also decrease foraging habitat quality through reductions in prey abundance and availability.

Low prey diversity results in higher sensitivity to habitat modification which may further reduce prey diversity and abundance. Disease and predation also contribute to population declines, especially in the presence of other stress factors such as prey shortages, but there is no indication that goshawks have experienced any significant problems with disease or predation in Alaska (USFWS 2007; 72 FR 63123). Goshawks are also susceptible to human disturbance during nesting period. Low reproductive rate makes recovery slow.

Indicators

Loss of nesting and foraging habitat, and disturbance to active nesting.

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

Under all the action alternatives there will be adverse impacts to individuals and or habitat, but these effects are not likely to result in a loss of viability nor cause a trend toward federal listing. The Central Tongass Project has the potential to directly affect goshawks through any activity that creates noise or removes potential habitat. When activities are proposed, appropriate surveys including those for goshawks will be conducted as required. Recent goshawk surveys have been completed on Mitkof Island, and have been initiated on Zarembo Island and Thomas Bay. Known or probable goshawk nests would receive a protected buffer in accordance with Forest Plan Standards and Guidelines. Therefore, none of the alternatives would directly impact known actively nesting birds but potential foraging habitat would be reduced and fragmented.

Goshawks are year-round residents in the project area; therefore, timber harvest and associated activities could disturb or temporarily displace birds throughout their life cycle. Indirect effects of the Central Tongass Project include the reduction of perching, foraging (POG), and potential future nesting habitat (High POG).

Alternatives that harvest the most POG and reduce the proportion of high POG, would be expected to have the greatest effect on goshawk habitat.

Based on the gross unit pool, under Alternative 2, the reduction of POG in individual WAAs where timber harvest would occur ranges from 3 to 21 percent, and high POG from 3 to 28 percent. In individual VCUs the reduction of POG ranges from 2 to 45 percent, and high POG from 1 to 51 percent.

Based on the gross unit pool, under Alternative 3, the reduction in POG in individual WAAs where timber harvest would occur ranges from 3 to 18 percent, and high POG from 1 to 23 percent. In individual VCUs the reduction of POG ranges from 0 to 39 percent, and high POG from 0 to 39 percent.

Cumulative Effects

Alternative 1 – No Action Alternative

The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute no cumulative effects.

Alternative 2 and Alterantive 3

Because there would be effects to goshawk individuals and their habitat from all the action alternatives there would be cumulative effects when combined with past, present, or reasonable foreseeable future activities. Past and present timber harvest along with other management activities have removed potential goshawk habitat across the project area, increased fragmentation, and reduced the amount of high-quality nesting habitat across the project area. Looking at Forest Service lands across the entire project area we currently have approximately 92 percent of POG remaining and 82 percent of high POG. Within individual VCU's the percent remaining from historic condition ranges from 61 to 100 percent for POG and 28 to 100 percent for high POG. At the WAA scale there is 68 to 100 percent of POG remaining and 33 to 100 of high POG. The reasonably foreseeable future utility and road easements would cause minor additional reductions in POG forest in some WAAs. Implementation of the actions alternatives would result in approximately 3 to 4 percent reduction in POG and high POG habitat. Any VCU or WAA's that fall below 40 percent POG or high POG are as risk of not being suitable for nesting and foraging goshawks. Ongoing and future management activities that remove POG and high POG habitat on NFS and non-NFS lands would result in additional fragmentation and loss of old-growth habitat.

Conclusion

The proposed project will not affect any old growth reserves (except for young-growth harvest in Old-Growth LUDs which would promote old-growth habitat conditions) but will harvest young-growth on a quick harvest rotation (55 years) and which may cause some VCU's to drop below 40 percent POG. Within the project area on NFS lands there would be cumulative reductions of potential habitat. Alternatives 2 and 3 would maintain 88 to 89 percent of the original total POG and 79 percent of the original high-volume POG. Under Alternative 2, two VCU's (4560 and 4570) will fall below the minimum amount of POG required to maintain viable populations of goshawks. Alternative 3 would cause one VCU to fall below minimum.

Cumulative reductions in nesting and foraging habitat across the VCU's that are above the minimum POG requirements would still result in the local expansion of individual goshawk home ranges, potentially leading to a reduction in breeding density on the landscape level. Effects would be greatest under Alternative 2. However, given that goshawks are highly mobile and that breeding density is currently low on the Tongass National Forest, the effects of Alternatives 2 and 3 in combination with past, present, and foreseeable activities would result in a minor effect to goshawks with the exception of the two VCU that fall below the minimum POG requirements. In those two VCUs there would be a major impact. Despite cumulative impacts from the proposed action alternatives, the project area would continue to provide suitable nesting and foraging habitat for the Queen Charlotte goshawk.

Alternatives 2 and 3 may impact individuals but not likely to cause a trend to federal listing or a loss of viability.

Wrangell Southern Red-backed Vole (Myodes gapperi wrangeli)

Existing Condition

The southern red-backed vole occurs on the mainland south of the Taku Inlet and on near-shore islands on the southern end of the Alexander Archipelago (MacDonald and Cook 1996, 1999). Four subspecies are recognized in the region; two taxa occur on the mainland, whereas the remaining two are island endemics (Runck and Cook 2005). The Wrangell southern red-backed vole (*Myodes gapperi wrangeli*) is the only endemic small mammal identified on Wrangell Island; it also occurs on nearby Sergief Islands (MacDonald and Cook 2007).

Information about Wrangell southern red-backed voles comes from Smith and Nichols (2004) and the related Smith (2005) and Smith et al. (2005) studies on Wrangell Island. They tested the association with old-growth specifically for the Wrangell Island southern red-backed vole and found that vole populations attain their highest densities in continuous, late-seral, mesic coniferous forests with abundant understory. However, in 1999 and 2000 they found that vole densities were unexpectedly similar between old-growth and young-growth stands. Muskegs and scrub forest (NPOG) supported the fewest voles and Smith and Nichols felt it was unlikely that these habitats supported breeding populations. Habitat features that were positively correlated with vole density included the amount of down, decayed wood and the cover of surface water during spring (Smith et al. 2005). Density of small (10–49 cm) [4–19 inches] diameter (DBH) snags and percentage of conifer seedlings were negatively associated with population density as was high moss cover in the spring (Smith et al. 2005). They also found that voles are constrained to wetter environments because of their physiological requirements for water, but this habitat selection may also mitigate desiccation following canopy removal and renders open-canopied young- growth more suitable for voles (Smith 2005).

From 1998 to 2000 Smith and Nichols caught 682 voles and 540 mice (unique individuals), with 72, 845 trap nights of effort. Average population density of voles on Wrangell Island in 1999 was 3.29 voles/ha and in 2000 it dropped to 2.36 voles/ha. The ISLES project conducted small mammal trapping on Wrangell Island in 2009 and caught 74 southern red-backed voles. The data from this study can be found in the Arctos online database along with the trap locations. In total eight different species were trapped in 169 captures with a total effort of 1,865 trap nights.

Threats

Endemic species are those isolated to islands or specific geography that potentially have an increased risk of adverse effects associated with management or natural disturbance. For

example, these species may not be able to travel between islands or may be adapted to living in a very specific habitat that has a limited distribution. Species tied to island archipelagos are more sensitive to the effects of introduced non-natives, including pathogens and disease, and natural events, such as climate change, than other managed landscapes due to their limited mobility and isolation from other subpopulations (Cook et al. 2006). Therefore, there is a higher probability of extinction on islands. Risk assessment panels, convened prior to the 1997 Forest Plan determined that endemic mammals were the most sensitive of all wildlife species to future landscape disturbances, such as that resulting from timber harvesting (Swanston et al. 1996). Such disturbances affect the likelihood of maintaining viable, well-distributed populations of endemic mammals across the Forest.

Indicators

Because densities and reproductive rates were highest in POG forest and questions remain on young-growth, all POG was selected (forest types SD67, SD5S, SD5N, SD5H, SD4S, SD4N, and SD4H) as the measurement criteria for Wrangell Island red-backed voles, although question do remain whether habitat features required to sustain breeding vole populations occur only in late seral forest.

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

Timber harvest would directly affect the Wrangell southern red-backed vole through habitat loss (all POG), and by altering the distribution of habitats across the landscape. On NFS lands, all action alternatives would reduce potential POG habitat from existing condition on Wrangell Island by approximately 4-5 percent (WAA 1903). Although project implementation would result in a reduction in habitat the project area would still maintain approximately 87 percent of the existing total POG. This may inhibit the ability of individuals to move between patches of suitable habitat, and therefore may further limit the distribution of a population or reduce genetic interchange between subpopulations. As a result of this project habitat patches would increase, but be reduced in size and ultimately becoming more fragmented. Alternatives that harvest the most POG would result in the greatest increase in the number of smaller POG patches on the landscape and would be expected to have the greatest effect to the Wrangell southern red-backed vole.

Cumulative Effects

Alternative 1 – No Action Alternative

The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute no cumulative effects.

Alternatives 2 and 3

Because there would be direct/indirect effects to Wrangell southern red-backed voles, there would be cumulative adverse effects with the implementation of proposed action alternatives (2 and 3).

Cumulative impacts to habitat is especially problematic for archipelagos such as the Tongass, where habitat is already naturally fragmented among oceanic islands, average population size is

smaller than in mainland habitats, source populations are isolated, and demographic stochasticity and inbreeding depression increase risk of extinction (Cook et al. 2006). This is particularly pertinent for endemic taxa that already exist in isolated populations by default, and for species that are less mobile. Implementation of the Alternatives 2 or 3 would result in approximately 4-5 percent reduction in POG habitat. The VCU's impacted on Wrangell Island would maintain approximately 70 – 89 percent (VCU's-4750, 4760, 4770, 4780 and 4800) of the historic POG depending on which alternative is chosen. Ongoing and future management activities that remove POG habitat on NFS, state, and private lands would result in additional fragmentation and loss of old-growth forest habitat and be cumulative with the action alternatives.

Conclusion

Alternatives 2 and 3 may impact individuals but not likely to cause a trend to federal listing or a loss of viability. Although there would be a reduction in habitat, Wrangell Island would still maintain sufficient to support red-back vole populations. Furthermore, the 2008 Forest Plan Conservation Strategy was designed to address this through the network of non-development LUDs, including the OGR system, and Forest-wide standards and guidelines both of which were intended to maintain habitat components important to a variety of species and maintain connectivity across the landscape (USDA Forest Service 2008c Final EIS p. 3-295).

Management Indicator Species

Management indicator species (MIS) are those wildlife species whose responses to land management activities are thought to reflect the likely responses of other species with similar habitat requirements. Under the MIS concept, the responses to management activities of a relatively few species are studied and monitored in an effort to ascertain the impacts to entire assemblages of species and associated habitats. MIS are used to assess population viability and biological diversity, and for the overall management of habitat (USDA Forest Service 2008c Forest Plan p. 3-230). MIS are also used to help establish management goals for other species in public demand (USDA Forest Service 1997b, p. 3-351).

The NFMA 1982 planning rule directed the use of Management Indicator Species in forest planning to help display the effects of forest management. The MIS used in this analysis are all thirteen identified in the Forest Plan since they would all be affected by the action alternatives. These are the Alexander Archipelago wolf, American marten, bald eagle, black bear, brown bear, brown creeper, hairy woodpecker, mountain goat, red-breasted sapsucker, red squirrel, river otter, Sitka black-tailed deer, and Vancouver Canada goose. Although some of the MIS are associated with several habitat types, all are associated with old-growth spruce and hemlock forest in some manner. Because of their dependence on Sitka black-tailed deer, only the Alexander Archipelago wolf will be further discussed in detail. The remainder of the effects to MIS are summarized in Table 38.

Alexander Archipelago Wolf

Existing Condition

The wolf was selected as a MIS because of population viability concerns in some areas of the Tongass National Forest (1997 Forest Plan FEIS, p. 3-355). Forest Service Standards and Guidelines for the Alexander Archipelago wolf can be found on page 4-91 (USDA Forest Service 2016b).

Wolves in Southeast Alaska use a wide variety of habitats but spend most of their time in productive and unproductive old-growth forests at elevations below 1200 feet (400 meters), because the abundance of prey is typically higher at lower elevations (USFWS 2015).

Wolf/Deer Interactions

Wolf populations are closely tied to prey abundance (Person et al. 1996). Sitka black-tailed deer are the principal prey of wolves in Southeast Alaska, representing up to 74 to 90 percent (Revillagigedo and POW Islands) of their diet, but wolves also feed heavily on beaver, spawning salmon, bear, moose, mountain goat, and mustelids (Person et al. 1996, Szepanski et al. 1999, Lowell 2012, USFWS 2015). Deer are also a Management Indicator Species, and the existing condition and effects of the alternatives to this primary wolf prey source is discussed in the Sitka black-tailed deer section of this document.

Deer Density

Since deer are the primary prey for wolves, deer habitat capability outputs from the interagency deer habitat capability model has been used as an indicator of the ability of an area to support deer populations capable of maintaining sustainable wolf populations and meeting human harvest demands. The deer model is discussed in more detail in the Sitka black-tailed deer analysis. Forest Plan Forest-wide Standard and Guideline WILD1 XIV (p. 4-91) emphasizes providing, where possible, sufficient deer habitat capability to first maintain sustainable wolf populations then to meet estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support 18 deer per square mile (using habitat capability model outputs) in biogeographic provinces where deer are the primary prey of wolves.

Historically, there were 22 out of the 40 WAAs in the project area where the calculated theoretical deer density was less than 18 deer per square mile when calculated based on the deer habitat capability and square mileage of current NFS land Many of these WAAs contain substantial portions of their total area in non-forested land (for example, muskeg, alpine, icefields, etc.) particularly in comparison to how much area contained productive old growth. There are currently 29 out of the 40 WAAs in the project area where the calculated deer habitat capability is less than 18 deer per square mile (when calculated based on the deer habitat capability and square mileage of current NFS land). The seven WAAs where the calculated deer density has dropped below 18 deer/mi^2 are WAAs 1902 (Deer Island), 1904 (Vank/Sokolof), 1905 (Zarembo), 2007 (Mitkof), 5131 (Western Kupreanof), 5132 (Western Kupreanof), and 5138 (Tonka/ Lindenberg). There are currently 11 WAAs where the historical calculated deer habitat capability was higher than 18 deer per square mile and where the existing calculation currently remains above 18 deer per square mile.

Road Density

One of the primary concerns to the long-term viability of wolf populations in a given area is road density. Roads themselves do not decrease habitat capability for wolves, but increased density of roads may lead to higher hunting and trapping mortality through improved human access (2008 Forest Plan FEIS, p. 3-237). The Tongass Conservation Strategy Review Workshop (2006) indicate that roads exert a strong influence on wolf mortality, particularly when connected to main road systems, and that closed roads also may contribute to wolf mortality (2008 Forest Plan FEIS, p. 3-237). A survey of hunters on POW Island indicates that hunters are using closed roads to pursue wolves. Thurber et al. 1994 found that wolves increase as traffic decreases, thus making the probability of harvesting wolves higher on closed roads (Person and Logan 2012).

When calculating open road densities, open and closed roads should be considered and consideration should be given to excluding high elevations (2008 Forest Plan FEIS, p. 3-238).

The Forest Plan states that a road density of 0.7 to 1.0 mile per square mile or less may be necessary to reduce harvest-related mortality risk where locally unsustainable wolf mortality has been identified. A wolf mortality concern has not been identified in the project area.

Threats

Since wolves are easily observed in open habitats, use of those habitats by wolves may increase risks of death from legal and illegal hunting, particularly in areas accessible to humans (Person and Russell 2008).Road density can increase wolf harvest by trappers and hunters (Person and Russell 2008).

In order to maintain viable, well-distributed wolf populations, the VPOP committee (Suring et al. 1993, p.. 157) recommended that road densities should be held below 1.0 mi/mi2 in any three contiguous WAAs.

A reduction in prey populations would result in reductions in wolf populations. Deer are the primary prey for wolves in the project area.

Indicators

Since some areas within the project area are road accessible from the different communities, road densities below 1,200 feet in elevations will be used as an indicator of alternative effects to potential wolf mortality.

Interagency Deer Model Habitat Capability outputs by WAA, calculated to deer density (deer per square mile).

Direct and Indirect Effects

Alternative 1 – No Action Alternative

With no action under this project, there would be no direct or indirect effects and the environmental conditions would remain as described in the *Existing Condition* section.

Alternatives 2 and 3

Alternatives 2 and 3 have the potential to directly and indirectly affect den sites, improve human access which could cause both an increase in wolf harvest and an increase in competition between humans and wolves for deer, and affect and prey habitat. It is also possible for wolves to be affected by timber harvest or other activities in undocumented ways, such as modification or loss of rendezvous sites or change in the use of movement corridors.

Project activities under either action alternative could cause disturbance to denning, and habitat change could cause den sites to become abandoned. Compared to Alternative 2, since Alternative 3 would include less timber harvest activity and associated road-building, the potential for effects to dens would be less.

Roads and access

All action alternatives involve road construction which can increase the risk of wolf hunting and trapping mortality through increased human access, and increased competition for deer amongst humans and wolves. Some impacts may be mitigated through road closures, though Person and Logan (2012) modeled the effects of such closures and found them to have little influence on

mortality risk. Open roads would be expected to have a greater effect than roads that are closed (either through storage or decommissioning) (Person and Russell 2008). Forest Plan Forest-wide Standard and Guideline WILD1 XIV (p. 4-91) includes a measure for road density and access, but would only apply where road access and associated wolf mortality is determined to be a significant contributing factor to locally unsustainable wolf mortality, and to our knowledge this circumstance does not exist anywhere within the project area.

Person et al. (1996) reported that wolf harvest increased twofold when total road density below 1,200 feet elevation exceeded 0.7 miles per square mile. Person and Russell (2008) found that road densities of 1.5 miles per square mile (0.9 kilometer per square kilometer) or greater had little additional effect on harvest rates. This indicates that once ample access is provided (for example, 1.5 mi/mi^2) there would be a plateau in the amount of wolf harvest. This study did not differentiate between open and closed roads though the authors stated that road status likely had an important influence on wolf mortality. The following tables (Table 34 and Table 35) show comparison data on existing roads and density by TAA and WAA with proposed roads and density by alternative. The tables include information on open and closed NFS roads and roads under other ownership. Proposed road construction would increase the potential for overharvest by hunters and trappers in some WAAs. The proposed increases in road density are discussed in more detail in the Cumulative Effects section.

Table 34. Road Density below 1,200 feet elevation on NFS Lands – Existing and by Alternative (Miles and Density by WAA). All roads on NFS lands

TAA	WAA	NFS – mi^2 below 1,200 ft	NFS - All roads below 1,200 ft – Miles (mi) and Density (mi^2)		New Proposed Roads Alt 2	Density – All FS roads + Alt 2 on NFS lands below 1,200 ft	New Proposed Roads Alt 3	Density – All FS Roads + Alt 3 on NFS lands below 1,200 ft
			Alt 1 (existing)					
			Miles	Density	Miles		Miles	
Thomas Bay	1605	58.3	52.8	0.91	7.2	1.03	7.2	1.03
Frosty Bay	1816	30.7	32.8	1.07	11.2	1.43	11.2	1.43
Etolin	1901	127.5	91.1	0.71	13.7	0.82	13.7	0.82
Wrangell	1903	102.4	121.0	1.18	22.3	1.40	22.3	1.40
Vank	1904	25.2	13.9	0.55	8.3	0.88	8.3	0.88
Zarembo	1905	137.1	212.3	1.55	62.2	2.00	62.2	2.00
Mitkof	2007	121.7	149.8	1.23	21.2	1.41	21.2	1.41
Kuiu	5012	172.3	191.1	1.11	16.7	1.21	15.1	1.20
	5018	72.0	32.2	0.45	11.2	0.60	9.5	0.58
	5130	134.6	23.4	0.17	0.0	0.17	0.0	0.17
W. Kupreanof	5131	105.7	68.6	0.65	18.9	0.83	18.9	0.83
	5132	53.5	59.1	1.10	14.7	1.38	14.7	1.38
Portage Bay	5136	58.9	66.2	1.12	14.6	1.37	14.6	1.37
Tonka	5138	57.5	72.2	1.26	10.6	1.44	10.6	1.44

Table 35. Road Density below 1,200 feet elevation on All Land Ownerships– Existing and by Alternative (Miles and Density by WAA).

TAA	WAA	All Lands – mi^2 below 1,200 ft	All Lands and all Roads below 1,200 ft – Miles and Density (mi/mi^2)		New Proposed Roads Alt 2	Density – All Lands + Alt 2 below 1,200 ft	New Proposed Roads Alt 3	Density – All Lands + Alt 3 below 1,200 ft
			Alt 1 (existing)					
			Miles	Density	Miles		Miles	
Thomas Bay	1605	62.91	56.5	0.90	7.2	1.01	7.2	1.01
Frosty Bay	1816	34.53	32.8	0.95	11.2	1.27	11.2	1.27
Etolin	1901	128.34	91.1	0.71	13.7	0.82	13.7	0.82
Wrangell	1903	134.9	147.7	1.09	22.3	1.26	22.3	1.26
Vank	1904	25.24	13.9	0.55	8.3	0.88	8.3	0.88
Zarembo	1905	139.65	214.7	1.54	62.2	1.98	62.2	1.98
Mitkof	2007	156.94	197.2	1.25	21.2	1.39	21.2	1.39
Kuiu	5012	181.32	191.1	1.05	16.7	1.15	15.1	1.14
	5018	71.97	32.2	0.45	11.2	0.60	9.5	0.58
	5130	135.47	23.4	0.17	0.0	0.17	0.0	0.17
W. Kupreanof	5131	105.73	68.6	0.65	18.9	0.83	18.9	0.83
	5132	119.29	70.5	0.59	14.7	0.71	14.7	0.71
Portage Bay	5136	59.01	66.2	1.12	14.6	1.37	14.6	1.37
Tonka	5138	80.29	72.2	0.90	10.6	1.03	10.6	1.03

Deer density

The interagency deer model is used to assess impacts to wolves, since deer are the primary prey for wolves in the biogeographical provinces which are within the project area. Proposed timber harvest of the gross unit pool for Alternatives 2 and 3 was incorporated into the deer model as clearcut. Declines in the deer population resulting from reduced habitat capability may decrease the availability of deer to wolves and hunters (Person 2001, Farmer et al. 2006, and Brinkman et al. 2009).

Timber harvest would decrease the estimated carrying capacity for deer over the long-term due to reductions in the amount of winter habitat capability. Within WAAs where timber harvest is planned under Alternatives 2 or 3, current deer habitat capability calculated using the deer model on all WAAs except WAAs 5012 and 5018 (both on Kuiu Island) are below the 2016 Forest Plan guideline of 18 deer per square mile, and suggests the project would result in higher risk that there could be insufficient numbers of deer for sustainable wolf populations and human harvest (Table 58). This concern exists despite the availability of alternative prey (such as moose and salmon) due in part to the fact that alternative prey may delay a decline in wolf numbers.

Deer habitat capability would be affected by the action alternatives in thirteen WAAs (Table 36). Timber harvest under Alternative 3 would affect the deer habitat capability less than Alternative 2. The three most affected WAAs under Alternatives 2 and 3, in order of magnitude would be:

WAA 5136 (Portage Bay): the deer habitat capability as determined by the deer model would be reduced by 18.6 percent from the existing condition at stem exclusion (estimated at Year 2045) under Alternative 2 and 14.1 percent under Alterative 3

WAA 1905 (Zarembo): the deer habitat capability as determined by the deer model would be reduced by 14.8 percent from the existing condition at stem exclusion (estimated at Year 2045) under Alternative 2 and 12.2 percent under Alterative 3

WAA 2007 (Mitkof): the deer habitat capability as determined by the deer model would be reduced by 11.5 percent from the existing condition at stem exclusion (estimated at Year 2045) under Alternative 2 and 9.6 percent under Alterative 3

Two of the top three most affected WAAs (Zarembo and Mitkof) also receive a substantial amount of hunter harvest demand in the project area, with Zarembo receiving the most deer harvest demand over any other WAA in the project area. The highest reported average deer harvest in the project area from 1997 to 2017 has been on Zarembo Island (WAA 1905; average of 202.3 deer harvested), followed by Wrangell Island (WAA 1903; average of 70.7 deer), Mitkof Island (WAA 2007; average of 63.2 deer), Tonka (WAA 5138; 48.5 deer), and North Etolin (WAA 1901; 45 deer).

Table 36. Direct and indirect effects of proposed timber harvest by Alternative on theoretical deer habitat capability, shown as theoretical deer density (deer per square mile) on NFS land, as determined by the deer model. Only the WAAs where the deer habitat capability would be affected by timber harvest are included in the table.

WAA	Locality	Square Miles NFS only	Theoretical deer density (deer per square mile) (NFS only)			Theoretical deer density (deer per square mile) and percent reduction in theoretical deer density on NFS land from the existing condition by Alternative and Year					
			Historic (1954)	Existing	Reduction from historic (NFS land only)	Alternative 1		Alternative 2		Alternative 3	
						2020	2045	2020	2045	2020	2045
1605	Thomas Bay	233	6.7	5.2	22.5%	5.2 0.0%	5.2 0.0%	5.0 4.4%	4.9 5.9%	5.0 3.2%	5.0 4.3%
1816	Frosty Bay	53	11.0	9.8	10.5%	9.8 0.0%	9.8 0.0%	9.2 6.1%	9.1 7.2%	9.4 4.2%	9.3 5.2%
1901	Etolin	206	17.8	16.1	9.6%	16.1 0.3%	16.0 0.9%	15.8 1.9%	15.5 3.5%	15.8 1.7%	15.6 3.2%
1903	Wrangell	177	15.1	12.7	16.3%	12.7 0.2%	12.6 1.0%	12.3 2.8%	12.0 5.1%	12.4 2.5%	12.1 4.7%
1904	Vank/Sokolof	36	26.3	17.6	33.1%	17.6 0.0%	17.5 0.6%	17.6 0.0%	17.5 0.7%	17.6 0.0%	17.5 0.6%
1905	Zarembo	181	20.6	14.7	28.5%	14.7 0.2%	14.6 1.2%	13.5 8.4%	12.6 14.8%	13.8 6.6%	13.0 12.2%
2007	Mitkof	170	19.7	14.8	24.9%	14.8 0.0%	14.8 0.2%	13.7 7.5%	13.1 11.5%	13.9 6.3%	13.4 9.6%
5012	Kuiu	217	29.6	22.2	25.1%	22.1 0.2%	22.0 0.6%	21.2 4.2%	20.6 7.0%	21.6 2.5%	21.2 4.3%
5018	Kuiu	76	21.8	20.2	7.3%	20.2 0.0%	20.2 0.0%	19.6 3.0%	19.3 4.7%	19.9 1.6%	19.7 2.5%
5131	W. Kupreanof	109	19.8	17.6	11.0%	17.6 0.0%	17.6 0.0%	17.0 3.8%	16.6 6.2%	17.1 3.3%	16.7 5.4%
5132	W. Kupreanof	58	21.9	15.4	29.8%	15.4 0.0%	15.4 0.0%	15.0 2.2%	14.5 5.7%	15.1 1.7%	14.6 4.8%

WAA	Locality	Square Miles NFS only	Theoretical deer density (deer per square mile) (NFS only)			Theoretical deer density (deer per square mile) and percent reduction in theoretical deer density on NFS land from the existing condition by Alternative and Year					
			Historic (1954)	Existing	Reduction from historic (NFS land only)	Alternative 1		Alternative 2		Alternative 3	
						2020	2045	2020	2045	2020	2045
5136	Portage Bay	94	16.4	13.5	17.8%	13.5 0.0%	13.2 1.7%	12.3 8.7%	11.0 18.6%	12.7 5.9%	11.6 14.1%
5138	Tonka/ Lindenberg	96	20.3	15.8	22.1%	15.8 0.0%	15.3 3.1%	15.5 1.8%	14.5 7.8%	15.7 0.6%	14.9 5.5%

Cumulative Effects

Alternative 1 - No Action Alternative

The past, present, and reasonably foreseeable activities would continue to influence the environmental conditions but the project would not contribute to cumulative effects.

Alternatives 2 and 3

Because there would be a direct/indirect effect to wolves from all action alternatives, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Past and present activities have resulted in the existing condition. The reasonably foreseeable future utility and road easements would cause minor additional reductions in POG forest and calculated theoretical deer habitat capability in some WAAs but is not expected to reduce carrying capacity or result in a decline in the deer population over the long term, and would therefore make a negligible contribution to impacts to the wolf prey base. Roads would further increase the road density and add to the potential for increased hunting and trapping pressure.

Except for WAA 1904 (Vank/Sokoloff), WAA 5018 (Kuiu), and WAA 5131 (West Kupreanof), all WAAs which have new road construction proposed in the project area already have road densities above 0.7 mi/mi2 on NFS lands below 1,200 feet in elevation (Table 34). Under Alternatives 2 and 3, road densities in WAA 1904 and WAA 5131 would also exceed 0.7 mi/mi2 on NFS lands below 1,200 feet elevation (Table 34).When calculating the existing road density on all land ownerships below 1,200 feet, WAA 5132 (West Kupreanof) falls below 0.7 mi/mi2 but would increase with Alternatives 2 and 3 (Table 35). Zarembo (WAA 1905 has the highest road density on NFS lands at 1.55mi/mi2 and would increase to 1.98 mi/mi2. Under Alternatives 2 and 3, the road density would not exceed 1.5 mi/mi2 in any other WAAs but it would approach 1.5 mi/mi2 in several (Table 34). When road densities approach 1.5 mi/mi2, harvest risk could plateau since an increase in road density beyond that point has been found to have little additional effect on wolf harvest rates (Person and Russell 2008). Whether this would result in an unsustainable level of wolf harvest is unknown. In their study area on Prince of Wales Island, Person and Russell (2008) noted that the wolf population declined significantly during 1993 to 1995 (Person et al. 1996) and annual mortality of radio-collared wolves averaged 55 percent during that period. During 1999 to 2004 average annual mortality was lower (38 percent), while wolf populations still declined during 1999 to 2002 (ADF&G 2003). Therefore, total annual mortality of 38 percent likely was unsustainable (Person and Russell 2008). Wolf harvest increases with road density but decreases with greater ocean distance from towns and villages (Person and Russell 2008). Therefore there would likely be greater risk of overharvest of wolves near communities (and where the demand for human harvest of deer is high), especially those attached to road systems and with shorelines in close proximity to communities such as WAA 1903 (Wrangell), WAA 2007 (Mitkof), and WAAs 5131 and 5132 (Western Kupreanof).

Commercial timber harvest has occurred on the Tongass National Forest since 1954 and as a result has reduced habitat capability for deer in GMU 3 through the removal of productive old-growth habitat. All action alternatives would result in additional reduction of deer habitat capability, contributing to similar effects associated with ongoing and future timber harvest across all ownerships.

For cumulative effects, the theoretical deer density is calculated from the deer habitat capability (number of deer an area can theoretically maintain on a sustainable basis) on NFS lands divided by the square miles of NFS land. Table 37 shows the comparison of the effects of each

alternative, immediately after project implementation (assumed to be Year 2020) and at the stem exclusion stage (assumed to be Year 2045). Most WAAs in the project area where timber harvest is proposed under Alternatives 2 and 3 have already experienced reductions of theoretical deer density below 18 deer per square mile. The calculated deer density in some WAAs historically was not above 18 deer per square mile (Table 37). The alternatives would further reduce the theoretical deer density, thus increasing the risk that a severe winter would cause declines in the deer population.

Table 37. Cumulative effects to deer density on NFS land. The calculations assume no current contributions to the deer habitat capability from non-NFS land.

WAA	Locality	Square miles NFS land	Calculated Deer/mi² NFS land only			Calculated Deer/mi2 and percent remaining in deer habitat capability from the historic condition by Alternative and Year. Calculated using deer habitat capability on NFS land and dividing by NFS land area.					
						Alternative 1		Alternative 2		Alternative 3	
			Historic (1954)	Existing	Reduction	2020	2045	2020	2045	2020	2045
1605	Thomas Bay	233	6.7	5.2	22.5%	5.2 78%	5.2 78%	5.0 74%	4.9 73%	5.0 75%	5.0 74%
1816	Frosty Bay	53	11.0	9.8	10.5%	9.8 90%	9.8 90%	9.2 84%	9.1 83%	9.4 86%	9.3 85%
1901	Etolin	206	17.8	16.1	9.6%	16.1 90%	16.0 90%	15.8 89%	15.5 87%	15.8 89%	15.6 87%
1903	Wrangell	177	15.1	12.7	16.3%	12.7 84%	12.6 83%	12.3 81%	12.0 79%	12.4 82%	12.1 80%
1904	Vank/ Sokolof	36	26.3	17.6	33.1%	17.6 67%	17.5 66%	17.6 67%	17.5 66%	17.6 67%	17.5 66%
1905	Zarembo	181	20.6	14.7	28.5%	14.7 71%	14.6 71%	13.5 65%	12.6 61%	13.8 67%	13.0 63%
2007	Mitkof	170	19.7	14.8	24.9%	14.8 75%	14.8 75%	13.7 70%	13.1 67%	13.9 70%	13.4 68%
5012	Kuiu	217	29.6	22.2	25.1%	22.1 75%	22.0 74%	21.2 72%	20.6 70%	21.6 73%	21.2 72%
5018	Kuiu	76	21.8	20.2	7.3%	20.2 93%	20.2 93%	19.6 90%	19.3 88%	19.9 91%	19.7 90%
5131	W. Kupreanof	109	19.8	17.6	11.0%	17.6 89%	17.6 89%	17.0 86%	16.6 83%	17.1 86%	16.7 84%
5132	W. Kupreanof	58	21.9	15.4	29.8%	15.4 70%	15.4 70%	15.0 69%	14.5 66%	15.1 69%	14.6 67%
5136	Portage Bay	94	16.4	13.5	17.8%	13.5	13.2	12.3	11.0	12.7	11.6

WAA	Locality	Square miles NFS land	Calculated Deer/mi² NFS land only			Calculated Deer/mi2 and percent remaining in deer habitat capability from the historic condition by Alternative and Year. Calculated using deer habitat capability on NFS land and dividing by NFS land area.					
			Historic (1954)	Existing	Reduction	Alternative 1		Alternative 2		Alternative 3	
						2020	2045	2020	2045	2020	2045
						82%	81%	75%	67%	77%	71%
5138	Tonka/ Lindenberg	96	20.3	15.8	22.1%	15.8 78%	15.3 75%	15.5 76%	14.5 72%	15.7 77%	14.9 74%

Conclusion

The proposed activities could include disturbance and displacement of wolves from unknown den locations as well as impacts to the abundance and availability of their prey (e.g. deer) either indirectly from forest treatments of habitat or directly from harvest.

Road density would increase the risk of overharvest of wolves in certain WAAs. The risk would likely be greatest in WAAs near communities, on western Kupreanof Island, Mitkof Island, and Wrangell Island.

Effects to important deer habitat is discussed and summarized in the deer effects analysis section. As noted there are no thresholds for what percentage of important deer winter habitat is required to prevent declines during severe winters, though it is known that the risk of severe winters impacting deer populations would be increased, particularly under Alternative 2.

Wolves would likely benefit substantially for a short amount of time during severe winter because deer would likely congregate into low elevation areas containing available forage. However, if these conditions led to a substantial decline in the deer population, a corresponding reduction in the wolf population would follow. The degree of the wolf population decline would likely depend somewhat on other alternative sources of prey such as moose and salmon, though a long-lasting decline in the deer population would be expected to cause a long term reduction in the wolf population regardless.

The theoretical deer density calculated using the deer model is already well below the target of 18 deer/square mile in many WAAs in the project area, and additional timber harvest would further reduce it. Additional reductions in the deer habitat capability (and theoretical deer density) would further increase the risk that a severe winter or series of severe winters would have substantial detrimental impacts to the deer population, with similar effects to the wolf population, in the long term. Alternative 3 moderates this risk of severe winters causing deer declines to some degree, particularly by providing for enhanced elevational movement of wildlife by maintaining corridors through areas proposed for timber harvest and maintaining more high value deer winter habitat.

As noted in the deer section conclusion, overall there would be a 2 to 3 percent reduction in the acres of high and moderately high value deer winter habitat when calculated for the whole project area, when using the gross unit pool which substantially over-represents the amount of actual timber harvest. In the project area overall, most WAAs would remain un-roaded and prey habitat unaffected. Because of the combined reductions of important deer habitat and theoretical deer density, as well as increases in road density in certain WAAs that could amplify wolf harvest in certain areas, the determination is that the effects to wolves (management indicator species) from Alternatives 2 and 3 would be moderate.

Other Management Indicator Species

The level of effects to other MIS are summarized in Table 38. The levels of influence are defined below.

Negligible: Individuals would not be affected, or the action would affect an individual but the change would be so small that it would not be of any measurable or perceptible consequence to the individuals or populations.

Minor: Individuals would be affected but the change would be small. Impacts would not be expected to have any long-term effects on species or their habitats, or the natural processes sustaining them. Occasional responses to disturbance by some individuals could be expected, but without interference to reproduction, or other factors affecting population levels.

Moderate: Individuals would be noticeably affected. The effect could have some long-term consequence to individuals or habitat. Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or juvenile states; or interference with activities necessary for survival can be expected on an occasional basis. Frequent response to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors affecting short-term population levels.

Major: Populations would be affected with a long-term, vital consequence to the individuals, populations, or habitat. Impacts on species, their habitats, or the natural processes sustaining them would be detectable. Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short-term declines with long-term population numbers significantly depressed.

Table 38. Summary of effects from timber harvest under Alternatives 2 and 3 to other Management Indicator Species. Acres displayed are for NFS lands only.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Bald Eagle Indicator: POG and young-growth in the 1,000-ft beach buffer	182,611 acres of POG existed historically in the 1,000-ft beach buffer	168,124 acres of POG currently exists in the 1,000-ft beach buffer	92% of POG currently remains in the 1,000-ft beach buffer compared to historic condition. There would be no effects of the no action alternative.	3,947 acres (13% of the existing amount) of young-growth in the 1,000-ft beach buffer is in the gross unit pool.	Harvest of young-growth in the beach buffer would promote old-growth conditions and therefore promote or maintain potential bald eagle nesting habitat.	2,276 acres (9% of the existing amount) of young-growth in the 1,000-ft beach buffer is in the gross unit pool.	Harvest of young-growth in the beach buffer would promote old-growth conditions and therefore promote or maintain potential bald eagle nesting habitat.	Since old-growth harvest would not occur in the beach buffer and young-growth harvest would promote old-growth conditions, effects to bald eagle habitat would be negligible.
Black Bear and Brown Bear Indicator: POG within 500 feet of Class I streams for foraging habitat, and all POG for denning habitat (all POG is summarized in the red squirrel section)	177,987 acres existed historically	162,793 acres currently exists	91% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	3,487 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 2 to 15% of the existing amount, with the highest in WAAs 1816 and 5136.	90% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 69 to 91% remaining.	2,730 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 1 to 13% of the existing amount, with the highest in WAA 5136.	90% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 70 to 92% remaining.	With potential reduction of at most 15% of the existing habitat within affected WAAs, the effects of either action alternative would be minor, particularly since at least 69% would remain from the historic amount in any individual affected WAA.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Brown Creeper Indicator: Interior POG	566,552 acres existed historically	409,808 acres currently exists	72% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	10,121 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 1 to 18% of the existing amount, with the highest in WAA 5132 (18%), WAA 1905 (15%) and WAA 2007 (15%).	71% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 30 to 73% remaining. The WAAs where harvest could occur that would be below 50% remaining are WAAs 1905, 2007, 5012, 5131, 5132, and 5138.	8,662 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 1 to 17% of the existing amount, with the highest in 5132 (17%), WAA 1905 (13%) and WAA 2007 (14%).	71% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 30 to 75% remaining. The WAAs where harvest could occur that would be below 50% remaining are WAAs 1905, 2007, 5012, 5131, 5132, and 5138.	While overall in the project area there would be 71% of the historic habitat remaining, additional reductions of up to 18% from the existing interior POG in some WAAs (especially WAAs 1905, 2007, 5012, 5131, 5132, and 5138) would further hinder the ability of these localized areas to support wildlife populations that rely on interior POG. In combination with past timber harvest there would overall be moderate effects in the project area, though major effects in localized areas.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Hairy Woodpecker Indicator: High-POG and number of habitat patches less than 500 acres (there is increased habitat fragmentation as larger habitat patches get broken up into an increased number of smaller habitat patches)	608,330 acres existed historically Historically there were 3,809 habitat patches less than 500 acres	499,631 acres currently exists. There are currently 4,767 habitat patches less than 500 acres.	82% currently remains compared to historic condition in the project area overall. In individual WAAs the range is from 33 to 100%, with the lowest in WAA 1906 (33%), WAA 5132 (36%), and WAA 1905 (47%). There would be no effects of the no action alternative.	20,973 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 3 to 28% of the existing amount, with the highest in WAA 1905 (28%), WAA 2007 (19%), WAA 5136 (19%), and WAA 5131 (18%). Based on the gross unit pool, there would be 12,136 habitat patches less than 500 acres	79% of the historic habitat would remain in the project area overall. In WAAs where harvest would occur the range could be from 34 to 81% remaining based on the gross unit pool, with the lowest in WAA 1905 (34%) and WAA 5132 (35%).	16,529 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 1 to 23% of the existing amount, with the highest in WAA 1905 (23%), WAA 2007 (16%), WAA 5131 (16%), and WAA 5136 (14%). Based on the gross unit pool, there would be 11,026 habitat patches less than 500 acres	79% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 36 to 84% remaining.	While overall in the project area there would be 79% of the historic habitat remaining, additional reductions of up to 28% of the existing high POG in some WAAs (especially WAA 1905 and 5132) would further hinder the ability of these localized areas to support wildlife populations that rely on high POG. Based on the gross unit pool, the number of habitat patches under 500 acres would increase nearly threefold, indicating substantial fragmentation in localized areas. In combination with past timber harvest, overall effects would be moderate in the project area, with major effects in localized areas.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Red-breasted Sapsucker Indicator: Low- and medium-POG and patches greater than 250 acres (there is increased habitat fragmentation as larger habitat patches get broken up into an increased number of smaller habitat patches)	690,335 acres existed historically Historically there were 3,738 habitat patches less than 250 acres	690,266 acres currently exists There are currently 4,680 habitat patches less than 250 acres	100% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	19,666 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 2 to 18%. Based on the gross unit pool, there would be 12,047 habitat patches less than 250 acres	97% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 82 to 98% remaining.	17,865 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 2 to 16% of the existing amount. Based on the gross unit pool, there would be 10,941 habitat patches less than 250 acres	97% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 84 to 98% remaining.	There is currently very little difference in the mapped low and medium POG from the historic condition. The effects of either action alternative would be negligible, since much of the historic low and medium POG would remain under either action alternative.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Mountain Goat Indicator: POG within 1,300 feet of escape terrain (focusing only on WAAs where POG could be harvested where mountain goats occur).	14,037 acres in WAA 1605 (Thomas Bay) 7,360 acres in WAA 1816 (Frosty Bay)	12,512 acres in WAA 1605 6,667 acres in WAA 1816	89% of historic amount remains in WAA 1605 91% of historic amount remains in WAA 1816	408 acres of old-growth in the gross unit pool in WAA 1605. 410 acres of old-growth in the gross unit pool in WAA 1816 1,007 acres of young-growth in the gross unit pool in WAA 1605, and 159 acres in WAA 1816	In WAA 1605 there would be a potential reduction of 3% of the existing amount of POG within 1,300 feet of escape terrain, and 86% of historic amount of POG would remain. In WAA 1816 there would be a potential reduction of 6% of the existing amount of POG within 1,300 feet of escape terrain, and 85% of historic amount would remain.	346 acres of old-growth in the gross unit pool in WAA 1605. 290 acres of old-growth in the gross unit pool in WAA 1816. 923 acres of young-growth in the gross unit pool in WAA 1605, and 147 acres in WAA 1816.	In WAA 1605, there would be a potential reduction of 3% of the existing amount of POG within 1,300 feet of escape terrain, and 87% would remain In WAA 1816, there would be a potential reduction of 4% of the existing amount of POG within 1,300 feet of escape terrain, and 87% would remain.	With potential reduction of at most 6% of the existing habitat within affected WAAs, the effects of either action alternative would be minor, particularly since at least 85% would remain from the historic amount in any individual affected WAA. If young-growth within 1,300 feet of escape terrain is harvested, it would not continue to develop toward old-growth condition. This effect would be minor since a relatively high proportion (at least 85%) of the historic habitat would remain under either action alternative.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Red Squirrel Indicator: All POG	1,295,323 acres existed historically	1,186,555 acres currently exists	92% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	40,639 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 3 to 21% of the existing amount, with at least 10% reduction in WAAs 1816, 1905, 2007, 5131, 5132, and 5136.	88% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 60 to 89% remaining.	34,393 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 3 to 18% of the existing amount, with at least 10% reduction in WAAs 1905, 2007, 5131, 5132, and 5136.	89% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 62 to 91% remaining.	With potential reduction of at most 21% of the existing habitat, the effects of either action alternative would be minor, particularly since at least 60% would remain from the historic amount in any individual affected WAA.
River Otter Indicator: POG within 500 feet of a Class I and II stream and within the 1,000-ft beach buffer	468,172 acres existed historically	424,648 acres currently exists	91% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	8,370 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 0 to 15% of the existing amount, with the highest in WAA 5136 (15%) and WAA 1905 (10%).	89% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 71 to 95% remaining.	6,626 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 0 to 12% of the existing amount, with the highest in WAA 5136 (12%) and WAA 1905 (9%).	89% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 72 to 95% remaining.	With potential reduction of at most 15% of the existing habitat, the effects of either action alternative would be minor, particularly since at least 71% would remain from the historic amount in any individual affected WAA.

MIS	Historic	Existing	Alternative 1	Alternative 2	Alt 2 effects summary	Alternative 3	Alt 3 effects summary	Conclusion
Vancouver Canada Goose Indicator: Hydric POG, forested muskeg, and other unproductive lands	1,342,012 acres existed historically (due to limitations of the historic GIS data, it is assumed no hydric POG, forested muskeg, and other unproductive lands were harvested historically)	1,342,012 acres currently exists	100% currently remains compared to historic condition in the project area overall. There would be no effects of the no action alternative.	8,585 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 0 to 5% of the existing amount. Most of the WAAs where timber harvest could occur would be reduced by less than 2%.	99.4% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 95 to 100% remaining.	7,901 acres in the gross unit pool. Potential reductions in individual affected WAAs would be from 0 to 5% of the existing amount. Most of the WAAs where timber harvest could occur would be reduced by less than 2%.	99.5% of the historic habitat would remain in the project area overall. In WAAs where harvest could occur the range would be from 95 to 100% remaining.	With potential reduction of at most 5% of the existing habitat in any individual WAA where harvest could occur, the effects of either action alternative would be negligible, particularly since Forest Service Standards and Guidelines would maintain habitats in beach/estuary buffers, riparian, and lake buffers.

Environment and Effects for Other Resources

The following sections describe the environmental effects of each of the alternatives as they relate to other resources for this project. Concerns, suggestions, and design recommendations are discussed as they relate to the project's affected environment and potential effects of the alternatives on resources.

Aquatics

Summary

Direct, indirect, and cumulative effects of the proposed activities on aquatics resources were analyzed spatially and temporally using the 6th level Hydrologic Unit Code (HUC) - specifically, the effects to streamflow, water quality, fish and other aquatic organisms, and the physical stream and floodplain habitat that supports them.

Of all activities proposed, timber harvest and roads have the greatest potential for adverse effects on aquatic resources. The analysis discloses maximum effects (assuming maximum levels of implementation), while incorporating the design features of Appendix A to avoid or minimize adverse effects to aquatic resources. The effectiveness of many of these design features is supported by annual water quality best management practices monitoring (USDA Forest Service 2013-2014).

Watersheds within the Central Tongass project area are currently rated overall as "functioning properly" under criteria established in the Watershed Condition Framework (WCF), a nationwide assessment of watershed condition. Within this framework, some watersheds within the project area are "functioning at risk" for specific indicators such as riparian vegetation, aquatic physical habitat, and others that combine for an overall rating (see watershed condition assessment scores in the project record). The analysis below considered additional quantitative and qualitative watershed characteristics for a more detailed assessment of the effects of the alternatives.

Peak Flow

Changes to peak flows may occur in response to cumulative timber harvest and roads in eight (Alternative 2) or seven (Alternative 3) of over 200 watersheds. The effects of peak flow increases, exacerbated by climate change effects, may result in adverse impacts to spawning habitat. This analysis represents a worst-case scenario based on maximum implementation of harvest and roads. During the implementation phase, careful consideration of timing, location, and characteristics of harvest and roads would minimize adverse effects on aquatic resources, using professional judgement based on the analysis described in the EIS and Appendix A.

Restoration activities would have a long-term beneficial effect to aquatic resources by improving watershed function and resiliency to climate change.

Sediment

Timber harvest, roads, restoration, and other proposed activities would result in short-term, localized increases in sediment. Application of water quality BMPs, 2016 Forest Plan direction, and project design features described in Appendix A will ensure compliance with water quality standards. The effectiveness of BMPs is supported by recent monitoring results cited in the EIS and included in the project record.

Fish Passage

NFS and temporary road building in Alternatives 2 and 3 would result in 715 and 713 additional stream crossings, with an estimated 128 new crossings on fish-bearing streams. Approximately 70 percent of the additional road crossings proposed in both action alternatives are on permanent NFS roads, which could potentially impact aquatic resources as described below in the long term. The potential for sedimentation associated with road building is a direct effect during

construction, with potential long-term indirect effects associated with road use and maintenance activities, and potential culvert blockage impacting aquatic organism passage through the crossings. Design features in Appendix A will be implemented to avoid or minimize these effects.

The risk of cumulative effects of the proposed activities to fish passage are considered low since culvert installation on proposed fish crossings would be conducted in accordance to 2016 Forest Plan direction, BMPs, and site-specific requirements found in the Implementation Plan (Appendix A.) However, should culverts installed during road and trail construction activities become passage issues, the effects could range from minor to major depending on length of time to rectify the passage issue. More information on culverts that impede fish passage (hereafter "red crossings") can be found in the "fish passage" portion in the Affected Environment section of this analysis. The project area currently contains 452 red crossings impeding fish movement at certain flows.

Activities other than timber harvest and road building were analyzed as if they would occur to the same extent between action alternatives. Direct, indirect, and cumulative effects vary by activity and range from negligible to minor, with expected short-term negative impacts but long-term benefits. For example, activities such as stream and floodplain restoration, fish habitat improvements, invasive plant treatments, and wildlife and riparian thinning treatments are expected to result in negligible to minor, direct and indirect negative effects to water quality but are expected to result in long-term cumulative benefits to water quality, riparian condition, and ultimately the multitude of organisms that use these areas. Effects of activities such as tent platform and cabin construction/reconstruction; trail construction/reconstruction; outfitter/guide and other hunting and fishing activities; cruise ship visits to remote sites and small communities within the project area; dispersed recreation and subsistence gathering; and similar activities can have negligible to minor site-specific impacts within discrete portions of a given watershed, but are not expected to negatively affect aquatic resources on a watershed scale or in the long-term.

Water Quality

Water quality is expected to be maintained in both alternatives, but risk of negative effects to aquatic resources are generally greater in Alternative 2 due to higher proposed acres of timber harvest and miles of road construction. Additionally, marten focal areas of use on Kuiu Island would expand protection for large stream corridors beyond those required for 2016 Forest Plan RMAs in Alternative 3 on streams most likely impacted by peak flow increases.

Regulatory Framework

The following analysis considers and is consistent with all mandated statutory and regulatory standards. Details can be found in the aquatics resource report (Whitacre and Castro 2019).

Methodology

The analysis was based on field data collected by Forest Service personnel and GIS. Field surveys focused on verifying fish habitat and mapping new streams. Field surveys will continue to delineate and evaluate riparian areas prior to any project or activity. Conditions under which fisheries enhancement projects and stream and floodplain restoration occurs are described in detail in Appendix A. Road-related comparisons between alternatives used mileage derived from the Logging System Transportation Analysis (LSTA) layer in GIS. This likely overestimates potential effects within any given watershed, but provides the maximum potential effect for

either action alternative. Additional information can be found in the aquatics resource report (Whitacre and Castro 2019).

Spatial and Temporal Scales

Direct, indirect and cumulative effects of proposed activities were analyzed spatially and temporally at the 6th level Hydrologic Unit Code (HUC). The 6th level HUC is the scale commonly used to determine the potential effects of management activities, rather than processes or functions of ecosystems (RIEC 1995). Appendix A describes finer scale consideration of watershed-scale impacts at the 7th level HUC for commercial timber harvest, roads, restoration and enhancement activities to ensure that aquatic resources are not degraded.

The longest anticipated temporal effects to aquatic resources in the project area originate from road building and timber harvest. For this analysis all roads were analyzed regardless of age or use (temporary or permanent) due to their continued impacts to natural flow patterns. Previous harvest is analyzed as a 30-year cumulative total to accommodate a maximum effect timeframe for hydrologic recovery. The timeframe for potential effects of management activities is included within descriptors characterizing the level (magnitude and intensity) of effects, described in the *Environmental Effects* section below.

Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The present and foreseeable activities within the Central Tongass Project Catalog of Events (Appendix C) affecting watershed and fisheries resources vary in their scope and intensity. Present activities with the most potential to affect these resources include currently advertised or ongoing timber sales such as the High Tower sale from the Central Kupreanof Timber Harvest decision (2011), Frenchie Integrated Resource Timber Contract, and potential timber harvest on non-Forest Service lands including Alaska Mental Health Trust Timber Sales, the Earl West Timber Sale, Mitkof Island Area Timber Sale, Thomas Bay Area Timber Sale, old growth timber harvest on University of Alaska lands near Kake, Kake to Petersburg Access Road, Kake/Petersburg Intertie Project and the Institute Property Development on Wrangell Island, including the associated road building activities. Potential harvest acres and road miles were included to help quantify cumulative effects where these were known. The Kake to Petersburg Intertie project, Kake to Petersburg Access Road, University of Alaska harvest near Kake, Mitkof Island Area Timber Sale harvest, and the Thomas Bay Area harvest all occur in watersheds with 30-year cumulative harvest levels below levels of concern for potential changes in peak flows and subsequent loss of spawning habitat. Additionally, most of the area occupied by the Thomas Bay Area Timber Sale has been selected by the Petersburg Borough for municipal entitlement land and planning and action on the sale has been deferred until the municipal conveyance process has reached a more definitive stage (ADNR 2018).

The present and foreseeable activities with less potential for negative impacts to aquatic resources include the Wrangell-Petersburg Weed Management project due to the use of herbicide as a potential control mechanism, and potential sedimentation resulting from mechanical treatments. The analyses in the Environmental Analysis conducted for that project concluded the risk to water quality and fisheries is minor. Timber harvest and puncheon trail construction associated with stream restoration implemented by heavy equipment also could affect cumulative harvest levels and potential sediment delivery to the stream. Ten acres harvested per watershed was assumed for restoration activities when computing cumulative harvest levels in this analysis. Trees harvested for these activities are used in support of the restoration project for puncheon trails and building instream structures. The Northern Southeast Regional Aquaculture

Association (NSRAA) has three hatchery chum salmon release locations within the marine environment found in the project area. Chum releases in the Southeast Cove Special Harvest Area near Skanax Bay on Kuiu Island has been ongoing for nearly 20 years, and the Thomas Bay Terminal Harvest Area first had chum released in 2016. The Gunnuck Creek Hatchery (now owned and operated by NSRAA) has had ongoing chum broodstock releases since the 1990's. The scale of these activities is considered minor and the potential effect short term, with expected long-term benefits to stream and floodplain habitat and improved watershed condition.

Projects with negligible anticipated effects to aquatic resources include the remainder of those listed within the Catalog of Events (Appendix C). Projects such as ongoing and anticipated special use permits for crab pot storage, private cabin removal, isolated cabins, fire hydrant lines, and power transmission lines; small-scale drilling associated with ongoing mining exploration on Etolin, Zarembo, and Woewodski Islands; vegetation-clearing for maintaining communications sites, and airport rights-of-way; ongoing and anticipated stream restoration using hand tools to implement such as the BITSU8 project; tent platform and cabin construction/reconstruction; trail construction/reconstruction; outfitter/guide and other hunting and fishing activities; cruise ship visits to remote sites and small communities within the project area; and dispersed recreation and subsistence gathering activities. Effects resulting from these and similar future activities can have negligible to minor site-specific impacts within discrete portions of a given watershed, but typically do not affect aquatic resources on a watershed scale. These activities will be considered qualitatively within discussions of cumulative effects but will not be discussed quantitatively as with timber harvest and road-building activities within this analysis.

Risks of negative impacts to aquatic resources are mitigated through the application of Forest-wide direction, project-specific BMPs, Alaska Department of Environmental Conservation (ADEC) and *Clean Water Act* (CWA) regulations and permitting processes, contractual project requirements, and project design features as described below. Cumulative effects to aquatic and riparian resources from past, present, and future projects will occur, with potential risk levels associated with each alternative described below.

Affected Environment

Existing Condition

This analysis focuses on increases to peak flows resulting from management activities because they are the primary mechanism by which channel altering changes to fish habitat may occur. Other flow-related changes documented by the literature include the potential to affect low flows, water yield, and timing of runoff. These effects are discussed within the aquatics resource report.

Peak Flow Effects

Changes in peak flow following timber harvest primarily result from a loss of canopy interception, which increases the amount of water received on the ground requiring removal by existing hydrological processes. This can lead to faster development and increased volume of peak flows, higher water tables, and increased erosion resulting from overland flow (Banner et al. 2005). In temperate rainforest stands like those of the project area and southeast Alaska in general, overland flow and surface erosion is minimized on the undisturbed forest floor. Little inorganic particle transport (surface erosion) occurs due to the dense, protective mat that accumulates as the result of litter fall and large wood accumulations from windfall, death and slow decay of old-growth trees. In a few locations bare or sparsely vegetated areas will undergo

surface erosion from uprooting due to windthrow, gully side wall unraveling, and denudation caused by occasional landslides and lateral stream cutting during storm events.

Quantifying cumulative harvest levels by age can help assess the risk of potential streamflow effects. A maximum-effect estimate of 20 percent of the timber harvested in the previous 30 years has been used as a measure of the time necessary for hydrologic recovery, referring to the decreasing impact of forest practices through time due to vegetation regrowth (Moore and Wondzell 2005). A recent synthesis report of relevant studies in western Washington and Oregon parses study results into hydrologic zones of rain-dominated, snow-dominated, and the transient snow zone that lies between them (Grant et al. 2008). The transient snow zone (TSZ) is likely the most sensitive to timber harvest effects due to rain-on-snow events common in this zone and is the predominant hydrologic regime of project area watersheds.

Mean peak flow responses for watersheds in the TSZ may be detectable (+/- 10 percent) at 20 percent basin harvest. The influence of roads exceeding 2 percent of basin area results in maximum interpreted detectable peak flow increases that double the mean value (for example, 20 percent basin harvest with roads exceeding 2 percent basin area results in maximum interpreted change in peak flow of 20 percent, double the detectable level).

Generally, the effect of timber harvest will diminish with both increasing flow magnitude (Leopold 1980) and decreasing harvest intensity. Further, when present, peak flow effects on channels would be confined to a relatively discrete portion of the channel network (Grant et al. 2008).

Numeric criteria based on cumulative harvest levels, presence of roads, and other hydrologic processes are incorporated into the findings of the Grant and others study. These findings are relevant to Southeast Alaska and the project area and are used to establish relative risk for this analysis. Most of the watersheds within the project area are located within the TSZ, and none have cumulative harvest levels higher than 10 percent in the past 30 years.

Water Quality

The primary water quality parameters potentially affected by timber harvest and road building are suspended sediment loads, turbidity, and stream temperature. The historic water quality data from active and historic stream gages provides information on temperature, which may help determine a local range of values and help assess risk resulting from the proposed activities.

Beneficial Uses of Waters in the Project Area

Waters in Alaska are protected for all uses according to standards outlined in the Alaska Water Quality Standards (ADEC 2018a). Numeric criteria standards are established according to protected use classes and subclasses. The Alaska Integrated Water Quality Monitoring and Assessment Report provides information on water bodies within the state that do not fully or partially support their designated beneficial uses, known as the Alaska Impaired Waters list. None of the streams in the project area, including nearby water bodies, are included on this list of impaired waters (ADEC 2018b).

Municipal water supplies in the communities of Kake, Petersburg, and Wrangell are within Municipal Watershed LUDs (USDA Forest Service 2016a, p. 3-51) and adjacent non-NFS lands. Municipal water protection zones for two state-classified public water systems are depicted for Petersburg and Wrangell on the Department of Natural Resources (DNR) website. Though water protection zones are not currently depicted on the DNR website for the community of Kake, the

defined protection zones are applicable. Multiple surface water rights near Wrangell and Petersburg, as well as potential potable water supply users on private property are in watersheds with proposed harvest units in both Wrangell and Petersburg. On Mitkof Island near Petersburg, these areas are within the Colorado Creek – Frontal Wrangell Narrows watershed (Spirit Creek-Frontal Sumner Strait-B, #19010210100408, #1901021010041, Spirit Creek-Frontal Sumner Strait-D catchments), Twin Creek, Falls Creek, and Blind Slough (Blind Slough-A, Big Gulch catchments) watersheds, draining into the Wrangell Narrows. Near Wrangell, multiple surface water right owners are in the Pat Creek-Frontal Zimovia Strait watershed downslope from a previously-harvested young growth stand located on non-NFS land.

Appendix A describes design features to protect drinking water consistent with 2016 Forest Plan direction.

Sedimentation and Turbidity

Short-term increases of sediment and turbidity can be expected during road construction, resulting from the removal of vegetation, exposure of bare soil and bedrock, and movement of road prism material during construction. Road construction has been shown to affect runoff generation, potentially altering the timing and volume of water delivery to streams (Wemple 1996). During and after construction, changes in runoff generation caused by the interaction of the road drainage network with the naturally occurring channel network, have resulted in road surfaces being implicated as a potential sediment source to stream channels (Wemple and Jones 2003; Wemple 1996; Megahan and Kidd 1972; Reid and Dunne 1984; Gucinski et al. 2001). Changes in natural flow routing and the increased rate of sediment delivery to streams and altered timing and volume of peak flows can result in bed surface fining, smoothing of stream channels, and filling of pools (Madej 1999; Wemple 1996; Sullivan et al. 1987). Road building has also been implicated with losses of wetlands through the effects of filling, fragmentation, and alteration of hydrology. Long-term sediment introduction from roads is influenced by the type of structure at the road/stream crossing, proximity of the drainage structures to streams, road slope, age, maintenance condition, time since last graded, seasonal timing of maintenance activities, amount of traffic, rock quality, weather, hillslope length, soil depth, and cutbank depth (Croke et al. 2005; Wemple and Jones 2003; Kahklen and Hartsog 1999; Reid and Dunne 1984).

Percentage of basin area comprised of roads has been used to help quantify the risk of flow-related impacts to aquatic systems, including sediment introduction into streams (Cederholm et al. 1980). Currently, approximately 1,130 miles of roads occur in project area watersheds (about 565 miles closed or decommissioned). This estimate includes all roads, NFS and temporary, ever built regardless of age. In Washington's Olympic Peninsula, accumulation of fine sediment in streambeds was found to be highest in basins where the road area exceeded 2.5 percent of the basin area (Cederholm et al. 1980). Specific to Southeast Alaska, statistical relationships between fine sediment and watershed disturbance were not found by Bryant et al. (2004) or Woodsmith et al. (2005). Ross (2013) found evidence of smaller median particle size in stream substrate in watersheds with historical timber harvest, which included historical timber practices of removing riparian trees down to the stream bank. Cederholm's suggested threshold provides a way to evaluate the potential impacts of roaded area in the affected watersheds in comparison to findings elsewhere in the Pacific Northwest. Percent basin area as roads and road density levels are considered very low in all project area watersheds (Table 39).

Table 39. Road density and percent basin area as roads[1] in watersheds with the highest proposed timber and road-building activity

Watershed Name	Location	Existing Road Density (mi/mi^2)	Existing Percent Basin as Roads
Skanax Creek	Kuiu Island	1.5	1.2
Saint John Harbor	Zarembo Island	1.8	1.4
Baht Harbor-Frontal Sumner Strait	Zarembo Island	1.6	1.2
190102100702 - Browns Creek	Kuiu Island	2.2	1.7
Falls Creek - PRD	Mitkof Island	1.0	0.7
Frosty Creek	Mainland	0.8	0.6
190102100101-Big Creek	Mitkof Island	1.0	0.8
Chipp Peak-Frontal Frederick Sound	Kupreanof Island	0.9	0.7

[1] "Percent basin area as roads" calculated as: {(Existing road miles * 5,280 ft/mi * 40 ft (assumed clearing width) / 43,560 ft2/acre) / watershed size (acres)} * 100

Temperature

Water temperature is a key aspect of water quality and stream ecosystem health, determining the rate of many chemical, physical, and biological processes in rivers and streams (Beschta et al. 1987; McCullough et al. 2009).

The Alaska Water Quality Standards for "growth and propagation of fish…" are "may not exceed 20 degrees C at any time" and are specifically 15 degrees for migration and rearing areas, and 13 degrees for spawning areas and egg and fry incubation. For all other water, the weekly average temperature may not exceed site-specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms (ADEC 2018a). Previous correspondence with USGS personnel indicated the 20-degree standard is exceeded most years on approximately half of the non-glacial streams in southeast Alaska (Solin pers. comm. 2009). Studies have argued for a shift from broadly applied water quality standards to regime-standards for nutrients, sediment, and temperature to describe desirable distributions of conditions over space and time within a stream network (Poole et al. 2004).

2016 Forest Plan direction provide for the protection of riparian buffers on all fish-bearing and Class III streams through designation of riparian management areas (RMAs). RMA buffers reduce the risk of increased stream temperatures through shading provided by the riparian vegetation. Previous harvest within the RMA occurred in many of the project area watersheds prior to the passage of the 1990 *Tongass Timber Reform Act* (TTRA), which subsequently provided buffers for all fish-bearing streams. This harvest may have raised stream temperatures on isolated stream reaches; however, enough vegetation regrowth has occurred since the passage of the TTRA for previously harvested riparian areas to recover. Currently, adequate legacy wood exists in most Class I and II streams in previously harvested RMAs, but reach-level stream habitat conditions may decline in the future along discrete reaches of previously harvested RMA due to lack of large wood recruitment from the riparian forest.

Timber harvest in upland areas has also been linked to increases in maximum daily stream temperatures. Pollock et al. (2009) observed that watersheds in the western Olympic Peninsula with 25 to 100 percent of the total area harvested had higher stream temperatures than those with little or no harvest. Potential causal mechanisms for these observations included heating of shallow soils containing groundwater sources which feed into streams; increased risk of debris flows and landslides impacting streams and the subsequent influence on alluvial exchange rates,

loss of large wood, and loss of riparian vegetation through scour; increased peak flows associated with timber harvest potentially widening channels and increasing total solar radiation to streams; and microclimate effects due to forest removal such as increased air temperatures, reduced relative humidity and increased wind speed potentially extending hundreds of meters into adjacent forests (Pollock et al. 2009). In contrast to many other studies, Pollock et al. (2009) found the strongest predictor of increased stream temperatures was the percentage of total watershed harvested rather than the percentage of riparian canopy harvested; however, the authors had difficulty parsing the two effects since most of the riparian vegetation was harvested concurrent with adjacent upland harvest. Current 30-year cumulative harvest levels in project area watersheds are below those identified in the above study, although many would increase above 25 percent with both action alternatives as discussed in the cumulative effects analysis below. The 2016 Forest Plan EIS (pp 3-56 and 3-72) discuss analysis of stream temperature data within southeast Alaska and found no detectable effect of watershed-scale timber harvest on stream temperature (Walters and Prefontaine 2005, Tucker and Thompson 2010).

Fisheries

Streams and lakes within the project area watersheds provide habitat and contribute to the production of fish that support the local subsistence, sport, and commercial fisheries of the area, and are a major food source for many wildlife species. Fish and aquatic resources on the Tongass National Forest provide major subsistence, commercial, and sport fisheries, as well as traditional and cultural values. Abundant rainfall and watersheds with high stream densities provide for the diversity of freshwater habitats.

Aquatic Habitat

Stream habitat is determined by mapping and classifying streams within the project area according to process group and channel type. Fluvial process groups describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition processes. Channel types further categorize streams using physical attributes such as channel gradient, channel width, channel pattern, stream bank incision and confinement, and riparian plant community composition. Streams on the Tongass National Forest are given values of Class I to IV indicating levels of habitat use by fish populations and are delineated according to the criteria described in the Aquatic Habitat Management Handbook. The quantity and overall quality of Class I and II streams and lakes in the project area indicate high fisheries value, as detailed in the project record (Whitacre and Castro 2019).

The Watershed Condition Framework and its accompanying technical guide uses specific habitat indicators such as riparian vegetation, aquatic physical habitat, and others for a combined overall score and condition rating (USDA Forest Service 2011a; USDA Forest Service 2011b). Higher scores within these categories was used with GIS to help guide where to focus restoration efforts (see Watershed Condition Assessment spreadsheet in the project record). Management practices prior to the 1990 *Tongass Timber Reform Act* (TTRA) that included timber harvest and road building along fish streams and within floodplains, and “stream cleaning” resulted in degraded habitat requiring restoration in many locations. The practice of stream cleaning in the 1960s and 1970s removed wood from streams, under the mistaken belief salmon transiting to spawning grounds would benefit. Similarly, wood removal from streams occurred in conjunction with timber harvest to speed transport of logs from the stand. Restoration activities would primarily occur in Class I (anadromous) or Class II (resident) fish streams with channel process groups identified as Floodplain (FP), Moderate gradient-Mixed containment (MM), or Alluvial Fan

(AF). However, restoration could potentially occur within any channel process group according to need. High WCF scores in key attributes within the Skanax Creek, Skanax Bay-Frontal Frederick Sound, Outlet North Fork Bradfield River, Ohmer Creek-Frontal Blind Slough, Sitkum Creek, Woodpecker Cove-Frontal Sumner Strait, Frosty Creek, Wrangell Island-Frontal Eastern Passage, and Deer Island-Frontal Ernest Sound watersheds indicate priority focal areas to determine if restoration work is required. The Rowan Bay, Kadake Creek, and 190102100702-Browns Creek watersheds on Kuiu Island also have high scores in these attributes and have known restoration needs. Watershed restoration and improvement activities are described in detail in the Implementation Plan (Appendix A).

Species in the Project Area

A variety of aquatic ecosystems occur within the project area that are shaped by the physical characteristics of the habitat as well as the composition of organisms that live there. Aquatic organisms in the project area include vertebrates (fish and amphibians), invertebrates (insects, zooplankton, mollusks, and worms), plants (riparian species and macrophytes [rooted and floating plants]), and microorganisms (algae, protozoa, fungi, and bacteria).

Thirteen fish species occur in the freshwaters of the project area. The annual spawning migrations of anadromous fish into freshwater are necessary for the function of many terrestrial plant and animal communities. Anadromous fish mature and spend much of their adult life in the ocean, returning to inland waters to spawn. Resident fish do not undertake migrations like anadromous fish, and many will complete their entire life cycle in fresh water. Some of the fish species in the freshwaters found in the project area have both anadromous and resident populations, and some of the resident populations also utilize estuarine habitats. A table of all the fish species found in the freshwaters surrounding the Petersburg and Wrangell Ranger Districts can be found in the aquatics resource report (Whitacre and Castro 2019).

Marine Environment

Most 6th level HUC watersheds have some degree of direct interaction with the marine environment, and some that contain diverse estuarian and tidal habitats are areas vital for some commercially important species such as Dungeness crab, king, crab, and juvenile salmon some of which are threatened and endangered species originating from Washington and Oregon systems. Nineteen log transfer facilities currently exist in the project area. Recent dive reports describing compliance with standards for marine bark deposition are available in the project record.

Fish Passage

Existing effects to fish passage are are related primarily to road crossings, but may also be affected by an increased risk of landslides due to timber harvest and road building (see the *Soils* section in this document). Potential changes in peak flow, and timing related to timber harvest and road building could increase the number of red crossings by creating flow-related passage barriers to juvenile fish.

Hiking trails are not typically associated with fish passage issues due to their location on the landscape, the size streams crossed, and oftentimes bridge over the stream rather than involving a culvert which can become blocked. The 120 miles of existing trails have 192 stream crossings, and 69 of which are over Class I, anadromous streams. Petersburg Creek watershed has over twice the amount of fish stream crossings than any other watershed in the project area.

District-wide aquatic organism passage surveys are used in conjunction with GIS to determine number of stream crossings, number of culverts with fish passage issues, and streams requiring additional information or field verification. As part of these surveys, each road crossing structure in a fish stream was assessed for its ability to provide unimpeded passage.

Fish crossings are categorized red, green, gray, black or yellow. A red fish crossing has a high certainty of not providing juvenile fish passage at all desired stream flows, while a green crossing has a high certainty of providing adequate passage. Gray crossings are those where the structure measurements need to be run in FishXing software to determine fish passage status. Black crossings are those where additional information is missing for determining status. Yellow crossings are on a watch list, where conditions are assumed to be adequate for fish passage and to meet State of Alaska juvenile fish passage flow standards. However, the potentially insufficient depth of bedload material in the bottom of the culvert elevates concerns about the ability of the bedload to be retained. These culverts are on a more frequent inspection schedule to assure that bedload is retained.

In the project area, there are 1,047 total fish crossings. Of those, there are 509 green crossings equating to 49 percent of the total fish crossings, 452 red crossings or 43 percent, 45 gray crossings, 26 black crossings, and 15 yellow crossings. A map showing the location of red crossings, including those without Upstream Analysis (UA) surveys completed, can be found in the project record. Additionally, a table documenting details of the red crossings, including road system and milepost identifier, amount of upstream habitat and remediation score is available in the project record. Table 40 summarizes the top ten watersheds with the highest number of red crossings in the project area.

Table 40. Watersheds with the highest number of red culverts in the project area

Watershed names	Ranger District	Culvert Passage Classifications					
		RED	GREEN	GRAY	BLACK	YELLOW	Grand total
Kadake Creek	PRD	26	46	4	3	3	82
Mitchell Slough	PRD	22	14				36
Outlet Hamilton Creek	PRD	22	10	1	1		34
190102100702	PRD	18	20	1			39
Goose Cove	PRD	17	22	2	1	1	43
190102100703	PRD	17	24	1		2	44
Big John Bay-Frontal Rocky Pass	PRD	17	10		1	2	30
Pat Creek-Frontal Zimovia Strait	WRD	16	21	3			40
Wrangell Island-Frontal Eastern Passage	WRD	16	1			3	20
Falls Creek	WRD	14	4		1		19

A stream crossing is classified as Class I (anadromous fish) or II (resident fish) if it has verified anadromous or resident fish downstream with habitat upstream or verified fish presence upstream. Upstream analyses are the most accurate estimate this agency has regarding habitat impacted by road crossings that do not meet current fish passage standards. All but 76 of the 452

red crossings in the project area have had UAs completed to assess maximum extent of possible fish presence in the stream. Based upon results from nearly 3,700 fish stream crossings across the Forest where UAs have been completed, average habitat inhibited by the red culverts were shown to be 0.36 and 0.19 miles for Class I and II streams, respectively. Measured statistics from the crossings where UAs were completed are separated from crossings where the blocked habitat was derived from the average.

The surveyed red crossings inhibit access to approximately 82 miles and 91 acres of Class I and II fish habitat. Nearly 17 stream miles are estimated to inhibit fish passage by the 76 unsurveyed stream crossings. Table 41 summarizes the watersheds in the project area with the most habitat inhibited by red culverts. A complete list of all red crossings can be found in the project record (Whitacre and Castro 2019).

Table 41. Watersheds with the greatest amount of total fish habitat inhibited by red culverts in the project area

Watershed Names	Ranger District	Meters of Habitat		
		Class I	Class II	Total
Pat Creek-Frontal Zimovia Strait	WRD	5,999	5,363	11,362
Outlet Hamilton Creek	PRD	0	8,215	8,215
Kadake Creek	PRD	748	7,157	7,905
Falls Creek	PRD	475	7,313	7,788
Frosty Creek	WRD	0	6,931	6,931
190102100702	PRD	1,732	4,970	6,702
Mitchell Slough	PRD	119	5,047	5,166
Mosman Inlet-Frontal Rocky Bay	WRD	668	3,641	4,309
Big John Bay-Frontal Rocky Pass	PRD	429	3,712	4,141
Threemile Arm-Frontal Keku Strait	PRD	1,688	1,954	3,642

The Wrangell Ranger District's 116 red crossings inhibit access to 28 miles of Class I and II streams. The Petersburg Ranger District's 336 red crossings inhibit access to nearly 54 miles of fish habitat. Within the project area, 13 watersheds, or 21 percent, have over 2 miles of fish habitat blocked. Nearly 50 percent have over 1 mile blocked, and seven watersheds 12 percent have no fish habitat blocked within the project area.

Within the project area, a total of 69 miles of Class II habitat is blocked by red culverts. The top three watersheds with restricted access to Class II habitat are found on the Petersburg Ranger District, comprising a sum of just over 14 miles, which is over 20 percent of all Class II habitat blocked in the project area.

Fish Habitat Improvement – Fish Passes and Barrier Modifications

Fish passes and natural instream barrier modifications are constructed to bridge natural waterfalls that historically restricted salmon from accessing quality upstream spawning and rearing habitat. These sites take many forms varying from non-structural "step-pools" blasted out of natural bedrock to the structural Alaskan steeppass, vertical slot, or concrete pool-and-weir designs, all aimed at allowing more fish access to additional habitat. Twenty-seven individual projects have been constructed in the project area. Two sites, Anan and Falls Creek, are managed by ADF&G. Of the 27 sites, 14 are on Petersburg, consisting of ten functional structural sites and

two blasted barrier modifications. Two additional structural sites, located at Kah Sheets, blew out due to ice over the first winter and were never replaced. Wrangell Ranger District has 10 functional sites, of which seven are structural and three blasted barrier modifications. Three additional Wrangell sites are considered non-functional, including Snowpass (one structural and one blasted modification) and Navy Creek. A map and the complete list of barrier modification projects can be found in the aquatics report (Whitacre and Castro 2019).

Of the 22 sites that have been altered or modified in the project area to provide improved upstream passage to salmon, approximately 238 anadromous stream miles and 2,167 lake acres were opened to unimpeded salmon passage. Nearly all the structural fish passes are near or past their project life (typically 25 years) and upgrades and retrofits are critical if benefits are to be sustained into the future.

Environmental Effects

The primary issues related to the aquatics resource from the proposed actions include potential changes in streamflow (magnitude, timing, duration) and water quality (temperature, sedimentation, turbidity). The potential of these changes to affect the physical habitat and biological components that aquatic organisms require is of primary concern.

Direct, indirect and cumulative effects for all affected watersheds are estimated using quantifiable surrogate measures for actual effects (for example, stream crossings are a measure for increased sediment) as supported by the literature cited. The following units of measure were used to evaluate current watershed condition, the effects of the proposal, and to compare alternatives:

- Increased peak flow: Cumulative harvest levels within project-area watersheds
- Increased sediment: Road-related metrics include percentage of basin area comprised of roads (from existing and proposed new road construction), and number of existing and new stream crossings. Other activities such as stream and floodplain restoration, road decommissioning, invasive plant treatments, and construction of cabins and trails are discussed qualitatively, since the effects of these activities tend to be site-specific and effects occur primarily as a function of proximity to aquatic resources.

The relative risk of an activity resulting in effects which would negatively impact aquatic resources is characterized as low, moderate or high; the level (magnitude and intensity) of effects is characterized by descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last. Descriptors of effects include:

- Negligible: Effects would be undetectable or if detected, would be considered slight, detectable only at the site, and last less than a day.
- Minor: Effects would be measurable, although the changes would be small, localized to the site or affected stream reach, and last less than a week.
- Moderate: Effects would be measurable at the stream reach or subwatershed scale, and last more than a week.
- Major: Effects would be readily measurable at the stream reach or subwatershed scale and would last for years.

Exceptions to risk characterizations and these descriptors are noted as applicable, since they are not a perfect fit for all effects.

Effects common to both action alternatives

Timber harvest and road building can affect streamflow by altering processes including evapotranspiration, canopy interception, cloud-water interception, snow accumulation and melt rates that control the amount and timing of water delivered to streams as previously described. Both alternatives share similar direct, indirect, and cumulative effects that would likely result in changes to the timing, magnitude, and duration of flow patterns in many project area watersheds. These changes could impact water quality and physical stream habitat, with subsequent effects to aquatic organisms including fish species.

Streamflow changes resulting from the proposed activities may occur in multiple project area watersheds in both action alternatives.

Peak Flow Response

Percent change in peak flows generally decreases with time after harvest (Jones 2000; Jones and Grant 1996; Thomas and Megahan 1998). Research suggests timber harvest can cause temporary increases in landslide potential and water yield during certain time periods, and that recovery to pre-harvest conditions is ongoing (Swanston and Swanson 1976; Swanston and Marion 1991; Harr and Jones 2000; May 2007). Recent studies have used much shorter post-harvest recovery times of 2 to 5 years for determining potential increases in peak flows (Grant et al. 2008). Assuming a 30-year recovery period, vegetation regrowth from previous harvest has resulted in slope stability and pre-harvest rates of canopy interception and evapotranspiration in most project area watersheds. However, detectable peak flow increases would be expected in 8 of more than 200 project area watersheds in Alternative 2, and 7 in Alternative 3 (Table 42).

Table 42. Cumulative harvest levels in watersheds with anticipated changes in detectable peak flows by alternative

Watershed name	Existing 30-year cumulative harvest (%)	Alternative 2 30-year cumulative harvest (%)[1]	Alternative 3 30-year cumulative harvest (%)	Detectable peak flow increase[2]	Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)
Skanax Creek	3.4	42.0	37.2	16% in Alt2, 15% in Alt3	No
Saint John Harbor	7.1	41.6	37.8	16% in Alt2, 15% in Alt3	Yes
Baht Harbor-Frontal Sumner Strait	4.9	35.5	32.7	13 % in Alt2, 12% in Alt3	Yes
190102100702-Browns Creek	5.8	25.7	22.9	11% in Alt2, 11% in Alt3	No
Falls Creek - PRD	1.7	23.0	21.8	11% in Alt2, 11% in Alt3	No
Frosty Creek	10.3	21.0	20.1	11% in Alt2, 10% in Alt3	No
190102100101-Big Creek	2.0	20.9	19.6	10% in Alt2, 10% in Alt3	No

Watershed name	Existing 30-year cumulative harvest (%)	Alternative 2 30-year cumulative harvest (%)[1]	Alternative 3 30-year cumulative harvest (%)	Detectable peak flow increase[2]	Double Interpreted Peak Flow Increase (>2% Basin in Roaded Condition)
Chipp Peak - Frontal Frederick Sound	1.8	19.9	18.0	10% in ALT2; ND[3] in ALT3	No

[1] Estimates for all alternatives assume implementation in 2020 and that all proposed acres are harvested. Cumulative harvest estimates assume even-aged management prescriptions except within previously-harvested beach buffers and RMAs, which are adjusted to partial harvest treatment prescriptions defined by 2016 Forest Plan (see the Forest Vegetation section of this DEIS). Cumulative harvest estimates include Forest Service and non-Forest Service lands and, roads, and estimated acreage for recreation and restoration activities.
[2] Values estimated from Grant et al. 2008, "Figure 10. Peak flow response in the transient snow zone".
[3] "ND" indicates values below detectable limits.

Peak flow increases could potentially alter anadromous fish habitat in moderate-gradient channels with less floodplain area due to channel confinement (MM, AF process groups). A recent study to assess potential spawning habitat loss due to climate change found that mean annual flood size was not a good predictor for potential changes (Sloat et al. 2016). Potential changes to spawning habitat were attributed primarily to the presence and amount of geomorphic controls such as channel confinement, stream gradient (steepness), and dominant substrate size and type (bedrock, boulder, cobble, gravel, etc.). No predicted losses of high-quality spawning habitat in unconfined channels occurred for any of the salmon species studied, but changes in the extent of moderate-quality spawning habitat in confined, steeper channels would be greatest for Coho due to their ability to spawn in a broader range of conditions (Sloat et al. 2016). Most of the predicted losses of spawning habitat were due to predicted coarsening of the streambed, with the remaining losses attributed to an increased probability of egg and embryo mortality from streambed scour (ibid). Two watersheds have more than 2 percent of the watershed area occupied by roads, and as such the interpreted peak flow increase doubles from the predicted mean values according to Grant et al. (2008). For example, the interpreted peak flow increase in the Saint John Harbor watershed is 32 percent in Alternative 2, and 30 percent in Alternative 3 due to the high relative area occupied by roads in the watershed (Table 42). Regardless of whether peak flow increases result from timber harvest, roads, climate change impacts, or a combination thereof, the effects to changes in spawning habitat are assumed to be the same. This may include scour of eggs and/or alevins in marginal-value spawning areas due to altered magnitude and timing of flows (Sloat et al. 2016; Littell et al. 2019).

Risk of peak flow increases are also affected by watershed-scale characteristics and management considerations. Characteristics such as watershed size and type (true, frontal), drainage efficiency, road density, road connectivity, harvest patch size and location, harvest prescription, presence and location of lakes and ponds, location of channel types susceptible to change, and riparian no-harvest buffers combine in complex ways to influence peak flows. The watersheds in Table 42 were assessed using the following assumptions:

1. The transient snow zone values reported in Grant et al. (2008) are most applicable to small watersheds of 2,500 acres or less. As watershed size increases, the magnitude of increased flows downstream declines due to a variety of factors (ibid). Peak flow increases in two adjacent first order streams cannot cumulatively yield a higher percent increase in flows below their confluence. The magnitude of peak flow increases for larger basins will be equal to or smaller than those reported for small watersheds.

Nonetheless, values for percent increase from the above study are reported in this analysis regardless of watershed size.

2. High road density, road connectivity to streams, and high stream density all act to accelerate surface runoff and increase peak flows. In comparison to the rest of the Pacific Northwest, Central Tongass project area watersheds generally have much lower road densities; project area roads have a relatively high degree of hydrologic connectivity to dense stream networks.
3. Larger clearcuts would likely increase the probability of peak flow effects more than small patches and high retention prescriptions. Cumulative harvest values in both action alternatives assume even-aged management prescriptions except within previously-harvested beach buffers and RMAs. Harvest within these areas allows partial harvest treatment prescriptions under specific conditions, as described in the 2016 Forest Plan (see also the *Forest Vegetation* section). This assumption of clearcut prescriptions would over-estimate the potential peak flow response.
4. The riparian buffers (RMAs) required on Class I, II, and III streams by the 2016 Forest Plan and TTRA reduce patch size and connectivity of disturbed areas and surface runoff to streams, thereby providing some mitigating effect.
5. Bedrock controlled stream channels (HC, LC, MC process groups) would not experience increased sediment transport or channel scour in response to increased peak flows. Palustrine streams, ponds, and lakes would diminish peak flow increases.
6. Higher elevation harvest combined with dense stream networks would be most sensitive to rain-on-snow events.
7. Predicted 17 percent increase in peak flow due to climate change may act cumulatively with peak flows predicted from timber harvest. However, peak flow increases from timber harvest are more likely to occur immediately following harvest, whereas those predicted due to climate change would occur more gradually. As such, the likelihood of a one-to-one “additive” cumulative effect to peak flows is low. Also, the length of time between predicted initiation of climate change increases (earliest in 2040) would result in significant vegetation regrowth and resultant hydrologic recovery, further diminishing the potential cumulative impact of these increases.
8. Planned harvest on non-NFS land was included in cumulative harvest estimates. Harvestable land acquired by Sealaska Corporation on Kuiu Island was recently set aside for carbon offset credits in the California cap-and-trade market and was therefore not included in cumulative harvest estimates.

These factors are highlighted in the following watershed descriptions where they apply.

Skanax (formerly Saginaw) Creek - The greatest 30-year cumulative harvest increase from 2 percent to 42 percent occurs in this watershed under Alternative 2, with a 16 percent predicted increase in peak flows (Table 42). This effect may be exacerbated by potential climate change impacts, predicted to occur by 2040. Mainstem floodplain channels within the Skanax Creek watershed occur along the West and South Fork sections and continue to saltwater from the confluence of these two streams. The condition of riparian vegetation was rated “poor” (impaired function) due to the amount of harvested timber within the riparian area according to metrics established for the nationwide Watershed Condition Framework. Similarly, the watershed condition class score for aquatic habitat was rated as “fair” (functioning at risk) likely reflecting degraded habitat condition in the larger mainstem channels. A large-scale restoration project was

completed along approximately 1.5 miles of the West Fork and Mainstem Skanax Creeks in 2014, and another large-scale project is planned along approximately 0.6 miles of South Fork Skanax Creek. These projects improve(d) instream habitat and flood resilience along the majority of the mainstem channels susceptible to peak flow changes. Similarly, active thinning of the riparian areas associated with these streams occurred beginning in 2010. Risk to loss of high-quality spawning habitat along these mainstem channels, as well as the majority of those not previously restored, would be low due to good connection with the floodplain along most of their reaches, allowing energy to dissipate during high flow events. Risk of channel-altering effects to Coho habitat resulting in potential scour of eggs and/or alevins due to altered magnitude and timing of flows is considered moderate in the moderate-quality spawning habitat typical of MM and AF channels, although these channels account for a small percentage of total stream miles (10.6 and 1.9, respectively) within the watershed, potentially diminishing potential effects. The Skanax Creek watershed is considered a Tongass priority watershed due to its relative low Watershed Condition Classification scores in riparian and aquatic condition.

Saint John Harbor – This watershed has the highest predicted peak flow increase of 32 percent due to proposed harvest levels and because more than 2 percent of the watershed area is occupied by roads (Table 42). Like the Skanax Creek watershed, increased peak flows may be exacerbated by potential climate change impacts, predicted to occur by 2040. Approximately 23 percent of the mapped channels are considered moderate-value Coho spawning habitat susceptible to higher flows. The high-value spawning habitat located in the floodplain channels used primarily by pink, chum, and Coho salmon is relatively limited, contributing approximately 4 percent of the mapped stream miles. Most of the mainstem channels in the watershed are controlled primarily by bedrock and boulders and are not susceptible to peak flow impacts. Riparian vegetation class, physical stream habitat, amount of large wood in the channel, and channel shape and function all received Watershed Condition Class ratings of “fair” (functioning at risk) due to the amount of riparian area harvested and subsequent impacts to aquatic habitat. Risk of peak flow impacts to stream channels and spawning habitat in this watershed is considered high.

Baht Harbor-Frontal Sumner Strait - Watershed-scale impacts to this watershed would be mitigated due to a drainage network dispersed over a large coastal area in this “frontal” watershed, and the predominance of steeper transport channel types draining directly to saltwater. However, this watershed has one of the highest predicted increases in peak flows of 26 percent due to the level of proposed harvest and because more than 2 percent of the watershed area is occupied by roads under both alternatives. Additionally, approximately 17 percent of the channels within this watershed are mapped AF or MM, considered the types of channels with moderate-value spawning habitat susceptible to increases in peak flows. For these reasons, risk of impacts due to peak flow increases is considered moderate.

190102100702-Browns Creek – Browns Creek is a “true” watershed with a mainstem stream draining into Rowan Bay on the west side of Kuiu Island. Road density is the highest of any within the project area watersheds at 2.2 mi/mi^2, although this is considered moderate compared to other Pacific Northwest watersheds. The relatively high road and stream densities, and road connectivity with stream channels would accelerate peak flow effects if they occurred. Most of the proposed harvest occurs on the mid-slope elevations considered within the TSZ, and as such would be more susceptible to rain-on-snow events. However, most of the streams within the watershed are bedrock-controlled channels considered “transport” reaches, including the majority of the mainstem channel (LC process group). Approximately 23 percent of the channels are in process groups with moderate-value Coho spawning habitat susceptible to peak flow

increases. Only 3 percent (1.7 miles) are mapped as FP channels with high-value pink, chum, and Coho spawning habitat. A stream restoration project completed in 2014 was completed on approximately 0.5 miles of this FP channel, and a smaller project was completed on approximately 0.3 miles of MM channel, increasing resilience to floods in these areas above the pre-restoration levels. Due to the relative lack of high-quality spawning habitat and higher percentage of moderate-value spawning habitat susceptible to peak flow increases, the risk of degraded conditions resulting from peak flow increases if they occur in this watershed is considered moderate.

Falls Creek – Falls Creek is considered a "true" watershed with a mainstem channel draining into the Wrangell Narrows on Mitkof Island. A fish pass was installed near the mouth of this stream in 1950 to provide access for salmon to quality upstream spawning and rearing habitat. Most of the proposed harvest in both action alternatives occurs in the TSZ and would be susceptible to rain-on-snow events. Road density is considered low, but stream density and road connectivity to the stream network are considered relatively high. Approximately 23 percent of the moderate-value spawning habitat is susceptible to channel-altering peak flow increases, with very few mapped lakes or ponds to diminish effects. This watershed also has a relatively high number of red culverts at 14, potentially exacerbating any additional channel alterations due to increased peak flows. The 30-year cumulative harvest levels are 23 and 22 percent for Alternatives 2 and 3, respectively, and the potential peak flow increase is 11 percent. Considering the above factors, the risk of loss of moderate-value Coho spawning habitat due to peak flow increases in this watershed is considered moderate.

Frosty Creek – This is a "true" watershed draining into the north end of Ernest Sound south of the Bradfield Canal. Approximately half of the proposed harvest occurs in the TSZ, and the watershed is marked by steeper ground and more alluvial channels relative to other watersheds. Approximately 10 percent of the streams are mapped as high-value floodplain spawning channels, predominantly higher in the watershed, and most lakes within this watershed are similarly located at higher elevations. Approximately 7 percent of mapped channels are those containing moderate-value Coho spawning habitat. For these reasons, peak flow increases may be less pronounced if they occur. The 30-year cumulative harvest levels are at the limit of detection at 21 and 20 percent for Alternatives 2 and 3, respectively. The risk of peak flow increases and potential impacts to fish habitat are considered low.

190102100101-Big Creek – This is also a "true" watershed located on Mitkof Island draining east into Frederick Sound. Relatively high stream density and connectivity to the road system, with approximately 21 percent of the channels classified as MM, or AF and very limited lake habitat would indicate a higher susceptibility to increases in peak flows if they occur. Most of the proposed harvest occurs on the mid-slope elevations considered within the TSZ, and as such would be more susceptible to rain-on-snow events. As a large watershed, the effects of peak flow increases would be attenuated in channels lower in the watershed. The 30-year cumulative harvest levels are at the limit of detection at 21 and 20 percent for Alternatives 2 and 3, respectively (Table 42). The predicted increase in peak flows is 10 percent in both alternatives. If peak flow increases occur in this watershed, the risk of diminished moderate-value spawning habitat susceptible to peak flow impacts is considered moderate.

Chipp Peak-Frontal Frederick Sound – This is a frontal watershed located near Portage Bay on the Petersburg Ranger District. Over 88 percent of the streams in this watershed are steeper, bedrock and boulder-contained "transport" channels. Road density and percent of the watershed area occupied by roads are very low. Less than 9 percent of the channels are mapped as AF or

MM, and most of the streams in the watershed drain straight to saltwater. The 30-year cumulative harvest level is at the limit of detection or increased peak flows at 10 percent for Alternative 2, and is undetectable in Alternative 3. Much of the proposed harvest occurs in lower elevation areas above previously-harvested units situated parallel to the coast, and new road construction is minimal. If peak flow increases occur in this watershed, the risk to moderate-value spawning habitat susceptible to peak flow impacts is considered low.

Other activities that add to the cumulative timber harvest within a watershed include microsales, recreation-related activities and harvest for stream restoration projects. Potential harvest for recreation-related and restoration activities was assumed for each alternative. Values assumed for each watershed included 10 acres of restoration-related harvest to be used in the restoration project, and one each of the following recreation-related activities: single structure (0.02 acres), structure with ancillary buildings (0.23 acres), a campground (0.92 acres), and 10 miles of new trail (24 acres). Microsales and wood salvage activities of standing dead-and-down trees will continue within the project area on a case-by-case basis, as discussed above in Alternative 1. Projects that may occur in the foreseeable future as identified in the Catalog of Events and discussed above in "Methodology" could also add to cumulative harvest levels. Cumulative harvest levels would remain below levels expected to increase peak flows in all watersheds except those in Table 42. Additional harvest in those watersheds would minimally increase cumulative totals, but the overall risk would remain the same due to the small amount of harvest associated with these activities and the relative low risk within the watersheds identified above. Appropriate riparian, soils, and water 2016 Forest Plan Standards and Guidelines and BMPs will continue to be applied to all microsale/salvage activities to minimize potential negative impacts due to erosion and sedimentation.

Timber harvest for building instream structures associated with restoration of streams, lakes and floodplains would increase cumulative harvest levels within watersheds where this activity occurs. Harvest levels would not increase the risk of peak flow effects in any of the watersheds not identified in Table 42 above. No new restoration projects are currently planned in any of the watersheds in Table 42 except for Skanax Creek, where the South Fork Skanax Creek project would harvest approximately 250 whole trees (less than 2 acres). These trees would be sourced primarily from the riparian management area (RMA) adjacent to the restoration reach, but also within future timber harvest areas further upslope as necessary. A silvicultural prescription would be developed for thinning the RMA to a wider spacing more typical of old-growth stand conditions, while protecting trees adjacent to the stream for bank stability and promoting growth of the largest trees within the RMA.

Water Quality

Beneficial Uses of Waters in the Project Area

Implementation of the action alternatives is not expected to negatively impact beneficial uses of water within the project area. Site-specific BMPs such as streamside buffers (Veg-3, 12.16a, minimum 100 feet), erosion control measures for timber planning and road construction (Veg-2, 13.14, Road-3, 14.5, 14.6, 14.8), and site-specific stream channel protection consistent with, and in addition to, streamside buffers where applicable (Veg-3, 13.16) would be used to avoid or minimize effects of the proposed harvest and road-building activities. All activities proposed in the project area will be inspected and assessed in the field by an aquatic resource professional to ensure compliance with all applicable BMPs, and Standards and Guides. Harvest prescriptions that minimize disturbance would also minimize potential downstream effects to beneficial water users. Effects to beneficial uses are expected to be negligible.

Water quality considerations common to both action alternatives include possible increases in sedimentation and erosion, and increased temperature due to stream bank vegetation removal. The potential effect of invasive plant treatments, including herbicides, on aquatic resources is detailed in the Hydrology Resource Report (Whitacre 2019) for the Northern Tongass Integrated Weed Management project, hereby incorporated by reference. That analysis found the potential to influence water quality parameters was minor in the short term and negligible in the long term due to the relatively small portion of any watershed that would be treated. The potential effects of each treatment method and individual herbicide is discussed in detail in that document.

Sedimentation and Turbidity

A temporary increase in sediment delivery to streams due to new road building, reconstruction of old roadbeds, bridge construction, installation of culverts, and decommissioning of temporary roads is a direct effect expected with implementation of either action alternative. Effects of the short-term sediment delivery from these activities would be minor and are not expected to degrade State water quality standards. These standards are addressed directly through project design features described in the Implementation Plan (Appendix A). Erosion control plans would be developed before construction to minimize or mitigate erosion, sedimentation, and potential water quality degradation (BMP 14.5).

Both action alternatives rely on the existing road system and would require the construction of National Forest System (NFS), temporary, and the reconditioning of existing roads. Construction and road reconditioning would require the use of quarry pits. Existing pits would be used where feasible; however, new road construction could require the development of new ones. NFS, temporary, and reconditioned roads would be built in both action alternatives, resulting in increases in road density (Table 39). All proposed temporary roads could remain open for up to five years to accommodate subsistence activities and fuelwood gathering, after which time they would be decommissioned. See the Travel Analysis (Appendix B) for additional information regarding management objectives for project area roads.

Both action alternatives would increase the number of crossings on Class I, II, III, and IV streams (Table 43). All new crossings on Class I and II streams will be designed and constructed to meet current Forest Service fish passage standards for both action alternatives. Risk of sediment delivery to streams is higher at road crossings, reflecting the potential for culverts to act as initiation points for delivery of sediment and debris downstream. Proposed road locations are estimated and may change during unit layout based on site conditions. All crossings on proposed road segments would be verified by a fisheries biologist or hydrologist during layout for either action alternative. All temporary roads would be decommissioned with all structures removed with the timber sale contract following harvest activities, thus eliminating the potential for sediment delivery to streams from the failure of drainage structures. Implementation of 2016 Forest Plan direction, BMPs and project design features described in the Implementation Plan (Appendix A) will reduce the risk of sediment introduction to streams.

Table 43. Proposed new crossings[1] on temporary and NFS roads by stream class

Stream Class	Alternative 2		Alternative 3	
	Temporary	NFS road[2]	Temporary	NFS road[2]
I	15	33	15	33
II	37	43	37	43
III	117	119	116	119

Stream Class	Alternative 2		Alternative 3	
	Temporary	NFS road[2]	Temporary	NFS road[2]
IV	178	173	177	173
Total	**347**	**368**	**345**	**368**

[1] Number of proposed crossings is based entirely from a GIS exercise documenting where the proposed road locations cross currently known stream segments.
[2] Includes proposed crossings for all proposed NFS road work including both new construction and reconstruction on an existing prism.

Removal of trees within 200 feet of NFS roads for expanding existing quarry pits and constructing new rock pits would be addressed by applying 2016 Forest Plan Standards and Guidelines and BMPs. A pit development plan would be reviewed prior to development of new quarry pits. Log landings are often the site of intense activity, and as such have a higher probability of being a source of concentrated overland flow containing sediment and other pollutants. Sediment delivery to streams may increase due to higher traffic volumes resulting from log transport between landing locations and the designated logging transfer facilities (LTF). High traffic volume has been implicated in increased risk to sediment delivery (Reid and Dunne 1984; Kahklen and Hartsog 1998). Log landings will be designed and constructed outside RMAs according to BMPs 13.10 and Veg-6 (USDA Forest Service 2012a). See the *Soils* and *Issue 1: Timber Supply and Economics* sections of this DEIS for more detail.

Direct negative effects of stream, lake, and floodplain restoration includes increased sedimentation associated with working directly within a wetted channel during implementation, construction of puncheon trails to access stream sites, and potential use of explosives for removal of abandoned culverts and/or breaching abandoned spur roads located in active floodplains. A beneficial direct effect of this activity is improved habitat condition immediately following restoration for fish species and other aquatic organisms. BMPs and project design features discussed in the Implementation Plan such as fish-timing restrictions, handling of fuel, power-washing equipment, and conversion to vegetable-based oils for instream work among others help mitigate effect. Work completed in the floodplain will improve riparian condition which will indirectly benefit many other species including wildlife and native vegetation in the long term. Beneficial impacts of restoration work are anticipated to be long term.

Manual and mechanical invasive plant treatments along stream banks could accelerate sediment delivery to streams through the removal of vegetation and ground disturbance. This impact would be minimized by tamping the soil back into place after removal of the invasive plants and by using this method only on small infestations. Aquatic and riparian treatment areas comprise a relatively small portion of any watershed for both action alternatives and are relatively short-lived. The methods discussed above could have a negligible, short-term, localized, adverse impact on water quality but are expected to have long-term positive benefits on water quality by returning native vegetation to currently infested areas. Project design features and pesticide permit stipulations will help mitigate for the potential of any long-term negative impact.

Temperature

The application of riparian management area (RMA) buffers provides protection and maintenance of naturally functioning aquatic ecosystems from ground-disturbing activities associated with timber harvest. The 2016 Forest Plan Standards and Guidelines require that RMAs be delineated according to stream value classification and channel type process groups, with minimum protection standards defined for harvest and road building activities (USDA

Forest Service 2008; USDA Forest Service 2016a, pp. D-1 through D-20). All Class I and II streams are protected from harvest activities within a minimum horizontal distance of 100 feet from the bankfull margins. Buffer widths more than 100 feet are determined based on stream process group classification (BMP 12.6), and the application of windfirm buffers where required. Riparian buffers provide protection from nonpoint source pollution, help maintain stream temperature and maintain riparian and aquatic habitat. Additionally, while even-aged harvest prescriptions are assumed in this analysis, it is likely that variable harvest prescriptions will be applied during implementation, which would further limit the potential for higher stream temperatures resulting from loss of timber basin-wide.

Cumulative harvest levels high enough to increase peak flows within eight project area watersheds in both action alternatives (eight in Alternative 2; seven in Alternative 3) suggest changes in stream temperature could occur according to Pollock et al. (2009). However, temperature increases linked primarily with the loss of riparian canopy suggests that if increases in stream temperature occurred they would likely be site-specific, resulting from potential landslides or debris flows and their subsequent effects on temperature.

The southeast Alaska stream temperature monitoring network was recently established to help collect regional baseline data for accurate assessments of the rate of change to stream temperatures in response to climate change (SAWC 2017). This network will provide the most recent and comprehensive stream temperature monitoring in the region, including watersheds within the project area, with monitoring results becoming increasingly valuable with the passage of time.

Fisheries

Aquatic Habitat

Riparian no-harvest buffers on Class I, II and III streams would avoid direct impacts to stream habitat. Effects would be minor to negligible and mostly limited to road-stream crossings due to the potential for culverts to become plugged with sediment and debris. The greatest number of proposed Class I crossings in both action alternatives occurs in the Skanax Creek watershed.

Stream habitat may be indirectly affected if changes in peak flow resulting from higher cumulative harvest levels occur in up to eight watersheds, including Skanax Creek and Saint John Harbor. Peak flow increases could potentially alter anadromous fish habitat in moderate-gradient confined channels with pockets of spawning gravels (MM and AF process groups), depending on local geomorphic conditions. Changes to moderate-value spawning habitat in these channel types could include coarsening of bed substrate and streambed scour, potentially impacting eggs and/or alevins due to altered magnitude and timing of flows (Sloat et al. 2016; Littell et al. 2019).

Potential sediment delivery to streams via windthrow trees is minimized with the application of reasonable assurance of windthrow buffers during unit layout according to recent guidelines (Landwehr 2007). Within the project area, a total of 100 windfirm buffers have been monitored, with 73 of those occurring on Petersburg Ranger District. Post-harvest windthrow is present in 58 percent of all buffers, with 34 percent of that windthrow falling into a stream, yielding an 8 percent average windthrow mortality (USDA Forest Service, 2016-2017 Tongass National Forest Monitoring and Evaluation Report, unpublished data).

The potential for sediment delivery to lake and pond habitat is considered negligible due to lake riparian buffers and implementing 2016 Forest Plan direction, as well as National and Regional BMPs.

Aquatic habitat may be impacted with proposed invasive plant treatments, including herbicides, along the streambank and upon emergent vegetation with approved aquatic formulations of herbicide. Potential impacts on aquatic resources have been analyzed in the *Aquatics Organism Resource Report* (Johnson 2018) and the *Aquatics Organism Resource Report Addendum* (Castro 2019) for the *Northern Tongass Integrated Weed Management EA* draft. This analysis is hereby incorporated by reference, and more detailed discussion can be found in these documents. The analysis found that if application rates remain below that specified on the container for each specific formulation, only fish sensitive to exposure have a hazard quotient (HQ) where potential adverse effect could occur when application occurred at the maximum rate. Glyphosate, the herbicide fish and amphibians are most susceptible, has a central HQ 250x less than the threshold where any observed adverse effects have been found in sensitive fish. The central HQs for the other herbicides upon macrophytes is the only other scenario where adverse effect is possible. The potential effects of each treatment method and herbicide is discussed in that document.

Fish Habitat Improvement

Fish habitat improvement activities are designed to increase production of a specific fish population in a specific location. Fish habitat improvement activities proposed in all the action alternatives on all lands within the project area include: fish pass construction, natural instream barrier modifications, fish stocking associated with fish pass and barrier modification activities, and lake fertilization. These activities generally aim to provide fish for harvest opportunities in the common property fishery, although individual fisheries may be targeted.

Fish Pass Construction and Barrier Modifications

As barriers are identified, site specific analyses are conducted to determine feasibility and cost effectiveness of structural construction or modification and any potential negative effects to fish already resident in the stream. A map of the potential barrier modification locations is included in the project record. Barrier modification activities could have major effects on fish and fish habitat in systems where barriers are limiting or preventing access to spawning and rearing habitat. Beneficial impacts include increased overall freshwater ecosystem productivity, increased size or numbers of resident or other anadromous salmonids that prey on supplemented species in freshwater, and overall production of target species as returning adults which provide harvest opportunities.

Bryant et al. (1999) and Wright et al. (1997) evaluated ecological impacts of introduced salmon in freshwater habitats in two Southeast Alaska systems where barriers were removed and fish stocking was conducted. Both noted some increased complexity in food webs and changes in resident population characteristics but no broad-scale displacement or replacement by introduced species.

Bursts of sediment would occur during implementation. The adverse effects to water quality would be minor because the increased turbidity would be short-term and localized. Adverse effects to fish are minimized by operating during species specific timing windows which are designed to avoid spawning adults, eggs and alevins in the gravel, and autumn high water. Effects to water quality, fish habitat, and aquatic organisms would be further minimized by following direction in the Fish Habitat Improvement Activity Guide (Appendix A), which

outlines required BMPs, 2016 Forest Plan direction, and requires identification of site-specific design features during implementation planning.

To improve the efficacy of any project implemented, bioenhancement (fish stocking) may be undertaken upstream of the modification after thorough biological and genetics consideration and professional review. Stocking a stream can boost the productivity of any barrier modification and is sometimes required to ensure early establishment of runs of adult spawners. Fish stocking has been a common occurrence upstream of many modification projects within the project area. As mentioned above, Wright et al. (1997) performed a multiyear assessment of the introduction of coho salmon into the Slippery Creek watershed and found no broad-scale negative interactions between resident and recently introduced salmonids. Pre and post-implementation monitoring of any affected site would capture changes to any population dynamic adjustments.

Lake Fertilization

Lake fertilization activities would be undertaken to improve nutrient conditions in well-monitored lakes containing sockeye salmon in order to increase the primary productivity and therefore increase the size and survival of salmon fry. Enriching lake nutrient levels may measurably increase the number and/or size of out-migrating juvenile salmon, resulting in increased availability of adult salmon for harvest. Lake fertilization, a relatively expensive improvement technique, requires detailed pre and post-fertilization monitoring. Lake fertilization activities could have major (readily measurable, last for years, have substantial consequences) positive effects on fish and fish habitat in lakes where sockeye salmon production has been limited by low lake fertility.

Adverse effects of lake fertilization activities on water quality, fish habitat, and aquatic organisms would be minor (small, last less than a week, localized to affected lake) due to the rigorous process of evaluation and post project monitoring required for successful fertilization projects. Potential adverse effects to lake fertilization include altering food-web dynamics so that other planktivore species are favored and outcompete juvenile sockeye salmon. Lake fertilization can also stimulate the growth of algal blooms resulting from excess levels of nutrients in the water. Algae will grow quick in high-nutrient environments but it is short lived, and after death the decay process consumes oxygen, reducing dissolved oxygen available to aquatic organisms. The Fisheries Improvement activity guide and decision tree (Appendix A) outline requirements during project planning. This includes assessments of historical abundance, assessment of all potential causes for decreased run sizes, assessment of lake fertility from detailed pre-project monitoring, and habitat capability and feasibility analyses to determine if the foodweb structure is appropriate for lake fertilization. All pre-project assessments must show lake fertilization would benefit the aquatic lake environment to positively benefit sockeye salmon production with minimal risk of adverse effects. The required consistent and long-term monitoring following initiation of any lake fertilization would provide early identification of water quality concerns, allowing for rapid abatement of any issues.

Fish Passage

Effects to fish passage are assumed to be site-specific, and are related primarily to road crossings, but may also be affected by an increased risk of landslides due to timber harvest and road building. Potential changes in water yield, peak flow, and timing related to timber harvest and road building could increase the number of red fish crossings by creating flow-related passage barriers to juvenile fish. Theoretically, higher peak flows could increase the number of days fish passage is inhibited due to flow velocity through culverts for juvenile fish. It is unlikely

these crossings would be complete barriers, but instead would remain passable at most flows as previously discussed.

Both action alternatives propose a minimum of 713 new stream crossings, and Alternative 2 has two more total crossings proposed. These two additional stream crossings are located along temporary roads that will be decommissioned following the end of the road or timber contract.

Recreation has identified up to 300 miles of new hiking trail proposed for construction. Using the assumption of 1.6 crossings per mile of trail (derived from existing condition), there could be up to 480 new stream crossings, and up to 173 new Class I stream crossings.

The risk of cumulative effects of the proposed activities to fish passage are considered low since new culvert installation on proposed fish crossings would be conducted in accordance to 2016 Forest Plan direction and BMPs. However, should culverts installed during road construction activities become passage issues, the effects could range from minor to major depending on length of time to rectify the passage issue. All road stream crossings will continue to require fish passage through the installed culverts until structures are removed through storage or decommissioning treatments.

Logging Transfer Facilities (LTF)

In both action alternatives, 18 logging transfer facilities are proposed for use in the Central Tongass Project. Fifteen are existing facilities, and three will require new construction (Three Mile Arm on Kuiu Island, and Vank and Shrubby Islands.) Two existing LTFs are barge only facilities, and eight of the 15 existing LTFs require reconstruction to meet current use standards. Refer to the project record for a map of these facilities within the project area.

Barging the logs would have less effect on marine species than log raft. Habitat for managed marine species and their prey may be diminished due to bark accumulation resulting from rafting logs at the LTF or from the possibility of water quality degradation through oil spill contamination from either rafting or barging. A possible negative effect of log rafting is reduced rearing capability for juvenile salmon and their prey species due to potentially reduced water quality from bark leachates. Primary and secondary production may also be reduced due to lower water quality caused by leachates from the bark debris.

The Alaska Pollutant Discharge Elimination System (APDES) permits for the LTFs authorizes discharge of bark and wood debris into the coastal water with stipulations. Continued bark monitoring surveys would be conducted if wood is placed into the water. All LTFs would be maintained to comply with all permits, including tidelands permits, solid waste permits, COE 404 (fill on wetlands) and Alaska Department of Environmental Conservation APDES permits, and a State 401 certification.

Threatened, Endangered and Sensitive Species (TE&S)

No federally listed threatened, endangered, or sensitive species are known to occur in the streams and lakes within the project area. However, some fish from stocks of federally listed salmon and steelhead from Washington, Idaho, and Oregon as well as the green sturgeon from California may migrate through the marine waters throughout the project area. By adhering to 2016 Forest Plan direction and all required BMPs, a determination of “may affect, but not likely to adversely affect” is documented in the biological assessment.

Direct and Indirect Effects

Alternative 1 - No Action Alternative

In the no action alternative, no commercial timber harvest would occur with this project, and no roads would be built other than those currently planned or scheduled through previous NEPA. Besides actions covered under existing NEPA, all other activities proposed in this document such as recreation improvements, fisheries improvements and aquatic organism passage red crossing remediation, and restoration of large streams using heavy equipment would not occur. This alternative, therefore, would not meet the purpose and need for this project. Selection of this alternative would not preclude regular maintenance of existing roads, including erosion control measures and removal or replacement of culverts. Previously planned projects summarized in the Catalog of Events (Appendix C) and described above in the *Methodology* section would similarly continue as planned. The direct and indirect effects of those projects and activities have been assessed in previous NEPA documents where required. The risk of landslides associated with previously built roads is ongoing and is considered an indirect effect, because if landslides do occur, they may or may not deliver sediment to streams. Sediment delivery to streams from periodic road maintenance is expected to be minor and within water quality standards set by the State of Alaska.

Alternative 2

Alternative 2 proposes harvesting up to 13,500 acres. Direct and indirect effects of harvest activities are similar between action alternatives and would occur to the greatest extent in this alternative due to higher amounts of proposed timber harvest. Direct effects to water quality include potential sedimentation resulting from harvest near streams not receiving RMA buffer protection (Class IV), although BMPs requiring slash clean-up in channels helps mitigate this effect. Indirect effects to streamflow may occur through potential peak flow increases, and water quality through sedimentation from management-induced landslides or windthrow, and though unlikely, temperature increases. The relative risk, magnitude and intensity of these effects were discussed above in the *Effects Common to Both Alternatives* section.

NFS and temporary road building in Alternative 2 would result in 715 additional stream crossings, with an estimated 128 new stream crossings on Class I or Class II streams. The Transportation section of this DEIS details the long-term objectives for project area NFS roads. All temporary roads would be decommissioned after timber harvest activities, which is expected to improve the initial impacts associated with roads to aquatic resources. This alternative would have the greatest potential for bark accumulation at LTFs since it proposes to harvest more timber than Alternative 3.

Minor, direct, negative effects to water quality from stream, lake and floodplain restoration include increased sedimentation associated with working within a wetted stream channel during implementation, construction of puncheon trails to access stream sites, and potential fuel spills from equipment. BMPs and project design features discussed in the Implementation Plan such as fish-timing restrictions, handling of fuel, removal of excess dirt and mud from equipment prior to entry into the stream, and conversion to vegetable-based oils for instream work among others help mitigate this effect. Harvesting trees for building instream structures is an activity with potential indirect and cumulative effects resulting, as detailed in discussions of tree harvest effects above in the *Effects Common to Both Alternatives* section. A beneficial direct effect of this activity is improved habitat condition immediately following restoration for fish species and other aquatic organisms. A broader network of organisms benefits both directly and indirectly through changes in energy flow through foods webs resulting from instream and riparian

improvements (Bellmore et al. 2017). Improved instream and riparian condition through restoration and thinning activities indirectly benefits competitors, predators, and prey of the target species, including important wildlife species and native vegetation communities in the long term.

Other direct and indirect effects to water quality are anticipated from those activities associated with trail and cabin construction, and later long-term use of the recreation site or trail, through potential sedimentation. These effects are expected to be negligible, as discussed in detail in the aquatics resource report (Whitacre and Castro 2019).

Alternative 3

Alternative 3 proposes harvesting up to approximately 11,725 acres. Direct and indirect effects of harvest activities were discussed previously and would occur to a lesser extent in this alternative compared to Alternative 2 due to less proposed timber harvest.

NFS and temporary road building in Alternative 3 would result in 713 additional stream crossings, with an estimated 128 new stream crossings on Class I or Class II streams (Table 43). Alternative 3 proposes 11.8 fewer miles of NFS roads than Alternative 2, and 18.6 fewer temporary road miles. The potential direct and indirect effects of roads to water quality due to sedimentation, level of use, maintenance activities, and potential culvert blockage was discussed above in the *Effects Common to All Alternatives* section and are relevant in this alternative. Temporary roads could remain open for up to five years to accommodate subsistence activities and fuelwood gathering, after which time they would be decommissioned, same as Alternative 2. This alternative would also have potential for bark accumulation at logging transfer facilities, but to a lesser degree than in Alternative 2 due to lower harvest levels.

Cumulative Effects

Alternative 1 - No Action Alternative

Cumulative effects were assessed using the same 6th level HUC watershed boundaries as direct and indirect effects. Foreseeable activities within project area watersheds were summarized in the Catalog of Events and described above in the *Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis* section. Ongoing activities relevant to this alternative include active timber sales, microsales and salvage sales, road and trail maintenance, stream restoration, silvicultural thinning and pruning treatments (pre-commercial, riparian and wildlife habitat enhancements), microsales, and invasive plant treatments.

A maximum-effect timeframe of 30 years was used as a measure of the time necessary for hydrologic recovery through vegetation regrowth and for assessing the risk of peak flow effects due to cumulative timber harvest and roads. Active timber sales were considered in the existing condition above, which indicated cumulative harvest levels under 10 percent for all project area watersheds. All negative cumulative effects of timber harvest under this no action alternative would continue to improve with time.

Microsales and wood salvage activities of standing dead-and-down trees will continue within the project area on a case-by-case basis, as they have in the past. Chapter 2 provides the context for how these activities will occur in the No Action Alternative description. The maximum annual harvest amount for microsale/salvage activities would not increase current or proposed harvest levels sufficiently to alter anticipated effects either directly, indirectly, or cumulatively due to the current trajectory of hydrologic recovery in project area watersheds. Salvage sales resulting from catastrophic events exceeding maximum annual harvest amounts would require additional NEPA

to complete. Cumulative harvest levels would remain below those expected to increase peak flows for the above activities as well as those identified in the Catalog of Events and discussed above in the *Methodology* section. Additionally, the appropriate riparian, soils, and water 2016 Forest Plan Standards and Guidelines and BMPs will continue to be applied to all microsale/salvage activities to minimize potential negative impacts due to erosion and sedimentation.

Since proposed roads would not be built under this alternative, management indicators such as percent of a basin comprising roads, road density, and proximity of roads to streams would not change from existing condition. Approximately half of the roads considered to quantify existing condition are currently decommissioned, closed, or stored. Continued active road and trail maintenance helps reduce potential sources of stream sedimentation by maintaining drainage efficiency through crossing structures.

Most previously-harvested riparian areas would continue to recover, particularly with ongoing riparian and pre-commercial thinning efforts. Streams, lakes and floodplains with declining habitat conditions due to either the intensity of previous disturbance and/or sensitivity of the location to disturbance improve more rapidly under active restoration. The South Fork Skanax Creek and East Ohmer Creek restoration projects would continue under previous NEPA and their completion would contribute to improved watershed condition scores under the Watershed Condition Framework. Similarly, smaller streams within the project area would continue to be restored under the *Stream Restoration Using Hand Tools Decision Notice*, which would improve these streams on a site-by-site basis. Minor cumulative watershed improvements are expected with this activity. Active restoration of other large streams and floodplains would not occur under this alternative, and therefore cumulative condition of these affected areas would decline.

Thinning treatments may have a localized effect on a portion of the stream network within a watershed, but the effects would be short-term, and undetectable at the watershed scale (Grant et al. 2008). Microsales are typically located on road systems connected to communities such as Kake, Petersburg and Wrangell within the project area. None of the watersheds near these communities have 30-year cumulative harvest levels approaching the detectable limits of potential peak flow increases after considering harvest from microsales. Cumulative effects to water quality resulting from these activities is non-existent to negligible.

Road and trail maintenance activities are expected to improve watershed hydrology in the long term by maintaining drainage efficiency through crossing structures, thereby reducing potential sources of stream sedimentation. Effects of the above-described projects to streamflow, water quality, and fish habitat would be unlikely to occur on a watershed scale. Instead, they are expected to be short-term, negligible to minor in intensity, and unlikely to have a long-term negative effect on fish populations.

With no action proposed, the influence of climate change on Alternative 1 would be reflected in the anticipated regional changes discussed in the *Existing Condition* section above. These changes are expected to occur by 2040, within the timeframe of the Central Tongass Project.

Alternative 2

Potential harvest of 13,500 acres within the project area would cumulatively affect project area watersheds to varying levels due to increased cumulative harvest levels as discussed above. Alternative 2 could potentially result in peak flow increases and the subsequent impacts to stream habitat discussed above in all eight watersheds identified in Table 42. Skanax Creek and Saint John Harbor watersheds would have the highest cumulative percent harvest (42.3 percent)

with this alternative. In Skanax Creek Watershed, risk of cumulative peak flow increases negatively impacting moderate-value spawning habitat is considered moderate as previously discussed. High-value spawning habitat associated with low-gradient floodplain channels is unlikely to be negatively impacted by increased peak flows due to good connectivity between the stream and floodplain throughout most of these reaches. Additionally, the extensive restoration work completed in a significant portion of mainstem channels and floodplains, as well as thinning the riparian areas in these areas has improved the overall condition and resilience of these areas compared to previous conditions. Cumulative impacts of timber harvest combined with road building and associated risk of water quality impacts of sedimentation and stream temperature increases are considered moderate in this watershed. The risk of negative impacts to moderate-value spawning habitat due to increased peak flows is high in the Saint John Harbor watershed. This is due primarily to the relative high amount of moderate-value habitat as well as well as high percentage of the watershed area occupied by roads.

Timber harvest associated with future restoration is minor but would contribute to overall cumulative effects of previous and proposed harvest in this alternative. Harvest-related cumulative effects negatively impacting aquatic resources would be greatest in this alternative due to higher levels of harvest compared to Alternative 3.

Cumulative effects of road-related activities such as construction, reconstruction, and maintenance of roads and stream crossing structures were discussed previously and would occur to the greatest extent in this alternative. As such, the potential cumulative road-related changes in streamflow, water quality, and stream habitat are higher than in Alternative 3.

Timber harvest associated with restoration activities would increase cumulative harvest levels as discussed above in the *Effects Common to Both Alternatives* section. Harvest levels associated with restoration is expected to be the same in both action alternatives, as presented in Chapter 2, *Alternatives Considered in Detail*.

The potential cumulative impacts related to climate change are detailed within the aquatics resource report (Whitacre and Castro 2019). The primary risk occurs to watersheds with predicted increases in peak flows resulting from timber harvest (Table 42). The estimated increase in peak flows attributable to climate change is 17 percent by 2040 for all project-area watersheds. This would increase the likelihood of cumulative impacts related to peak flows, but the effect would be diminished depending on the timing of implementation of potential timber harvest. If timber is harvested in the near-term as assumed in calculations of cumulative harvest levels in this analysis, the effect would likely be minor due to hydrologic recovery resulting from vegetation regrowth by 2040, as well as the slower onset of climate impacts compared to a harvested timber stand. In areas where harvest occurs nearer to the predicted 2040 initiation of climate change impacts, cumulative effects of timber harvest would be more “additive” with expected climate change increases. This would increase the likelihood and the magnitude of peak flow events in all harvested watersheds under these conditions, but particularly within watersheds with proposed harvest resulting in cumulative totals above detectable levels (Table 42). Based on these estimates, the factors discussed above in the *Peak Flow Effects* section, and the literature regarding subsequent risk to spawning and rearing habitat, the relative risk of negative cumulative effects is highest in this alternative.

Alternative 3

Harvest of 11,725 acres within the project area would increase cumulative harvest levels in the same watersheds as Alternative 2, but to a lesser extent. Seven of these have the potential for

increased peak flows due to the proposed harvest levels, in contrast to eight in Alternative 2 (Table 42). However, estimated increases in peak flows attributable to climate change would increase the likelihood and the magnitude of peak flow effects in all harvested watersheds with proposed harvest resulting in cumulative totals above detectable levels (Table 42). As such, the relative risk of negative cumulative effects is slightly lower in this alternative, and ranges from low to high depending on the affected watershed. All other proposed activities are assumed to occur to the same extent in this alternative as Alternative 2, and as such would have the same direct and indirect effects to aquatic resources, but cumulative effects would be diminished slightly due to lower levels of proposed timber harvest and road building.

This alternative also increases protection to large stream corridors on Kuiu Island due to the location of marten focal areas of use around these large streams. These areas effectively expand the buffers around these streams. This would increase overall resilience to disturbance from timber harvest and climate change-related impacts from peak flows, as well as diminish potential effects to water quality from sedimentation and stream temperature increases.

Essential Fish Habitat Assessment

The *Magnuson-Stevens Fishery Conservation and Management Act* requires consultation with the National Marine Fisheries Service (NMFS) for any activities that could affect the essential fish habitat (EFH) of federally managed fish species identified in fishery management plans developed by the North Pacific Fishery Management Council and approved by the Secretary of Commerce. EFH includes all waters and habitat necessary for fish spawning, breeding, feeding or growth to maturity. The Forest Service has determined that activities in the Central Tongass Project may adversely affect both freshwater and marine essential fish habitat for federally managed fish species. A copy of this DEIS will be provided to the NMFS to initiate EFH consultation. Any conservation recommendations provided by NMFS will be included in the final Central Tongass Record of Decision.

Several marine species use the nearshore waters surrounding the islands composing the Petersburg and Wrangell Ranger Districts including arrowtooth flounder, Pacific cod, walleye Pollock, dusky rockfish, shortraker/rougheye rockfish, yelloweye rockfish, sablefish, sculpin, and skates (North Pacific Fishery Management Council 2017). Pacific salmon species (chum, coho, pink, and sockeye) are included in a Fishery Management Plan (North Pacific Fishery Management Council 2018) and utilize freshwater habitats within the Central Tongass Project. The nearshore marine waters are also used by adult and juvenile salmon.

Effects on Freshwater EFH

Approximately 3,178 miles of Class I anadromous streams and 1,936 miles of Class II resident streams have been identified in the over 200 6th level HUC watersheds within the project area. Populations of federally managed species of pink, chum, sockeye, and coho, as well as populations of Dolly Varden char, cutthroat trout, and steelhead occur within the project area.

Potential effects on freshwater EFH include changes in water yield, peak flow volume and timing of flow delivery, sediment delivery, altered riparian vegetation and herbicide treatments, and road-stream crossing channel disturbance. A complete discussion of potential adverse effects, including cumulative effects, of the proposed action is included in the aquatics resource report (Whitacre and Castro 2019). The Forest Service will minimize potential adverse effects on freshwater EFH by following the Implementation Plan (Appendix A) which includes BMPs, 2016 Forest Plan direction, applicable laws and regulations, and design features. Careful

consideration of potential changes to peak flow rates will be made during the implementation phase. Given the geographic location of specific activities, professional judgement based on the analysis method provided in the FEIS will be followed to ensure that no adverse effects to EFH will occur.

Effects on Marine EFH

Project activities that could affect marine EFH include vessel and large equipment along shorelines; log loading; rafting of logs; grounding and/or anchoring of barges; development and improvement of LTF and MAF sites and the maintenance associated with these actions. These potential effects include temporary displacement and site avoidance of federally managed fish species and their prey and temporary.

There are 18 logging transfer facilities (LTFs) proposed for use in the Central Tongass Project. Fifteen of these are existing, with three new LTFs proposed (Three Mile Arm on central-western Kuiu Island, Vank and Shrubby Islands). Two of the fifteen existing LTFs are barge only facilities. The alternative maps in Chapter 2 show the proposed LTFs considered in the Central Tongass project area. Up to 69 marine access points will continue to be utilized by the public for access to recreation and cabin sites, but no efforts will be made to extend any infrastructure below mean high tide without following steps outlined in the Implementation plan (Appendix A).

LTF construction and operations in the past have been found to affect benthic resources and some EFH habitat primarily through the accumulation of bark from dumping, storage, and rafting of logs. Some shoreline disturbance can occur from the development of LTF sites, including modification or loss of habitat through the addition of rock or other structures on the shoreline. There is also potential for runoff of sediment and oils from landing areas and beach access trails to the marine environment. Soils at onshore facilities where logs are decked can become contaminated with gasoline, diesel fuel, solvents, etc., from trucks and heavy equipment. These contaminants could leach into nearshore EFH. Out of these potential impacts to EFH habitat, the largest impact is due to bark accumulation in the marine system (Faris and Vaughan 1985).

Typically, LTFs have affected approximately two acres of marine benthic habitat for the average site, mostly due to bark accumulation (Faris and Vaughan 1985). This would equate to no more than 32 acres associated with the proposed action, considering that two of the existing fifteen LTF are barge only facilities. Depending on abundance, bark and other wood fragments that sink to the bottom, can have varied adverse effects to marine areas by reducing organism diversity, burying benthic organisms, and reducing organism abundance (Sedell et al. 1991). If bark accumulations are high enough, specific benthic areas may become locally toxic or anoxic. This could result in adverse effects to organisms such as crabs, shrimp, and nearshore rearing marine and anadromous fish. Bark can remain for extended periods (decades) but, based on dive survey results for LTF sites of concern, the bottom area covered with bark (based on bottom area with continuous coverage) can be greatly reduced within a few years once use ends. Additionally, after deposition has ceased, over time these areas can become biologically similar to areas unaffected by even large accumulations of bark and wood debris (Germano and D. Browning 2006). Log rafts and temporary beach barge access use also have the potential to cause adverse effects to habitat primarily from grounding of the rafts and barges, which can damage intertidal habitats and organisms that are present. These effects are expected to be minor and temporary in nature.

The 69 marine access points may be converted to marine access facilities by new construction or with site improvements including docks, boat ramps, mooring buoys, etc. Fill activities may cause adverse effects to aquatic prey resources and EFH. There would be some negligible (lasting less than a day) to minor (lasting less than a week) localized adverse effects to water quality, fish habitat, and aquatic organisms depending on the type of activity being implemented, and the days required to develop the facility. While EFH prey resources may be impacted by habitat alterations associated with the proposed action, it is unlikely that these areas are primary feeding locations, therefore any minor effects to prey are considered insignificant. Given the small area of the project sites and the fact that any physical changes to this habitat would not measurably reduce the localized availability of prey, we expect effects to EFH would be minor.

The Forest Service will minimize potential adverse effects on marine EFH by following the Implementation Plan (Appendix A) which includes BMPs, 2016 Forest Plan direction, applicable laws and regulations, and design features. Specific Siting Guidelines (2016 Forest Plan Appendix G) for LTFs, Log Raft Storage, and Collateral Facilities, TRAN4 V. (p. 4-80) Log Transfer Facilities Siting, Construction, Operation, and Monitoring LTF; and for Water Dependent Facilities Other Than Log Transfer (TRAN4 III.3 (p. 4-79)) Wetlands, Flood Plains, Estuaries, and Tidal Meadows Water Dependent Transportation will be followed to minimize adverse effects to aquatic resources. Following the siting guidelines and BMPs in the NPDES General Permit will reduce the amount of bark and wood debris that enters the marine and coastal environment, reduce the potential for displacement or harm to aquatic species, and reduce the accumulation of bark and wood debris on the ocean floor.

Conclusions

Based on the known effects of timber harvest, road building, and other project activities, the Forest Service concludes the Central Tongass Project may adversely affect Freshwater EFH and Marine EFH. Some impacts to EFH are recognized as permanent (fill below mean high tide), since full recovery can require decades. In contrast to a few long-term impacts to EFH, the direct impact on the EFH managed species would be largely temporary. This is because the primary impact directly to the fish themselves is the temporary impairment of water quality due to bark accumulations, sediment delivery from fish stream crossing construction/reconstruction, and stream restoration, fill in near-shore marine waters (less than 20 feet deep). Most adult fish are mobile and will actively avoid direct impacts from project activities. Some impairment of ability of EFH managed species to find prey items could occur, but this effect should be temporary and spatially limited to the immediate vicinity of construction activities. While stream restoration and improvement activities and red crossing remediation may have temporary and localized adverse effects, these activities are expected to promote the conservation, enhancement, and proper functioning of EFH over the long-term. The Forest Service expects that by applying the project design features described in the Implementation Plan (Appendix A), which includes 2016 Forest Plan direction and Best Management Practices, negative effects to essential fish habitat will be minimized under both action alternatives. The effectiveness of BMPs is supported by recent monitoring results cited in the EIS and included in the project record.

Botany

This section provides a summary of existing conditions for sensitive and rare plants and discloses effects in the Central Tongass project area.

Summary

Forest Service direction requires that botanical resources be evaluated to ensure there is no loss in viability to sensitive plants or rare botanical resources across the Central Tongass planning area. No proposed or federally listed plant species are known on the Tongass National Forest.

In comparing alternatives, Alternative 1 has a smaller impact for all suspected or known sensitive plants due to NEPA work already completed and the absence of additional proposed activities. Alternative 2 and Alternative 3 have similar relative impacts for Calder's loveage, the lichen *Ricasolina*, Kruckeberg's sword fern and Henderson's checkermallow because these species' preferred habitat is outside of areas proposed for road construction or timber harvest. The other potential activities, such as recreation or watershed improvements, are the same for both alternatives. Alaska rein orchid, the lesser round-leaved orchid, Unalaska mist-maid and mountain lady's slipper have the potential for greater impact in Alternative 2 than Alternative 3 simply because the disturbance footprint is larger in potential habitat in Alternative 2 as compared to Alternative 3. Forest Service Region 10 sensitive plants within the project area have a "may affect" determination for all alternatives, as there are populations outside of the project area which will ensure there is no trend toward federal listing or loss of viability in the planning area. With one exception: Alternatives 2 and 3 run the risk of adversely impacting the viability of the mountain lady's slipper within the planning area. There is only one known population that occurs within a timber development land use designation, roughly 100 feet from the road and downslope of both the road and potential timber harvest.

Regulatory Framework

Forest Service policy requires a review of programs and activities, through an effects analysis, be conducted to determine their potential effect on threatened and endangered species, species proposed for listing and Regional Forester designated sensitive species. The purpose of this document is to present the analysis and determination of effects of the alternatives on federally listed species (endangered, threatened, and proposed) and Forest Service sensitive species (FSM 2670.31-2670.32).

For threatened and endangered species and species proposed for listing, the analysis and document are referred to as a Biological Assessment or BA. No plants federally listed or proposed by the U.S. Fish and Wildlife Service are known or suspected to occur in the Alaska Region, therefore there is no further discussion of federally listed or proposed plants in this document.

For sensitive species, the analysis and document are referred to as a Biological Evaluation or BE (FSM 2670.3). Preparation of a Biological Evaluation as part of the NEPA process ensures sensitive species receive full consideration in the decision-making process.

Methodology

Spatial Scale

The Central Tongass project area is the spatial boundary for analyzing the direct, indirect and cumulative effects to R10 sensitive plants as the distribution of known/suspected R10 sensitive plants and probable habitat is across the project area.

Temporal Scale

Direct effects to Forest Service Region 10 sensitive plants and the indirect effect of herbicide drift (non-target plants may exhibit signs of stress in the short-term) are observable in conjunction with the associated activity or within the week following implementation. Indirect effects are visible from a week to several years post-activity, so in the short- and long-term any discernible impact beyond a single growing season is considered a long-term effect for assessing cumulative impacts.

Analysis Methods and Assumptions

Within the Central Tongass project area, the maximum potential disturbance footprint by alternative is considered in the analysis of effects. R10 sensitive and Tongass National Forest rare plants occur across a variety of habitats; therefore, an analysis based on acreage and/or miles impacted provides the best metric for determining effects (Krosse 2016). Roads are buffered by 150 feet to determine acreage impacted.

Presence data analyzed for this report comes from the NRIS TESP-IS database and the two additional lichen locations documented in the Consortium of Pacific Northwest herbaria (CPN 2019).

Incomplete or Unavailable Information

Sensitive and rare plant occurrence data is based on past field surveys largely associated with NEPA projects, with the addition of rare plant studies focused on probable habitat on Zarembo Island in 2012. Comprehensive habitat surveys have not been conducted for sensitive and rare plants within the entirety of the project area and it is likely that additional populations occur in un-surveyed areas. In addition, there is a general absence of information regarding impacts to sensitive and rare plants and the number of populations necessary to ensure their persistence over the long term. We base our evaluations on the best available information, which are documented in the species assessments for the several sensitive species of concern (Dillman et al. 2017, Fulkerson et al. 2017a, Fulkerson et al. 2017b, Nawrocki et al. 2017).

Affected Environment

Region 10 Sensitive Plants

Seventeen vascular plants and one lichen are designated as sensitive in the Alaska Region (R10) (Goldstein et al. 2009). Three of the seventeen R10 sensitive plants are known and six are suspected within the project area (Stensvold 2011) (Table 44).

Table 44. R10 sensitive species suspected or known to occur within the Central Tongass project area, the general habitat where found, and the Land Use Designation (LUD)

Species	Common Name	Habitat	LUD (# populations)
Cirsium edule Nutt. var. *macounii* (Greene) D.J. Keil	Edible thistle	Dry meadows, talus slopes, in subalpine and alpine	(0)
Cypripedium montanum Douglas ex. Lindl.	Mountain lady's slipper	Upper beach medows, beach/forest ecotone, open forest, wet meadows; calcareous substrate	Development (1)
Ligusticum calderi Mathias & Constance	Calder's loveage	Forest edge, meadows, alpine and subalpine; typically with calcareous substrate	(0)
Platanthera unalascensis (Spreng.) Kurtz	Alaska rein orchid	Open forest, stream banks, bogs, heath, ultramafic substrate	(0)
Platanthera orbiculata (Pursh) Lindl.	Lesser round-leaved orchid	Forest (open and forest edges as well), bogs	Natural Setting (3), Wilderness (7), Development (1)
Ricasolina amplissima (Scop.) De Not. ssp. *sheiyi* Derr and Dillman	Lichen, no common name	Old-growth beach fringe forest in exposed locations	Natural Setting (2), Wilderness (8), Development (1), non-NFS land (2)
Polystichum kruckebergii W.H. Wagner	Kruckeberg's sword fern	Talus slopes and rock outcrops; ultramafic substrate	(0)
Romanzoffia unalaschcensis Cham.	Unalaska mist-maid	Forest edge, stream banks, rock outcrops	(0)
Sidalcea hendersonii S. Watson	Henderson's checkermallow	Upper beach meadow and forest edge	(0)

Rare Plants

Rare plants have similar protections as R10 sensitive plants in the 2016 Forest Plan (USDA Forest Service 2016a). Rare plant species known or suspected to occur on the Tongass National Forest are evaluated based on a list derived from the Alaska Center for Conservation Science (ACCS 2019, Stensvold 2015). Included are species with a State of Alaska Ranking of S1 (imperiled), S2 (critically imperiled), sometimes S3 (rare), species that are disjunct or range extensions within the Tongass National Forest, and excluding species already listed as sensitive in the Alaska Region. The list has been static the past 4 years, however, it is intended to be dynamic as more is learned about the taxonomy and the distribution. There are 26 rare plants documented in the Central Tongass project area (Table 45).

Table 45. Rare plants known within the Central Tongass project area

USDA Code	Species	AK State rank	Frequency of occurrence
AMCH4	*Ambrosia chamissonis*	S2	1
ASTRT	*Asplenium trichomanes*	NR	1
BOAK	*Botrychium alaskense*	S3	1
BOLU	*Botrychium lunaria*	NR	1
BOMI	*Botrychium minganense*	NR	1

USDA Code	Species	AK State rank	Frequency of occurrence
BOTU3	*Botrychium tunux*	S2	1
CAGY2	*Carex gynocrates*	NR	2
CAIN11	*Carex interior*	S3	1
CHTE3	*Chrysosplenium tetrandrum*	NR	3
ERVI9	*Eriophorum viride-carinatum*	S2S3	1
FESU	*Festuca subulata*	NR	2
JUAR	*Juncus articulatus*	S1S2	1
LYCO3	*Lycopodium complanatum*	NR	1
LYIN2	*Lycopodiella inundata*	S3	12
MAPA4	*Malaxis paludosa*	NR	4
PHCA11	*Physocarpus capitatus*	S2	1
PHEM	*Phyllodoce empetriformis*	S1S2	1
PICA13	*Piperia candida*	NR	2
POSE	*Polystichum setigerum*	S3	3
RAORO	*Ranunculus orthorhynchus*	S2S3	1
RAPA	*Ranunculus pacificus*	S3S4	2
SAREG	*Salix reticulata*	NR	2
SARTO2	*Saxifraga tolmeii*	NR	1
SCSU10	*Schoenoplectus subterminalis*	S2	2
TABR2	*Taxus brevifolia*	S3	1

Existing Condition

The Central Tongass project area has 3,474,556 acres in the Wilderness land use designation (LUD) group, 2,870,107 acres in the Natural Setting LUD group, and 1,657,996 acres in a Development LUD group.

The largest extent of the potential proposed activities within the Central Tongass project area occur on the large islands and the mainland around Thomas Bay and Bradfield Canal. All of the larger islands – Wrangell, Mitkof, Kupreanof, Kuiu, Etolin and Zarembo – have had large-scale logging operations, while harvest is variable on the mainland (Bradfield Canal and Thomas Bay) and on some of the smaller islands. Four percent (154,559 acres) of productive old growth has been harvested to date within the project area. Both the round-leaf orchid and the Alaska rein orchid can be found in forested habitat.

There are 1,703 miles of road, including closed or decommissioned. Buffering the road segment by 75 feet on either side results in roughly 30,846 acres of impact. This includes 3,170 acres of wetland[10]. One-thousand ninety-two stream crossings on NFS lands in the Central Tongass project area reflect the number of streams, ranging from bridges across floodplain or alluvial fan systems to culverts at smaller high-gradient channels. Wetlands and streams are habitat for mountain lady's slipper, Alaska rein orchid, round-leaved orchid, and Unalaska mist-maid. The marine access facilities along the beach (which include boat ramps, log transfer facilities and

[10] Acres derived from the National Wetland Inventory (NWI).

cabin access for example) include potential habitat for Henderson's checkermallow and the lichen *Ricasolina*.

Pre-TTRA harvest has occurred along stream banks, and oftentimes yarding down the stream corridor. These areas are now assessed for riparian restoration activities which help stabilize the system. The current young-growth strategy allows for limited harvest in the beach and riparian young-growth stands (USDA Forest Service 2016a). Thinning in all young growth stands – predominantly to benefit timber production, but also for fish and wildlife – continues across the project area when stands reach 20 to 35 years of age. Round-leaved orchid and Unalaska mist-maid are the two sensitive species likely to occur along the riparian corridor in these previously harvested areas, and the lichen *Ricasolina* may occur on remnant trees within the harvested beach fringe forest.

There are 5,811 gross infestation acres within the project area; all but roughly 650 gross acres are associated with roads, rock quarries, recreation sites and communities. Invasive plants can compete with sensitive and rare plants and have adverse consequences. There is currently one R10 sensitive plant population (mountain lady's slipper) known to occur roughly 35 meters from an invasive plant infestation.

All of the suspected or known sensitive species have habitat potentially impacted by recreation or any of the existing mineral, outfitter and guide, or special use permits.

Climate Change

The Scenarios Network for Alaska and Artic Planning (SNAP) models temperature and precipitation data based on the International Panel on Climate Change predictions of mid-range emissions. Precipitation is expected to increase slightly over the years when comparing historical and current precipitation to projected precipitation (2050 and 2100) for both Wrangell and Petersburg (SNAP 2019); however, more significantly for plant communities, more rain will fall than snow in the winter months. Temperatures are predicted to be 2 degrees Celsius warmer in the next 20 to 40 years compared to present, or 3.5 degrees Celsius above the historical average (SNAP 2019).

Open habitat is considered probable rare plant habitat, and these community types may eventually convert to shrub- and tree-dominated species under the predicted climate scenario (Carlson and Cortes-Burns 2013). Alpine and post-glacial plant communities are particularly vulnerable to the warmer and wetter trends with less precipitation as snow; change may be quite rapid. Wetlands may become drier during the summer months with the predicated warmer and drier weather patterns.

Other habitats within the Alexander Archipelago are expected to be more resilient to the projected change (Carlson and Cortes-Burns 2013). With the exception of the endemic lichen *Ricasolina* and Calder lovage (*Ligustichum calderi*), the remaining R10 sensitive plants suspected or known within the project area are at the northern extent of their range. Therefore, one could infer that climate change alone will not unduly impact the population trends for these species. Some plant species may benefit while other plant species are stressed, depending on the species-specific biology. Invasive plants, however, are expected to benefit from the longer growing season and warmer temperatures (Hinzman et al. 2005). Competition with native species could become a more significant issue.

Environmental Effects

Alternative 1 – No Action Alternative

Under Alternative 1, none of the specific management activities as proposed in the DEIS would be implemented to accomplish project goals and objectives. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as recreation maintenance and improvements, road and trail maintenance, stream restoration, invasive plant treatments, and other routine forest management activities not associated with the Central Tongass decision would continue as authorized by previous decisions. Direct and indirect effects would continue as described in project documents.

Direct and Indirect Effects

Invasive Plant Treatments

Under Alternative 1, up to 200 acres of invasive plants can be treated annually up to the water's edge. Treatment options include manual, mechanical and herbicide.

Direct effects: Manual hand pulling can disturb the soil and potentially uproot non-target plants; however, the area treated is typically small and therefore the likelihood of impacting other plants is negligible. Mowing can cut non-target vegetation. Tarping covers more than the target plant and therefore impacts adjacent and intermixed non-target species. Hand application (wicking/wiping or stem injection) of herbicides is unlikely to result in movement of herbicides beyond the target plants due to the precise application of small amounts of herbicide and direct effects are negligible. Foliar spot spray will similarly have a negligible to minor effect because the herbicide application is not as precise and may contact non-target species.

Indirect effects: Treatment can be beneficial, as the competition from the invasive species is removed and habitat is restored. Effects can also be negative with respect to herbicide, as off-site movement of chemicals from spray drift, surface water runoff, or soil percolation could damage or kill non-target vegetation. These three parameters are minimized with proper application techniques, including controlling spray droplet size and monitoring wind speeds. Overall, the indirect effects are expected to be beneficial.

Watershed Improvements

East Ohmer Creek and Skanax (formerly Saginaw) Creek restoration activities with heavy equipment and the hand-crew restoration projects for both the Wrangell and Petersburg Ranger Districts are approved for implementation.

Direct effects are considered negligible to minor, and indirect effects negligible. Direct effects from the restoration activities include uprooting, burying, crushing or trampling plants and/or their habitat as trees are felled, moved, staged and installed on site. Indirect effects include changes in the light regime, changes in soil drainage patterns, and root wad removal creates soil disturbance conducive to invasive plant colonization. The indirect effect of stabilizing the stream channel and advancing the succession of riparian communities to its natural condition - the goal of restoration activities - typically benefits sensitive plants and associated habitat.

Recreation Management

Sonar cabin replacement, Anan Wildlife Observatory trail and observatory reconstruction, and Raven Trail construction are three activities approved for implementation.

"No impact" determinations were provided as complete field surveys were conducted at the appropriate time of the year to identify sensitive and rare plants. None were found.

Access Management

Only a portion of the 1,703 miles of open and closed roads are maintained. Under Alternative 1, road construction, reconstruction and maintenance associated with on-going timber sales such as Navy and Skipping Cow will continue (See Appendix C – Catalog of Events for a complete list of present activities).

Road construction has the direct impact of disturbing the soil and burying all vegetation (or removing all of the vegetation) within the width of the road prism. Undocumented R10 sensitive plants could be destroyed and habitat lost as the road bed is constructed. Impacts may include mortality or inhibit the vigor and reproductive capability of the plants. There is a risk of imposing direct effects to the habitat and to any undocumented occurrence of sensitive or rare plants. Indirectly, culvert placement and road bed materials could alter water drainage patterns which would impact downslope plant communities. Additionally, opening the canopy in forested habitat, altering the humidity, and providing substrate for invasive plants to colonize are indirect effects.

Reconstructing and maintaining roads involves cleaning out borrow ditches, brushing vegetation and replacing structures such as bridges. Reconstruction and maintenance operate within the existing disturbance footprint so effects are typically negligible (typically, because sensitive or rare plants occur along the road shoulder in disturbed sites). Other indirect effects could include allowing increased light to reach the ground (beneficial or adverse effect, depending on the plant species), increasing human use with the additional access and increasing the likelihood of spreading invasive plant species and the resulting competition with native plant communities. Potential indirect effects of reconstruction and maintenance include spreading invasive plants, if present.

Vegetation Management

Thinning to benefit timber, riparian and wildlife resources is on-going, as are several timber sales (see Appendix C for the complete list).

The direct effects of thinning include opening the canopy to increased light and burying vegetation with slash (no expected indirect effects). The direct effects related to thinning are considered minor.

Direct effects related to timber harvest include trampling, crushing, and burying plants and associated habitat. Shovel yarding can score the ground and heavy equipment can compact the soil. Undocumented R10 sensitive plants could be destroyed and habitat would be lost. Impacts may cause mortality or may inhibit the vigor and reproductive capability of the plants. Indirect impacts related to timber harvest could include: changes in the light regime, increased water table due to the absence of evapotranspiration; changes in hydrology due to puddling and displacement from soil compaction, increased competition due to changing abiotic factors, particularly from invasive plant species, and increased human use for recreation and subsistence as access is provided. Direct and indirect effects related to timber harvest are expected to range from minor to moderate.

Cumulative Effects

2016 Forest Plan components (USDA Forest Service 2016a) include a provision for reviewing the implementation and effectiveness of conservation actions for sensitive plants. This review provides information to improve conservation efforts and reduce the likelihood of negative effects to sensitive plant species due to management actions. Under Alternative 1, the effects to previously documented sensitive plant populations or their habitats have been analyzed under past NEPA decisions. No additional cumulative effects to sensitive plants on NFS lands are anticipated.

Alternatives 2 and 3 – Effects Common to All Alternatives

All activities outside of timber harvest and associated road construction are common to both alternatives; therefore, the effects for those actions are analyzed together. Where comparisons to existing actions in Alternative 1 are warranted, the details are provided. The effects to R10 sensitive plants for Alternatives 2 and 3 are evaluated separately for timber harvest and access management due to the difference in acreage proposed for each alternative.

When project activities are identified, consideration of effects specific to that location will be documented according to procedures outlined in the Implementation Plan (Appendix A).

Direct and Indirect Effects

Invasive Plant Treatments

With regards to invasive plant treatments, Alternatives 2 and 3 differ from Alternative 1 in that they include non-NFS lands, remove the limit on treatment acreage (the limit was set at 200 acres per year or 10,000 acres over the life of the project), allow broadcast spraying, and permit hand application and foliar spot spray to emergent vegetation. These additions provide tools for an all-lands management approach to control invasive plants with the potential to increase the capacity for treatment through partnerships, and allow treatment of target plants growing where the water level fluctuates (for example, the Stikine River and the intertidal zone of the Duncan Salt Chuck).

The analysis for the *Northern Tongass Integrated Weed Management Environmental Assessment* draft (USDA Forest Service 2019) discloses the effects of treating all land ownerships, treating emergent vegetation, utilizing broadcast spray, and removing the acreage cap. The three proposed herbicides in the Central Tongass Project – glyphosate, aminopyralid and imazapyr – were also analyzed in the *Northern Tongass Integrated Weed Management EA*. Given that the analysis was just completed and the described activity is similar to the Central Tongass Project, a brief summary of the direct, indirect and cumulative effects follows. More-detailed information can be found in the Biological Evaluation for Sensitive Plants and Rare Plant Resource Report (Turner 2018) and the Northern Tongass Integrated Weed Management Addendum to the BE and resource report (Johnson 2019c) hereby incorporated by reference, as well as the Central Tongass Project Botany Biological Evaluation (Johnson 2019a) housed in the project record.

Because the Central Tongass Project only proposes four additional components, the direct and indirect effects stated in Alternative 1 (above) remain. What follows is the analysis for changes:

Direct effects from contact with the chemical are considered minor with broadcast spray, as the herbicide is more likely to directly affect non-target vegetation where plant species are intermixed. Within the project area, the largest infestation of any 6th order watershed is in the

North Arm Duncan Canal – Frontal Duncan Canal Watershed. Roughly 2 percent, or 630 gross acres, is infested by brass buttons, which includes the infestation below the mean high tide line[11].

Indirect effects are likewise expected to be minor regarding the chance of drift from broadcast spray; however, because of the net positive effect of removing invasive species and restoring habitat, as well as following proper application techniques, the overall indirect impact on sensitive, rare or non-target vegetation is negligible. Treating up to 5,811 gross acres, including emergent vegetation, on any and all lands as funding and capacity allows, has the indirect effect of removing invasive plants and restoring natural conditions across the planning area. Invasive plants know no political boundary; therefore, this should also benefit sensitive plants and its associated habitat.

Watershed Improvements

Watershed restoration activities would cause instream disturbance as well as open up travel corridors between the road and the instream work sites. Plants could get crushed, buried, or trampled by heavy equipment, logs or earth movement. Indirectly, the hydrology will be changed at the sites where logs are placed. More light will reach the soil where the canopy is opened. Invasive plants could establish within the project area as a result of open travel corridors and increased light availability.

At the wood source site, similar direct effects could occur through the felling and yarding of trees. Potential indirect effects include opening up canopy thereby increasing light exposure or changing hydrology when logs are yarded off site. Non-native plant species could establish and out-compete native plants for preferred habitat. Root wad removal is of particular concern for the spread of non-native plants due to the extent and depth of soil disturbance combined with the opening of forest canopy.

Nutrient enhancement of lakes has no foreseeable direct effects, but does have the potential indirect effect of altering the water chemistry and impacting plants adapted to living in an oligotrophic environment.

Recreation Management

Potential direct effects of cabin and trail construction activities proposed in Alternatives 2 and 3 include uprooting, burying, crushing or trampling plants and/or their habitat. Indirect effects could include exposing mineral soil or adding crushed rock which increases the likelihood of invasive plant colonization, changing the hydrology and light regime and increasing user days of the site and the surrounding area. Decommissioning cabins would have the indirect effect of allowing a gradual restoration to the natural condition.

Access Management

Log transfer facilities (LTF) construction has the direct impact of disturbing the soil and burying all vegetation (or removing all of the vegetation) within the width of the site. Because of this, direct effects to the habitat are considered major. LTF maintenance operates within the existing disturbance footprint so effects are typically negligible (typically, because there can be sensitive or rare plants that occur at these disturbed sites). Other Marine Access Facility (MAF) sites include kayak or cabin access points as well as boat ramps, for example could have similar direct effects but commensurate with the scale of the activity. Indirect effects of MAF construction

[11] Lands below the mean high tide are not considered NFS lands. These areas would fall under the jurisdiction of the State of Alaska.

(including LTFs) include changing the drainage patterns, opening the canopy in forested habitat, altering the humidity, and providing substrate for invasive plants to colonize. Potential indirect effects of reconstruction and maintenance include spreading invasive plants, if present.

Alternatives 2 and 3 also include culvert replacement (AOP), fish pass construction and natural instream barrier modifications where direct effects are largely limited to the existing footprint. These locations are road shoulders and the adjacent stream reach and within streambeds, typically outside of areas where sensitive plants may have established; hence, the direct and indirect effects are expected to be negligible.

Vegetation Management

Direct and indirect effects are no different from those stated for Alternative 1.

Alternatives 2 and 3 – Comparing Access Management and Harvest

Direct and Indirect Effects

Access Management

New NFS road and temporary road have the same impact on sensitive plants and their habitat as described in Alternative 1. Alternative 2 would impact 2,284 more acres than Alternative 1, and 401 acres more than Alternative 3. Both alternatives propose developing or improving 44 rock quarries, which have similar direct and indirect effects as road construction.

Timber harvest

Direct and indirect effects related to old-growth harvest are stated in Alternative 1 with the range of effects expected to be minor to moderate. Alternative 2 of the Central Tongass Project would directly impact 9,500 acres of old growth and 4,000 acres of young growth. Alternative 2 impacts 1,325 more acres of habitat than in Alternative 3, with the indirect effect footprint proportionally larger to account for changing hydrology, light and humidity regimes.

Direct effects related to young-growth harvest are similar to that of old-growth harvest, as are indirect effects. Direct and indirect effects are expected to range from minor to moderate.

Cumulative Effects – All Activities

In addition to the foreseeable, past and present projects summarized in the Affected Environment section, the State of Alaska, Mental Health Trust and Sealaska hold lands that could include old-growth harvest within the project area in the future (reference Appendix C for more details). Additionally, the potential intertie and road easements on the Central Tongass project area would involve clearing a 300-foot swath the length of the easement as well as potential road construction (reference Appendix C for more details).

In considering the direct and indirect effects for all activities, recreation management, invasive plant treatments and watershed improvement activities are likely to have a negligible contribution to the cumulative effects on sensitive plants or their habitat. With regard to restoration activities and invasive plant treatments, returning a system to its desired condition benefits plants and their habitat.

The minor to moderate direct and indirect effects for vegetation and access management, as well as the disturbance footprint, means that harvest and road construction are the two activities likely to contribute the greatest impact to sensitive plants and their habitat. Cumulative effects may

occur to species that occupy old-growth forest habitat, such as round-leaved orchid and Alaska rein orchid, as a result of harvest. Round-leaved orchid has been found in young-growth stands as well. Cumulative effects are expected to be minor to moderate with proposed harvest of 11,715 to 13,500 acres. Road construction contributes to the cumulative effects in both forested and non-forested sensitive plant habitat; this would include the same two species mentioned previously, in addition to the mountain lady's slipper. The cumulative effect of road construction would range from minor to moderate with a proposed 104 to 118 miles of new NFS and temporary road.

Potential adverse impacts to sensitive plant habitat cannot be completely avoided since most proposed actions include ground-disturbing activities. Maintaining viable populations of sensitive and rare plants (and their habitat) depends upon the total abundance and distribution of a species across a landscape. When populations are known within the non-development LUDs of the project area, the cumulative effects are ameliorated by the protection status of these lands. These LUDs contain a range of habitat types where sensitive plants are known or suspected to occur (for example, wilderness areas). In addition, other areas protected either through legislation or by Forest-wide standards and guidelines, including TTRA stream buffers, Riparian Management Areas and beach and estuary buffers, are considered high value habitat for some sensitive plant species.

One R10 sensitive plant, the mountain lady's slipper, is located within a timber development LUD and could be affected by road maintenance as well as potential harvest upslope. These actions may result in a loss of the species' viability in the project area. Design features would include maintaining and/or protecting the source hydrology and adjacent habitat that feeds the mountain lady's slipper wetland complex.

Design Features and Monitoring

Project design features that minimize effects on sensitive plants populations are incorporated into the Implementation Plan (Appendix A). Prior to implementation, a qualified botanist/ecologist must conduct a site-specific pre-field review to determine if known populations or potential habitat is present for plants on the Forest Service R10 Sensitive Species List (Goldstein et al. 2009) or for rare plants on the Tongass National Forest. Any field surveys required shall be conducted at the appropriate time of the year by a qualified individual and at an appropriate intensity level for the project (USDA Forest Service 2016a, PLA3, p. 4-40). If any sensitive plants are found, project design features will be developed and recommended to mitigate impacts.

Comparison of Determination by Alternative

In conclusion, "may affect" determinations (FSM 2670) are appropriate for all R10 sensitive plants known or suspected to occur on the Tongass National Forest for all alternatives. These determinations are based on the analysis provided in the Central Tongass Project Botany BE (Johnson 2019), and reflect whether or not the proposed project would cause a trend toward federal listing.

Table 46. Comparison of alternatives

Species	Relative Impacts of the Alternatives	Determinations		
		Alternative 1	Alternative 2	Alternative 3
Edible thistle (Cirsium edule)	1<3=2	May affect	May affect	May affect

Species	Relative Impacts of the Alternatives	Determinations		
		Alternative 1	Alternative 2	Alternative 3
Mountain lady's slipper (Cypripedium montanum)	1<3=2	May affect	May affect	May affect
Calder's loveage (Ligusticum calderi)	1<3=2	May affect	May affect	May affect
Alaska rein orchid (Platanthera unalascensis	1<3<2	May affect	May affect	May affect
Lesser round-leaved orchid (Platanthera orbiculata	1<3<2	May affect	May affect	May affect
Lichen Ricasolina amplissima ssp. sheiyi	1<2=3	May affect	May affect	May affect
Kruckeberg's sword fern (Polystichum kruckebergii)	1<3=2	May affect	May affect	May affect
Unalaska mist-maid (Romanzoffia unalaschcensis)	1<3<2	May affect	May affect	May affect
Henderson's checkermallow (Sidalcea hendersonii)	1<2=3	May affect	May affect	May affect

Cultural Resources

This section provides a summary of existing conditions and an analysis of environmental consequences for cultural resources in the Central Tongass project area.

Summary

Implementation of certain activities proposed in Alternatives 2 and 3 may result in indirect, direct effects or contribute to cumulative effects to cultural resources and historic properties.

Regulatory Framework

Heritage Program Management direction can be found in the Forest Service Manual, 2008, Chapter 2360, the Forest Service Handbook, 2015, 2309.12, and the 2016 Forest Plan, 2016, p. 4-16. The Forest Service follows procedures in NEPA and the *National Historic Preservation Act* (NHPA) to inventory and evaluate cultural resources and historic properties that may be directly or indirectly affected by forest activities. NEPA requires us to consider effects on cultural resources which can be districts, sites, buildings, structures, objects, sacred sites and traditional cultural properties, regardless of their eligibility status to the National Register of Historic Places. NHPA requires us to consider effects to historic properties which are a specific subset of cultural resources eligible to the National Register of Historic Places. This document assesses potential effects to known cultural resources in the Central Tongass Project area.

As Central Tongass activities are identified with specific locations the Forest Service will comply with federal regulations 36 CFR 800 and start the Section 106 process. Implementation will not occur until the Section 106 process is complete. This process is outlined in Appendix A - Implementation Plan and Activity Guides and is considered in the appendix's Implementation Checklist. The Record of Decision will make clear the Section 106 process is not completed at the signing of the decision.

Methodology

Federal agencies are required to assess the effects of undertakings on cultural resources and historic properties and many of the activities discussed in this document have the potential to affect these resources. Because site specific locations are not identified we relied on the known cultural environment and the Alaska Region site probability model to consider effects (Programmatic Agreement 2017). Probability zones are defined as areas of land where the probability that a cultural resource will be discovered is either "high" or "low" based on models that take into account the physical, biological, and cultural features and history of those areas or approximately similar areas. The basic premise is that areas with suitable habitat or resources, both currently and in the past, are more likely to have a greater cultural resource density and probability of discovery, than areas without suitable habitat or resources.

Spatial Scale Context for Analysis

The Central Tongass analysis area for cultural resources includes all land, regardless of ownership, within the greater project area boundary (Figure 1). All lands are considered because activity locations are not specifically defined and may occur on or adjacent to non-federal land. We consider the current status of known cultural resources and how past and future activities have the potential to cause effects.

Analysis Methods and Assumptions

We gathered cultural resource information from the Forest Service National Heritage Database, Forest Service files and atlases, and the Office of History and Archaeology Integrated Business Suite. These sources include sites identified through field survey, consultations with Alaska Native Tribes, informal conversations and input from the general public.

We quantified known sites and plotted their location in GIS along with two aspects of the high probability zone:

- All lands, regardless of slope, from Mean High Water (MHW) to 100 feet in elevation above MHW are considered to be in the high probability zone.
- Lakes and stream systems containing, or known to have contained, anadromous fish runs.

For purposes of effects analysis, we evaluated known site locations and high probability zones with how they spatially relate to the Central Tongass gross unit pool and the potential location of new Forest Service roads. This allows us to estimate impacts to known cultural resources and identify survey focus areas should future activities occur in areas defined as suitable for timber management and road building. Additionally, we anticipate project activities not associated with timber or road management to occur in the high probability zone for cultural resources and on or near known site locations. These include activities listed in the Catalog of Events (Appendix C) which are reasonably foreseeable actions that could directly and cumulatively affect cultural resources, particularly where land ownership adjustments may occur, where ground disturbing actions are proposed or where existing buildings and structures will be modified. Since specific activity locations are not defined, we will rely on the Section 106 process to further evaluate potential affects to cultural resources and historic properties.

Affected Environment

Existing Condition

Geologic and glacial processes shaped southeast Alaska creating mountain peaks, hills, fjords, bays and inlets, beaches and deltas; all ecological niches suitable for human settlement and advancement. Archaeological evidence indicates humans were living across the Alexander Archipelago, where the Central Tongass is located, for over 10,000 years. Their cultural manifestations were used to formulate a regional northern Northwest Coast cultural sequence divided into stages or periods (Ames and Maschner 1999, p. 18; Davis 1990, pp. 197-202; Moss 1998, p. 88; Moss 2004, pp. 181-182; Moss 2011, p. 47). Each period is related to the temporal landscape and was influenced by environmental processes and change. What people left behind, the archaeological record, defines what we refer to as cultural resources and these reflect the environmental and social influences associated with each period. As a result, for example, 10-7,000 year old Early Holocene archaeology sites differ from those 1,000 years old, just as pre-European contact sites differ from historical sites. Our site probability model considers ecological niches and environmental conditions to reasonably predict where cultural resources might be present.

The complex history of Southeast Alaska is captured in the archaeological record throughout the Central Tongass project area. Early Holocene sites are remnants of the original peopling of the northern Northwest Coast and are located in areas that reflect the unique environmental conditions of the post glacial period where cold adapted flora and fauna inhabited coastal refugia and unglaciated ridges, and were available for exploitation in an otherwise ice laden landscape.

Continued environmental warming resulted in changes in flora and fauna species, which in turn affected the changes in the subsistence tool kit. Middle Holocene sites have a more diverse tool assemblage with a focus on fishing. Late Holocene sites continue the emphasis on fishing and include fort sites. The Late period segues into the time when tribal entities are clear, namely the traditional lands of the Tlingit Indians; for the project area, these include the Kake, Klawock and Wrangell (Stikine) tribes. Site types associated with pre-European contact include villages, shell middens (camps), gardens, petroglyphs, pictographs, burials, sacred places, fish traps and weirs, rock cairns, and lithic sites (living and use areas identified by stone tool production remnants). Post- European contact settlement produced sites associated with industry and recreation. Sites include buildings and structures that represent activities associated with canneries, fur farms, homesteads, cabins, mines, and trails.

Review of existing records indicate there are approximately 1,086 known sites in the project area, not including sites in downtown Petersburg and Wrangell, which are mostly homes and businesses. Of the known sites, approximately 822 are in high probability zone according to the two variables we used for this analysis. The majority of the remaining sites are cabins or fishing structures, the later are located on intertidal state land and therefore not considered in the Forest Service high probability model. Analysis results show the model is successful at predicting site locations, but is not all inclusive.

Our comparison between known sites and their relationship to the Central Tongass gross unit pool and new Forest Service roads shows some overlap. There are 10 known sites located within the gross unit pool boundaries and 12 within the new Forest Service road prisms. These represent many site types including both pre-European contact and historic period sites: trails, cabins, industry, portages, shell midden, culturally modified trees, fish weirs and petroglyphs.

There are also instances where the gross unit pool and proposed roads overlap with the high probability zone and these are areas where new sites may be discovered during project specific survey. Other proposed activity locations will also fall within the high probability zone and new survey may be required based on whether the undertaking has the potential to affect cultural resources or historic properties.

Environmental Effects

Alternative 1 – No Action Alternative

Direct and Indirect Effects

The No Action Alternative would not result in direct or indirect effects to cultural resources because no ground disturbing activities or modifications to the built environment on buildings and structures would occur and existing conditions would remain unaffected. Natural disturbances and current management of the project area would continue.

Cumulative Effects

Implementation of the No Action Alternative would not contribute to cumulative effects to cultural resources because no ground disturbing activities or modifications to the built environment would occur.

Alternatives 2 and 3

Direct and Indirect Effects

Both action alternatives propose ground disturbing, building and structure modification activities that have the potential to affect known and not yet discovered or identified cultural resources. Effects depend on the location, nature and size of the activity and could include removal of all or parts of sites, or modifications that impact site integrity such as changing the character of a historic structure.

Indirect effects could be caused by increased use either by visitors or by those implementing the project. Sites could be buried or eroded as a consequence of project work. The Section 106 process will allow for more specific direct and indirect assessment when specific activities and their locations are proposed on a case-by-case basis.

Activities common to all alternatives that affect Cultural Resources

All activities that propose ground disturbance and modifications to the built environment have the potential to affect cultural resources and sacred sites. These could include stream and floodplain restoration, fisheries improvement, invasive plant management, recreation facility and trail improvements or decommissioning, vegetation management including harvest and silvicultural treatments, road management, aquatic organism passage and marine access facility management.

It is Forest Service policy to avoid adversely affecting sites; in unavoidable instances we will mitigate the effects by entering into a Memorandum of Agreement with the SHPO (USDA Forest Service 2016a, HSS1.IV, pp. 4-17 and 4-18; FSM 2360.3).

Activities common to all alternatives that do not affect Cultural Resources

Project activities that have no potential to affect cultural resources include those that do not propose ground disturbing activities or modifications to the built environment. Activities may include herbicide plant treatment, fish stocking, young growth tree thinning, pruning and girdling, and routine road maintenance activities.

Cumulative Effects

The Catalog of Events (Appendix C) provides information on where ground disturbing and reconstruction projects have occurred and where future activities may occur in the project area. Cultural resources and historic properties, have been affected by past actions and future activities may also cause effects.

Site types across the landscape are affected by different types of activities in different ways. Trail construction through a grove of Culturally Modified Trees affords one, lesser, kind of effect, while the demolition of a historic cabin to make way for a new facility is another, more significant effect. As discreet activities are identified during implementation, these sites will be subject to Section 106 review and procedures outlined in the Implementation Plan (Appendix A) and effects will be avoided or minimized in accordance with agency policy if it all possible. Some cumulative adverse effects on cultural resources may be unavoidable, but are allowable with mitigation under the NHPA. Unavoidable effects change the archaeological record and affects our ability to fully interpret the past. Adverse effects to pre-European contact sites impacts quantifying analyses and our capacity to understand the complexity of the northern northwest coast cultural identity. As well, the loss is irreversible and impacts the legacy of our tribal partners. Removal or changing the integrity of historic structures, like cabins and trails,

affects the recreating public who, in general, appreciates historical sites and accompanying information, which adds to visitor experience.

Design Features and Monitoring

To assess effects to cultural resources, or more specifically historic properties, the Forest Service will determine if the activity is an undertaking as defined in NHPA and, if so, start the Section 106 process. If we determine historic properties will be adversely affected by an activity, we will enter into a Memorandum of Agreement with the Alaska State Historic Preservation Office to mitigate effects. The process is discussed in the *Heritage* section of the Implementation Plan (Appendix A). Monitoring locations where activities may occur near cultural resources will assure the resource is unaffected by project activities.

If human remains are discovered, a Plan of Action in accordance with the *Native American Graves Protection and Repatriation Act* will be prepared prior to project implementation.

Forest Vegetation

The Central Tongass Project proposes old-growth and young-growth timber harvest and intermediate stand improvement treatments resulting in changes to forest vegetation in portions of the project area. Timber harvest and intermediate stand treatments will cause changes to forest structure, species composition, and stand health and stability. Changes in vegetation are determined by a prescribed silvicultural system that meets project goals and objectives while adhering to 2016 Forest Plan direction.

Desired Conditions

The desired condition for stands within the Central Tongass project area is determined by Forest Plan LUDs with desired conditions specific to young-growth management as described in the 2016 Forest Plan (pp. 5-2 to 5-8).

Methodology

This vegetation resource analysis includes past treatments (silvicultural activities), and proposed treatments, on NFS lands only. For this project, analyzing the vegetation resource on NFS lands only, is appropriate because a decision to implement activities will not include lands of other ownership, without authorization by other ownerships. The analysis area for direct, indirect and cumulative effects to forest vegetation is National Forest System (NFS) lands in the Central Tongass project area.

Initial project area information was obtained from the Tongass National Forest GIS library, aerial photos, and the Forest Service Activity Tracking System database (FACTS). An extensive inventory of old-growth stand data exists across the TAAs. Young-growth inventory data in stands 40 years in age or older have been collected through two different inventories in the project area over the past several years. A portion of the stands considered for commercial harvest, or potentially "near-term operable", were inventoried under the Challenge Cost Share Agreement (CCSA) at a plot intensity of one plot for every 2.5 acres. A sample of younger stands (ages 40-54) were inventoried under the Common Stand Exam (CSE) protocol with a plot intensity of one plot for every 5 acres. This young-growth data is incorporated into the Forest Planning and Projection System database (FPS). The FPS program allows data from inventoried stands to be extrapolated into non-inventoried stands that have similar characteristics. FPS also allows stands to be 'grown forward' using a Tongass-calibrated growth and yield model. Future inventory efforts are expected to further refine yield estimates during the life of the project. This information should help timber planning efforts through the life of this project, from within the project's gross unit pool. For more information see the Young Growth Inventory Portal at: https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=e748ce92139c4100a65ad8b12510d620#

Refer to the project record for more information about the inventory.

Spatial and Temporal Context for Analysis

The analysis area for direct and indirect effects to forest vegetation is NFS lands in the Central Tongass project area.

Units of Measure

Measures used to disclose the effects on vegetation from the proposed timber harvest include:

- Forest Structure: changes to stand structure over time
- Forest Health and Productivity: changes in forest health and stand productivity, including volume production
- Regeneration and Species Composition: changes in regeneration and species composition of each stand
- Wind-throw Risk: effects of wind on forest stands

Incomplete or Unavailable Information

Research on the benefits of young-growth management to wildlife is ongoing. Active management is proposed to improve habitat conditions in young stands; however, questions remain regarding the trade-offs associated with the benefits and costs of different types and timing of treatments (USDA Forest Service 2008b).

Affected Environment

Existing Condition

The Central Tongass project area is a mosaic of coniferous forests in managed and unmanaged conditions, interspersed with muskeg, scrubland, and alpine plant communities and saltwater passages. Forest stands younger than 150 years old are considered young-growth on the Tongass for timber inventory purposes. Most young-growth stands in the project area originated primarily from large-scale even-aged clearcut harvest that began in the mid-1950s. Higher volume stands, primarily consisting of large-diameter spruce and hemlock, were targeted in the beginning to offset the costs of the infrastructure. To date, there are about 180,000 acres of young-growth in the project area (Table 54). The species composition for near-term operable young-growth stands in the project area TAAs is shown in Table 9.

Old-growth stands are relatively well-dispersed amidst even-aged young-growth stands regenerated from previous harvests. The old-growth stands proposed for harvest contain a greater composition of western redcedar and yellow-cedar than what had been initially harvested. Old growth in the ten TAAs totals 580,301 acres and is broken out by TAA in Table 49 and the species composition is shown in **Error! Reference source not found.**.

Young-growth timber can be either commercial or pre-commercial. Factors that determine whether a stand is commercial include average stem diameter, volume per acre, and percent of that volume consisting of trees containing two 34-foot logs. Other factors include accessibility of the stand, purchaser requirements and market conditions. For purposes of this analysis, a stand that is age 55 or older is considered to be a commercial young-growth stand.

Species Composition

Old Growth

The primary species in the old-growth and mature timber types are western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), mountain hemlock (*Tsuga mertensiana*), western redcedar (*Thuja plicata*), and yellow-cedar (*Callitropsis nootkatensis*). Higher percentages of Sitka spruce are found along streams and other well-drained sites. Forested muskegs occur throughout the project area and contain a high percentage of yellow-cedar. Muskeg areas also support shore pine (*Pinus contorta*) and mountain hemlock (*Tsuga mertensiana*). Mountain hemlock is also more prevalent at higher elevations. Red alder (*Alnus rubra*) is found on

disturbed sites such as roadsides, along stream banks, and in certain areas within harvested stands. The species composition of old growth by TAA is shown below in Table 2, collected from stand exam plots and represented as a percentage of the total estimated volume computed on a per acre basis. The estimated average old-growth tree species composition by volume within the project gross unit pool is: western and mountain hemlock (67 percent), Sitka spruce (21 percent), yellow-cedar (9 percent), western redcedar (3 percent), shore pine and red alder (each less than 1 percent). Table 47 shows the tree species composition of old growth in each TAA as was collected in past stand exam inventories.

Table 47. Species composition of old growth by TAA (percent of volume/acre)

TAA	Sitka spruce (%)	Western hemlock (%)	Mountain hemlock (%)	Western redcedar (%)	Yellow-cedar (%)	Red alder (%)	Shore pine (%)
Etolin Island	14.9	47.5	6.1	17.1	14.3	<1	<1
Frosty Bay	21.7	46.0	0*	16.9	15.5	<1	<1
Kuiu Island	16.3	77.1	3.8	<1	3.0	<1	<1
Mitkof Island	25.0	60.9	5.0	<1	9.0	<1	<1
Portage Bay	24.0	66.6	2.8	<1	4.2	<1	<1
Thomas Bay	7.6	84.1	0*	<1	8.5	<1	<1
Tonka	24.3	61.8	4.3	<1	9.5	<1	<1
West Kupreanof	15.1	62.9	4.1	<1	16.9	<1	<1
Wrangell Island	20.7	53.9	9.9	3.6	11.9	<1	<1
Zarembo Area	22.3	50.0	5.4	6.5	15.7	<1	<1

*Mountain hemlock composition included with Western hemlock

Young-Growth

Young-growth stands are primarily dominated by western hemlock and Sitka spruce. The older young-growth stands (age 55 and older) being considered for harvest in this project generally contain less cedar, as early harvests focused on high volume spruce and hemlock stands. These higher volume stands grew on the most productive sites and at lower elevations. Sitka spruce and western hemlock tend to have a greater competitive advantage on the higher productivity sites while cedars are generally better represented on mid to lower productivity sites. Sitka spruce was the favored tree in early pre-commercial thinning treatments (1970s and 80s). Not until the early 1990s did the emphasis switch to favor yellow-cedar and western redcedar which remain the favored species. The species composition of near-term operable young-growth by TAA is shown in Table 48 below.

The understory shrubs are primarily blueberry (*Vaccinium* spp.), huckleberry (*Vaccinium parvifolium*), and rusty menziesia (*Menziesia ferruginea*). Many other species of vascular plants, lichens, and mosses occur throughout all habitat types or plant associations. The amount, distribution and mix of understory plants varies between old-growth and young-growth stands and is dependent on many ecological components, including stand structure, site quality and the plant association of the stand.

Table 48. Species composition of young growth by TAA for near-term operable volume (percent of volume/acre)

TAA	Sitka spruce (%)	Hemlock (%)	Western redcedar (%)	Red alder (%)
Etolin Island	0	0	0	0
Frosty Bay	67	30	3	0
Kuiu Island	56	43	0	2
Mitkof Island	65	30	0	5
Portage Bay	65	35	0	0
Thomas Bay	78	19	0	3
Tonka	69	25	0	6
West Kupreanof	60	38	0	2
Wrangell Island	N/A	N/A	N/A	N/A
Zarembo Area	76	15	1	8

Forest Planning and Projection System database (FPS)

Stand Productivity

Productivity of forests is largely defined in terms of site quality, usually expressed as volume production of a given species (Helms 1998). Site quality is the sum of many environmental factors including soil depth and drainage, aspect and microclimate. Site quality can vary from stand to stand and within a stand.

Old Growth

Old-growth forest lands are stratified into high, medium, and low volume strata as a proxy for estimating site productivity. The volume strata are delineated in GIS as the Size Density Model (SDM) layer. The acres of existing old-growth forest by volume strata for each Timber Analysis Area is shown in Table 49. Old-growth acres identified for the gross unit pool for the Central Tongass Project are shown in Table 50 and Table 53. The proposed harvest acres by alternative are shown in Table 7.

1. **High Volume Strata** – Areas within timber inventory volume classes 5, 6, and 7 on non-hydric soils, and on hydric soils with slopes greater than 55 percent. These are considered to be highly productive acres.
2. **Medium Volume Strata** – Areas within timber inventory volume classes 5, 6, and 7 on hydric soils with slopes less than or equal to 55 percent; areas within timber inventory volume class 4 that are either on non-hydric soils, or are on hydric soils greater than 55 percent. These are considered to be medium productivity acres.
3. **Low Volume Strata** – Areas within timber inventory volume class 4 on hydric soils with slopes less than or equal to 55 percent. These acres are considered low productivity acres.

Table 49. Old-growth acres (development and non-development LUDs) by volume strata and timber analysis area on NFS lands in the Central Tongass project area

	Volume Strata Acres			
Timber Analysis Area	High	Medium	Low	Totals
Mitkof Island	21,594	23,844	10,272	55,710
Portage Bay	11,955	12,421	3,166	27,542

	Volume Strata Acres			
Timber Analysis Area	**High**	**Medium**	**Low**	**Totals**
West Kupreanof Island	36,541	43,702	41,600	121,843
Thomas Bay	13,539	7,259	3,115	23,913
Kuiu Island	85,395	41,674	16,437	143,506
Tonka	11,761	9,832	2,868	24,461
Zarembo Island	19,284	24,346	15,941	59,571
Wrangell Island	19,209	21,204	11,891	52,304
Etolin Island	25,169	24,546	8,612	58,327
Frosty Bay	3,322	6,832	2,970	13,124
Totals	**247,769**	**215,660**	**116,872**	**580,301**

Table 50. Alternative 2 potential old-growth harvest acres by timber analysis area (TAA) volume strata and percentage of total existing TAA volume strata acres

Timber Analysis Area	Alternative 2 Potential Harvest Acres			Percent of Existing (from Table 95)			
	High	**Medium**	**Low**	**High**	**Medium**	**Low**	**Totals**
Mitkof Island	4,096	2,467	506	19	10	5	13
Portage Bay	2,248	1,854	313	19	15	10	16
West Kupreanof Island	1,342	2,003	1,106	4	5	3	14
Thomas Bay	973	146	103	7	2	3	5
Kuiu Island	5,219	1,148	76	6	3	<1	4
Tonka	406	630	94	3	6	3	4
Zarembo Island	3,999	4,041	2,201	21	17	14	17
Wrangell Island	1,373	694	338	7	3	3	5
Etolin Island	948	763	233	4	3	3	3
Frosty Bay	369	464	486	11	7	16	10
Total Project Area	**20,973**	**14,210**	**5,456**	**8**	**7**	**5**	**7**

Table 51. Alternative 3 potential old-growth harvest acres by timber analysis area (TAA) volume strata and percentage of total existing TAA volume strata acres

Timber Analysis Area	Alternative 3 Potential Harvest Acres			Percent of Existing (from Table 95)			
	High	**Medium**	**Low**	**High**	**Medium**	**Low**	**Totals**
Mitkof Island	3,551	2,252	465	16	9	5	11
Portage Bay	1,712	1,678	299	14	14	9	13
West Kupreanof Island	1,139	1,799	1,055	3	4	3	12
Thomas Bay	745	143	99	6	2	3	4
Kuiu Island	3,727	897	65	4	2	<1	3
Tonka	146	599	90	1	6	3	3
Zarembo Island	3,219	3,609	2,040	17	15	13	15
Wrangell Island	1,243	657	306	6	3	3	4
Etolin Island	808	701	212	3	3	2	3

Timber Analysis Area	Alternative 3 Potential Harvest Acres			Percent of Existing (from Table 95)			
	High	Medium	Low	High	Medium	Low	Totals
Frosty Bay	239	438	463	7	6	16	9
Total Project Area	**16,529**	**12,773**	**5,094**	**7**	**6**	**4**	**6**

Young Growth

Productivity can vary considerably across and within young-growth stands, usually highest in the valley bottom and decreasing with elevation. Site quality plays a major role in all aspects of stand development. Higher site quality generally translates into taller trees and greater volume per acre than stands of the same age and similar treatments found on lower quality sites. Higher site quality generates higher density (more trees per acre) and increased rates of change in tree characteristics and stand structure. Height to diameter ratios increase at a faster rate on high sites and live crown ratios tend to decrease at a faster rate due to the effects of competition. In general, young-growth stands nearing commercial size within the project area are located on high, or medium productivity sites.

Stand Structure

Forest stand structure is defined as the horizontal and vertical distribution of components including the height, diameter, crown layers, and stems of trees, shrubs, herbaceous understory, snags, and down woody debris (Helms 1998).

Old Growth

Old-growth structure is variable but contains large trees over 150 years in age, multi-layered canopies, including various densities of shrub understory. Structural features include large, living old trees; large, dead standing trees; massive fallen logs; relatively open canopies with foliage in many layers; and diverse understories (Oliver and Larson, 1996). Such structures are achieved by a variety of major and/or minor disturbance patterns in single- or mixed-species stands (Oliver and Larson, 1996). Coarse, woody debris typically is abundant on the forest floor as large, decaying logs. Some whole trees may lay horizontally, uprooted by wind-throw.

Young Growth

Young-growth structure is less variable than old-growth structure but does vary by age, site quality and past treatment, if any. Young-growth stand development typically follows the structural stages of stand initiation, stem exclusion, understory re-initiation and old-growth (Oliver and Larson, 1996).

1. *Stand Initiation* – After clearcut harvest, trees germinate and the site is occupied by seedlings and saplings. Residual shrubs and herbaceous plants respond to increased light for several years, at which time the conifers begin to overtop vegetation. Biological attributes during this phase include rapid tree growth, high browse production and low snow intercept. This stage has seedlings, and then seedlings grow into small saplings.
2. *Stem Exclusion* – After a couple decades, trees begin competing for light, nutrients, water and space. Very few additional trees are regenerated. During this phase, a dense canopy reduces light reaching the forest floor. Understory plants decline rapidly and can be completely eliminated unless the canopy is opened to allow light to penetrate. At canopy closure, trees are larger saplings. As morality occurs due to competition, there are interspersed pole-size trees and small saw-timber trees. Suppressed trees may still be sapling-size.

3. *Understory Re-initiation* – Trees continue suppressing understory shrubs and forbs which eventually re-appear. During this phase, understory shrubs and herbaceous plants appear and increase and snow interception is effective. Trees at this stage of development are pole-size, then small to mature saw-timber.
4. *Old Growth* – From about age 150, large trees dominate the stand. Growth eventually declines with decay and mortality keeping pace with in-growth. Understory plant abundance and tree regeneration increases within gaps caused by wind and natural mortality. Snow interception is still present. The multi-layered canopy contributes to improved habitat and species diversity.

Pre-commercial Young Growth and Commercial Young Growth

Young-growth stands suitable for intermediate pre-commercial treatments in the Central Tongass Project TAAs are mostly between the ages of 15 and 30. There are 28,841 acres in this age class within the Central Tongass project area (25 percent of the young growth in the project area). Age classes are broken out below and also shown in Table 52.

Stands around age 45 are usually approaching commercial size. A tree with two 34-foot logs equates to a tree that is about 100 feet in total height. Rotating a stand, or clearcutting it, when this volume condition is met, is considered economically viable, or commercial. Therefore, before these volume conditions are met in a young-growth stand, it would for intent and purpose, be considered pre-commercial. The Tongass Advisory Committee (TAC) defined the rotation age under CMAI for the purposes of modeling, as when 50 percent of a stand volume consists of trees that contain two 34-foot logs. CMAI, or Culmination of Mean Annual Increment, is defined as the age in the growth cycle of a stand at which the mean annual increment (MAI) for height, diameter, basal area, or volume is at a maximum (Helms 1998).

The following age classes are commonly found in pre-commercial young growth.

Age Class 0–15 Years (Harvested Between 2004 and 2018)

There are 7,047 acres of young growth within the 0 to 15 year age class (6 percent of total young-growth in the project area). None of these acres have been thinned yet. Canopy cover in this age class can be open to near closed. Tree density ranges from 1,500 to 10,000 trees per acres (TPA) and crown ratios are 75 to 100 percent depending on site quality. Understory shrubs and herb cover can be dense to sparse depending on stand age and stocking. Trees in this age class are considered seedling or sapling size and are mostly less than 5 inches DBH.

Age Class 16–30 Years (Harvested Between 1989 and 2003)

There are 28,841 acres of young growth within the 16 to 30 year age class (25 percent of total young-growth in the project area). This age range is considered the optimal window for pre-commercial thinning to reduce tree stocking to approximately 220 to 300 TPA and delay stem exclusion. Of the 28,841 acres of young growth in this age class, 6,179 acres (21 percent) have been pre-commercially thinned. After thinning, understory vegetation usually increases.

Stands within this age class that are un-thinned have begun to enter the stem exclusion stage. There is very little light penetrating the stand. Canopy cover ranges from 75 to 100 percent with crown ratios low (25 to 30 percent) due to inter-tree competition. Understory vegetation can be very sparse to absent. Tree densities drop to around 3,000 TPA. Understory vegetation may be more abundant on low- or medium-quality sites stands take longer to reach the stem exclusion stage.

Trees in these stands are pole-size and do not usually have any commercial value. Trees are 5 to 9 inches DBH. On poorer sites, the average DBH may be smaller.

Age Class 31–45 Years (Harvested Between 1974 and 1988)

There are 40,093 acres of young growth that fall within the 31 to 45 year age class (34 percent of total young-growth within the project area). Stands in this age class are usually considered too large for pre-commercial thinning but not large enough to be commercially economical, at least in the central Tongass. These stands, remain in stem exclusion and very little, if any, understory vegetation. If these stands have been previously thinned, then densities average 220 to 300 TPA, crowns are larger, diameters are larger and understory vegetation is usually present. About 74 percent (29,792 acres) of this age class has been thinned at least once.

Trees in these stands are pole-size, ranging from 6 to 12 inches DBH with some larger stems dispersed throughout the stand. The average DBH is around 7 inches. On higher quality sites, there may be a commercial component with an average DBH of 10 inches and about 50 TPA with DBH's of 14 inches and larger. On poorer sites, the average DBH may be closer to 5 inches and areas of sparse vegetation may still be present.

Commercial Young Growth

Whether a young-growth stand is commercial depends on several factors; one of the most important is site productivity. The oldest young-growth stands in the Central Tongass area are found at lower elevations on high productivity sites. Many of these older (age 55+) young-growth stands contain acreage within the beach buffer, alluvial deposits or productive salmon streams where timber harvest is limited by the 2016 Forest Plan. Many of these stands have not been thinned and are in stem exclusion. Some of the oldest stands (age 70+) are beginning to enter the understory re-initiation phase as natural disturbance and gap dynamics begin to occur, particularly along shorelines, riparian edges, and sites with high exposure to storm winds.

Age Class 46–55 (Harvested Between 1964 and 1973)

There are 27,364 acres in the 46 to 55 year age class (23 percent of Central Tongass Project young growth). Trees in these stands are usually too large to be treated pre-commercially, yet do not contain enough volume to be economically viable. Trees in this age class are growing very rapidly, often adding a thousand board feet per acre, per year. Commercial opportunities are likely to exist in these stands during the 15 year span of this project. Of the 27,364 acres, 23,595 (86 percent) have been pre-commercially thinned at least once.

Age Class 56+ (Harvested Before 1964)

Across the project area, there are 14,310 acres greater than 56 years of age (12 percent young growth). Depending on assumptions and factors that determine economic viability, and other resource considerations, the number of acres projected to be commercially viable for the near-term (1 to 15 years) ranges between 14,310 acres in 2020 to more than 40,000 acres in 2034. The number of acres increases annually as additional stands in the 46 to 55 age class "grow into" a merchantable volume class.

Table 52. Young-growth acres by age classes and percent thinned in the Central Tongass project area

Age Class	Young Growth Acres	Thinned Acres	% Acres thinned
0 - 15	7,047	0	0

16 - 30	28,841	6,179	21
31 - 45	40,093	29,792	74
46 - 55	27,364	23,595	86
56 +	14,310	3,549	9
Total	**117,655**	**63,115**	**54**

Forest Health and Natural Disturbance

In the old-growth forest in the Central Tongass project area, hemlock dwarf mistletoe (*Arceuthobium tsugense*), decay fungi, wind disturbance, yellow-cedar decline, porcupine damage and softwood defoliators are the primary concerns related to forest health and natural disturbances.

Dwarf Mistletoe

The occurrence of dwarf mistletoe in old growth western hemlock stands is widespread throughout Southeast Alaska, and was recorded in many of the proposed harvest areas in the project area at varying infestation levels. Dwarf mistletoe is apparently limited by climate (elevation and latitude), becoming uncommon or absent above 500 feet in elevation and 59º N latitude (Haines, AK) (USDA Forest Service 2008b). It often produces cankerous swellings at the point of infection of limbs or main stems. It reduces the vigor and growth rate of infected trees and reduces the quality of timber. Heavily infected western hemlock trees have branch proliferations (called "witches' brooms"), bole deformities, reduced height and radial growth, less desirable wood characteristics, and a greater likelihood of heart decay, top kill, and death. These symptoms are all potential problems in stands managed for wood production. Growth loss in heavily infested stands can reach 40 percent or more (Thomson et al. 2008). Mistletoe-infected stands with a primary objective of timber production will not achieve the desired condition. Mistletoe infection does contribute to diversity in stand structure and gap dynamics.

Clearcut harvest is an effective method of controlling hemlock dwarf mistletoe if reduction, or eradication of the disease is consistent with management objectives (USDA Forest Service 2001). Substantial reductions of timber volume are only associated with high disease levels. In regenerated stands, high levels of mistletoe will result only when numerous, large, highly-infected hemlocks are retained throughout a stand following harvest (USDA Forest Service 2007b, p. 44).

Old-growth stands in the project area have varying degrees of hemlock dwarf mistletoe infection. Existing stand exam data across the project area recorded 7 percent of the hemlock sampled were infected with dwarf mistletoe. Of the hemlock trees infected with mistletoe, 48 percent were coded as light severity; 37 percent as moderate severity and 15 percent recorded high severity, according to the Hawksworth's six-class rating system (Trummer et al. 1998). In young-growth, small amounts of dwarf mistletoe are present throughout the project area, with higher concentrations along boundaries with old-growth stands and in stands with infected residual hemlock trees.

Decay Fungi

Approximately one-third of the old-growth timber board foot volume in Southeast Alaska is defective, largely due to decay from heart-rot fungi (USDA Forest Service 2015b). Heart-rot and root-rotting fungi in trees can weaken the support structures, thereby leading to breakage. As the broken portion of the tree falls to the forest floor, it may wound other trees and lead to infection

of the damaged trees. This process decreases the overall health and wind-firmness of the stand, leading to a decreased timber supply.

Decay-causing fungi are present in all old-growth stands within the project area. Decay fungi is most abundant in late successional western hemlock stands, and volume loss associated with the decay is concentrated in hemlock and to a lesser extent spruce. Redcedar and yellow-cedar are considered less susceptible to infection by disease and decay fungi.

Preliminary data on commercial-size young-growth within the project area show defect and decay levels are very low, with isolated occurrences within residual hemlock following harvest, or within stems that have died due to inter-tree competition. For more information see the Young Growth Inventory Portal at: https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=e748ce92139c4100a65ad8b12510d620#.

Wind Disturbance

The major natural disturbance in Southeast Alaska is wind. Wind influences stand structure and stand development. The effects of wind can be beneficial. Windthrow often provides mineral soil and soil mixing as the roots churn the soil when trees are uprooted (Kramer 2004). Mineral soil and soil mixing favors the regeneration of Sitka spruce and cedar. Wind-thrown trees can benefit certain wildlife species that use large downed wood for habitat.

Wind disturbance occurs over a continuum dependent on topographic features (Nowacki and Kramer 1998, pp. 1-8). Old-growth stand structure develops naturally through a process called gap dynamics, where small openings are created in the forest canopy when trees fall or die. The additional light allows shrubs and new conifers to re-establish. Some gaps are created by wind disturbance, in the form of uprooted trees and stem breakage. Over time, a multi-layered stand develops. In areas where wind disturbance promotes gap dynamics, stands may reach a certain degree of stability with respect to wind. The severity and frequency of wind disturbance is determined by many related factors. These influencing factors include tree size and vigor, tree height-diameter ratio and tree crown size. Other factors include slope, aspect, soil characteristics, stand composition, canopy structure and topography, which may influence wind flow (Harris 1999). Timber harvest also has the potential to exacerbate the rate and extent of windthrow in adjacent stands.

In the Central Tongass project area, risk of high wind disturbance is generally found in areas with topographical exposure to prevailing southeast winds and areas adjacent to newly created openings (Nowacki and Kramer, 1998). The amount of existing windthrow in a stand may indicate future windthrow. A stand's windthrow history and the influencing factors are used to evaluate the windthrow risk and to determine the silvicultural prescription (Stathers et al. 1994). The prescription will also include measures to protect stream buffers and stand edges, known as Reasonable Assurance of Windfirm (RAW) buffers using the Reasonable Assurance of Windfirmness Guidelines Version 2.0 (Landwehr 2007).

Young-growth stands in the project area show little sign of wind or weather damage. This is primarily due to the single-age structure of young-growth. The uniform canopy has greater resistance to the unravelling nature of windthrow. Individual tree stability becomes more important during a large-scale wind event when nearby clearing activities have occurred. Height-to-diameter ratio, or the taper of the tree bole, is a factor wind hazard in young growth. Tall trees with small diameters are more likely to succumb to windthrow or stem breakage than trees with diameters better suited to support associated tree heights. When the ratio of height to diameter is

greater than 90, the wind speed required to damage the tree is lower, and more likely to occur during any typical storm event (Stathers et al. 1994). Height-to-diameter ratios can be managed using appropriately timed stand treatments, such as tree thinning. Pre-commercial thinning reduces the height-to-diameter ratios and the susceptibility to wind damage. Thinning will be effective if trees have not reached a high height-to-diameter ratio, at which point the stand may be at high risk to survive the treatment. Pre-commercial thinning early in the rotation has proven to be an effective, low-risk method to positively influence more wind-resistant stem taper. Table 52 shows young-growth acres with and without pre-commercial thinning in the project area.

Hemlock is a shade-tolerant species that can survive and continue to add height growth in overstocked stand conditions. Dense stands of young-growth hemlock are prone to develop high height-to-diameter ratios if they remain un-thinned. The greater the spruce component of young stands the less pronounced this condition tends to be. As a result, mixed species stands will develop better diameter growth and lower height-to-diameter ratios.

Alaska Yellow-cedar Decline

Yellow-cedar decline functions as a classic forest decline and is linked to climate change (Hennon et al. 2016). Yellow-cedar trees are killed by freezing injury to fine roots where there is insufficient snowpack to insulate roots from lethal cold temperatures (less than 23 degrees F). Yellow-cedar is a long-lived tree, and many affected yellow-cedar trees became established during the colder, more favorable climate of the Little Ice Age (1400 to 1850). An increased rate of yellow-cedar mortality began around 1900, spiked in the 1970s and 1980s, and continues today. On wet sites, where yellow-cedar faces less competition from western hemlock and Sitka spruce and is more abundant, yellow-cedar trees with shallow fine roots are particularly vulnerable to freezing injury. Research into root and foliar cold tolerance has shown that yellow-cedar roots are more vulnerable to this type of injury than associated conifers. Impacted forests tend to have mixtures of old dead, recently dead, dying, and living trees, indicating the progressive nature of tree death or decline. From the time crown symptoms appear, it often takes 10 to 15 years for trees to die, making it difficult to associate observations from aerial surveys to weather events in particular years. Yellow-cedar is extraordinarily decay resistant and trees often remain standing for 80 to 100 years after death (USDA Forest Service 2016a). While the species has experienced little overall range contraction, local populations are becoming smaller and generally confined to favorable sites. Sites formerly occupied by yellow-cedar are transitioning toward western hemlock-dominated plant communities, including understory vegetation (Oakes et al. 2014, Hennon et al. 2016).

Aerial detection surveys through 2018 have detected and mapped yellow-cedar decline on 271,705 acres of NFS lands and about 16,135 acres of state and private land in the Central Tongass project area (USDA Forest Service 2018). During project implementation, potential harvest stands will be assessed for the presence of yellow-cedar decline.

A comprehensive conservation strategy for yellow-cedar in Southeast Alaska was developed. This report, *A Climate Adaptation Strategy for Conservation and Management of Yellow-Cedar in Alaska* (Hennon et al. 2016), focuses on what is known about yellow-cedar decline and opportunities for active management of yellow-cedar for 33 management zones in Alaska, ten of which are in the Central Tongass project area. Recommended management activities for this project include planting yellow-cedar and thinning to favor yellow-cedar, particularly at higher elevations and well-drained sites where long-term survival is favorable. The report is available for download at: http://www.fs.fed.us/pnw/pubs/pnw_gtr917.pdf.

Yellow-cedar decline has been observed recently in young-growth stands ((USDA Forest Service 2018). In 2013, decline was identified in two adjacent young-growth stands on Zarembo Island. Prior to this, it was thought that the fine roots of young-growth cedar would be deeper and protected from freezing injury. However, these sites on Zarembo are lower productivity sites and some of the young cedar trees were not rooting deeper and are succumbing to decline. Subsequent to this finding on Zarembo, other young-stands with yellow-cedar decline has been ground-verified in 31 young-growth stands in the Central Tongass project area ((USDA Forest Service 2018). Most of these stands have a low incidence of yellow-cedar mortality (1 to15 trees). In a few severe cases, it is estimated that up to one-half of the yellow-cedar crop trees are dead or dying. Affected stands range in age from 27 to 45 and were thinned between 2004 and 2012.

The U.S. Fish and Wildlife Service received a petition to list yellow-cedar as endangered or threatened under the *Endangered Species Act* in June 2014. The initial finding was that a review of the science and status of yellow-cedar is warranted. The Species Status Assessment was completed in fall 2018 and the listing decision is due in 2019 ((USDA Forest Service 2018).

Porcupine Damage

Evidence of porcupine feeding on the boles of hemlock trees is relatively common in old-growth stands within the Central Tongass project area. This feeding activity is considered minor in its damaging effect to the old-growth timber resource. Feeding activity is usually found at the base of hemlock trees and wounds are not large, often less than a square foot. These wounds are mostly superficial and heal-over with the affected area remaining outside the timber scaling cylinder (outside the squared-lumber cant).

In 2018, more than 2,500 acres of porcupine damage in young-growth were mapped in Southeast Alaska (USDA Forest Service 2018). Despite the relatively low mapped acreage, porcupine-girdling is a significant cause of spruce and hemlock mortality in managed stands on the Tongass National Forest. Damage is typically most severe in 10- to 30-year-old stands on Wrangell, Etolin, Mitkof and Kupreanof Islands and on the coastal mainland near major river drainages (USDA Forest Service 2018).

Softwood Defoliators

Middleton hemlock sawfly (*Neodiprion tsugae*) populations rose to outbreak levels in 2018 with large areas of defoliation observed in Southeast. Defoliation was recorded on more than 48,000 acres of western hemlock, most of which was in the Tongass National Forest on Admiralty, Mitkof, Wrangell, Etolin, Prince of Wales, Revillagigedo, Gravina and Annette islands and the Cleveland Peninsula. This was the first notable damage from hemlock sawfly recorded since 2013. Defoliation was heaviest in areas with southern or western facing aspects. Hemlock sawfly larvae preferentially feed on the older foliage of western hemlock, often leaving part of the needle uneaten which results in a thin inner crown.

Typically, outbreaks last a couple of years and may result in growth loss and top kill, but tree mortality is limited unless outbreaks co-occur with the western blackheaded budworm, which was not observed. Hemlock sawfly are native to Alaska and populations are limited by several species of entomopathogenic fungi and parasitoid wasps. Historically, activity has fluctuated from having little-to-no damage observed one year and thousands of acres of damage recorded the following year.

Sawfly populations are indirectly tied to environmental conditions; entomopathogenic fungi are more abundant during cool/wet summers. Southeast Alaska exhibited warmer and drier than average summer conditions which limited this fungal growth, allowing larval populations to build to outbreak status. Pupal cases collected in collaboration with partners from Tongass National Forest had low parasitism rates indicating the outbreak may continue especially if conditions remain dry in 2019.

Environmental Effects

Direct, indirect, and cumulative effects for the vegetation resource are estimated using quantifiable measures or indicators for actual effects. The level (magnitude and intensity) of effects are also assessed in terms of how widespread the effect is likely to be and how long it is likely to last. The effects of timber harvest will vary by silvicultural prescription. The following discussion of effects relates to the various components of the vegetation resource including stand structure, forest health and productivity, regeneration and species composition, and windthrow risk.

All proposed project activities are described in Appendix A and include resource-specific direction to reduce or minimize effects. The activities not discussed below will have negligible effects to forest vegetation.

Direct and Indirect Effects

Stand Structure

Silvicultural systems are a planned series of treatments for tending, harvesting, and re-establishing a stand of timber (Helms 1998). A silvicultural system will be selected for all proposed activities requiring a silvicultural prescription that best achieves project objectives. The effects of timber harvest vary by silvicultural prescription. Three silvicultural systems, even-aged, two-aged and uneven-aged, are considered for the Central Tongass project to develop silvicultural prescriptions.

Stand-specific objectives that influence prescriptions include but are not limited to:

- Retention of old-growth characteristics, or the development of old-growth structural characteristics in young-growth.
- Providing favorable timber sale economics and a sustainable level of forest products over time.
- Protection or enhancement of soils, watershed and aquatics, wildlife habitat, and scenery characteristics.
- Improvement of stand health and productivity.

The Implementation Plan includes decision trees for determining how the appropriate silvicultural prescription will be selected during implementation.

Alternative 1 – No Action Alternative

Timber harvest would continue to occur on areas under contract or NEPA-cleared. Old-growth stands would remain in a predominantly old-growth condition. Disease and decay would continue to degrade the structural integrity of mature and over-mature trees, leading to tree mortality and increasing the stands' susceptibility to damage caused by wind. Structural features include large, living old trees; large, dead standing trees; massive fallen logs; relatively open

canopies with foliage in many layers; and diverse understories (Oliver and Larson, 1996). Some stands within the project area may eventually experience larger-scale disturbance such as a major storm event. This would either result in areas of regeneration in what would likely be a two-aged stand or in cases of large areas blowdown, an even-aged condition. Young-growth stands would continue to grow, but if thinning does not occur, would remain in the stem exclusion phase of development, and understory plants would disappear until the canopy is opened, which could take many decades.

Young-growth stands with a NEPA decision would continue to be thinned. Treated stands would continue in the stand initiation stage, with an abundance of understory plants.

Commercial-size young-growth stands would continue growing at a steady rate until they reach the peak of their annual growth. These stands may remain in a stem exclusion stage for an extended period of time, limiting the amount of understory vegetation beneficial to wildlife. Incremental advancement of disease and decay, along with small-scale disturbance events, would result in gaps and would progress through the understory re-initiation phase and eventually to old-growth.

Alternatives 2 and 3 – Old-Growth Harvest

The structure of the forest would be changed by harvest under both action alternatives. The spatial scope and degree of this change would vary by alternative (Table 53).

Even-aged Management

Clearcutting or clearcutting with reserves under even-aged management would result in relatively homogenous young-growth stands. The clearcutting method fells and removes all merchantable trees essentially, while clearcutting with reserves designates a small portion of the stand to remain standing. The reserve trees could be clumped or dispersed. Reserve trees can meet a variety of objectives that include wildlife habitat, scenery design features and seed tree sources for natural regeneration. New stands would develop from seedling establishment; the stand is initiated, followed by stem exclusion, where extreme competition for canopy space would shade out understory vegetation. Trees would compete for all available resources. Eventually, tree mortality would open the canopy and re-initiate understory development. At this stage, the stand would begin to develop structural characteristics of old-growth forests. The time period for each stage of development is dependent on site productivity, susceptibility to natural disturbance, and any treatments that are applied, such as thinning.

Two-Aged Management

In old-growth stands where two-aged management is prescribed, at least 15 percent of the stand area would remain intact, with retained trees either grouped or distributed throughout. Harvest openings would progress through structural changes similar to even-aged management, including intermediate treatments, especially in stands where residual trees are clumped rather than dispersed throughout. The two-aged system would have more structure than the even-aged system, with two distinct age classes and more edge effect, as long as the residual areas are not placed on the stand boundary. Understory vegetation will be abundant in harvest openings and increase in residual areas with increased side-lighting.

Uneven-aged Management

Uneven-aged management in old growth would leave much of the stand intact while harvesting a portion. Three or more distinct age classes would be maintained and a range of diameter classes would be well-distributed across the stand. The stand would have high structural diversity. The

overall change in structure due to harvest would be minor. There would be dispersed openings that would contribute to structural diversity by increasing tree regeneration, as well as understory plants. The abundance and diversity of species would be increased. The stand would retain old-growth structure on a sustainable basis, unless affected by a major natural disturbance event.

Alternatives 2 and 3 – Young-Growth Management

The structure of the forest would be changed by harvest under both action alternatives. The spatial extent and degree of this change varies by alternative (see Table 53).

Even-aged Management

In young-growth stands where even-aged management is prescribed, the entire stand would be harvested and would naturally regenerate. Then the stand would progress through the same stages as harvesting as even-aged management in an old-growth stand.

Two-aged Management

In young-growth stands where two-aged management is prescribed, at least 15 percent of the stand area would remain intact, with retained trees either clumped or dispersed. Harvest openings would progress through structural changes similar to even-aged management, including intermediate treatments. The most likely structure of the two-aged managed young-growth stand would be a patchwork of two distinct cohorts developing through the same stages as an even-aged stand, but on separate time scales. This patchwork structure is most likely because it offers the best operability for conventional logging systems.

Uneven-aged Management

Where the uneven-aged management method of Group Selection is used, about two-thirds of the stand area would be retained in the first harvest entry. Where Single Tree Selection is prescribed, at least 67 percent of the stand basal area would be retained. The retention areas would continue to advance from late stem exclusion to understory re-initiation structure. The harvested areas with Group Selection prescriptions would regenerate as homogenous young growth and move through the same structural stages as the even-aged system. The second entry would be scheduled to occur in about 30 years. This entry would harvest another third of the stand. One-third of the stand would be in late understory re-initiation and trending toward old-growth structure. One-third of the stand would be in 30-year-old stem exclusion from the first harvest and ready for pre-commercial thinning, and one-third would be regenerating new growth. The third entry, 60 years after the first entry, would harvest the oldest portion of the stand. Harvesting the stand by thirds over this timeframe would result in high structural diversity, both vertically and horizontally, due to the different age and size classes. The repeated harvest entries would mimic a natural regime of frequent but relatively low-intensity disturbances.

Pre-commercial Thinning

Stands proposed for pre-commercial thinning in the project area range in development from the stand initiation stage to stem exclusion. A pre-commercial thinning treatment would delay the stem exclusion stage and promote understory structure. In non-development LUDs where the desired condition is ultimately old growth-like structure, pre-commercial thinning would promote conditions to achieve old-growth structure in a shorter timeframe.

Pre-commercial thinning in riparian and beach fringe areas would encourage the development of understory re-initiation and old-growth structure. Biodiversity within a stand can be increased by leaving trees with specific characteristics that are important for wildlife. Wildlife corridors

would remain un-thinned if the need is identified. Un-thinned corridors would provide some structural diversity within a thinned stand.

Table 53. Summary of direct/indirect effects on stand structure

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Old-growth Harvest	Even-Aged	No foreseeable change	Up to 9,500[1] acres converted from old-growth structure to homogeneous young-growth.	Up to 8,075[1] acres converted from old-growth structure to homogeneous young-growth.
	Two-aged		Minor % of EA acres	Minor % of EA acres
	Uneven-Aged		Up to 9,500[1]acres remaining in a predominantly old-growth structure post-harvest.	Up to 8,075[1] acres remaining in a predominantly old-growth structure post-harvest
Young-growth Harvest	Even-Aged	Continued stand structural development	Up to 4,000[1] acres regenerated from current condition to early stand development.	Up to 3,700[1] acres regenerated from current condition to early stand development.
	Two-Aged			
	Uneven-Aged		Up to 4,000[1] acres would be treated- creating more structural diversity.	Up to 3,700 acres would be treated- creating more structural diversity.
Intermediate Treatments	Thinning, Planting and Pruning	No foreseeable change	PCT would reduce stems and the canopy while increasing understory vegetation on up to 3,000 acres per year.	PCT would reduce stems and the canopy while increasing understory vegetation on up to 3,000 acres per year.

[1] Assumes maximum acreage of harvest allowed for this alternative.

Species Composition and Regeneration

Alternative 1 – No Action Alternative

Alternative 1 proposes no new harvest in either old growth or young growth. Trajectories of species composition would depend on the current conditions and site quality. As natural processes create openings in the forest canopy, western hemlock would have a competitive advantage over other species. Larger-scale disturbance from severe storm events may occur and those areas will regenerate. Regeneration would likely be prolific with species composition similar to the former stand. There would be less opportunity to plant yellow-cedar in new, more suitable long-term sites.

Alternatives 2 and 3 – Old-Growth Commercial Harvest

Even-aged Management and Two-aged Management

Where even-aged and two-aged management are prescribed, tree regeneration is expected to be prolific in harvest openings. The natural species mix will be representative of the former stand. Sitka spruce composition may increase while cedars have maintained or may increase slightly and western hemlock composition has decreased. This is primarily due to future intermediate treatments that select spruce and cedars as crop trees over the otherwise dominant western

hemlock. Yellow-cedar species and Sitka spruce are relatively shade intolerant. Larger openings created by even-aged and two-aged management provide more favorable site conditions for regeneration of cedar and spruce. Even-aged and two-aged management promote good conditions for future intermediate treatments, such as pre-commercial thinning and tree planting that allow for influencing species composition (Activity Guide 08 and Supporting Action – Timber Stand Establishment).

Uneven-aged Management

Where uneven-aged management is prescribed for old-growth harvest, understory regeneration may increase but less than regeneration with even-aged or two-aged management. The high amount of shade and less ground-disturbance would favor hemlock regeneration over spruce and cedar. It is unlikely that a significant change in species composition would occur using uneven-aged management prescriptions which focus on maintaining existing species distributions.

Alternatives 2 and 3 - Young-Growth Commercial Harvest

Even-aged Management

Even-aged management in young-growth would result in prolific tree regeneration following harvest. Sitka spruce and western hemlock would naturally occupy openings, as these are the dominant species in the current stands. There may be opportunities to plant redcedar and yellow-cedar on favorable sites to increase the composition of these species.

Two-aged Management

The effects of two-aged management on species composition and regeneration are similar to even-aged management. In openings created, vigorous young stands of spruce and hemlock would regenerate. Compared to even-aged management, there would be an increase in area of edge-effect. This would likely increase plant species diversity and abundance. Openings created by two-aged management would provide opportunities for planting redcedar and yellow-cedar on favorable sites, if natural regeneration of those species is lacking.

Uneven-aged Management

Uneven-aged prescriptions in young-growth would create smaller openings that would regenerate with both spruce and hemlock. Due to the limited area of openings, the more shade-tolerant western hemlock is expected to have a competitive advantage. Group selection with two-acre openings would provide opportunity to plant less shade-tolerant species, such as redcedar and yellow-cedar. The extensive edge created under this system would greatly enhance understory plant abundance and diversity.

Table 54. Summary of direct/indirect effects on species composition and regeneration

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Old-growth Harvest	Even-Aged and Two-aged	No foreseeable change.	Better conditions for establishment of cedars and spruce in regenerated stands on up to 9,500[1] acres. Increased opportunities for planting and managing regenerated stands for yellow-cedar.	Better conditions for establishment of cedars and spruce in regenerated stands on up to 8,075[1] acres. Increased opportunities for planting and managing regenerated stands for yellow-cedar.
	Uneven-Aged		Likely increase in composition of hemlock regeneration in harvested areas on up to 9,500[1] acres.	Likely increase in percentage of hemlock regeneration in harvested areas on up to 8,075[1] acres.
Young-growth Harvest	Even-Aged and Two-Aged	No foreseeable change in species composition. Regeneration would remain effectively non-existent until a disturbance event opens the canopy.	No foreseeable change in composition. Regeneration would be maximized on up to 4,000[1] acres. Increased opportunities for managing stands for yellow-cedar.	No foreseeable change in composition. Regeneration would be maximized on 3,700[1] acres. Increased opportunities for managing stands for yellow-cedar.
	Uneven-Aged		Likely increase in composition of hemlock regeneration in harvested areas on up to 4,000[1] acres.	Likely increase in composition of hemlock regeneration in harvested areas on 3,700[1] acres.
Intermediate Treatments	Thinning, Planting and Pruning	No foreseeable change in species composition. Regeneration would remain effectively non-existent until a natural disturbance event opens the canopy.	Thinning and planting would improve species composition. Pruning would increase understory vegetation.	Thinning and planting would improve species composition. Pruning would increase understory vegetation.

[1] Assumes maximum acreage of harvest allowed for this alternative.

Species Composition and Regeneration

Alternative 1 – No Action Alternative

Alternative 1 proposes no new harvest in either old growth or young growth. Trajectories of species composition would depend on the current conditions and site quality. As natural processes create openings in the forest canopy, western hemlock would have a competitive advantage over other species. Larger-scale disturbance from severe storm events may occur and those areas will regenerate. Regeneration would likely be prolific with species composition similar to the former stand. There would be less opportunity to plant yellow-cedar in new, more suitable long-term sites.

Alternatives 2 and 3 – Old-Growth Commercial Harvest

Even-aged Management and Two-aged Management

Where even-aged and two-aged management are prescribed, tree regeneration is expected to be prolific in harvest openings. The natural species mix will be representative of the former stand. Sitka spruce composition may increase while cedars have maintained or may increase slightly and western hemlock composition has decreased. This is primarily due to future intermediate treatments that select spruce and cedars as crop trees over the otherwise dominant western hemlock. Yellow-cedar species and Sitka spruce are relatively shade intolerant. Larger openings created by even-aged and two-aged management provide more favorable site conditions for regeneration of cedar and spruce. Even-aged and two-aged management promote good conditions for future intermediate treatments, such as pre-commercial thinning and tree planting that allow for influencing species composition (Activity Guide 08 and Supporting Action – Timber Stand Establishment).

Uneven-aged Management

Where uneven-aged management is prescribed for old-growth harvest, understory regeneration may increase but less than regeneration with even-aged or two-aged management. The high amount of shade and less ground-disturbance would favor hemlock regeneration over spruce and cedar. It is unlikely that a significant change in species composition would occur using uneven-aged management prescriptions which focus on maintaining existing species distributions.

Alternatives 2 and 3 - Young-Growth Commercial Harvest

Even-aged Management

Even-aged management in young-growth would result in prolific tree regeneration following harvest. Sitka spruce and western hemlock would naturally occupy openings, as these are the dominant species in the current stands. There may be opportunities to plant redcedar and yellow-cedar on favorable sites to increase the composition of these species.

Two-aged Management

The effects of two-aged management on species composition and regeneration are similar to even-aged management. In openings created, vigorous young stands of spruce and hemlock would regenerate. Compared to even-aged management, there would be an increase in area of edge-effect. This would likely increase plant species diversity and abundance. Openings created by two-aged management would provide opportunities for planting redcedar and yellow-cedar on favorable sites, if natural regeneration of those species is lacking.

Uneven-aged Management

Uneven-aged prescriptions in young-growth would create smaller openings that would regenerate with both spruce and hemlock. Due to the limited area of openings, the more shade-tolerant western hemlock is expected to have a competitive advantage. Group selection with two-acre openings would provide opportunity to plant less shade-tolerant species, such as redcedar and yellow-cedar. The extensive edge created under this system would greatly enhance understory plant abundance and diversity.

Table 55. Summary of direct/indirect effects on species composition and regeneration

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Old-growth Harvest	Even-Aged and Two-aged	No foreseeable change.	Better conditions for establishment of cedars and spruce in regenerated stands on up to 9,500[1] acres. Increased opportunities for planting and managing regenerated stands for yellow-cedar.	Better conditions for establishment of cedars and spruce in regenerated stands on up to 8,075[1] acres. Increased opportunities for planting and managing regenerated stands for yellow-cedar.
	Uneven-Aged		Likely increase in composition of hemlock regeneration in harvested areas on up to 9,500[1] acres.	Likely increase in percentage of hemlock regeneration in harvested areas on up to 8,075[1] acres.
Young-growth Harvest	Even-Aged and Two-Aged	No foreseeable change in species composition. Regeneration would remain effectively non-existent until a disturbance event opens the canopy.	No foreseeable change in composition. Regeneration would be maximized on up to 4,000[1] acres. Increased opportunities for managing stands for yellow-cedar.	No foreseeable change in composition. Regeneration would be maximized on 3,700[1] acres. Increased opportunities for managing stands for yellow-cedar.
	Uneven-Aged		Likely increase in composition of hemlock regeneration in harvested areas on up to 4,000[1] acres.	Likely increase in composition of hemlock regeneration in harvested areas on 3,700[1] acres.

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Intermediate Treatments	Thinning, Planting and Pruning	No foreseeable change in species composition. Regeneration would remain effectively non-existent until a natural disturbance event opens the canopy.	Thinning and planting would improve species composition. Pruning would increase understory vegetation.	Thinning and planting would improve species composition. Pruning would increase understory vegetation.

[1] Assumes maximum acreage of harvest allowed for this alternative.

Stand Productivity and Forest Health

Alternative 1 – No Action Alternative

Old-growth Stands

Tree growth would continue to be exceeded by decay in old-growth stands. Insect and disease processes would persist at approximately current levels but due to the general lack of vigor in un-treated stands, the forest remains at risk and vulnerable to insect and disease attack. Hemlock dwarf mistletoe, where present, would remain in the stand and may infect hemlock regeneration in gaps. Mistletoe reduces the vigor of hemlock trees, while producing low quality wood, and in some cases, killing trees.

Porcupine damage is present in many old-growth stands in the project area. Porcupines are absent from some islands in the project area, including Zarembo Island.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Young-growth Stands

Young-growth stands of commercial size in the project area are mostly healthy and growing well with no foreseeable insect or disease issues. Thinned stands are more stable and vigorous. Growth rates of individual trees are increased by past thinning, at least until the unoccupied space is re-filled. Thinning allocates resources, including space to fewer stems. Unthinned stands may be less stable due to competition-related stress. Unthinned stands are more susceptible to decay and damage, as trees die and fall into standing trees, creating more damage and allowing access for decay agents.

Without treatment, unthinned young stands would remain predominantly in the stem exclusion stage. The over-stocked condition causes stress that increases the likelihood that insects and diseases can take hold and spread. The overall productivity of a stand may be at a maximum when in an over-stocked conditions; however trees are less vigorous when competition for light is also at a maximum. Although these stands are relatively free from insect, disease and defect, there would be less opportunity with Alternative 1 to improve the stocking conditions for most of these young-growth stands, except where existing decisions allow for thinning When considering a warming climate, there is potential for future issues to develop that are not yet apparent today.

Porcupines can do considerable damage to young-growth hemlock and spruce, so the regenerated cohort of these species can be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Alternatives 2 and 3 – Old-Growth Harvest

Even-aged Management

With even-aged prescriptions, stand productivity for the purpose of volume production would be maximized. The risk of insect or disease outbreaks and decay within the newly established growing timber crop would be minimized. The new stand would be comprised of vigorous, disease-free trees. There is some risk of mistletoe infection in new trees near stand edges, adjacent to residual old-growth hemlock, dependent upon the level of infection in the residual trees.

Porcupine can do considerable damage to young-growth hemlock and spruce, so the regenerated cohort in EA stands could be vulnerable. Where cedar exists, favoring cedar helps avoid some damage by porcupine.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Two-Aged Management

The productivity of the site would not be reduced, just as with even-aged management; volume from the stand would be in two entries. There may be little difference between a two-aged system and an even-aged system in some cases, in the first entry treatment. The second entry in the two-aged system plans to remove the residual trees left from the first entry, which results in regenerating trees for the youngest cohort of trees. The risk of insect or disease activity may increase due to the potential that residual trees are damaged during the first entry harvest, creating wounds that may become vectors to insects and disease. The level of mistletoe infection may remain if the residual trees are infected. The retained portions of the stand are not expected to be at any major risk of declining health within the planned rotation period.

Porcupines can do considerable damage to young-growth hemlock and spruce, so each of the regenerated cohort could be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Uneven-aged Management

Productivity, in terms of volume production, would not be increased where uneven-aged management is prescribed in old-growth. Old-growth structure will make up the majority of the stand. In the long term, over several cutting cycles spanning 150 years or more, productivity in terms of volume production, could be closer to that of an even-aged managed stand; however, uneven-aged management prescriptions in the project area have multiple objectives that include wildlife habitat and scenery objectives. These non-timber production objectives detract from the overall productivity of the stand, in terms of timber volume.

Forest health may improve slightly with an uneven-aged system. To improve forest health in a particular stand, the prescription may include specific objectives, such as the removal of mistletoe-infected trees; however, this may not be effective if there is a high retention level for the prescription, and the high hemlock component in old-growth stands. Trees retained in the uneven-aged system, and regeneration within newly-created openings, would be at risk of infection by disease and decay currently present within the stand. There is a potential for damage to retained trees during harvest activities which may cause the spread of disease, as wounds created provide entry-points for decay organisms. Larger trees with high defect would likely be retained for wildlife would not increase growth rate or improve in health as a response to space created by harvest. Retained trees in the co-dominant and intermediate crown classes are expected to increase growth rates and vigor in response to newly-created growing space and increased light.

Porcupines can do considerable damage to young-growth hemlock and spruce, so the regenerated cohort in uneven-aged stands could be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Alternatives 2 and 3 – Young-Growth Management

Even-aged Management

Where even-aged management is prescribed in young-growth, no change is anticipated in the productivity of the land or in forest health. Stands would be reset to the stand initiation phase of development, a rotational harvest. The same low risk factors are anticipated as were present in the previous stand of trees; however, there may be reason for cautious concern considering climate change and any potential ill-effects to forest health. Reserve trees left from the previous old-growth stand within the unit may be infected with mistletoe, or decay that could spread to the new cohort.

Porcupines can do considerable damage to young-growth hemlock and spruce, so there may be some existing damage in young-growth stands and the regenerated cohort in even-aged stands could be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Two-aged Management

There would be less volume output in the near-term with a two-aged system due to a reduction in harvest acres, or harvested trees this entry. The productivity of the site is not reduced, just as with even-aged management; volume flow, however, is staggered to create two distinct cohorts. Two-aged management would likely produce more wood for a given area than clearcut management if the clearcut prescription rotates the stand prior to CMAI.

There may be a slight increase in the risk of insect or disease activity due to the potential that residual trees are damaged during harvest, creating wounds that may become vectors to insects and disease. The retained portions of the stand are not expected to be at any major risk of declining health within the planned rotation period.

Porcupines can do considerable damage to young-growth hemlock and spruce, so there may be some damage in the regenerated cohorts in two-aged stands could be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Uneven-aged Management

Stand productivity, in terms of volume, would not be increased in the near term where uneven-aged management is prescribed in young-growth. In the long term, over several cutting cycles spanning 150 years or more, productivity in terms of volume production, may be similar to that of an even-aged managed stand. Studies in different regions show comparable volume production between the two silvicultural systems. O'Hara and Nagel (2006) suggest that multi-aged ponderosa pine stands were as efficient at turning light energy into volume as even-aged stands of the same species. They found no reason to think that productivity should be inherently different between the two systems. When growing vigorously, multi-cohort stands with balanced sizes and ages between cohorts, have different sizes of trees and timber volumes than single-cohort stands. The range of growth (mean annual increment) over extended periods is within the same order of magnitude as single-cohort stands of the same species and on the same site (Larson 1982).

Uneven-aged management in young-growth has potential for insect and disease activity. Multiple entries expose residual trees to harvest-related injury each times. Wounded trees are more susceptible to decay organisms and if stressed, may attract insects such as bark beetles.

Porcupines can do considerable damage to young-growth hemlock and spruce, so there may be some existing damage in young-growth stands and the regenerated cohort in uneven-aged stands could be vulnerable.

Mortality in old-growth associated with high populations, or outbreaks of softwood defoliators, is expected to affect tree growth and in some cases result in top kill or even mortality if conditions remain dry. However, unless outbreaks co-occur with the western blackheaded budworm, which has not been observed in over large areas, mortality is expected to have negligible effects to stand productivity and forest heath.

Intermediate Treatments

Pre-commercial thinning increases productivity by allocating resources to fewer trees. Forest health is improved by removing trees that show signs of disease or low vigor. Pre-commercial thinning reduces competition stress and mortality. Crop trees are selected primarily for form and vigor.

Porcupines can damage young growth stands in the project area by feeding on trees, often girdling trees causing mortality. If trees are not killed, the damage will often be extensive enough to deform growth, leaving a live tree with no commercial value. The tree uses growing space and resources but will not produce merchantable volume. Porcupines feed on hemlock and spruce but do not feed on cedars. Young-growth stands in the "thinning window" age range of 15 to 35 years old are especially susceptible to porcupine feeding and damage. Pre-commercial thinning with specifications to select cedars as crop trees can temper porcupine damage.

Table 56. Summary of direct/indirect effects on stand productivity and forest health

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Old-growth Harvest	Even-Aged	Decline in general vigor and forest health outpaces growth until natural disturbance.	Forest health and near-term productivity would be maximized on 9,500[1] acres.	Forest health and near-term productivity would be maximized on 8,075[1] acres.
	Two-Aged		A slight increase in risk to forest health, and decrease in near-term productivity on a small % of EA acreage	A slight increase in risk to forest health, and decrease in near-term productivity on a small % of EA acreage
	Uneven-Aged		Forest health and productivity may improve slightly or remain unchanged on up to 9,500[1] acres.	Forest health and productivity may improve slightly or remain unchanged on up to 8,075 acres.
Young-growth Management	Even-Aged	May be slight increase in susceptibility to insect and disease due to high densities on 4,000 acres.	Little change to forest health or productivity on 4,000[1] acres.	Little change to forest health or productivity on 3,700[1] acres.
	Two-Aged			
	Uneven-Aged		Slightly higher risk of insect and disease activity over time on up to 4,000[1] acres.	Slightly higher risk of insect and disease activity over time on up to 3,700[1] acres.
Intermediate Treatments	Thinning	Decreased vigor and increased susceptibility to insect and disease due to overstocking.	Forest health and productivity would be improved on 4,500 acres per year.	Forest health and productivity would be improved on 4,500 acres per year.

[1] Assumes maximum acreage of harvest allowed for this alternative.

Wind Hazard Risk

Alternative 1 – No Action Alternative

Old-growth stands would remain in the current condition, experiencing relatively frequent, small-scale disturbance events until a large-scale event occurs. Wind hazard risk to old-growth stands in the project area would remain unchanged or progress naturally.

Commercial harvest of young-growth and thinning of young-growth proposed with this project would not occur. Young trees in unthinned young-growth stands would not be conditioned to withstand strong winds, as they grow tall but stem diameters are small. Tall, skinny trees are unstable to strong winds. Competition stress reduces vigor and stability, and over-stocking limits root development that can anchor trees.

Alternatives 2 and 3 - Old-Growth Harvest

Even-aged Management

Even-aged management removes the entire over-story, except in stands where over-story reserve trees are prescribed. Even-aged management eliminates wind hazard risk to that stand except for any reserve trees identified. The new young-growth stand would have a more uniform canopy with vigorously-growing, limber upper stems that would be relatively wind-firm. Planned pre-commercial thinning selects the best growing trees and spaces them appropriately so they are more exposed to wind stress which allows them to develop structural characteristics to better deal with this stress. The crop trees are conditioned to withstand strong winds. Ideally, the wind-conditioned stand continues growing upright through the rotation, which is likely to be around 100 years.

Exposed stand edges do have increased risk of wind-throw for several years following harvest. Clearcuts can create wind hazard risk due to increased surface wind speed and turbulence. Wind-throw damage is usually concentrated within the first 30 to 60 feet of the stand edge. In created openings greater than 2 to 3 acres, opening size does not appear to play a role in the amount of wind-throw (Stathers et al. 1994). This is typically a short-term effect as residual trees develop structural characteristics to abate wind stresses.

Wind hazard risk will be assessed for each stand at implementation. In stands rated as high wind hazard risk, specific measures will be prescribed to reduce, or minimize risk. The prescription will also include measures to protect stream buffers and stand edges, known as Reasonable Assurance of Windfirm (RAW) buffers using the Reasonable Assurance of Windfirmness Guidelines Version 2.0 (Landwehr 2007).

Two-Aged Management

Two-aged management creates large openings and increased edge, and may therefore have a slightly higher potential for wind damage. This may be offset with strategic placement of openings, or shaping design of openings, if local wind patterns are understood.

Uneven-aged Management

Where uneven-aged management is prescribed, wind hazard risk may be mitigated by increasing retention in higher risk areas, or “feathering” rather than creating “hard” edges that may be more susceptible to the sudden direct wind exposure. There will be windthrow, as there is naturally in old-growth, but it is expected to occur within the natural range. Stands with Group Selection opening edges, especially openings up to 2 acres in size, may be at a slightly increased wind hazard risk than stands implementing the Single Tree Selection method. The Group Selection openings may create more hard edges exposed to wind resulting in some unravelling of the residual stand.

In most stands with uneven-aged prescriptions, the need for additional wind-firming treatments in RAW zones would be unnecessary because RAW buffers would effectively already be in place. A stand with an RMA requiring protection would not have a prescription to implement 2-

acre group openings adjacent to the RMA. The Single Tree Selection method would be appropriate adjacent to the RMA.

Alternatives 2 and 3 – Young-Growth Management

Even-aged Management

The entire stand is removed and wind hazard risk is eliminated. Exposed stand edges would have increased risk of wind-throw following harvest. Neighboring stand ages factor into each stand's edge wind hazard risk. Young-growth stands similar in age have a decreased risk of wind-throw at stand edges compared to the edge of an old-growth stand adjacent to a young-growth stand. Wind hazard risk can be minimized by strategic harvest planning across a landscape, harvest area design (shape and size) and specific location factors (topography, wind pattern and aspect).

Two-aged Management

In two-aged management, the potential for wind damage to stand edges might be slightly higher than under even-aged management because of the increased edge, however this may be somewhat offset by the smaller opening size associated with these prescriptions. Wind-throw risk can be minimized through careful planning of the size, shape and location of openings.

Uneven-aged Management

Where uneven-aged management is prescribed, opening size would be limited to 2 acres. The Group Selection method would retain at least 67 percent of the area as uncut, per entry. The Single Tree Selection method would retain at least 67 percent of the basal area per entry. This level of retention should be mostly wind-firm to normal strong wind events that occur in the project area. An acceptable amount of wind-throw, about 5 percent, is anticipated, as this occurs naturally in the project area. An objective for uneven-aged management as part of the Central Tongass Project is to minimize the wind hazard risk, to the extent practicable. The high retention level of at least 67 percent stand area or basal area is a component to meet that objective.

Pre-commercial Thinning

Stands that are pre-commercially thinned may have a slight increase risk of wind-throw directly following treatment due to the sudden removal of numerous stems and crowns that were buffering wind and somewhat supporting each other. However, young-growth stands in the project area that have been thinned at an appropriate age when trees have adequate vigor and stability, have shown very little susceptibility to windthrow. Appropriate crop tree spacing can mitigate this risk, and over time, the thinned stand would stabilize, in terms of wind-firmness.

Table 57. Summary of direct/indirect effects on wind-throw risk

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
Old-growth Harvest	Even-Aged	No foreseeable change	Wind-throw risk would be eliminated on up to 9,500[1] acres. Risk would be increased along edges of openings > 3 acres	Wind-throw risk would be eliminated on up to 8,075[1] acres. Risk would be increased along edges of openings > 3 acres

Activity	Silvicultural System	Alternative 1	Alternative 2	Alternative 3
	Two-Aged		Wind-throw risk to the residual would be increased on a small percentage of the EA acres	Wind-throw risk to the residual would be increased on a small percentage of the EA acres
	Uneven-Aged		Wind-throw risk is slightly increased	Wind-throw risk is slightly increased
Young-growth Management	Even-Aged (EA) and Two-Aged (2A)	Wind-firmness would remain stable in the near-term. Long-term wind-firmness would decrease as trees H/D ratios increase	(EA) Wind-throw risk would be increased along edges of openings > 3 acres; (2A) Risk would be higher than EA on a small % of EA acres	(EA) Wind-throw risk would be increased along edges of openings > 3 acres; (2A) Risk would be higher than EA on a small % of EA acres
	Uneven-Aged		A slight increase of wind-throw risk on up to 9,500[1] acres	A slight increase of wind-throw risk on up to 8,075[1] acres
Pre-commerical thinning	Thinning	No foreseeable change.	Decreased risk of wind-throw long-term on up to 4,500 acres per year	Decreased risk of wind-throw long-term on up to 4,500 acres per year

[1] Assumes maximum acreage of harvest allowed for this alternative.

Cumulative Effects

The analysis area for cumulative effects is the entire Central Tongass project area. Present and reasonably foreseeable vegetation management projects within the project area, identified for the cumulative effects analysis, are summarized in Appendix C of this document. The following are the activities expected to have cumulative effects to forest vegetation within the next 15 years:

- Identified projects on NFS lands include 428 acres of old-growth even-age management from the Wrangell Island EIS project, 378 acres from the Navy EIS, 1,329 acres from the Central Kupreanof Timber Harvest and 870 acres from the Kuiu Timber Area Project.
- Firewood cutting and free use sawtimber removal along existing roads
- Continued pre-commercial thinning on NFS lands throughout the project area
- Harvest on non-NFS lands within the project area

Pre-commercial Activities on All Land Ownerships

The Central Tongass project area has approximately 150,000 acres of young-growth resulting from past even-aged harvest across all ownerships. Of these acres, roughly 30,000 are located on land owned by entities other than the NFS, and 43,000 acres were harvested less than 30 years ago. These stands are now in, or approaching, the window for pre-commercial thinning. Additionally, approximately 11,600 acres of young growth on NFS lands are currently NEPA-cleared and awaiting pre-commercial thinning.

Where accomplished, pre-commercial thinning would delay or prevent the stem exclusion phase of stand development and result in higher levels of understory vegetation, improve overall stand productivity, likely favor spruce and cedar over western hemlock, and improve windthrow risk

over the long-term. Unthinned stands would enter, or remain in stem exclusion throughout this project.

Present and Reasonably Foreseeable Future Commercial Harvest on All Land Ownerships

There are 50,000 acres of potentially economical forested land under other ownership within the project area. Approximately 6,500 of these acres are even-aged young-growth currently greater than 46 years old and are anticipated to be commercially viable within the next 15 years. The remaining 43,500 acres are currently old-growth with at least 8 MBF per acre which are considered commercial timber lands.

These other ownerships include the State of Alaska, the Alaska Mental Health Trust, the University of Alaska Trust, and various native corporations, the largest of which is Sealaska Corporation. The rate and location of future old-growth harvest for these other ownerships is unknown, but estimates can be made based on public 5-year schedules, rates of past harvest, and capacity of the local industry. It is assumed, based on these estimates, that 100 acres of old-growth harvest per year across these other ownerships, for a total harvest over the next 15 years of 1,500 acres. It is also assumed that 100 percent of these acres will be managed through even-aged harvest, and that this harvest would result in the creation of even-aged forests in addition to that proposed in the Central Tongass Project. Acres harvested on non-NFS land would undergo effects similar to those harvested under an even-aged management system described above, and any future precommercial activities would have effects outlined above.

The rate and location of future young-growth harvest on other ownerships is subject to the same unknowns as that of old-growth. For the purpose of estimating effects, it is assumed that all 6,500 acres on other ownership considered to be approaching a commercially viable age class will be harvested under even-aged management over the next 15 years.

Regeneration is expected to be vigorous and representative of the approximate species mix of the former stand. Slight changes in species composition in the project area may occur as a result of harvest operations and follow-up treatments such as precommercial and commercial thinning.

Stands heavily affected by yellow-cedar decline are naturally progressing toward hemlock-dominated communities (Oakes et al. 2014). Western redcedar and mountain hemlock may also replace yellow-cedar on lower productivity sites, thus increasing their overall presence on the landscape (Hennon et al. 2016). Planting of Alaska yellow-cedar can be used where site conditions allow to maintain or increase its composition in the stand or group of stands and reduce the effects of yellow-cedar decline. It is unknown whether or to what level non-NFS landowners would use this management approach.

Effects of timber harvest to forest vegetation are usually confined to the harvested stand area and its immediate vicinity. However, when the landscape-scale of many stands is considered, the primary effects of timber harvest results in greater structural diversity and improved vegetation health and productivity. While windthrow risk will temporarily increase along edges of residual stands following harvest, risk will likely decrease overall as more stands are converted from high-defect old growth to vigorous young growth under even-aged management. The rate of harvest, variation in site productivity, spatial relationship of harvested stands to reserves, and the locations of ownership boundaries in relation to federal land affect the scale and intensity of these impacts to the landscape.

With an additional 1,500 acres of old-growth harvest (even-aged management) on other ownership, and 1,712 acres of right of way for the potential Kake-South Kupreanof Road and Kake to Petersburg intertie, and up to 9,500 acres assumed harvested on National Forest under the Central Tongass Project, there could be approximately 163,000 acres total of young-growth in 15 years within the project area.

Invasive Plants

This section provides a summary of

1. The existing conditions and effects of proposed activities on the introduction or spread of invasive plants in the Central Tongass project area. Species are considered invasive if they are not native to an ecosystem and are likely to cause harm to human health, the economy, or the environment (Executive Order [EO] 13112); and
2. The analysis of effects to human health from the herbicide treatments. Aminopyralid, glyphosate and imazapyr are the three herbicides considered for use. The use of herbicide for all other impacted resources is analyzed within their respective sections.

Risk of Introduction or Spread of Invasive Plants

Summary

The Forest Service has direction to move toward controlling and eradicating invasive species to protect viable populations of desired species and their habitat. Where invasive plant treatment has been on-going, the level of risk associated with proposed Central Tongass Project activities is negligible to low due to the successful control of targeted invasive plant species, as well as specific design features that reduce the risk of spread or introduction. Alternative 1 has a lower level of risk when compared to Alternatives 2 and 3 because the disturbance footprint is smaller and invasive plant treatments have been occurring ahead of or in conjunction with projects to control for the introduction or spread. Alternatives 2 and 3 have the same proposed activities; however, the size and scope differs with the harvest and road access portions of the alternative. Alternative 2 proposes 1,785 harvest acres and 401 road construction acres more than Alternative 3. Potential watershed improvement activities have a low-to-medium risk of introducing or spreading invasive plants. With respect to activities associated with recreation management, the risk of spread or introduction is medium due to the increased visitor use days (an increase in vectors) that goes with developing new sites. With respect to vegetation management the level of risk for the introduction or spread ranges from low (for example, thinning) to medium because thinning is not likely to spread invasive plants into the natural setting whereas harvest does. The risk is only medium for harvest because forested areas are not typically vulnerable to colonization by invasive plants unless soil disturbance is major. Access management activities, on the other hand, have a high risk to the introduction or spread of invasive plants as roads connect existing infestations to new terrain and cross through vulnerable habitat such as riparian corridors or wetlands.

Current treatments efforts include manual, mechanical and herbicide methods. The Central Tongass Project adds non-NFS lands, removes the acreage limit, adds broadcast spray, and adds the ability to treat emergent vegetation to the toolkit for invasive plant treatments. These changes in the approach to treating invasive plants on the Wrangell and Petersburg Ranger Districts should make control efforts more effective and increase the capacity to treat more gross acreage through partnerships.

Desired Conditions

The purpose of this project is to move the Central Tongass project area toward the desired future condition where “viable populations of native and desired non-native species and their habitat

are maintained and are not threatened by invasive species…" (USDA Forest Service 2008 p. 2-1).

Regulatory Framework

This section follows direction from FSM 2900 Invasive Species Management (2011) and Executive Order (EO) 13112 (1999), as amended December 5, 2016. FSM 2900 provides National Forest System policy, and responsibilities and direction for the prevention, detection, control from aquatic and terrestrial invasive species that includes vertebrates, invertebrates, plants and pathogens, as well as restoration following treatments. FSM 2900 is also referenced as guidance in the Tongass National Forest Land Management Plan for Invasive Plants (USDA Forest Service 2016a, Chapter 4). The amended EO 13112 maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee but expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into federal efforts to address invasive species; and strengthens coordinated, cost-efficient federal action. *The Guidance for Invasive Plant Management on the Tongass National Forest* (Krosse 2017b) outlines Weed Best Management Practices (Weed BMPs) recommended to reduce the risk of introduction and/or spread of invasive plants before, during or after project implementation.

Methodology

Spatial Scale (direct, indirect and cumulative effects analysis areas)

The Central Tongass project area is the spatial boundary for analyzing effects and the risk of introduction and/or spread of invasive plants. While the island scale might make the most sense for activity-specific analysis, this large scale analysis, combined with the movement of people between islands, supports analyzing the project area as a whole.

Direct effects include the disturbance footprint. Indirect effects include the area adjacent as openings in the forest canopy alter light, wind and humidity. For example, indirect effects of proposed road construction are analyzed by buffering the 26-meter width of the road corridor by 50 meters and overlaying the buffered area over known invasive plant occurrences. Indirect effects for harvest units are similarly buffered 50 meters from the unit boundary.

Cumulative effects are evaluated based on the maximum proposed disturbance footprint by alternative, combined with the past and present disturbance (see Appendix C for complete list).

Temporal Scale (length of time effects are considered for impacts)

A single growing season was used to bound short-term impacts to assess direct effects, while discernible impacts beyond a single growing season are considered a long-term effect to assess indirect and cumulative effects for invasive plants.

Analysis Methods and Assumptions

Within the Central Tongass project area, analysis of effects is compared by alternative using the the maximum potential disturbance footprint by alternative is considered in the analysis of effects. Because of the difficulty in estimating the amount of disturbance that will be caused by each alternative, a relative estimate of the maximum total acres of vegetation management, recreation management, watershed improvements and access management are used to compare each alternative's potential for establishment and spread of invasive plants (Krosse 2017). However, it should be noted that the estimated acreage is many times greater than the soil

disturbance that would likely result from these activities. The exception to this is road construction which is a direct source of soil disturbance; therefore, total miles of road construction may be interpreted as a relatively accurate accounting of the level of soil disturbance created as a result of this activity.

To access risk, acres of gross infestation, the invasiveness ranking (that is, the Alaska Center for Conservation Science (ACCS) ranking system), the site type and the presence of vulnerable habitat are considered in conjunction with the disturbance footprint to assess risk (Table 58). Not all site types are equal even if highly vulnerable for the colonization by invasive plants.

Table 58. Acres of inventoried invasive plants by site type, with associated vulnerable habitat noted

Site Type	Acres	Current and/ or new vectors to consider	At-risk habitats and vulnerability (Low, Med, High)
Access Management			
Roads	2,934	Current: Vehicle traffic, brushing/mowing, water and wind. New: Road construction increases the frequency of current vectors and introduces equipment.	Riparian areas at stream crossings (High); Shallow wetland soils (Med)
Marine Access Facilities	44	Current: Vehicle traffic, water, wind. New: Construction/maintenance increases the frequency of current vectors and introduces equipment.	Well-drained beach meadow (Med to High); Mineral soil (High)
Barrow pits	232	Current: Vehicle traffic, wind. New: Construction and maintenance increases the frequency of current vectors and introduces equipment.	Disturbed soils (High)
Recreation Management			
Cabins/Shelters/ Trails	21	Current: Vehicle or boat traffic, water, wind, animals. New: construction/maintenance-related activities which increases the frequency of current vectors and introduces equipment	Well-drained beach meadow (Med to High); Lake shore (Med to High); Riparian areas (High)
Watershed Improvement			
Estuaries	630	Current: Boats, minimal foot traffic, wind, water and animals. New: Invasive plant treatments = increased foot traffic and introduces equipment	Upper beach meadow, exposed muck (Med to High)
Riparian Management Areas (including road - stream crossings)	442	Current: Water, wind, animals, vehicles and equipment. New: construction/maintenance/restoration-related activities which increase the frequency of occurrence of most current vectors and introduces equipment	River corridors (High); Stream crossings (currently 581) provide opening for invasive plants to entire the stream corridor from roads.
Vegetation Management			
Forested (Volume Class ≥4-7)	1,727	Current: Vehicle traffic and wind. New: Harvest increases the frequency of current vectors and introduces foot traffic and equipment	Disturbed forest habitat (Low to Mod in the short-term; Low in the long-term)

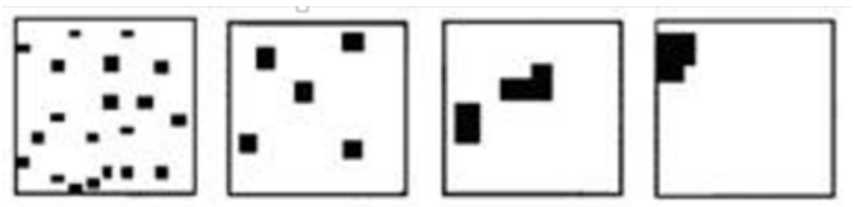
Invasive plant data used for this risk assessment comes from the NRIS TESP-IS database, the AK EPIC database (ACCS 2019), and the invasive inventory data completed by contract for the SEAPA corridor (Meridian 2012). Secondarily, the presence of vulnerable high-value habitat by site is coarsely assessed due to the large scale of the project; site-specific review will follow for each activity in accordance with the Implementation Plan (Appendix A). The acreage by site type was obtained from the Tongass National Forest GIS library: forest from volume class greater than 3 in the cover type layer, roads and barrow pits from the transportation activities layer, recreation sites from the recreation layer, estuaries from the NWI layer, and stream crossings and 6th order HUC from the hydrology and streams layers.

Affected Environment

Existing Condition

Eighty-nine different invasive plant species cover an estimated 5,811 gross acres within the Central Tongass project area. There are three aspects of these 5,811 acres to keep in mind regarding the existing condition of our data:

1. Gross acres is defined as the entire area delimited by the extent of the plant species regardless of the percent cover, as opposed to canopy acres which is calculated based on the area of actual plant cover within the aerial extent (Figure 15). Using the average percent cover available for invasive inventory (a crude calculation), the total canopy acreage within the project area is roughly 697 acres.



Outside boundary is considered the gross acreage whereas the black squares within the box are considered the canopy acres. In this example, with a 1 gross acre mapped (the square), and 5 percent cover (the black squares), the canopy acres equals 0.05 acre.

Figure 15. Canopy acres.

2. The data set used is only an estimate. Inventory work conducted in 2006, 2007 and 2012 collected point data along the road system, the SEAPA powerline corridor and at borrow pits/marine access facilities. This data was then represented spatially as a polygon based on the rough acreage every quarter mile; therefore, the data gives reasonable presence/absence data but does not provide the invasive infestation acreage between sample points. This presence/absence information has been used to map continuous polygons along roads for reed canarygrass and orange hawkweed where present on NFS lands. Lastly, this data contains other inventory work over the past two decades that maps an entire infestation as a polygon.
3. Due to the spatial overlay of the shoreline with the infestation data points, roughly 1,000 gross infested acres of the total 5,800 is not included in the island/LUD/site type tabular presentation. Most of this is within the Duncan Salt Chuck (brass buttons occur below mean tide) and where the State highway parallels saltwater on Mitkof and Wrangell Islands.

Of these 5,811 gross infestation acres, 20 species with an estimated 4,336 gross acres are ranked moderately invasive or higher by the Alaska Center for Conservation Science (ACCS 2019) (Table 59) (

Figure 16). The ACCS ranks invasiveness based on the biology of the species, ecological impacts, distribution within natural areas/human role as a vector, and feasibility of control (Carlson et al. 2008). Five are ranked as highly invasive (greater than or equal to 80), including two knotweed species (*Fallopia* x *bohemica*, *Fallopia japonica*), reed canarygrass (*Phalaris arundinaceae*), spotted knapweed (*Centaurea stoebe*), and one infestation of giant hogweed (*Heracleum mantegazzianum*). The majority of the estimated gross acreage is reed canarygrass with 3,806 gross acres. Five species are ranked as highly invasive (70-79), including two of the hawkweeds ranked at 79 and covering an estimated 173 gross acres (*Hieracium aurantiacum*, *Hieracium caespitosum*). The remaining 11 species are ranked as moderately invasive. The complete list of 89 species is provided in Appendix B of the *Invasive Species Risk Assessment* (Johnson 2019b).

Table 59. Invasive plants within the Central Tongass project area ranked as moderately invasive or higher

Species	Gross acres	Rank	Where found/Treatment if any
Knotweed (*Fallopia japonica* and *Fallopia* x *bohemica*)	20	87	Tarp treatment in Stikine – Leconte Wilderness; Herbicide treatments at NFS admin site, on NFS land, and on non-NFS lands
Spotted knapweed (*Centaurea stoebe*)	0.09	86	Hand-pulled on NFS and non-NFS lands at Kake, thought eradicated
Reed canarygrass (*Phalaris arundinaceae)*	3,806	83	Hand pulling in Petersburg Creek – Duncan Salt Chuck Wilderness and along lower Raven Trail; Herbicide treatments at admin sites, in riparian restoration sites, along select road systems, and along the river in the Stikine-LeConte Wilderness
Giant hogweed (*Heracleum mantegazzianum*)	0.001	81	Non-NFS lands, one location only
Orange hawkweed (*Hieracium aurantiacum*)	201	79	Tarp treatments in S. Etolin Wilderness and at SUP sites; Herbicide treatments at NFS admin sites and along select NFS roads
Meadow hawkweed (*Hieracium caespitosum*)	1.3	79	Herbicide treatments at NFS admin sites and along select NFS roads
Canada thistle (*Cirsium arvense)*	0.1	76	NFS and non-NFS lands, roadside
Field sowthistle (*Sonchus arvensis*)	0.1	73	Non-NFS land, roadside
Creeping buttercup (*Ranunculus repens*)	32	72	NFS and non-NFS lands, road shoulder and recreation sites
Bigleaf lupine (*Lupinus polyphyllus* ssp. *polyphyllus var. polyphyllus*)	0.08	71	Non-NFS land, road shoulder
Scotch broom (Cytisus *scoparius*)	0.1	69	Non-NFS land, thought eradicated
Robert geranium (*Geranium robertianum*)	0.1	67	Hand pulling on non-NFS land, road shoulder
Pale yellow iris (*Iris pseudacorus*)	0.4	66	Digging on NFS lands, recreation sites, thought eradicated
Bird's foot trefoil (*Lotus corniculatus*)	0.5	65	NFS and non-NFS land, road shoulder
Tall fescue (*Schedonorus arundinaceus*)	6.7	63	NFS and non-NFS lands, road shoulder

Species	Gross acres	Rank	Where found/Treatment if any
Stinking willie (*Senecio jacobaea*)	0.1	63	Non-NFS land, road shoulder
Smooth brome (*Bromus inermis*)	0.4	62	NFS and non-NFS lands, road shoulders
Oxeye daisy (*Leucanthemum vulgare*)	277	61	Human disturbance on NFS and non-NFS lands: homes, road shoulders, admin sites
Bull thistle (*Cirsium vulgare*)	6.1	61	Digging up on NFS land, road prism; non-NFS lands road shoulder

Humans have been the most significant vector for the introduction of invasive plants within the project area. Communities are invasive hotspots - Wrangell with 65 different species, Petersburg with 53 and Kake with 52. Roughly 1,117 gross acres are documented on non-NFS lands, with surveys focusing on communities and state highways. Typically the spread radiates out from these sources over time as people recreate and work across the landscape. Knotweed is a species of concern regarding spread, as the shrubs are predominantly located within the communities. However, small infestations have been documented in the Stikine-LeConte wilderness and islands outside of the city of Wrangell.

Reed canarygrass, on the other hand, was utilized in the seed mix for erosion control, and is distributed throughout the road corridor (Johnson 2019b). Because of the seeding along the road system, this is one species that is moving into riparian corridors as wind and water transport the seed form road stream crossings. There are presently 443 gross acres inventoried within the riparian management area; however, the majority of these gross acres are at stream crossings and not downstream within the stream corridor.

Brass buttons (*Cotula coronopifolia*) in the Petersburg Creek – Duncan Salt Chuck wilderness is one of the exceptions to humans as the vector. The source of this infestation within the intertidal (418 gross acres) and estuarine (212 gross acres) environment is unknown. Reed canarygrass in the Stikine-LeConte wilderness is now being transported by water, as well as by humans and spreading up sloughs. Moreover, these are the only infestations within wilderness not associated with a cabin or special use site.

Thomas Bay is notable for not having any invasive plants ranked as moderate or higher by the ACCS along NFS roads. The community of Agassiz does have one infestation of reed canarygrass (0.1 gross acres) and one infestation of black bindweed (*Fallopia convolvulus*) within a garden (0.0001 gross acres).

The estimated 5,811 gross acres of infestation is 0.16 percent of the project area. When looking at the 6th order Hydrologic Unit Classification (HUC), or drainage basin, the largest proportion of any given watershed infested by invasive plants is in the Duncan Salt Chuck Wilderness. Roughly 2 percent of the North Arm Duncan Canal – Frontal Duncan Canal Watershed - based on gross acres - is infested by brass buttons, which includes the infestation below the mean high tide line (Johnson 2019b).

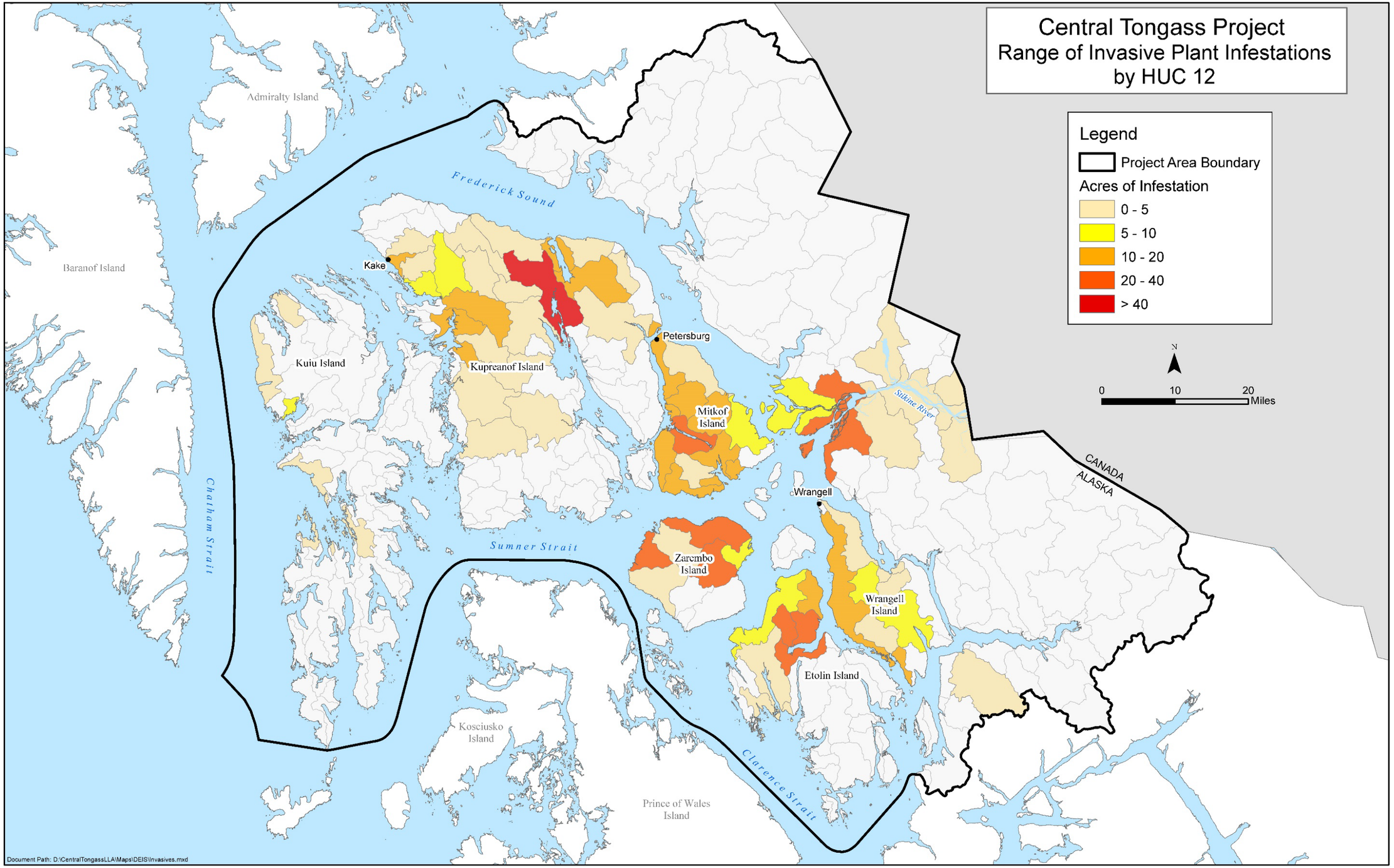


Figure 16. Range of invasive plant infestation in the Central Tongass project area

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Current Treatments

Invasive species treatments implemented under the Wrangell-Petersburg Weed Management Decision Memo (USDA Forest Service 2013) on the Wrangell and Petersburg Ranger Districts included 37 gross acres of manual and mechanical treatments in 2017, and 147 gross acres of herbicide treatments (estimated at 22.1 canopy acres). In 2018, 25 gross acres of manual and mechanical treatments occurred, with 102 gross acres of herbicide treatments (estimated at 15.2 canopy acres).

The Wrangell-Petersburg Weed Management Environmental Assessment assumed a 10 percent annual increase in invasive plant infestations, and an increasing percentage of acreage controlled for any given treatment site (USDA Forest Service 2013). When looking at four riparian restoration treatment sites on the Petersburg Ranger District, the average decrease in canopy acreage after year 1 was 49 percent (predicted 30 percent). After year 2 an additional 15 percent decrease in canopy acreage was measured, although this is conservative because adjacent areas were treated for the first time as well (predicted 20 percent). This provides only one example and is not representative across treatments; however, it shows treatments are out-pacing the expected efficacy. Invasive plant treatments on Etolin Island on the WRD started with 10.8 canopy acres treated in 2015 and decreased to 2.6 canopy acres by 2018 (de Montigny 2019).

Environmental Effects

Climate Change

Regardless of the alternative, changes in Southeast Alaska's climate could create the conditions that encourage the spread of invasive plants into new areas. Changing climate may also result in range extensions for invasive plant species (Hinzman et al. 2005), and they may become established or more widespread within the Central Tongass project area as a result. Changes in growing conditions would likely favor some plant species and stress others. There is uncertainty about the effect changes in the climate could have on invasive plant populations in the project area.

Risk of Introduction or Spread of Invasive Plants

Alternative 1 – No Action Alternative

Direct and Indirect Effects

Watershed Improvements

East Ohmer Creek and Skanax Creek restoration activities with heavy equipment, and the hand-crew restoration projects for both the Wrangell and Petersburg Ranger Districts have been approved. Invasive plant treatments are on-going as allowed by the *Wrangell-Petersburg Weed Management EA* (USDA 2013) and current funding levels.

Negligible direct and indirect effects for the approved watershed restoration activities are expected due to current invasive plant treatments controlling existing infestations within and/or adjacent to the project sites. The invasive plant treatments directly reduce the size and number of infestations within the Central Tongass project area; therefore the risk of introduction and spread is **low** at watershed improvement sites.

Recreation Management

The Sonar cabin replacement, Anan Wildlife Observatory trail and observatory reconstruction, and Raven Trail construction are three projects within the project area that were approved for implementation prior to the Central Tongass Project proposal.

Weed BMPs (Krosse 2017) were recommended for these projects to minimize the risk of introduction or spread. Direct and indirect effects should be negligible to minor as 1) invasive plant treatments are occurring along the Anan Trail to control the infestations, and 2) the Raven Trail does not pass through high-risk habitat. Sonar Cabin does occur in high-risk habitat along the Stikine River; hence the potential minor direct and indirect effects. The level of risk is **low**.

Access Management

Only a portion of the 1,703 miles of open roads are maintained. Under Alternative 1, road construction, reconstruction and maintenance associated with on-going timber sales such as Navy, Frenchie Ridge and Skipping Cow will continue (see the Catalog of Events, Appendix C, for the complete list of the present and foreseeable activities within the project area).

Direct and indirect effects are expected to be moderate because highly invasive plants such as reed canarygrass occur along the NFS road system and are likely to spread along the new roads over time. The direct effects of road construction are straightforward as the soil is heavily disturbed. Indirectly, the canopy is opened up, including beyond the road bed, creating more habitable conditions for invasive plants. Moreover, new roads increase access for people which increases the foot and vehicle traffic (vectors). The heightened risk occurs from road passage through high value and vulnerable habitats such as riparian corridors and wetlands. The level of risk is **medium to high** because highly invasive plants are present and road construction is creating new habitat. Moderate risk is for road segments in forested habitat with stream crossings on Class IV streams; risk is high for road segments through non-forested wetland and with stream crossings on Class I, II, or III streams. The exception is the road work on Etolin Island where the level of risk is low due to the invasive plant control efforts over the past 5 years.

Culvert replacement and road maintenance will have minor to moderate direct and indirect effects depending on the distribution of moderately to highly invasive plants and the extent of disturbance. For example, grading a road bed with orange hawkweed along the road shoulder will likely spread the plant, whereas brushing may incidentally transport plant propagules. Timing becomes important as well, as brushing when seed is set will spread the plant more readily than prior to flowering. The level of risk is **medium to high** because of the likelihood of spread and the potential for high-value sites such as streams.

Vegetation Management

Thinning to benefit timber production, and riparian and wildlife resources is on-going, as are several timber sales (see the Catalog of Events, Appendix C for the complete list).

Thinning to benefit timber production, and wildlife or riparian resources has negligible direct and indirect impacts on the spread or introduction of invasive plants into a natural setting. The soil is not disturbed and typically the canopy is not opened up enough to allow the establishment of graminoids. The level of risk is **low**.

Timber harvest directly opens up the canopy, and depending on the yarding method, can disturb the soil as well. Direct and indirect effects range from minor to moderate. Indirect impacts are consistent across the alternatives and could include: 1) changes in the light regime, 2) increased water table due to the absence of evapotranspiration and potentially from soil compaction, 3) increased competition due to changing abiotic factors, particularly from invasive plant species, and 4) increased human use for recreation and subsistence as access is provided. The level of risk is low for spread into the forested habitat that is harvested; however, the level of risk is **medium** for the spread or introduction of invasive plants from the equipment moving in and out of the harvest area.

Cumulative Effects for All Alternatives

Direct, indirect and cumulative effects are described in the existing NEPA documents. Watershed restoration, thinning and recreation management activities will have a negligible contribution due to the existing control efforts, the low-risk habitat, and in the case of watershed restoration, stabilizing an unraveling system. Invasive plant treatments likewise lower the risk of introduction and spread and have a beneficial effect. Access management and timber harvest contribute to the cumulative effect as invasive plants are spread and/or introduced either directly through the activity or indirectly as habitat is opened up and natural vectors transport invasive plants. Lacking the capacity for more invasive plant treatments means that at the predicted 10 percent annual increase (USDA 2013), treating 182 gross acres does not keep up with the projected 581 gross acre increase (5,811 * 10 percent).

Alternatives 2 and 3 – Effects Common to Both Alternatives

All activities outside of timber harvest and associated road construction are common to both alternatives; therefore, the effects for those actions are analyzed together. Where comparisons to existing actions in Alternative 1 are warranted, the details are provided. The effects to invasive plants for Alternatives 2 and 3 are evaluated separately for timber harvest and access management due to the difference in acreage proposed for each alternative.

Ground disturbance associated with the Central Tongass Project provides an opportunity for invasive plant introduction or expansion. All potential activities disturb soil and/or remove existing vegetation, providing opportunities for invasive plants to establish or spread. The impacts of invasive plant spread and colonization can often spread beyond the area of disturbance.

Direct and Indirect Effects

Watershed Improvements

Watershed restoration activities will remove cut logs from the roadside stands, as well as root wads. Increased light reaching the soil is a direct effect of harvest. Additionally, where root wads are removed, mineral soil is exposed. Equipment and personnel working in the area are a vector from a seed source along the road corridor into the stands. Indirectly, removal of timber opens up the stand and exposed soil to windblown seed.

The direct effect of proposed restoration activities within the stream channel will be the movement and exposure of soil during excavation and log placement. Heavy equipment will be moving from access points down into and along the stream channel, directly disturbing soil not protected by corduroy. Equipment and personnel moving from the road corridor into the stream channel and harvest unit are vectors for the dispersal of reed canarygrass and other invasive plant species (likewise for barrier modifications). Indirectly, opening old roads and developing corduroy trails will create open paths in the forest through which wind and equipment could transport seed. On the other hand, stabilizing the stream channel in the long-term will improve habitat for native plants and decrease the likelihood of non-native plant establishment. With regard to barrier modifications, the indirect effects would be negligible as exposed rock and concrete are not probable habitat for invasive plants.

Overall the direct effects of watershed improvement have a minor effect, but over the long term the indirect effects should be beneficial and therefore negligible. Barrier modification is expected to have a minor direct and negligible indirect effects. The risk is **medium** with regard to the spread or introduction of invasive plants because of the high vulnerability and the high value habitat.

Invasive Plant Treatments
The ability to treat emergent vegetation and assist in treating non-NFS lands increases the opportunity to control invasive plants across southeastern Alaska and more effectively control invasive plants on the Wrangell and Petersburg Ranger Districts. Alternatives 2 and 3 would allow treatment of the brass buttons below the mean high tide line (in coordination with the State of Alaska), as well as riverine and palustrine systems with reed canarygrass that currently require narrow timing windows that coincide with the right water levels (which means that some years the treatment cannot occur).

The direct effect of expanding where treatments can occur by removing the treatment limit and allowing broadcast spray provides a greater flexibility to treat priority areas. Funding and personnel capacity constrains the treatment acres; however, the "all hands all lands" approach ought to have a more successful outcome with increased partnership capabilities and therefore increased treatment capabilities. To summarize, Alternatives 2 and 3 allow for at least 650 more gross acres of invasive plant treatments than Alternative 1 based on habitat. Additional acreage may be treated through partnerships with other land owners to control common non-desirable plant species.

Recreation Management
Ground disturbance associated with cabin, shelter and trail construction, as well as cabin decommissioning, has the direct effect of exposing soil and the understory to light. Opening the road to ATV/UTV use introduces more vehicular traffic that may contain invasive seed. These activities all increase the likelihood of introducing invasive plants. These activities have the indirect effect of increasing public user days, and people and their equipment act as vectors for the introduction and spread of invasive plants. Minor direct and indirect effects are expected. Recreation sites typically occur in high vulnerability, high-value sites such as the upper beach meadow, lake shores, and within the riparian corridor. As a result, the risk is **medium** for the spread or introduction of invasive plants.

Vegetation Management
Thinning to benefit timber production, or wildlife and riparian resources has the same direct and indirect effects as Alternative 1. The risk is **low**.

Alternatives 2 and 3 –Timber Harvest and Access Management

Direct and Indirect Effects

Vegetation Management
The direct and indirect effects related to old-growth harvest are stated in Alternative 1. Alternative 2 proposes 13,500 acres of harvest – 9,000 acres of old-growth and 4,500 acres of young-growth timber whereas Alternative 3 proposes 11,715 acres – 8,000 acres old-growth and 3,715 acres of young-growth timber harvest. Alternative 2's harvest footprint is 1,785 acres greater - 1,000 of those acres in old-growth habitat - than Alternative 3. The risk is **medium** because of the high risk, high vulnerability habitat adjacent to and traveled through during harvest activities. Moderately to highly invasive plants are present in most watersheds proposed for harvest.

Access Management
The direct and indirect effects of road construction, maintenance and reconstruction are the same as those stated in Alternative 1. Alternative 2 would directly impact 2,284 acres whereas Alternative 3 would impact 1,883 acres. Both alternatives propose developing or improving 44 rock quarries. The risk of spread or introduction of invasive plants is **high** for most NFS roads

because infestations occur along the road corridor, and the road corridor crosses high value and high vulnerability habitat or connects with high value habitat.

Cumulative Effects

In addition to the present and foreseeable activities summarized in Appendix C - Catalog of Events, the State of Alaska, Mental Health Trust and Sealaska hold lands could include old-growth harvest in the future as could the State of Alaska intertie/road corridor easements.

Collectively, the cumulative effects of the activities proposed in the Central Tongass Project range from a negligible to a moderate impact on the risk of introduction or spread of invasive plants within the project area (Table 60). Invasive plant treatments and riparian restoration activities should have the beneficial effect of restoring natural habitat and decreasing the presence of both the invasive plants and the conditions that favor invasive plant growth. Other watershed improvement activities such as barrier modifications or lake enrichment will not likely contribute to the cumulative risk of spread. Similarly, thinning is not likely to cumulatively contribute to the risk of spread since it is geared to move forested areas to more mature stands which are less hospitable to invasive plants.

Table 60. Summary of effects and risk of invasive plant introduction and spread for each category of activity in the Central Tongass Project

Activity category	Alternative 1				Alternatives 2 and 3			
	Direct Effect	Indirect Effect	Cumulative Effect	Risk	Direct Effect	Indirect Effect	Cumulative Effect	Risk
Watershed Improvement	Negligible	Negligible	Negligible	Low	Minor	Negligible	Negligible	Low to Med
Recreation Management	Negligible	Negligible to Minor	Negligible	Low	Minor	Minor	Minor	Med
Vegetation Management	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Med	Alt 2 > Alt 3 Moderate for both	Alt 2 > Alt 3. Moderate for both	Moderate for both	Low to Med
Access Management	Moderate	Moderate	Moderate	Med to High	Alt 2 > Alt 3. Moderate for both.	Alt 2 > Alt 3. Moderate for both.	Moderate	Med to High

Design Features and Monitoring

Following weed BMPs (Krosse 2017) will minimize the likelihood of the introduction and spread of invasive plants. Invasive plant surveys will be conducted and activity-specific project design features will be detailed during the proposed activity review in accordance with Appendix A - Implementation Plan and Activity Guides.

Human Health

Human health and safety are special concerns when considering an invasive plant management project due to the potential for herbicide exposure to applicators, the public, and employees.

Summary

Herbicide exposure could occur via direct contact, drinking contaminated water, eating contaminated plants or fish, gathering and using special forest products, or as a result of recreational users coming into contact with contaminated vegetation. However, the likelihood of harm from such exposure is extremely low for several reasons: the proposed herbicides are considered to have low toxicity levels (toxicity is defined as the degree to which a substance is

able to damage an organism), human contact with the herbicide would be minimal, and the herbicide is taken up quickly by plants. Strictly adhering to label requirements, following the project design features (PDFs) in Appendix A, the Pesticide Use Proposal (PUP) process, and the permitting or regulatory requirements provide additional precautionary guidance when applying herbicides. After evaluating the SERA risk assessments for aminopyralid, glyphosate and imazapyr under agricultural conditions of broadcast spraying the specified rate over an entire acre, and considering the EPA review on the health effects of glyphosate and the precautionary steps mentioned above, the Forest Service concludes the risk of the specified herbicides negatively affecting human health is low for Alternatives 1, 2 and 3.

Existing Condition

The Forest Service has treated up to 182 gross acres of invasive plants in a single year with 147 of those acres treated with either glyphosate or aminopyralid. Other treatment methods include hand pulling, tarping, and mowing. The community of Kake is treating roughly 5 acres of knotweed with glyphosate through either foliar spot spray or stem injection. The community of Petersburg is treating roughly 2 acres of knotweed with glyphosate or with tarps. The Alaska Department of Transportation (ADOT) has herbicides as a tool in its *Integrated Vegetative Management Plan*[12], however, herbicide use within the right of way is not occurring.

Environmental Effects

Application Rates

Herbicide mixture ratios are determined based on label application rate recommendations and more species-specific knowledge that revolves around effectiveness at different times of year. Application may include cut-stump painting, stem injection, or foliar spot spray or broadcast spray. SERA risk assessments utilized the maximum application rate permissible by the label to evaluate and determine the acceptable available tools for treating invasive plants (Table 61).

Table 61: Herbicides considered for use in the proposed action, including formulations and the range of application rates

Active Ingredient	Formulation	Range of application rates[1]
Glyphosate	RoundUp Custom	0.5 – 8 lbs a.e./acre
Imazapyr	Habitat	0.03 – 1.5 lbs a.e./acre
Aminopyralid	Milestone	0.06 – 0.11 lbs a.e./acre

[1] Acid equivalent (a.e.) indicates the acid portion of the active ingredient in the herbicide formulation

Alternative 1 – No Action Alternative

Herbicide application by Forest Service employees utilizes small quantities with treatment one to two times a year. On the Petersburg Ranger District, 64 ounces of RoundUp Custom (aquatic formulation of glyphosate) and 1.9 ounces of Milestone (aminopyralid) were applied in 2018 to treat 11 gross acres of knotweed, reed canarygrass and orange hawkweed in several different watersheds. On the Wrangell Ranger District, 299 ounces glyphosate and 2.1 ounces aminopyralid were used to treat 182 gross acres of reed canarygrass, yellow and orange hawkweeds, knotweed and oxeye daisy across several different watersheds. Under the *Wrangell-Petersburg Weed Management Environmental Assessment* (USDA Forest Service 2013), a 200-

[12] http://dot.alaska.gov/stwdmno/ivmp

acre limit was put in place largely due to limited resources and the high cost of treatment per acre.

Alternatives 2 and 3

The amount of herbicide used in Alternatives 2 and 3 could be higher than in Alternative 1 due to potential partnerships with other agencies, treatment in previously restricted habitat (emergent vegetation), no acreage treatment limit, and the allowance for broadcast spray. The all lands approach provides a more efficient means of treatment for many invasive plant populations that span ownership boundaries. Additionally, partnerships would allow for additional grant funding for invasive plant treatments and increase treatment capacity. The ability to treat emergent vegetation increases potential habitat for treatment by roughly 650 gross acres. No limit on treatment acres increases the Forest Service capacity to treat invasive plants, as funding allows. Lastly, broadcast spray as a tool for specific locations enables treatment of larger areas more quickly.

The SERA herbicide risk assessments include analysis for both workers and the general public. The Forest Service chose low risk chemicals for proposed treatments. Table 62 provides a summary of the ratings of risk to human health and safety based on this analysis. The *Human Health and Herbicide Use Report* (Krosse 2019) completed for the *Northern Tongass Integrated Weed Management EA* draft details the analysis of effects to human health. Because the Northern Tongass Integrated Weed Management and the Central Tongass projects are similar, the analysis is hereby incorporated by reference. The types of herbicide proposed for use are considered to have low or negligible toxicity levels and consequently the inherent level of health risk is minimal and readily mitigated through full compliance with herbicide label stipulations, worker training requirements, and PDFs for safe herbicide storage, transportation, use, and disposal.

Table 62. Rating of risk to human health and safety for each herbicide and adjuvants (in general) considered in all alternatives

Rating of Risk	
Negligible	**Low**
Aminopyralid	Glyphosate
Imazapyr	Adjuvants

Activities considered in the effects analysis for both workers and public safety in the short term (seasonally) and long-term (greater than ten years) are:

1. The accidental, incidental or general exposure that could occur during herbicide application by workers (possibility of direct contact or ingestion);
2. The potential for short-term or acute exposure by the general public due to consumption of water, fish, fruit or vegetation coming into contact with sprayed foliage after application;
3. The potential for long-term or chronic exposure by the general public due to consumption of water, fish, fruit or vegetation coming into contact with sprayed foliage after application; and
4. The potential for long-term or chronic (repeated/cumulative) exposure due to any herbicide use outside of Forest Service lands (for example, people treating invasive

plants on their own property, or other invasive plant eradication projects that could potentially utilize herbicides).

What follows is a summary of the effects analysis (Krosse 2019).

Direct and Indirect Effects – All Alternatives

Alternatives are assessed together for effects, as the potential increase in herbicide use in Alternatives 2 and 3 still falls well below the SERA risk assessment scenarios for broadcast spray in an agricultural setting. The Northern Tongass Integrated Weed Management Environmental Assessment (USDA Forest Service 2019) analyzes the effects of herbicide use at the highest application rate permissible by the label which provides the maximum scenario to analyze for effects to human health.

Potential adverse direct and indirect impacts to human health and safety regarding herbicide exposure and risk are addressed for each herbicide. The risk assessments (SERA reports) referenced in the analysis conducted exposure assessments for both workers and members of the general public for each of the proposed herbicides. The effects of using both the typical and the maximum application rate as permitted by the label, are discussed in the risk characterization using worst-case exposure assumptions. These scenarios include the effects of aerial application of herbicide which are not being considered as application methods for this project.

Aminopyralid

The direct and indirect human health and safety hazard and risk for aminopyralid is negligible. This conclusion is based on the hazards (that is, formulated end-use products highest toxicity category is IV; "not likely" to be carcinogenic; and no basis to assert aminopyralid would cause an adverse effect on nervous system, immune system, endocrine functions, reproduction and development) and dose response and risk characterization longer-term and short-term exposure calculations were below the level of concern There is no basis for suggesting that adverse effects are likely in either workers or members of the general public even at the maximum application rate that might be used in Forest Service programs (Table 61).

Glyphosate

The analysis of direct and indirect effects includes pure glyphosate and its salts, and excludes any of the adjuvants. Direct effects of glyphosate contact with the skin, eyes or through inhalation include mild to moderate temporary irritation. Data suggests that glyphosate is not readily absorbed by the skin. Additionally, ingested glyphosate is typically eliminated rapidly from the body. Indirect effects are more challenging to pinpoint given the complexity of environmental variables (and are therefore largely based on experiments with animal subjects). To date, the risk of causing reproductive, neurologic, immunologic, or disrupting the endocrine system has been deemed low. More subjects receive greater attention than others, for example studies are few for measuring any effects to the endocrine system Glyphosate as a carcinogen has received much attention and is therefore a stand-alone health issue.

Glyphosate and Cancer

The analysis is based on the SERA risk assessments and literature (Krosse 2019). In early 2019 the EPA reviewed public comments and current literature and found no new information that changed its conclusion that glyphosate “is not likely to be carcinogenic to humans” (EPA 2019a). Additionally, in April 2019 the EPA released an updated toxicology profile for glyphosate. Aside from the known temporary irritation of the eye or skin with contact or gastrointestinal distress,

the EPA found no human health effects not related to acute high doses of glyphosate (EPA 2019b).

A paper by Zhang et al. (2019) looked at published studies regarding cancer risk for groups of people with the highest exposures to glyphosate (agricultural workers). Several issues have emerged concerning the methods used in the analysis which warrant consideration. This paper only looked at existing studies and did not collect any new data. They merged data sets from across studies. The manner in which they merged data from dissimilar studies has drawn criticism of their techniques from cancer epidemiologists (those who study the patterns and distribution of diseases) (Salzberg 2019). Also, due to the focus only on high-exposure groups, the conclusions - possible multiple myeloma or non-Hodgkins lymphoma - applies to the high-exposure groups rather than the general public or occasional workers (Zhang et al. 2019).

Glyphosate is currently approved for use under the No Action Alternative. Best available science indicates that glyphosate, under any alternative, is not likely to cause cancer. Moreover, the potential increase in herbicide application under Alternatives 2 and 3 is for small areas and exposure is short-term in duration. The level of risk is determined low.

Imazapyr

The human health and safety hazard and risk assessment for imazapyr is negligible. Direct effects of exposure to imazapyr include mild irritation to the skin and eyes (studies show at high exposure levels). No adverse indirect effects have been observed in reproductive, developmental, carcinogenic, mutagenic or neurologic studies.

Adjuvants

Adjuvants are compounds added to the herbicide formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant, e.g. surfactants) or offset any problems associated with its application (special purpose or utility modifiers, for example, colorants and defoamers).

Adjuvants are not under the same registration guidelines as pesticides and the US EPA does not register or approve the labeling of adjuvants. The State of Alaska DEC also does not have an approved adjuvant list. This project references the adjuvants approved for aquatic use in the State of Washington. (https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-standards). This project will use only low-risk aquatically approved surfactants (for example, Agri-Dex®, Class Act® NG®, Competitor®). This feature would eliminate potential impacts from surfactants such as Polyoxyethyleneamine (POEA) which can have adverse effects to aquatic wildlife species.

Diamond and Durkin (1997) completed a SERA risk assessment for Agri-Dex®, a paraffin oil-based surfactant not listed by the EPA on its inerts list for toxicological concern. The label does have the caution symbol for "mildly irritating to the skin and eyes." The surfactant was noted for its low toxicity to mammals and aquatic organisms (Diamond and Durkin 1997; Bakke 2007), or "practically non-toxic" by the Washing State Department of Agriculture (2017). Class Act®, a fertilizer/surfactant mixture has "caution" on the label for mildly irritation to the skin and eyes due to the ammonium nitrate present in the mixture (Bakke 2007). Toxicity to mammals and aquatic organisms is low (ibid) or "practically non-toxic" by the State of Washington (2017). Competitor was determined slightly toxic to fish under acute exposure scenarios and "practically non-toxic" to aquatic invertebrates (State of Washington 2017). The health risk for humans and the environment is considered low due to the above findings and the fact that these compounds

are proprietary and not all ingredients are disclosed. (Note: The State of Alaska does not require adjuvant registration.)

Cumulative Effects

Workers and the public may be exposed to the herbicides used to treat invasive plants under all alternatives in this project. Cumulative doses are possible within the context of this project, or when combined with herbicide use on adjacent lands, or home use by a worker or member of the general public, or from foods from the grocery store that we consume. However, the risk is very small that a person would receive additive exposures because studies indicate that the selected herbicides are not retained in the body.

Overall, herbicide use associated with any alternative, even at full implementation, would contribute no measurable effects when combined with the effects of other past, present and reasonably foreseeable activities. To further minimize the cumulative risk and potential harm of herbicide use on human health and safety, project design features (see Appendix A) have been developed and will be implemented as necessary.

Early Detection / Rapid Response (EDRR)

If effective treatments of new infestations required herbicide treatments outside the scope of the project, or if project design features could not be applied without a significant loss of effectiveness, further analysis would be required.

Herbicide Treatment Conclusions

Herbicide use may have direct beneficial effects to human health and safety by decreasing exposure to potentially dangerous tools, such as chainsaws or sharp objects used to treat weeds manually and mechanically. The types of herbicide proposed for use are considered to have low toxicity levels and consequently the inherent level of health risk is minimal and readily mitigated through full compliance with herbicide label stipulations, worker training requirements, and PDFs for safe herbicide storage, transportation, use, and disposal. Herbicide would be an effective tool in many cases, and as such its use would decrease as the number of infestations decrease. Combining the EDRR treatment strategy with herbicide while populations are small and scattered is expected to reduce overall treatment costs with less chemical use over the life of the project, and less disturbance due to fewer entries than may be necessary with manual and mechanical treatments.

Karst and Cave Resources

This section discusses the potential effects to karst and cave resources on NFS lands in the project area.

Summary

The karst management analysis shows similar effects between Alternatives 2 and 3. Alternative 3 involves fewer acres of old-growth timber harvest than Alternative 2, but both have a similar young-growth component. Alternative 2 involves more acres of old-growth harvest and acres of young-growth. Cumulative acres of karst disturbance are very similar between the action alternatives. Assuming Appendix A and 2016 Forest Plan karst and cave management direction are fully implemented, there should be no adverse effects to karst and cave resources.

Regulatory Framework

Applicable federal, state, and municipal laws, regulations, policies which govern the management of karst include:

- The *Federal Cave Resources Protection Act* (FCRPA) of 1988 (16 U.S.C. 4301-4309; 102 Stat. 4546), 36 CFR Part 290, 36 CFR part 261,
- Forest Service Manuals 2356 and 2880,
- Forest Plan, Karst and Cave Resources, Forest-wide Standards and Guidelines pp. 4-23 to 4-25, Standard S-YG-KC-02 p. 5-6, and Appendix H (USDA Forest Service 2016c).

Methodology

Units of Measure

To compare the effects to karst and cave resources between alternatives the following measures will be used:

- Estimated acres of past timber harvest,
- Miles of existing road,
- Acres of gross unit pool on karst by alternative, and
- Miles of proposed roads, either NFS or temporary.

These measures align with the 2016 Forest Plan Karst and Cave Resource direction and direction in Appendix H of the 2016 Forest Plan.

Analysis Methods

A karst resource vulnerability assessment is conducted for each project regardless of its scale following direction in the 2016 Forest Plan Appendix H.

A karst vulnerability assessment is a four-step process. It includes:

1. Identify Potential Karst Lands. Identify those lands underlain by carbonate rocks. As a practical matter, all lands underlain by carbonate rocks within the project area should be considered a karst landscape. These include outcrops of limestone, marble, and dolomite.

2. Inventory Karst Resources. At the beginning of any ground-disturbing activities such as timber harvest or road construction, determine the activity's proximity to or position on a karst landscape. If it is determined that karst occurs in the area, require an inventory adequate to characterize the resources. Assess the degree and location of karst development.
3. Delineate Karst Hydrologic System and Catchment Area. Define, to the extent feasible, the karst hydrologic system and the recharge area watershed or catchment area for each karst system. The character of the catchment area (such as, the area, slope gradient, vegetation, water quality, soils, etc.) controls the nature of the receiving karst system and defines the volume of runoff available for infiltration into the system. Recharge area delineation is a crucial component of vulnerability mapping; it is important to know where the water comes from and resurges to credibly assess and characterize possible impacts.
4. Assess Vulnerability of Karst Terrain to Activity. The final step is to delineate the land under investigation into various vulnerability categories. An area's vulnerability rating must be sensitive to potential surface management practices based on the extent to which epikarst has developed and the openness of the karst system. Where recharge is diffused through deep soils, the underlying karst is less vulnerable to increased sediment inputs and other pollutants than in areas where recharge is discrete and soils are thin or nearly absent. Where soils are thin or nearly absent, surface disturbances will almost always result in exposure of the epikarst, providing an easy pathway for sediment and other pollutants to enter the subsurface drainage network. Discrete recharge areas are especially vulnerable to ground-disturbing activities because the flowing surface water can carry sediment and other pollutants directly to the subsurface drainage network. Karst vulnerability mapping recognizes the variability in karst terrain and uses the vulnerability concepts described here to assign a high-, medium-, or low-vulnerability rating to an area of karst terrain. The proposed ground-disturbing activity is considered when determining mitigation or applying karst management guidelines.

Spatial and Temporal Context for Analysis

The boundary selected for analysis of karst and cave resources is the same as the Central Tongass Project boundary. Direct, indirect, and cumulative effects to karst and cave resources are assessed at the stand or harvest unit scale and by karst watershed or catchment area when defined.

The temporal bounds of all existing karst and cave resource disturbances are from the beginning of timber harvest and road construction to the present, and through the life of the project.

The timeframe for the effects analysis looks at all past disturbance, such as, past harvest, road construction, and quarry development on karst and within the karst watershed catchment areas, and proposed activities, in this case for the next 15 years. Recovery rates for impaired karst systems have not been established. For purposes of this analysis, the Forest Service relies on the vulnerability assessment to protect karst features and the discrete and diffuse recharge to those systems.

Incomplete or Unavailable Information

Though focused geologic mapping has been completed for much of the project area, some boundaries of the karst polygons have not been field verified. These boundaries will be verified during field reconnaissance.

Past karst resource inventory has been focused on proposed timber harvest units and the lands immediately adjacent to those units in proposed timber sale projects since 1990. Approximately 97 percent of the NFS karst lands within the project area have not been assessed as to their vulnerability. Many of these acres underlie young growth. Much of the karst lands that were assessed have recently been transferred to Sealaska Corporation and Alaska Mental Health Trust Authority. Approximately 3,470 acres of karst lands have not been assessed in the gross unit pool with 572 acres in old growth and 2,898 acres in young growth. One of the benefits of this project will be completing a vulnerability assessment for these acres.

Affected Environment

Karst lands impose land management challenges not encountered in non-karst areas because this three-dimensional landform functions differently than other landforms. Karst resources must be evaluated according to their vulnerability to land uses affecting karst systems. Vulnerability mapping recognizes that some parts of the karst landscape are more sensitive than others to surface activities and groundwater contamination. These differences in vulnerability may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from karst groundwater systems. The vulnerability categories and their criteria are briefly described below and discussed in detail in the 2016 Forest Plan, Appendix H.

Since 1991, within the project area few inventories of karst and cave resources have been conducted. A few caves have been inventoried and mapped. The full extent of the karst lands has not been mapped. No tracer dye studies have been conducted to determine karst ground water flow paths. What inventory exists has been accomplished through efforts in support of timber sale and road building projects. The current karst resource data base has evolved from those efforts. Table 63 below summarizes the acres of karst within the project area and the acres of karst disturbed by various management activities.

Analysis of GIS data shows that 27,509 acres of karst exist in the project area, 25,010 acres on NFS lands. Of these, 24,327 acres are known to be karst but their vulnerability has not been assessed. Six-hundred and eighty-three (683) acres have been designated as high vulnerability during previous inventory efforts. About 6,742 of the karst lands mapped on NFS lands have had timber harvest, 27 percent of the karst lands (Table 63). Also of concern are the adjacent land whose waters flow to the karst, sinking along its margins.

Low-Vulnerability Karst Lands

Low-vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate.

Moderate-Vulnerability Karst Lands

The moderate-vulnerability karst lands are those areas where resource damage threats associated with land management activities, timber harvest and road construction in this instance, in the areas are appreciably greater than those posed by similar activities on low-vulnerability karst lands.

High-Vulnerability Karst Lands

The high-vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low-

or moderate-vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features.

Table 63. Existing karst resource condition in the Central Tongass project area

Total Karst Acres	Acres
Karst within project boundary	27,509
NFS karst within project boundary	25,010
Karst by LUD and Vulnerability	**Acres**
NFS karst within project boundary karst but not assessed	24,327
NFS karst within project boundary high vulnerability	683
NFS karst within project boundary moderate vulnerability	0
NFS karst within project boundary low vulnerability	0
Sum	25,010
Harvested Karst Acres in the Project Area All Ownerships	**Acres**
NFS karst harvested but not assessed	6,742
NFS karst harvested high vulnerability	6
NFS karst harvested moderate vulnerability	0
NFS karst harvested low vulnerability	0
Non-NFS karst harvested but not assessed	310
Sum	7,058
Roads	**Miles**
Miles of existing roads on karst on all ownership	60
Miles of roads on NFS karst	29

Invasive Plant Populations on Karst Lands

Invasive plant populations have been recorded on about 5,811 acres on all lands throughout the Central Tongass project area. Most infestations occur along road corridors, rock quarries, and other areas of human disturbance (see discussion in section *Invasive Plants* above). As mentioned previously, since most karst lands have not been assessed for vulnerability, it is possible that some infestations are on high-vulnerability karst lands. Most karst lands adjacent to invasive plant populations are likely low- to moderate-vulnerability karst; however, there is potential for high-vulnerability karst at higher elevations. The Northern Tongass Integrated Weed Management Karst Resources Report (Baichtal and Krosse 2019, located in the project record and hereby incorporated by reference), discusses the potential effects of invasive plant treatment measures on known karst lands. Those effects are expected to be similar for similar treatments on karst lands in this project area.

Appendix H of the 2016 Forest Plan provides direction for conducting karst vulnerability assessments prior to any surface management practice. The karst vulnerability assessment process described above under the methodology section is designed to identify those karst features (for example, the subsurface drainage network) most vulnerable to the impacts of sediments or other debris that may enter karst features as a consequence of surface activities (USDA Forest Service 2016a, p. H-6). Manual and mechanical invasive plant treatment methods have the highest potential to add sediment or other debris to the karst systems. Depending on the outcome of a karst vulnerability assessment, some management practices are avoided in high-

vulnerability karst, such as timber management and related activities, some recreational development, road construction and quarry development.

The potential effects of invasive plant treatments, including manual, mechanical, and herbicide methods, on karst lands are discussed below. More-detailed analysis of how these types of proposed treatments may affect karst areas is included in the Northern Tongass Integrated Weed Management Karst Resources Report (Baichtal and Krosse 2019).

Environmental Effects

Alternatives 2 and 3 propose similar activities but the amount of each activity varies between alternatives. Each alternative will have differing effects both possibly adverse and/or desirable. Assuming all 2016 Forest Plan karst and cave management direction and design features included in the Implementation Plan, Appendix A, are fully implemented, there should be no detrimental effects to karst and cave resources.

Any new road construction on karst will follow the 2016 Forest Plan Karst and Cave Resources Standards and Guidelines for road construction and quarry development (USDA Forest Service 2016a, pp. 4-23 to 4-25 and Appendix H, pp. H-5 to H-7).

Alternative 2 would have the highest percentage of disturbance, mostly in young-growth harvest acres. Alternative 2 would harvest the most acres of old growth (Table 64). Both action alternatives effects could initially increase in flow through karst systems after initial harvest in low- and moderate-vulnerability karst areas and subsequent (approximately 15 years post-harvest) decrease in flow through these karst systems due to dense forest regeneration (Aley et al. 1993). An increase of turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Tracer dye studies have shown that some downstream effects may be as much as a mile away within a 24-hour period, often at spring-fed anadromous streams (Prussian and Baichtal 2007). Karst resource design features and prescription development will strive to minimize these effects.

Approximately 11.6 percent of the gross unit pool is on karst, some 3,467 acres. These include 572 acres of old-growth and 2,898 acres of young-growth. For analysis, the assumption is that harvest of old-growth will be spread evenly across the landscape.

Action alternatives will consider harvesting 2,747 to 2,898 acres of young growth. None of these acres of karst have been assessed. Some of these acres will be found to be of moderate vulnerability. From other projects across the Forest, approximately 73 percent of these lands are found to be of moderate vulnerability. Because of the requirements of Standard S-YG-KC-02 (USDA Forest Service 2016a, p. 5-6), the maximum size of any created opening for commercial timber harvest must not exceed 10 acres with a maximum removal of 35 percent of the acres of the original harvested stand.

Table 64. Potential acres of harvest and miles of road construction on karst by alternative and percent change from existing

	Old growth/ Young growth	Total acres	% Gross unit pool acres on karst	Estimated acres of harvest on karst	Estimated miles of NFS and temp road	% Karst acres/miles change
Alt 2	Total old growth	42,779	1.3	572		7.8
	Total young growth	28,268	10.3	2,898		30.0

	Old growth/ Young growth	Total acres	% Gross unit pool acres on karst	Estimated acres of harvest on karst	Estimated miles of NFS and temp road	% Karst acres/miles change
	Total	**71,046**		**3,470**	**13.5**	**34.0**
Alt 3	Total old growth	36,778	1.0	358		5.0
	Total young growth	26,259	10.5	2,747		28.9
	Total	**63,036**		**3,105**	**13.5**	**31.5**

Alternative 1 – No Action Alternative

Direct and Indirect Effects

Under the No Action Alternative, none of the specific management activities proposed in the DEIS would be implemented to accomplish project goals and objectives. Natural disturbances and current management of the project area would continue as before.

Cumulative Effects

Cumulative effects to karst and cave resources occur at a stand or harvest unit scale and by karst watershed or catchment area when defined. Since no areas are proposed for harvest and no new roads will be constructed, no cumulative effects will occur in those stands or areas on karst.

According to Forest Service GIS, 2,898 acres of young growth are in the gross unit pool. Under this alternative, these acres would not be commercially thinned. By commercial thinning older young-growth stands on karst, the stand will have closer-to-pre-harvest tree spacing, thus hastening the hydrologic recovery of the site. The canopy of these stands are closed to varying degrees. Reducing the canopy cover could restore the “health” of young-growth forests on karst lands by increasing the volume of throughfall, flushing sedimentation out of diffuse and discrete karst openings, and reconnecting surface to subsurface flow pathways. The management of older young-growth stands can also hasten the return to more natural stand characteristics and conditions. Considering the above discussion, a commercial thinning prescription that minimizes ground disturbance and treats the whole stand, decreasing the canopy closure to increase throughfall would be best for the karst systems and their associated streams (Karst Review Panel, 2002; Prussian, 2011). By not commercial thinning these stands, possible benefits to the karst systems will not be realized.

Effects Common to Action Alternatives - Invasive Plant Management on Karst Lands

Both Alternatives 2 and 3 propose herbicide application (such as broadcast spraying, spot spraying, and hand/selective treatment) on invasive plant populations throughout the project area, as well as manual and mechanical treatment (hand pulling and tarping) particularly in areas with site-specific conditions or public concerns.

The potential effects of invasive plant treatments in karst lands are two-fold: the first is the potential for sediments to enter open karst features and subsurface drainage networks as a result of manual or mechanical treatment methods. The second are the impacts of the herbicides on water quality when or if it enters the karst system.

The preferred method of invasive plant treatment for the Central Tongass Project is herbicide application, through foliar spot treatment, stem injection, brushing, broadcast spraying or other targeted spraying. Using herbicides rather than manual or mechanical methods decreases the

potential for surficial erosion because the plant root mass is left undisturbed. However, herbicide treatments along streams and roadside ditches in karst lands may result in herbicide reaching water bodies through runoff and/or leaching. Whether herbicides enter the subsurface waters of karst features or not, literature suggests at the planned rate of application combined with treatment methods, the likelihood for adverse risk to water quality or aquatic organisms is minor (Whitacre 2019; Johnson 2019).

Three herbicides considered for use include glyphosate and imazapyr (aquatic-approved formulations) and aminopyralid (a selective herbicide used to target aster, legume and nightshade family plants among others). The aquatic formulations of imazapyr and glyphosate proposed for invasive plant treatments near aquatic systems would be expected to have only minor effects to water quality and aquatic organisms. While the herbicides considered for use in this project kill aquatic plants, aquatic habitats and the food chain would not be adversely impacted because:

- The amount of herbicide that could be delivered is relatively low in comparison with levels of concern.
- The duration to which any non-target organism (including aquatic plants) would be exposed is very short-lived and impacts to aquatic organisms would be localized.

The types of chemical application methods proposed (spot spraying, wicking, injection and broadcast) have negligible potential to harm beneficial uses of surface water and the function of aquatic organism when project design features are applied.

The use of herbicides adjacent and within water bodies will be allowed using only aquatic blend glyphosate and imazapyr. All label instructions for herbicide applications will be followed. A karst vulnerability assessment will be completed prior to any surface management practice, including the consideration of applying herbicide in karst terrain.

These and other design features as described in the Implementation Plan, Appendix A, are expected to minimize impacts to karst lands in the project area. Appendix A contains more-detailed information and guidance on the proposed use of herbicides, limitations, and required design features to reduce risk and potential effects to karst systems, as well as other project area resources.

Additional information on the use and potential effects of these herbicides on karst lands and aquatic systems is contained in the Northern Tongass Integrated Weed Management Karst Resources Report (Baichtal and Krosse 2019).

Alternative 2 – Proposed Action

Direct and Indirect Effects

Karst disturbance would increase by 3,470 acres (572 acres of old growth and 2,898 acres of young growth) and 13.5 miles of road. This equates to a 7.8 percent increase in harvest of karst old growth (Table 64).

Approximately 2,116 acres (modeled 73 percent) of young-growth management would be on moderate-vulnerability karst. The maximum size of any created opening for commercial timber harvest must not exceed 10 acres with a maximum removal of 35 percent of the acres of the original harvested stand (S-YG-KC-02). A commercial thinning prescription that minimizes ground disturbance and treats the whole stand, decreasing the canopy closure to increase throughfall would be best for the karst systems and their associated streams.

Effects from harvest could initially increase flow through karst systems after initial harvest in low- and moderate-vulnerability karst areas and subsequently (approximately 15 years post-harvest) decrease flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increased turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Karst resource design features and unit prescription development will strive to minimize these effects.

Cumulative Effects

Assuming all 2016 Forest Plan karst and cave management direction and design features included in the Implementation Plan, Appendix A, are fully implemented, there should be no detrimental cumulative effects to karst and cave resources. The karst vulnerability assessment will be used to approximate the disturbance index of specific karst watersheds and catchment areas.

Disturbance in the karst watersheds will continue to change through time, with stands aging and canopy closing in younger stands. Active management of the older stands appropriate for commercial thinning could help lessen the hydrologic effects of throughfall and canopy closure.

Alternative 3

Direct and Indirect Effects

Karst disturbance would increase by 3,105 acres (558 acres of old growth and 2,747 acres of young growth) and 13.5 miles of road. This equates to a 5 percent increase in harvest of karst old-growth (Table 64).

Approximately 2,005 acres (modeled 73 percent) of young-growth management would be on moderate vulnerability karst. The maximum size of any created opening for commercial timber harvest must not exceed 10 acres with a maximum removal of 35 percent of the acres of the original harvested stand (S-YG-KC-02). A commercial thinning prescription that minimizes ground disturbance and treats the whole stand, decreasing the canopy closure to increase throughfall would be best for the karst systems and their associated streams.

Effects could initially increase in flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequent (approximately 15 years post-harvest) decrease in flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increased turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Karst resource design features and unit prescription development will strive to minimize these effects.

Cumulative Effects

All action alternatives will have differing effects both possibly adverse and/or desirable. Until the exact extent and location of any proposed action is determined, a determination of specific effects cannot be made. Assuming 2016 Forest Plan karst and cave management direction and Appendix A are fully implemented there should be no detrimental effects to those resources. As an interim measure, the karst vulnerability assessment procedures will be used to approximate the disturbance index of specific karst watersheds and catchment areas.

Disturbance in the karst watersheds will continue to change through time, with stands aging and canopy closing in younger stands. Active management of the older stands appropriate for commercial thinning could help lessen the hydrologic effects of throughfall and canopy closure.

Recreation

This section discusses the potential effects to recreation assets and visitor use of National Forest System (NFS) lands in the Central Tongass project area. Recreation assets are evaluated using quantitative and qualitative measurements to analyze potential effects. Quantitative analysis relies on potential inventory changes to the existing Recreation Opportunity Spectrum (ROS) classes, while qualitative analysis examines potential effects to the physical resources and facilities actively maintained by the Forest Service and the potential changes that could occur to established visitor use of the area.

Summary

Alternative 1 would result in no change to recreation assets in the Central Tongass project area, while Alternatives 2 and 3 may result in minor to moderate impacts, depending on the nature of the activity being implemented.

Regulatory Framework

Tongass Land and Resource Management Plan (2016 Forest Plan)

Management activities on NFS lands must be consistent with the 2016 Forest Plan and comply with federal and state laws. The 2016 Forest Plan contains forest-wide direction along with specific Standards and Guidelines for Recreation and Tourism that apply and provide for resource protection across the Forest (USDA Forest Service 2016a, Chapter 4). In addition, the Recreation Opportunity Spectrum (ROS) Class Standards and Guidelines are included in Appendix I of the 2016 Forest Plan.

Recreation Opportunity Spectrum (ROS)

The ROS system is a land classification system developed by the Forest Service to help identify and describe possible combinations of recreation activities, settings, and experiences for management purposes (USDA Forest Service 1982). The ROS Class Standards and Guidelines are included in Appendix I of the 2016 Forest Plan.

Other Laws, Policies, and Relevant Direction

Executive Order 12962 (Aquatic Systems and Recreational Fisheries) directs federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities.

The September 2009 decision based on the *Wrangell Outfitter and Guide Management Plan* allocates use to outfitters and guides in specific areas within the Wrangell Ranger District.

The May 2010 decision on the *Petersburg Outfitter and Guide Management Plan* allocates use to outfitters and guides in specific areas within the Petersburg Ranger District.

The April 2008 decision on the *Anan Wildlife Observatory Management Pla*n determines the capacity of both commercial and private visitor use during the peak wildlife viewing season (July 5-August 25) at Anan Wildlife Observatory

Connecting People with America's Great Outdoors: A Framework for Sustainable Recreation, USDA Forest Service 2010 directs agency personnel to sustain the benefits of outdoor recreation

for present and future generations, through recreation programs that address and work toward a sustainable balance among the three spheres of environmental, social, and economic conditions.

The *Sustainable Cabin Strategy* is a Tongass-wide initiative to "right-size" the Tongass cabin program to meet current recreation trends, foreseeable budget constraints and deferred maintenance needs. This strategy is likely to influence proposed cabin projects.

Methodology

Spatial and Temporal Context for Analysis

The analysis area for direct and indirect effects is the entire project area, although most activities are likely to occur in the timber analysis areas (TAA), of which there are ten within the Central Tongass project area. Cumulative effects evaluate impacts to developed and dispersed recreation sites across the roughly 3.7 million-acre planning area (this excludes the 133,505 acres of non-NFS lands).

Direct effects are short-term impacts and are associated with the time period in which the activity is implemented. Indirect and cumulative effects are measured over the long term after implementation is complete. For example, the noise of trucks and heavy equipment operating would be considered short-term direct effects, whereas the harvested unit or new NFS road may impact the visual quality or remoteness of a recreation site in the long term.

Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A variety of reasonably foreseeable activities are listed in Appendix C that may impact developed and dispersed recreation sites. For example, major enhancement and construction projects such as the new observation deck at Wrangell's Anan Wildlife Observatory and the newly re-constructed Raven Trail in Petersburg are likely to affect visitor use in these communities. Established local uses, including gathering of subsistence resources are expected to continue and change with local trends over the life of the project.

Changes in large and mid-sized cruise-line offerings are anticipated to impact local visitor use within the project area, changing opportunities for outfitter and guide offerings and other tourist-related activities. More broadly, economic upturns or downturns effect potential visitors' abilities to access this part of Alaska - leading to increased or decreased number of cruise or independent visitors.

Units of Measure

- Recreation Opportunity Spectrum (ROS): Acres of ROS class affected by proposed activities.
- Recreation Assets: Geographic Information Systems (GIS) and INFRA, database of record for recreation facilities data were used to identify current locations and extent of recreation assets in the project area. Input from the public regarding potential recreation activities were used to provide measurable effects and comparisons between alternatives. Potential effects to recreation opportunities based on the proposed activities in this assessment are performed qualitatively based on professional experience and visitor use observations and trends.
- Visitor use: Determined quantitatively through outfitter and guide use reporting, recreation.gov reservation numbers for Forest Service cabins and Anan Wildlife

Observatory visitation. The remaining visitor use is undocumented, as there is no system in place to track independent visitors, trail use, etc.

Potential impacts are estimated based on the maximum proposed acreage of projected activities such as timber management, temporary road construction, or stream restoration. The effects analysis of proposed recreation activities would consider lands and resources directly modified by, and adjacent to, planned activities. An example of concerns to adjacent lands could include firewood gathering in proximity to a shelter that may lead to user created trails and timber felling. Recreation specialists would consider the effects of proposed activities by other resources on adjacent recreation assets, and their consequences to the recreation experience. Views from recreation sites is considered in the *Scenery* section of this DEIS.

Incomplete or Unavailable Information

Recreation management is based largely on qualitative measures to determine social trends. These qualitative data may be interpreted in various ways.

Affected Environment

Existing Condition

The majority of the Central Tongass project area is undeveloped and primarily used for dispersed recreation activities (50 percent of the project area is in a primitive ROS class with very little or no development). Viewing scenery and wildlife, boating, fishing, beachcombing, hiking and hunting are the primary dispersed recreation activities that take place within the project area. While most areas of the Forest have the potential to provide recreation opportunities to a varying degree, patterns of use tend to be associated with existing road systems, known protected boat anchorages, boat landings, high quality fishing streams and spectacular natural features such as glaciers or caves.

The following section is divided into three parts that present an overview of 1) Recreation Opportunity Spectrum (ROS) settings, 2) existing recreation assets within the project area, and 3) forest visitation and use.

Recreation Opportunity Spectrum (ROS)

The ROS system defines appropriate combinations of activities, setting, and experiences along a continuum, which ranges from primitive to highly modified environments. Seven classifications are identified along this continuum:

- Primitive (P)
- Semi-Primitive Non-Motorized (SPNM)
- Semi-Primitive Motorized (SPM)
- Roaded Natural (RN)
- Roaded Modified (RM)
- Rural (R)
- Urban (U)

ROS classes represent a spectrum of possible experiences, from those with a high probability of self-reliance, solitude, challenge, and risk; to those with a relatively high degree of interaction

with other people. The setting, activities, and probable recreation experience opportunities associated with each ROS setting are described in Appendix I of the 2016 Forest Plan.

The ROS system does not specify or prescribe what types of activities are allowed in an area. Land use designations (LUDs) defined in the 2016 Forest Plan (Chapter 3) prescribe allowable management activities in conjunction with federal, state, and local laws and regulations. If a LUD allows for increased development, timber harvest, or increased recreation use, the ROS class associated with the LUD typically aligns with the designation. If expanded development occurs within a project area based on an area's LUD, the 2016 Forest Plan allows a change in ROS setting. Changes to existing inventoried ROS classes were anticipated as part of the 2016 Forest Plan implementation, and direction on how to make changes was incorporated into the Plan.

Table 65 displays the acreage inventoried in each ROS class and Figure 17 shows the location of the inventoried ROS classes in the project area.

Table 65. ROS designations for NFS lands in the Central Tongass project area

ROS Class	Acres	Percent of Project Area
Primitive (P)	1,831,957	50
Semi-Primitive Non-Motorized (SPNM)	745,756	20
Semi Primitive Motorized (SPM)	447,802	12
Roaded Natural (RN)	47,791	1
Roaded Modified (RM)	608,536	16
Rural (R)	3,128	0.08
Urban (U)	5,707	0.15
Total	**3,690,677**	**100**

Nearly half the Central Tongass project area is currently inventoried in the Primitive ROS class. Those acres are predominantly located in lands congressionally designated as Wilderness and LUD II.

Semi-Primitive Non-Motorized acres border the Primitive ROS class, and are also found on the islands where very few developments are found beyond any road access.

Semi-Primitive Motorized acres rarely have road access, but are close to roads or waterways with the expectation of hearing boats, planes and vehicles and the likelihood of more frequent social encounters than in the more primitive ROS classes.

The Roaded Natural ROS class is found in those areas with access routes (usually waterways) with frequent social encounters, but very few developments that are obvious to users.

The Roaded Modified ROS class is most often associated with the road construction and vegetative changes that occur during timber harvest.

The conversion of acres inventoried in more Primitive ROS classes to the Roaded Modified class is often the most useful measurement to describe the overall land character changes expected from project implementation.

The final two ROS classes, Rural and Urban, are relatively uncommon in the project area and are located close to towns and other areas with residential use.

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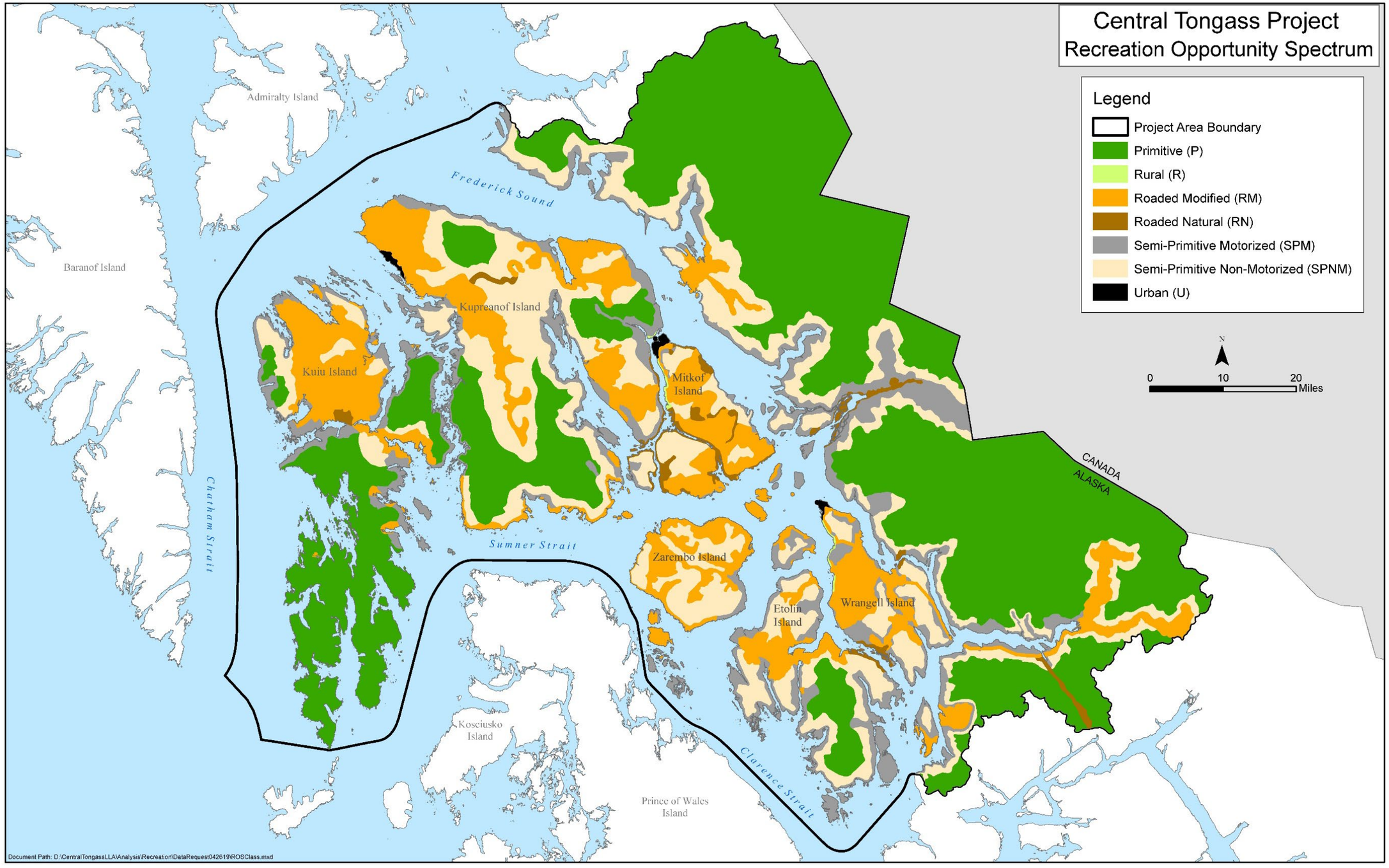

Figure 17. Recreation Opportunity Spectrum classes within the Central Tongass project area

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Existing Recreation Assets

The majority of the project area is undeveloped and primarily used for dispersed recreation activities. The current inventory of approximately 83 assets includes cabins, shelters, campgrounds, trails, and day-use sites and does not include dispersed recreation sites. All cabins, most developed recreation sites such as Blind Slough Recreation Complex and the dispersed campsites on the Wrangell road system are all prioritized in the 2016 Forest Plan as Visual Priority Routes and Use Areas for visual scenery emphasis (Appendix F). Anan Wildlife Observatory is a unique site within the project area as outfitters and guides and the public congregate in one area to view wildlife activity.

Points for boat access may be on or close to NFS land; their use is not monitored. Boat access points and anchorages often include, but are not limited to, launches and docks that are managed and maintained by the Forest Service, and are often in proximity to a recreation site or cabin. Salt and freshwater recreation areas may be accessed by floatplanes and may use the same docks as boaters; however, in many cases floatplanes will taxi directly onto shorelines in proximity to recreation sites and areas. Use levels are affected by modes of access. For example, remote cabins accessed exclusively by floatplanes tend to be low use unless they are close enough to make the flight affordable for visitors, such as Swan Lake Cabin.

Developed Recreation Sites

Approximately 83 recognized recreation assets are within the project area. These resources are monitored and maintained by the Forest Service at different levels based on Forest Service standards, need, use levels, and capacity or people/funding availability (program resources).

The Forest Service charges fees for the 41 cabins and at the Anan Wildlife Observatory. In general, these fee sites are prioritized for maintenance because the fees charged return to the districts to support site maintenance.

The following sections provide an overview and brief description of the available recreation assets in the project area broken down by structures including: cabins, 3-sided shelters, trails, day-use sites, interpretive sites, campgrounds, and dispersed camping. Most of these sites are identified on the Tongass produced Petersburg and Wrangell Visitor Maps. Detailed descriptions of assets and their existing conditions are available in the recreation resource report (Houser et al. 2019).

Cabins

Within the project area there are 41 cabins available to users through a reservation system, https://www.recreation.gov. Cabins have an outhouse and often a wood shelter that is occasionally stocked with firewood. These sites are maintained by Forest Service staff. Cabin maintenance typically involves small repairs and cleaning, toilet maintenance and cleaning, and stocking the woodshed or performing oil stove or heater maintenance. Cabin use varies based on location and ease of access. Many cabins are accessible only by boat or float plane. Recent efforts have been made to locate newer cabins on road-accessible sites, such as the popular Middle Ridge Cabin, which receives the highest use (146 average nights from 2012 to 2017) on the Wrangell Ranger District.

Twenty-seven of the 41 cabins were built between 1962 and 1969 and have either a sharp-roofed "A" frame structure or a small square hunter/trapper structure (see Houser et al. 2019 for photos). Recently the agency has built larger cabins to comply with the *Architectural Barriers Act* standards and visitor trends. Visitor trends favor larger cabins for family and extended

family-sized groups; examples include Middle Ridge Cabin, Kadake Bay Cabin and Anan Bay Cabin, all of which receive relatively high use levels (see the *Recreation and Visitor Use* section for cabin use figures). Descriptions of cabins can be found on the Recreation page of the Tongass National Forest public website (https://www.fs.usda.gov/activity/tongass/recreation/) and in Houser et al. 2019.

Campgrounds

For the purpose of this analysis, the Forest Service defines a campground as a location with more than one campsite and a toilet. Ohmer Creek is the only campground in the project area, with 10 campsites and a toilet. The campground has been closed since 2015 and does not have a host, collect fees, and is on a minimum maintenance schedule. No campgrounds are proposed in the Central Tongass Project.

Campsites

Campsites differ from campgrounds in that they do not contain a toilet. Yunshookuh and Lower Salamander, for example, contain multiple campsites, but do not have an associated toilet or fee collection.

Shelters

There are 12 three-sided shelters dispersed across the project area. They are typically associated with a trail system or positioned in a remote location. Use of these shelters varies, but is relatively low. Twin Creek and Frenchy Shelters receive more use in the winter than summer, by snowmobile users. No fee is charged for the use of these structures. Amenities also vary at these sites. Some like Shoemaker Bay, Kunk Lake, Long Lake and North Wrangell High Country and North Wrangell Pond have pit toilets, Frenchy and Twin Creek also have a woodstove.

Dispersed Camping

Dispersed camping is a popular activity, particularly on Wrangell Island along NFS roads (Table 66. These campsites have basket-style toilets and hardened pads for overnight camping use. These 10 sites are distinguished from campgrounds and campsite because they usually have only campsite. Notice in the table below that these sites are located within ROS classes and development LUDs that allow for timber harvest and road construction.

Table 66. Project area dispersed camping sites

District	Site Name	Site Type	ROS Class	LUD
WRD	Anita Bay Overlook Campsite	Campsite	RM	Modified Landscape
WRD	Three Sisters Viewpoint Campsite	Campsite	RM	Modified Landscape
WRD	Long Lake Recreation Site	Campsite	RM	Timber Production
WRD	Thoms Creek Crossing Recreation Site	Campsite	RN	Old-Growth Habitat
WRD	Turn Island Beach Campsite	Campsite	SPM	Scenic Viewshed
WRD	Upper Salamander Creek Recreation Site	Campsite	RN	Timber Production
WRD	Highbush Lake Recreation Site	Campsite	RM	Timber Production
WRD	HighlineCampsite	Campsite	RM	Modified Landscape
WRD	Earl West Recreation Site	Campsite	RM	Old-Growth Habitat
WRD	Nemo Campsites Entry Site	Campsite	RM	Modified Landscape

Picnic Sites

Picnic sites differ from dispersed campsites because they are managed for day use activities only. There are four developed picnic sites in the project area. Typically these sites are located along well-traveled highways or roadways and can accommodate larger groups. For example, Blind Slough Picnic Area south of Petersburg along Mitkof Highway is a locally popular day use site, with a large parking area, vault toilet, small boat ramp, and three shelters with associated fire rings and barbeque grills. The slough is used for picnicking, swimming, and small boating during the summer months and ice skating in the winter. The Seal Point Recreation Area near the city of Kake is popular with the residents of Kake.

Twin Lakes Picnic Area was a traditional use area in 1980 when the Stikine River corridor became part of the Stikine-LeConte Wilderness. Due to changes in the river and water levels, Twin Lake Picnic Area is not used nearly as much as it once was. At this time the only remaining development is a small pit toilet. Picnic table and fire rings have been removed.

Wildlife Viewing Areas

Wildlife viewing areas are a major draw for tourists within the project area. They range in size and complexity. The Swan Observatory is a sturdy, covered bird-watching blind. Anan Wildlife Observatory is a major development with an elevated, multi-level viewing platform, 0.5 mile trail with a lagoon viewing deck along the trail and a two-stall vault outhouse. This site represents the largest asset investment in the project area, along with the highest use level.

Another relatively significant recreation asset investment is the Chief Shakes Hot Springs site (developed hot tubs) within the Stikine-LeConte Wilderness. Chief Shakes Hot Springs site has a developed indoor and outdoor tub along with two toilet facilities and enclosed changing areas.

Boat Docks, Landings, and Launches

Docks, launches, and landings are discussed in the *Transportation* section of this DEIS. These sites have been typically developed in association with timber harvest activities and road construction. Their purpose is generally to provide a location to bring timber to saltwater for shipment to processing locations. When timber activities are completed, these sites are sometimes used for recreation purposes because they offer access to saltwater for small boats, provide open hardened locations by saltwater, and are suitable for camping and picnicking. Examples of landings used for recreation purposes are Woodpecker log transfer facility (LTF) and Earl West Cove MAF. Earl West Cove has been developed with a small dispersed campsite and toilet facility for visitors.

The 2016 Forest Plan differentiates a Marine Access Facility (MAF) from a Marine Access Point. The 2016 Forest Plan defines a MAF as “An area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, LTF, boat ramp, or a combination of these.” Examples of MAFs include West Point Cabin (mooring buoy) and Anan Bay Cabin (dock). The 2016 Forest Plan defines a MAP as “An area used by humans to transfer items to saltwater generally where there is a trail that leads to saltwater and that has no associated structures”. Wrangell Spur Road Kayak Access is an example of a MAP. A list of MAFs is included in the *Transportation* section of this document.

Undeveloped Recreation Sites

Undeveloped recreation sites are used for undeveloped recreation opportunities, including hunting and fishing. These sites are not developed or maintained by the Forest Service. The majority of the 3.7 million acres in this project area fall into this category. Visitors may use any

of these undeveloped areas throughout the year. Like developed recreation sites, the amount of use in undeveloped areas depends on access.

Trails

The project contains about 67 NFS trails, totaling approximately 131 miles. Most trails are less than 2 miles long and typically associated with a site or feature. Examples include interpretive trails within day-use areas or on the roadside terminating at land features or fish passes. Most trails within the project area are not barrier free or fully accessible for users with disabilities. Many of the trails were constructed with a relatively simple step-and-run boardwalk style. This style uses either two parallel boards affixed to sills, or parallel sills with perpendicular walking planks on sills to traverse the ground and gain elevation. Recently, the agency has recognized the benefits of planning and constructing trails with gravel rather than wooden boardwalk. The gravel trails, if designed well for the contours and elevation changes on the ground, will outlast boardwalk with greatly reduced annual maintenance. Dependent on length, trails often cross multiple ROS settings.

Hiking trails are designed and maintained for pedestrian use and in some cases bicycle or equestrian use. Predominantly, the trail use in this project area is pedestrian due to the wet terrain. Snow trails have little development other than bridges over waterways that do not fully freeze. These trails may be cleared of brush or downed trees in the winter by available Forest Service personnel or trail users.

The Forest Service maintains 95 miles of traditional pedestrian trails in the project area. Twenty-seven miles of trail are within Wilderness (Petersburg Lake, Petersburg Mountain and Portage Loop, Chief Shakes Hot Springs and Mallard Slough Trails). These trails are maintained to primitive standards using only hand-tools.

There are 21 motorized trails in the project area, which are generally former NFS roads transitioned to motorized use for off highway vehicles (OHV). Only the Burnett Inlet Portage Trail was designed and constructed as an OHV trail rather than a transitioned road.

OHV use has grown in popularity especially in association with subsistence hunting. OHV owners from Wrangell transport OHVs to Zarembo and Etolin Islands to ride the road systems and OHV trails, often in search of deer. Similarly, residents of Petersburg and Kake ride their OHVs on the Kupreanof Island road system.

Recreation Visitation and Use

This section discusses the current use patterns for recreation assets within the project area based on figures collected for fee sites such as the 41 cabins and Anan Wildlife Observatory permits, actual use reports supplied by outfitters and guides, and visitor observations and information provided by the National Visitor Use Monitoring (NVUM) survey.

Generally recreation users are categorized into three groups: resident, regional (Alaskan), and non-resident (non-Alaskan). The Recreation section of Chapter 3 in the 2016 Forest Plan discusses resident and non-resident use at the Forest level, based on information generated through the NVUM Survey process, which uses the same survey of recreation users across the Forest Service System from Washington D.C. to Alaska. This survey is administered at each district every 5 years. In 2016, NVUM survey results found just under 50 percent of visitors to National Forests nationally came from within 50 miles of the recreation site where the survey took place (residential/regional). The 2014 NVUM results for the Tongass National Forest

individually showed an average of nearly 70 percent of Tongass visitors came from Alaska. These figures demonstrate the importance of the recreation resource to local residents of Petersburg and Wrangell and regional visitors from other parts of Alaska. The majority of recreation sites within the project area (cabins and trails) receive the majority of their use from resident and regional users, while some sites like Anan Wildlife Observatory represent a tourism draw and receive a higher proportion of non-resident visitation.

The Alaska Marine Highway stops in both Wrangell and Petersburg approximately twice weekly. In addition, mid-sized and small cruise boats make about 75 port calls in Wrangell between May and October. This works out to an average of two cruise ships per week in the high use season June-August. These boats hold between 75 and 450 passengers. According to the *Wrangell Visitor Economy: By the Numbers*, approximately 14,700 tourist (non-resident and regional) visitors came to Wrangell in 2014, over half of which came by cruise boat. Tourism figures grew 26 percent in Wrangell from 2011 to 2014. Current cruise boat and tourism figures are not available, but tourism use at popular sites like Anan Wildlife Observatory have generally remained steady since 2014 with a slight decrease in Anan Wildlife Observatory visitation recorded. Petersburg only has smaller 100-350 foot boats with capacities of approximately 50-150 passengers, but they have 150 port calls, or cruise boat visits during the June to August season.

Non-resident visitors, or users, can be generally divided into package and independent visitors. Package visitors are typically cruise ship clients, though some arrive by ferry and airplane, and most often visit on set itineraries. Independent visitors tend to arrive by air or ferry and engage in a variety of activities. Independent visitors spend more time in the communities and on the Forest, and may secure the services of outfitters and guides, restaurants, motels, and transportation services, such as floatplanes, boats, and gas stations. Independent travelers tend to plan their own itineraries, but often secure the services of mini-packages, such as day excursions or fishing charters. According to the *Wrangell Visitor Economy: By the Numbers*, independent travelers who stay overnight in town represent the greatest tourism investment in the local community ($560 average independent traveler compared to $117 average cruise visitor). Although the figures are not available for Petersburg, this assessment assumes that independent travelers to Petersburg area also spend more in the local community.

Local residents, regional visitors, and independent travelers make up the majority of overnight camping and cabin use in the project area with an average of 77 percent Alaska regional use of Wrangell cabins and an average of 53 percent Alaska regional use of Petersburg cabins. The range of regional cabin use for Wrangell is 13 percent for Anan Bay Cabin and 100 percent for Gut 1, Koknuk, and Deep Bay. Petersburg shows less of a disparate range with 29 percent for Kah Sheets and 86 percent for Big John Bay. Although the two districts are similar, with many of the same style cabins, built in the same era, the Wrangell cabins tend to be more difficult to access, because 12 of the cabins are located on the Stikine River, which requires a strong knowledge of the local river and river delta, the tides and a specialized jet boat to access. Due to these challenges, use levels for cabins on the Stikine River and associated “flats” or delta are relatively low. In addition, fly-in cabins in Wrangell, which does not have a flight service at this time, are cost prohibitive for most visitors so use is also very low. Forest Service cabins in Petersburg receive a steady amount of use, which is generally attributed to their locations in places where people want to go to hunt, fish or hike. The Petersburg community supports a local flight service and boat services to provide access to these cabins and many local residents use their own boats and can access the cabins. In total, there were 2,225 reserved cabin visits in the

project area during 2017. Cabin use tends to remain steady from year to year, unless a cabin is rebuilt or a fee is changed, then visits can fluctuate considerably.

Visitation numbers are also collected for the Anan Wildlife Observatory between July 5th and August 25th annually. Anan is managed with a 64 person per day limit during the peak bear viewing season July 5th to August 25th and runs consistently at about 78 percent capacity. The majority of use at Anan Wildlife Observatory is through outfitters and guides because most visitors need a guide to bring them the 30 miles by boat to the area. The majority of Anan Wildlife Observatory visitors are non-resident (non-Alaskan). This site is an anomaly compared to other recreation sites in the project area.

Other recreation uses within the project area include dispersed camping, hiking, driving for pleasure, hunting, fishing, relaxing in the outdoors and boating (motorized and non-motorized). The Wrangell and Petersburg Ranger Districts have several developed recreation sites to support these activities discussed above, but neither ranger district collects use data for these activities. The NVUM provides some general information about the percentages of visitors participating in these activities on the Tongass National Forest.

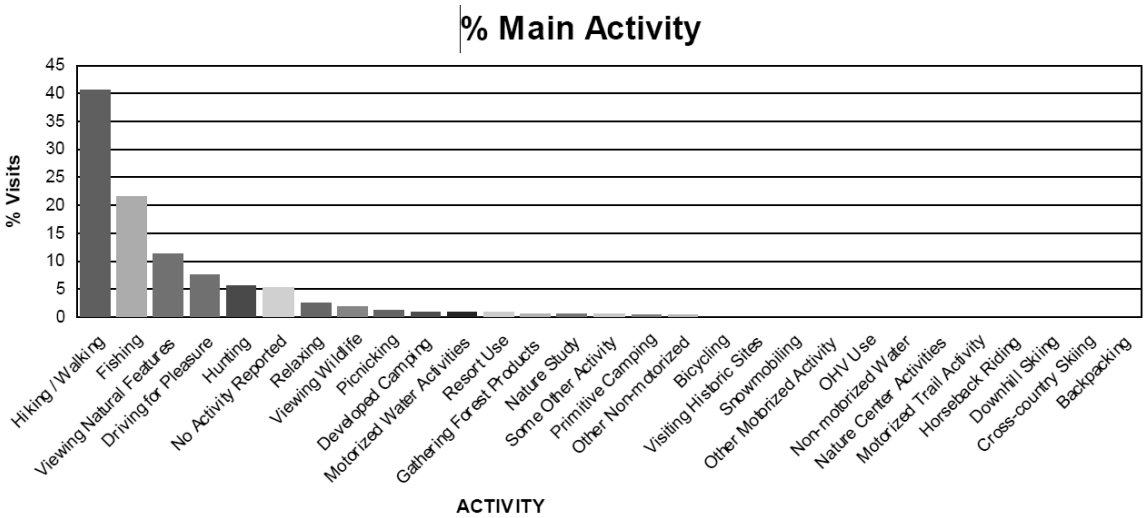

Figure 18. NVUM Petersburg-Wrangell-Yakutat 2012 recreation activity participation

Viewing natural features, hiking/walking, fishing, driving for pleasure, relaxing, and viewing wildlife have the greatest levels of visitor participation for the Wrangell-Petersburg-Yakutat survey area. Evidence of these uses for Wrangell and Petersburg are tours to view natural features such as the LeConte Glacier and the Stikine River, hiking on the Raven Trail in Petersburg and the Rainbow Falls Trail in Wrangell, both of which can receive over 100 visits daily during peak periods over the summer season, and viewing wildlife at Anan Wildlife Observatory or along the Forest road system.

Outfitter and guide use is a major component to visitor use within the project area. As demonstrated above, outfitter and guide use makes up for more than 75 percent of the visitation at Anan Wildlife Observatory (outfitters and guides aid private individuals to purchase permits on recreation.gov and then transport and guide them at the site).

Approximately 20,000 service days[13] on the National Forest in the Petersburg and Wrangell Ranger Districts include of outfitter and guide use. These service days are broken into several different types of use: hunting, freshwater fishing, camping, sightseeing and outfitting equipment such as supplying a kayak. In Petersburg, 81 percent of the visitor use was in sightseeing, small cruise boats or charter boats bringing visitors to the Forest to view a feature. In Wrangell, the sightseeing and camping numbers are more-evenly split. Wrangell is home to a wilderness therapy program, which brings at-risk youth canoeing and camping on the Wrangell Ranger District. This authorized use contributes over 5,000 camping service days (nights) per year.

The majority of outfitter and guide use is concentrated in a few locations that have special features such as a glacier view or waterfall. In some cases, like Cascade Creek, the Forest Service responded to an increase in use by re-constructing a trail to provide a durable surface for the increased numbers of visitors. Concentrated use sites for each districts include:

- Petersburg: Baird Glacier/Baird Glacier Moraine; Bay of Pillars; Cascade Creek Trail; Halleck Harbor; Ideal Cove Trail; Petersburg Lake Trail; Skanax Bay
- Wrangell: Anan; Stikine River Twin Lakes; Shakes Lake; Berg Bay

Outfitters and guides pay a fee to bring clients onto NFS lands; a proportion of this fee is reinvested in the recreation assets that support the outfitter and guide use, such as improvements to the Anan Trail, Cascade Trail and Ideal Cove Trail.

Environmental Effects

Recreation effects are expressed qualitatively by analyzing proposed changes in ROS; specifically, the potential for acres to be converted to higher development ROS classes, along with a qualitative assessment of potential effects to the project area's recreation assets and established visitor use. Proposed activities associated with the action alternatives that may directly, indirectly, or cumulatively affect recreation assets are described here.

Alternative 1 – No Action Alternative

Direct and Indirect Effects

ROS

Alternative 1 would not result in any changes to the existing inventoried ROS classes for the Central Tongass project area.

Existing Recreation Assets

The no action alternative would not affect existing recreation assets. Under Alternative 1, none of the specific management activities proposed would be implemented to accomplish project goals and objectives. Repair and maintenance of existing recreation assets would continue at present levels based on available program resources and prior approved plans.

[13] A service day is an allocation of use constituting a day or any part of a day on National Forest System lands for which an outfitter or guide provides services to a client. The total number of service days is calculated by multiplying each service day by the number of clients on the trip (FSH 2709.14, section 53.1e).

Visitor Use

The No Action Alternative would not affect visitor use. Current trends in visitor use are likely to continue.

Alternatives 2 and 3

Direct and Indirect Effects

ROS

Effects to ROS are analyzed assuming proposed activities are implemented, followed by re-mapping the ROS classes as they would be inventoried once the development was complete. Analyzing the resulting acreage changes to an area can give an overall impression of how the character of the land involved will change as developments occur.

Road construction and timber harvest result in changes to ROS classes. With the Central Tongass Project, proposed activities are concentrated in ten timber analysis areas (TAAs). To determine effects to ROS for this project, each TAA was re-mapped with GIS, assuming proposed roads were constructed and entire proposed unit pools were harvested. Although this results in a gross-overestimation of resulting changes to ROS class because not every road in the action alternatives will be constructed, nor will every acre within a proposed unit pool be harvested; it does show which TAAs are likely to show the most change to the existing ROS inventory when development projects are implemented over the 15-year life of this project.

Table 67 to Table 76 display existing ROS classes within the ten TAAs and the resulting ROS inventory after it was re-mapped in GIS based on the proposed road construction and gross unit pool harvest in Alternative 2 and Alternative 3. The last row of each table shows the percentage of total TAA acres that could be converted from a more-primitive ROS class to the Roaded Modified (RM) class. See Figure 4, Figure 5, Figure 6 and Figure 7 in Chapter 2 for locations of the timber analysis areas.

Table 67. Etolin Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	13,624	0	0
Semi-Primitive Non-Motorized (SPNM)	46,984	-206	-200
Semi Primitive Motorized (SPM)	33,317	-31	-31
Roaded Natural (RN)	12	0	0
Roaded Modified (RM)	36,650	+237	+231
Total acres	**130,587**	**237**	**231**
Percent change		**0.18% Converted to RM**	**0.18% Converted to RM**

Table 68. Frosty Bay Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	14,620	0	0
Semi-Primitive Non-Motorized (SPNM)	7,677	0	0

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Semi Primitive Motorized (SPM)	6,064	-86	-85
Roaded Modified (RM)	7,812	+86	+85
Total acres	**36,173**	**86**	**85**
Percent change		**0.23% Converted to RM**	**0.23% Converted to RM**

Table 69. Kuiu Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	55,200	-382	-323
Semi-Primitive Non-Motorized (SPNM)	36,235	-1,812	-1,760
Semi Primitive Motorized (SPM)	48,608	-1,190	-1,087
Roaded Natural (RN)	2,613	0	0
Roaded Modified (RM)	112,210	+3,384	+3,170
Total acres	**254,868**	**3,384**	**3,170**
Percent change		**1.33% Converted to RM**	**1.24% Converted to RM**

Table 70. Mitkof Island Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Semi-Primitive Non-Motorized (SPNM)	36,297	-160	-157
Semi Primitive Motorized (SPM)	4,376	0	0
Roaded Natural (RN)	17,789	-3,299	-3,288
Roaded Modified (RM)	71,604	+3,506	+3,492
Rural (R)	1,338	-47	-47
Urban (U)	2,432	0	0
Total acres	**133,836**	**3,506**	**3,492**
Percent change		**2.62% Converted to RM**	**2.61% Converted to RM**

Table 71. Portage Bay Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	5,428	0	0
Semi-Primitive Non-Motorized (SPNM)	13,696	-28	-28
Semi Primitive Motorized (SPM)	7,650	0	0
Roaded Modified (RM)	32,877	+28	+28
Total acres	**59,651**	**28**	**28**
Percent change		**0.05% Converted to RM**	**0.05% Converted to RM**

Table 72. Thomas Bay Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	29,658	0	0
Semi-Primitive Non-Motorized (SPNM)	32,680	-815	-810
Semi Primitive Motorized (SPM)	3,502	0	0
Roaded Modified (RM)	18,681	+815	+810
Total acres	**84,521**	**815**	**810**
Percent change		**0.96% Converted to RM**	**0.96% Converted to RM**

Table 73. Tonka Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	53	0	0
Semi-Primitive Non-Motorized (SPNM)	21,167	0	0
Semi Primitive Motorized (SPM)	13,308	-1,018	-1,018
Roaded Natural (RN)	1,958	0	0
Roaded Modified (RM)	30,078	+1,018	+1,018
Rural (R)	89	0	0
Total acres	**66,653**	**1,018**	**1,018**
Percent change		**1.52% Converted to RM**	**1.52% Converted to RM**

Table 74. West Kupreanof Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Primitive (P)	83,455	0	0
Semi-Primitive Non-Motorized (SPNM)	136,601	-87	-87
Semi Primitive Motorized (SPM)	34,924	-224	-223
Roaded Natural (RN)	2,833	-35	-35
Roaded Modified (RM)	94,739	+346	+345
Urban (U)	1,941	0	0
Total acres	**354,493**	**346**	**345**
Percent change		**0.10% Converted to RM**	**0.10% Converted to RM**

Table 75. Wrangell Island Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Semi-Primitive Non-Motorized (SPNM)	40,987	-64	-64
Semi Primitive Motorized (SPM)	27,839	-1,766	-1,758
Roaded Natural (RN)	2,771	0	0
Roaded Modified (RM)	59,611	+1,973	+1,965

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Rural (R)	1,415	-143	-143
Urban (U)	1,205	0	0
Total acres	**133,828**	**1,973**	**1,965**
Percent change		**1.47% Converted to RM**	**1.47% Converted to RM**

Table 76. Zarembo Timber Analysis Area

ROS Class	Existing acres	Alternative 2 +/- acres	Alternative 3 +/- acres
Semi-Primitive Non-Motorized (SPNM)	60,512	-6,176	-6,170
Semi Primitive Motorized (SPM)	12,796	-5	-5
Roaded Modified (RM)	68,958	+6,181	+6,175
Total acres	**142,266**	**6,181**	**6,175**
Percent change		**4.34% Converted to RM**	**4.34% Converted to RM**

Both Alternatives 2 and 3 would result in changes to the inventoried ROS classes for the Central Tongass project area. The changes would not be significant, as most of the proposed activities are located in areas already inventoried in the Roaded Modified ROS class, due to past timber harvest activities. The Roaded Modified ROS class would "grow" in each of the timber analysis areas listed above as proposed roads and harvest units are implemented, while the more-primitive ROS classes would "shrink". Neither action alternatives would result in more than a 5 percent increase in the number of acres converted to Roaded Modified in any of the timber analysis areas, and most would see less than 2 percent converted.

Difference between Alternatives 2 and 3

While neither of the action alternatives would result in significant changes to the ROS inventory for the Central Tongass project area, Alternative 3 proposes slightly fewer acres that could be converted to the Roaded Modified ROS class, as shown in Table 77, below.

Table 77. Alternatives 2 and 3 - timber analysis area acres converted to Roaded Modified ROS class

Timber Analysis Area	Alternative 2 (acres)	Alternative 3 (acres)
Etolin	237	231
Frosty Bay	86	85
Kuiu	3,384	3,170
Mitkof Island	3,506	3,492
Portage Bay	28	28
Thomas Bay	815	810
Tonka	1,018	1,018
West Kupreanof	346	345
Wrangell Island	1,943	1,965
Zarembo	6,181	6,175

Timber Analysis Area	Alternative 2 (acres)	Alternative 3 (acres)
Total	**17,544**	**17,319**

Existing Recreation Assets

The action alternatives are discussed together for recreation assets because the effects of the proposed activities are similar.

Harvest and Road Construction Activities

The map below shows the proposed timber analysis areas (TAAs) and the existing recreation assets. Just under half of the existing recreation assets are within TAAs. For those outside, no proposed timber and road construction activities are planned within their proximity. Examples of these sites include the cabins in Wilderness and the Anan Wildlife Observatory. Direct and indirect effects on recreation infrastructure within the TAAs by proposed non-recreation activities are low to moderate. There are occurrences where proposed activities could occur in proximity to recreation infrastructure. In these cases an evaluation of effects would be made to determine the level of disturbance to recreation activities and assets. In all action alternatives, regardless of the proximity, when activities are identified, consideration of effects on recreation infrastructure and the recreation experience specific to that location will be documented according to procedures outlined in the Implementation Plan.

In some cases, such as the dispersed recreation campsites on Wrangell Island, timber harvest activities may have a short-term effect of site closures while harvest activities occur, but will also result in improved road access and improved or hardened sites, using nearby road gravel. These dispersed sites were originally developed in association with harvest activities and the surrounding harvest has allowed for the panoramic views enjoyed at these sites. It is anticipated that local users will be displaced for a short period but will return to these sites at typical use levels. Similarly, the developed recreation sites on Mitkof Island road system, most of which receive local use, may see a temporary displacement of users from harvest activities.

Road development and maintenance would provide improved access to some sites, which in turn could lead to improved opportunities.

Most of the recreation assets are identified as priority use areas and are within priority travel routes identified in Appendix F of the 2016 Forest Plan, therefore, effects from activities in proximity to these assets will be minimized to ensure the scenic quality of these areas. If a 2016 Forest Plan amendment changes the Scenery Integrity Objectives (SIO) for timber management LUDs, it is likely most recreation assets will be minimally affected as they are not located in timber harvest or modified landscape LUDs. Recreation users traveling in priority travel routes may observe more harvest activities, potentially negatively affecting their recreation experience. To better understand the potential effects to scenery resources, see the *Scenery* section of this DEIS.

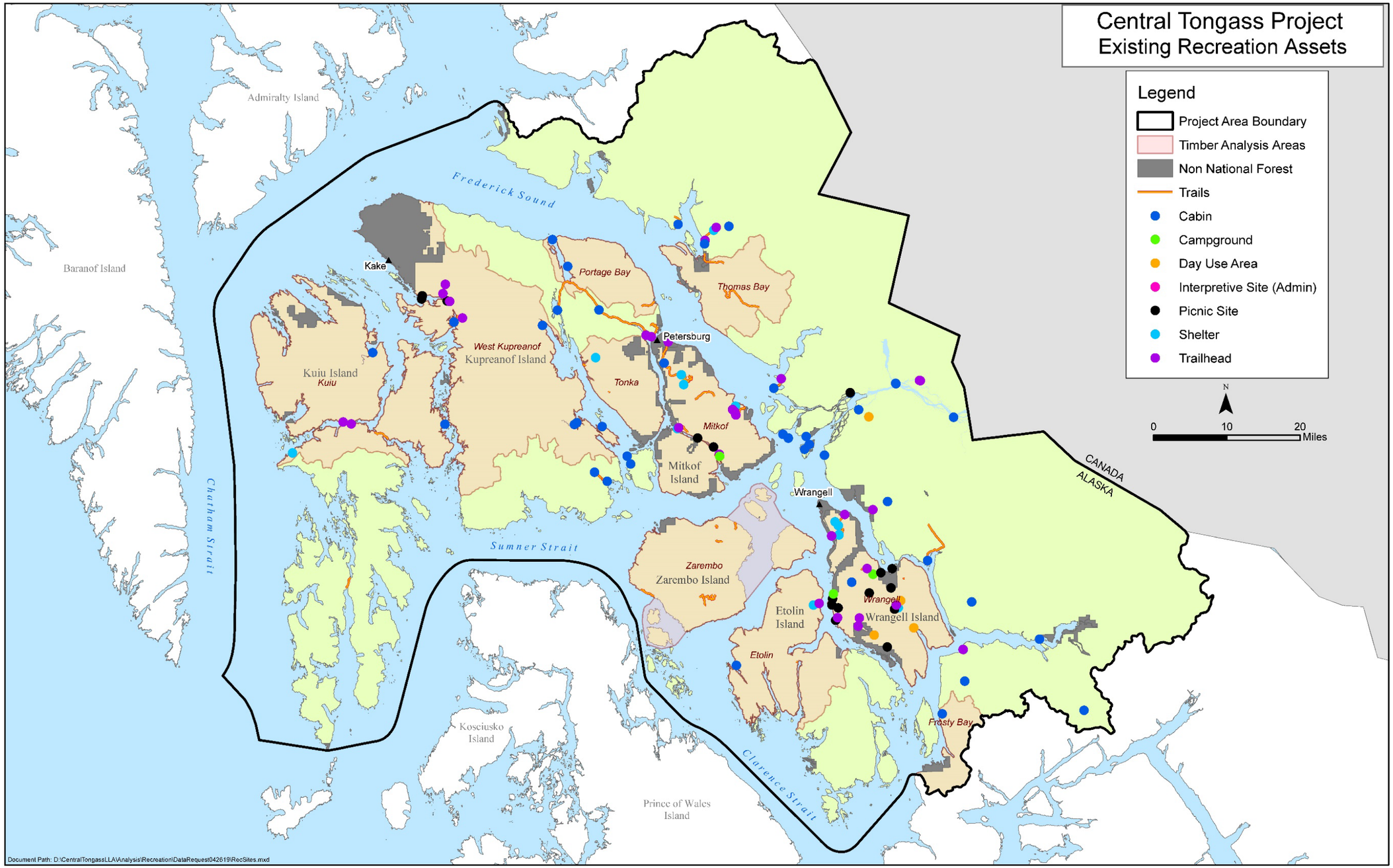

Figure 19. Existing recreation assets within the Central Tongass project area

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Other Activities

Direct and indirect effects of proposed activities that may occur inside or outside the TAAs include treating invasive species populations, stream and floodplain restoration, fisheries improvement and recreation management activities. Invasive species may occur wherever vectors for spread exist, such as roads, rivers, cabins, and trails. New recreation site development has the potential to increase the risk of invasive species introduction and spread because an area may be disturbed, and people, vehicles and pets may carry species to these sites. Some moderate effects to recreation assets may occur if invasive species populations are targeted in or near a recreation site, because techniques used to address these species may be visible to recreation users (for example, plastic bags full of pulled plants; tarped areas to prevent light exposure; or dead patches, use of herbicides). Because invasive plant treatments and resulting effects are similar within the Central Tongass project area and the Northern Tongass Integrated Weed Management project area, more information on potential effects can be found in the Northern Tongass Integrated Weed Management Recreation Resource Report (Cisneros 2017, hereby incorporated by reference).

Stream restoration work generally benefits recreation assets because it ultimately would increase fish populations and fishing opportunities. Nevertheless, stream restoration work may use heavy equipment, cut large trees to put into streams and construct trails or roads for stream access. Direct effects to recreation assets may be noise disturbance, temporary site closures and potential changes in water levels at popular fishing areas. Indirect effects may be increased fishing opportunities, removal of large trees that may have been used as bridge stringers for trails, and increased wildlife viewing because better fish runs draw more wildlife to streams and fish ladders. Anan Wildlife Observatory, for example, was originally a fish ladder that attracted visitors because of the bears that congregated to eat fish. An indirect effect of stream restoration is the inadvertent development of a recreation attraction.

Construction, reconstruction and maintenance of Marine Access Facilities and associated LTFs, buoys, docks etc. is likely to have direct and indirect effects on recreation assets. Some developed recreation sites have been established at these MAFs, and short-term closures of these sites would occur during timber harvest activities. Indirect effects would occur as recreation visitors discover the MAFs and use them for recreation purposes because they provide access to and from uplands to saltwater often on a road system. Potentially, new developed recreation sites will be constructed in association with these MAFs.

Direct effects of proposed recreation activities on existing recreation assets are minor. There are currently 83 existing assets on 3.7 million acres. There is plenty of room for additional recreation enhancements, improvements to existing facilities and decommissioning of assets that no longer meet the needs of the recreation users. Recreation facility use data for cabins do not show a decrease in use of existing cabins after a cabin is renovated or constructed. New cabin construction appears to attract more use and not displace use from other sites, although the potential for displacement of users is possible. An example of this trend is the construction of Middle Ridge Cabin in Wrangell. Middle Ridge received high levels of use once open but the other Wrangell cabins maintained the same annual use.

For this analysis, recreation infrastructure is divided into two types: discrete and linear. Campsites, cabins and shelters, day-use/picnic sites, interpretative sites, and wildlife viewing areas are considered discrete. Discrete sites are defined as sites contained within a defined area at a specific location. Depending on site type, and a site's ancillary infrastructure, the extent of a discrete site can range from a couple of hundred square feet to a few acres. Trails are defined as

linear sites. Linear sites are comprised of a series of segments covering a linear distance, across varying landscapes, and are defined by trail length and tread width.

Discrete sites may be subdivided into three types based on the extent of ground coverage that may result in potential ground disturbances. We do not have site-specific designs for proposed sites; therefore, for this analysis an allowance of 80 percent of a site's base structure(s) area has been added to account for design variables such as boardwalks, trails, and accessibility considerations, and user activities (exploring, firewood gathering, etc.) adjacent to the site. The extent of camp sites, day-use/picnic areas, and interpretative areas are based on conceptual perimeters that would contain all of a site's features; therefore, the 80 percent allowance is not added.

Types of proposed discrete sites and their ground coverage:

- Single structure (shelter) with no ancillary buildings or infrastructure: less than 900 square feet (0.02 acre).
- Structures (cabins and shelters) with ancillary buildings and infrastructure: typically less than 10,000 square feet (0.23 acre).
- Campsites, day-use/picnic areas, and interpretative sites: variable acreage but based on existing examples the average size is approximately 40,000 square feet (0.92 acre).

Ground coverage for trails (linear sites) is measured by the length of the route and the width of the trail plus immediately adjacent ground. For this analysis, trail coverage is 2.4 acres per mile. This measure accounts for variability of trail widths, potential activity within 10 feet of tread centerline, and other features such as trail head parking and viewpoints.

Available recreation assets and resources would be considered for proposed infrastructure in all alternatives because an infrastructure inventory that is not manageable with program resources would not be practical. Maintenance and improvements of existing infrastructure keeps recreational opportunities viable, improves the recreation experience and public health and safety.

Overall the ground-disturbing activity involved with the development of proposed recreation infrastructure would have a negligible impact on the overall landscape. Existing discrete and linear sites total approximately 352 acres, while proposed sites could contribute an additional 764 acres to the recreation infrastructure. Existing recreation infrastructure directly affects 0.01 percent of the acres of NFS land in the project area. The addition of all the proposed projects would directly affect 0.03 percent of NFS lands. Based on the quantity of proposed recreation sites and their individual footprints, implementation would result in negligible effects at the landscape level. Implementation of proposed activities would result in localized ground disturbance, but these activities would be contained within limited areas and design features identified in Appendix A would be applied, thus reducing effects.

Development of sites may result in user concentrations, but this would be relative to ongoing project-wide use levels. This may result in some disturbances, but would generally be of short duration and would not result in alterations to the natural state of the landscape.

The development of proposed recreation infrastructure would have a negligible effect to the overall landscape. Variations in the distribution and types of recreation infrastructure across the project area would not result in meaningful changes to the discussions regarding LUD, ROS,

recreation sites or visitor use due to the relatively small impact of recreation infrastructure proposed in this project.

The differences in alternatives for recreation are driven primarily by the capacity of the Forest Service to maintain and improve existing infrastructure, and to develop and maintain proposed sites. This driver may indirectly or directly affect social and economic interests associated with local recreation opportunities.

Visitor Use

Tourism associated with Anan Wildlife Observatory, the Stikine River and LeConte Glacier, Baird Glacier and other small and medium cruise boat opportunities will not likely be substantially affected by the proposed activities. It is possible that harvest activities may be seen when accessing these remote sites. Small- and medium-sized cruise boat tours are likely to continue at current levels, therefore, nonresident use will not likely be affected by the activities proposed in Alternatives 2 and 3. Regional and resident visitors may incur minor to moderate effects to recreation assets from the proposed activities because the assets used by these groups are closer to the TAAs, and associated with the affected road systems. For example, the Deep Bay Cabin, located on the Zarembo Island road system within Zarembo TAA, receives 100 percent local resident and regional use. Sites within TAAs may experience temporary decreases in use during harvest activities, but would resume after timber harvest activities are completed (1 to 3 years). Indirectly, the sites within TAAs may later see an increase in use due to improved roads, docks and boat ramps.

Access to and connectivity between recreation assets will be a determining factor in the development of new assets in the project area. Recreation trends show less use in locations dependent on floatplane access or in areas on the Stikine River that are inaccessible except on a few very high tides and river flows. New recreation assets would be proposed in locations that offer easier access for the public. Based on the maritime culture of Southeast Alaska, boating will remain a viable means of recreation access into the future. Therefore, future development of recreation assets would concentrate on creating recreation opportunities that are road or boat accessible.

Proposed recreation activities in the action alternatives would likely affect visitor use. If recreation assets are constructed that meet the demands and visitor use trends, then it is likely visitor use will increase at these sites. The increases in visitor use, however, would be minor to moderate based on the populations of Wrangell, Petersburg, Kake and Kupreanof along with the difficulty and expense to travel to Alaska. For instance, if six new cabins were constructed in the project area and each cabin averaged 75 nights of annual use (average to high use for cabins within the project area), there would be an addition of about 450 visitors to the project area annually. Visitor use to popular places like LeConte Glacier and Anan Wildlife Observatory would not likely see much change in visitation based on the activities proposed in this project.

The proposed activities are not anticipated to directly affect outfitter and guide activities in the project area. Outfitter and guide use would continue at current levels. Based on tourism trends and continued demand for Alaskan tours, outfitter and guide requests for use in the project area are likely to increase. Currently, outfitter and guide use is set by the allocations in the decisions made for the *Petersburg Outfitter and Guide Management Plan* and the *Wrangell Outfitter and Guide Management Plan*. These plans allow for some allocation adjustments through an adaptive management process. These plans may be reevaluated in the future to ensure that they remain relevant to current and projected use trends. Recreation asset development or improvements may

result in changes to current activities, but will not affect allocated service days. The majority of high-use outfitter and guide sites are located in non-development LUDs, where no harvest activities would take place. In addition, fees from outfitter and guide use would continue to support recreation assets in the project area.

Visitors may temporarily avoid a site being treated for invasive plants, but are likely to return to the site following treatment and regrowth of vegetation. Herbaceous and shrubby vegetation grows relatively quickly in the temperate rainforest climate so effects of vegetation reduction is usually only observed during the first 1 to 3 years.

Stream restoration activities may have a minor to moderate beneficial effect on visitor use by indirectly creating a recreation attraction in the form of a high-value fishing site or wildlife viewing site. If these sites are accessible by road or boat, the site could become a valued recreation site over time.

Cumulative Effects

Cumulative effects examine the impacts to recreation assets from current and reasonably foreseeable activities on NFS lands and non-NFS lands, at the landscape level, over the 15-year timeline for this project.

Reasonably foreseeable activities could affect recreation opportunities and assets. Construction, reconstruction, or maintenance of a MAF, for example, are likely to create greater access for recreation use.

Generally, activities on non-NFS lands would have minimum to no effect on recreation assets and their associated activities; however, some activities (timber harvest) may change recreation experiences associated with a site because of noise, visible transformations to the landscape, and temporary or permanent loss of access to the recreation asset. Impacts to recreation experiences could result in reduced use levels at sites in proximity to these activities. In contrast, road construction and reconstruction in association with timber harvest activities provide access to potential recreation assets and may increase recreation activities in more developed areas of the project.

Enacted legislation and future land transfers into and out of federal ownership could affect recreation assets and use levels. The Pat Lake area on Wrangell Island is part of a foreseeable land exchange to the Forest Service and this area represents the potential for large increases in recreation use on NFS lands along with potential for recreation development. Outfitters and guides already use Pat Lake for paddle board tours. These commercial uses are likely to continue after lands are transferred. Lands transferred out of federal ownership may result in fewer Forest Service recreation opportunities in the project area. Loss of opportunities may in turn affect communities by impacting local socio-economic activity. Changes in land ownership could disrupt accessibility to, and connectivity between, recreation opportunities on NFS lands, which could result in sites becoming isolated and experiencing reduced or no use. Land ownership changes would also effect outfitter and guide activities in the project area. Changes could lead to a reduction of service days because of fewer recreation use areas, and could lead to greater concentrations of authorized activities on remaining NFS lands.

There are a few major road construction projects proposed within the project during the foreseeable future. These include the Kake Access Road, which would travel from Kake to a saltwater access point near Petersburg and the City of Kupreanof. This road would affect recreation assets by creating access to potential recreation sites by vehicle, open opportunities for

new recreation facility construction and reduce the remoteness of the semi-primitive areas. It would become much easier to travel between the communities of Petersburg, Kupreanof and Kake and recreation use in all of these areas would likely increase.

Another potential road project is the proposed Wrangell to Fools Inlet Road on Wrangell Island. This road would connect the City of Wrangell to Fools Inlet on the southern end of the island, across from the Bradfield Canal and Anan Bay. The Wrangell to Fools Road would likely terminate in an MAF providing access from the upland road to the saltwater inlet. Recreation assets would be affected as visitors could to tow their boats to Fools Inlet and fish or take a quick 10 minute boat ride to the Anan Wildlife Observatory, creating a higher demand for access to the site. Local use of the Observatory may increase as a result of the road construction.

Scenery

This section evaluates the expected scenic impacts of the activities included in this project. In addition to three alternatives, it includes an analysis of the proposed 2016 Forest Plan amendment.

Summary

With up to 13,500 acres of even-aged management in both young growth and old growth, Alternative 2 ranks highest between the action alternatives in terms of impacts to the scenery resource. Alternative 3 ranks second-highest between the action alternatives in terms of impacts to the scenery resource, with up to 11,725 acres of even-aged management in both young growth and old growth.

The proposed 2016 Forest Plan amendment would allow for greater opportunities to provide positive timber sales by reducing any constraints that scenery may have on the unit design and layout. The scenic impacts of the proposed amendment are likely to last beyond the implementation timeline of this project.

Methodology

Methodology used to evaluate scenery impacts for this project is the Scenery Management System (SMS) and is described in *Landscape Aesthetics* (USDA Forest Service 1995).

Under the 2016 Forest Plan, all National Forest System (NFS) land has a Land Use Designation (LUD), which guides the types and intensity of development actions. The management prescriptions for each LUD define the Scenic Integrity Objectives (SIO) for each area. SIOs define the degree to which the natural landscape can be visibly altered, and provide guidelines for timber harvest, road building, and other activities, to ensure they are conducted in a way that allows the scenic objectives to be maintained. A LUD may have different SIOs within it, depending on the distance zone (foreground, middleground, background) in which the development activity is to take place. SIOs are classified using terms for scenic integrity: Very High, High, Moderate, Low, and Very Low. For a description of the levels of scenic integrity used for both Existing Scenic Integrity (ESI) and SIO, see the 2016 Forest Plan Scenery Forest-wide Standard and Guidelines p. 4-54, and the 2016 Forest Plan FEIS, p. 3-388.

Table 78. SIOs for all land within the analysis area

Scenic Integrity Objective	% of project area
High	36
Moderate	33
Low	7
Very Low	24

Spatial and Temporal Context for Analysis

The analysis area for direct and indirect effects is the NFS lands in the project area. The temporal boundaries are the timeline of the project implementation.

Analysis Methods and Assumptions

Assumptions made for this analysis:

- Proposed activities in this project, outside of timber harvest, will result in small, localized impacts, all of which will be designed to be consistent with the 2016 Forest Plan Scenery components.
- The most visible impacts will be from timber harvest and its corresponding road construction.
- Scenery analysis examines the acres of timber harvest to represent the scale of the visible impacts of each alternative.
- Even-aged management timber harvest will have more visible impacts than partial harvest.
- All harvest acres planned for ground or cable logging systems are assumed to be clearcut. All gross unit pool acres planned for helicopter harvest are assumed to be partial harvest.

Affected Environment

The present condition for scenery is described using existing scenic integrity (ESI).

Existing Scenic Integrity

The existing scenic resources of the Tongass encompass everything from vast tracts unmodified by human activity to extensive areas of heavily modified landscapes. The Existing Scenic Integrity (ESI) inventory is used by the Forest Service to represent the degree of intactness of the landscape character. This inventory is used to categorize the degree of alteration visible in the landscape on a continuum from a natural setting to a heavily altered landscape. Visible alterations can be a result from any human activity, including but not limited to timber harvest, road construction, recreation and special use developments, building construction and power infrastructure. ESI applies to the broad landscape affected, not just the acres altered. ESI also changes over time because some alterations may revegetate and begin to blend in with the surrounding landscape, or new projects may impact scenic integrity. ESI ranges over six levels of integrity, from Very High to Unacceptably Low. This inventory was last completed on a large scale before 2005, and would be reevaluated on smaller scales as proposed activities are implemented.

Table 79. Percent of analysis area by ESI

Existing Scenic Integrity	% of Analysis Area
Very High	82
High	<1
Moderate	2
Low	5
Very Low	11
Unacceptably Low	<1

Environmental Effects

With the activities proposed in this project being general in nature, and not specific with regards to location or appearance, the scenic analysis is focused on determining if there is capacity within the analysis area and gross unit pool to support the alternatives. For this analysis, capacity is defined as the ability to reduce the scenic integrity of an area while still meeting the SIOs and applicable 2016 Forest Plan components. The existing condition (ESI) is compared to the desired condition (SIO) for both the analysis area, to determine how much of the analysis area has an

existing condition that has room to support activities that cause visual impact. In other words, if the ESI is higher than the SIO (for example, Moderate ESI compared to Very Low SIO), there is capacity to proceed with projects that lower the scenic integrity of an area. If the ESI is currently the same as the SIO for an area, it does not mean that activities cannot take place, but that there is limited capacity, and care would need to be taken when designing a project to minimize visible impacts to continue to meet the SIO and remain consistent with 2016 Forest Plan Scenery components. Where the ESI is lower than the SIO, a generalized assumption would be that activities may be able to occur but would need to have no visible impact.

There are several LUDs that allow exceptions to the SIO for various developments. It is assumed that any non-timber harvest project developed from this analysis will be designed to meet the SIO of the area it is located in, and any related exceptions to SIO would be considered and used as needed and applicable (refer to Appendix A and the 2016 Forest Plan for more details).

Table 80. Existing condition (ESI) compared to the desired condition (SIO) in the analysis area

ESI/SIO Comparison	% of Analysis Area
ESI is greater than SIO	85
ESI is the same as SIO	7
ESI is lower than SIO	8

In Table 80 which looks at the entire analysis area, 85 percent has an ESI greater than SIO. This includes all LUDs including non-development LUDs. The analysis area has the overall capacity to absorb various activities expected to be implemented as a result of this project. However, the situation changes as we look more specifically at acres within the analysis area intended for timber harvest.

Next we compare ESI and SIO for the gross unit pool, looking at young growth and old growth separately. For all young-growth harvest, the SIO is Very Low (2016 Forest Plan, p. 5-7). Twelve percent of the gross unit pool young growth has an ESI greater than its SIO. For old-growth harvest in the gross unit pool, only 3 percent is in areas where the ESI is greater than the SIO. This means there is very limited capacity for large scenic impacts in areas planned for timber harvest within this project, especially in old-growth areas.

Table 81: Existing condition (ESI) compared to the desired condition (SIO) in the gross unit pool

ESI/SIO Comparison	% of Gross Unit Pool	% of Young Growth in Gross Unit Pool (SIO = V. Low)		% of Old Growth in Gross Unit Pool	
ESI is greater than SIO	4	12	837 acres	3	1,279 acres
ESI is the same as SIO	51	54	3,770 acres	50	21,324 acres
ESI is lower than SIO	45	34	2,374 acres	47	20,044 acres

Analysis was narrowed down even further to look specifically at even-aged management acres, as these areas will have the highest probability of having scenic impact when implemented. Sixty-six percent of the young-growth planned for even-aged management has an ESI that is greater to or equal to its SIO. For old-growth planned for even-aged management, 58 percent has an ESI greater to or equal to its SIO.

Table 82: Existing condition (ESI) compared to the desired condition (SIO) for lands within the gross unit pool available for even-aged management

ESI/SIO Comparison	% of Gross Unit Pool, Even-aged	% of Young Growth in Gross Unit Pool, Even-aged (SIO = V. Low)		% of Old Growth in Gross Unit Pool, Even-aged Management	
ESI is greater than SIO	12	12	835 acres	12	3,818 acres
ESI is the same as SIO	47	54	3,761 acres	46	14,198 acres
ESI is lower than SIO	44	34	2,368 acres	42	13,030 acres

Alternative 1 – No Action Alternative

Direct and Indirect Effects

For Alternative 1, current management of the project area would continue as before. Any ongoing activities that occur would have scenic analysis on a project-by-project basis. If no activities occur that impact the scenic integrity, then there would be no direct effects. There would be a continued increase of the Existing Scenic Integrity (ESI) (for example, from Low to Moderate) because regrowth in previously harvested or disturbed areas would lessen the visual impact of older cuts and they would slowly become less noticeable.

Alternative 2 – Proposed Action

Direct and Indirect Effects

In Alternative 2, the project area has a limited capacity to absorb the scenic impacts from the proposed activities. Most activities outside of timber harvest-related activities will have minimal impacts to the scenic integrity, and will be developed to comply with the 2016 Forest Plan scenery components. Young-growth harvest of 4,000 acres could occur with some scenic impact in the 66 percent (4,584 acres) of the gross unit pool young-growth area that has an ESI greater than or equal to Very Low. Three-thousand, seven hundred and seventy (3,770) acres of this has an ESI that is equal to the SIO, which indicates that when implementation begins, harvest in these areas would need to be carefully sited and designed in order to maintain the existing scenic integrity of the area, and compliance with the SIO may be difficult to achieve.

Old-growth timber harvest is estimated at 9,500 acres for Alternative 2. This is 42 percent of the 22,603 acres of old-growth within the gross unit pool that has an ESI greater than or equal to its SIO (Table 81). If the entire 9,500 acres is assumed to be implemented as even-aged management, it could be harvested from the 18,016 acres of the gross unit pool that have an ESI as greater than or equal to its SIO (Table 82).

Of those acres, only 3,818 acres have an ESI greater than its SIO. Implementation of even-aged management will likely be difficult in the implementation phase with almost 60 percent of the 9,000 acres needing to be harvested from areas where the ESI is equal to the SIO.

The existing condition of the project area is unlikely to be able to absorb visible effects of the proposed old-growth and young-growth timber harvest activities of Alternative 2 while complying with the current 2016 Forest Service Standards and Guidelines.

Alternative 3

Direct and Indirect Effects

In Alternative 3, there is also limited capacity for the project area to absorb the scenic impacts from the proposed activities. Most activities outside of timber harvest-related activities will have

minimal impacts to the scenic integrity, and will be developed to comply with the 2016 Forest Plan scenery components. Young-growth harvest of 3,650 acres could occur with some scenic impact in the 66 percent (4,584 acres) of the gross unit pool young-growth area that has an ESI greater than or equal to Very Low. 3,770 acres of this has an ESI that is equal to the SIO, which indicates that when implementation begins, harvest in these areas would need to be carefully sited and designed in order to maintain the existing scenic integrity of the area, and compliance with the SIO may be difficult to achieve.

Old-growth timber harvest is estimated at 8,075 acres for Alternative 3. This is 36 percent of the 22,603 acres of old-growth within the gross unit pool that has an ESI greater than or equal to its SIO (Table 81). If the entire 8,075 acres is assumed to be implemented as even-aged management, it could be harvested from the 18,016 acres of the gross unit pool that have an ESI as greater than or equal to its SIO (Table 82).

Of those acres, only 3,818 acres have an ESI greater than its SIO. Implementation of even-aged management will likely be difficult in the implementation phase with almost 53 percent of the 8,075 acres needing to be harvested from areas where the ESI is equal to the SIO.

The existing condition of the project area is unlikely to be able to absorb visible effects of the proposed old-growth and young-growth timber harvest activities of Alternative 3 while complying with the current 2016 Forest Service Standards and Guidelines.

2016 Forest Plan Amendment – Common to Alternatives 2 and 3

There is a proposed 2016 Forest Plan amendment that would allow the SIOs of certain areas of old-growth harvest to be lowered during the implementation phase to provide for a positive timber sale offer. As planning becomes site-specific, the scenic effects will be more easily assessed, and where proposed harvest opening sizes are not compatible with the current plan, the areas' SIOs may be selectively lowered as needed to provide for a positive timber sale offering.

For analysis, it is assumed that all areas would be lowered from their current SIO to Very Low SIO. During implementation, it may end up that some areas are lowered to Moderate or Low SIO, depending on the implementation plans.

Table 83: Existing condition (ESI) compared to the desired condition (SIO) for lands in gross unit pool affected by proposed 2016 Forest Plan amendment

ESI/SIO Comparison	% of Gross Unit Pool in Forest Plan Amendment Area, Current 2016 Forest Plan SIOs		% of Old Growth in Gross Unit Pool, Even-aged Management	
ESI is greater than SIO	8	957 acres	39	4,946 acres
ESI is the same as SIO	15	1,886 acres	61	7,779 acres
ESI is lower than SIO	77	9,882 acres	0	0 acres

As shown in Table 83, with the proposed 2016 Forest Plan amendment, 39 percent of the old growth acreage in the GUP would have an ESI greater than the proposed SIO of Very Low. 7,779 acres would have an ESI that is the same as the SIO of Very Low, in which there could be harvest but care would have to be taken to ensure the visible impacts were minimal and did not reduce the scenic integrity to Unacceptably Low, which is below Very Low, a category the Forest Service does not manage for.

With this change, 12,084 acres (95 percent) of the GUP within the 2016 Forest Plan amendment areas could change SIO, in four of the tem timber analysis areas (TAA). This would increase the capacity of the entire project area while providing for a positive timber sale offer. The proposed harvest would be able to comply with the amended 2016 Forest Plan.

While this amendment is proposed as "project-specific," the changes in scenic integrity will last for longer than the implementation of the project, up to approximately 60 to100 years, depending on the current existing condition and the regrowth of the area. These areas will therefore not be able to comply with the current 2016 Forest Plan outside of this project. Any scenic impacts outside of this project, in areas where the implementation does require an SIO change, will likely not be able to be implemented to comply with the 2016 Forest Plan.

Cumulative Effects Common to All Alternatives

Past activities outside of this project that have created scenic impacts are considered and accounted for in the Affected Environment section.

It is not possible at this time to predict the impacts to scenic integrity of many of the reasonably foreseeable projects. Activities planned for NFS lands will be taken into consideration during the implementation phase of this project. Activities off of NFS lands, including those due to land ownership adjustments, may have impacts to the scenic integrity if located in areas where both non-NFS and NFS lands are visible simultaneously.

Overall the cumulative effects of past, present, and reasonably foreseeable actions on scenery are not expected to be substantially different than the effects addressed under direct and indirect effects.

Socioeconomics

This section assesses social and economic conditions and trends in project area communities and provides a foundation for considering how project activities may affect community economic well-being including economic stability, employment, income, and environmental justice. The analysis focuses on the Wrangell and Petersburg Ranger District communities in the project area including Kake, Kupreanof, Petersburg, and Wrangell. Socioeconomic effects are discussed across three alternatives including one no action and two action alternatives.

The purpose of the Central Tongass Project is to implement 2016 Forest Plan direction to provide diverse opportunities and resources that contribute to local and regional economies and employment (USDA Forest Service 2016a, p. 2-3). At this time, a need exists to contribute to the economic viability of Southeast Alaska communities, by providing a sustainable level of forest products to help maintain and transition expertise and infrastructure of the timber industry, quality recreation and tourism opportunities for the public.

Summary

Alternative 1, the No Action Alternative, would have no direct effects on economic activity and well-being in the project area. Alternative 1 would result in increased economic uncertainty and reduced economic activity in forest product related businesses in the project area. This would be due to a reduction in timber harvests levels over the next 15 years on the Wrangell and Petersburg Ranger Districts and may result in the reduction of jobs and labor income in forest product related industries. Businesses in the project area that rely on expenditures of local firms and wage earners in forest product related industries may be indirectly affected by declining economic activity and experience increased economic uncertainty. Recreation and tourism would continue to contribute to jobs and labor income under Alternative 1. Existing conditions and trends related to subsistence incomes for households in the project area would not be affected by Alternative 1.

Alternatives 2 and 3 would contribute to economic stability and community well-being in the project area. Both action alternatives are likely to sustain more jobs and labor income than Alternative 1 in project area communities in forest products and transportation industries due to timber harvests on the Wrangell and Petersburg Districts. See Issue 1: Timber Suppy and Economics for a summary of the number of direct jobs and labor income that may be generated under these alternatives. Both action alternatives contribute to a reliable and predictable flow of timber sales that can be packaged to meet market demand. Both action alternatives facilitate the transition to young-growth harvest while providing economic opportunities in timber related industries. Project activities under alternatives 2 and 3 related to recreation and tourism may yield more economic contributions for local communities due to enhanced lodging opportunities offered in the project area.

Given the balance of risks and benefits to freshwater salmon habitat it is difficult to predict how commercial and subsistence fishing may be affected under both action alternatives. However, it is important to note that Alternative 3 poses fewer new risks to freshwater salmon habitat than Alternative 2 due to fewer road-stream crossings and fewer watersheds at risk for peak flow events. Hence risks to commercial and subsistence fishing, and their related economic contributions to household livelihoods, are greater in Alternative 2. Similarly, Alternative 3 poses less risk to deer populations that communities in the project rely on for subsistence incomes and household livelihoods than Alternative 2 which maintains less high-value winter deer habitat.

The analysis of effects to environmental justice communities found that there were no disproportionately adverse risks to low-income or minority communities from any of the alternatives considered in detail.

Regulatory Framework

Executive Orders

Executive Order 12898

The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations. For more information see the socioeconomic report in the project record.

Other Guidance or Recommendations

Forest Service Handbook 1909.17 provides direction for social and economic impact analysis.

Methodology

Spatial Scale

The spatial scale of the direct, indirect and cumulative effects for the project is primarily focused on communities in the project area, Kake, Kupreanof, Wrangell and Petersburg.

Temporal Scale

Proposed project activities are expected to occur over 15 years, from 2021 to 2036. Past projects are considered in the existing condition discussion because they reflect the aggregate effect of all preceding human actions and natural events that might contribute to cumulative effects. Past projects are generally physically located on the landscape, such as timber harvest, thinning of harvested stands, recreation developments, road construction, and stream restoration and enhancement.

Analysis Methods and Assumptions

The four communities in the project area are classified as rural. Rural Alaskan communities rely on a mixed cash-subsistence economy comprised of hunting, fishing and gathering referred to as a subsistence component (also called subsistence income), and a cash component. Cash is used to complement subsistence incomes and to support participation in the subsistence economy. Purchases of equipment and tools, such as boats, fishing nets, guns, and rain gear, support subsistence activities (ADF&G 2019). Given the importance of subsistence to the well-being of rural Alaska communities, methods were designed to assess the project's contribution to both subsistence and cash components of the economy.

With respect to contributions to the cash component, project activities may affect four industries: commercial forest products, transportation, commercial fishing, and recreation and tourism. Indicators of direct effects from project activities to forest products and transportation industries is located in the Issue 1: Timber Supply and Economics section of this EIS. This analysis considers the other economic impacts related to forest products and transportation industries. Indicators used to evaluate economic effects related to recreation and tourism and the commercial fishery include:

- Assessment of risks to freshwater salmon habitat from changes in stream flow, peak flow events and fish passage described in the aquatic resources section of this EIS.
- Number of cabins accessible by road with completed environmental analysis and decision.
- Acres of foreground viewsheds with high Scenic Integrity Objectives modified along high profile excursion routes and popular recreation features.

In respect to contributions to subsistence incomes, project activities may affect the subsistence salmon fishery and deer harvests. Indicators of potential effects from project activities include the following:

- Assessment of risks to freshwater salmon habitat from changes in stream flow, peak flow events and fish passage described in the aquatic resources section of this EIS.
- Changes in high-value deer winter habitat in wildlife analysis areas where communities in the project area either individually or collectively have secured over 75 percent of deer harvest between 2000 and 2017, as measured through ADF&G hunter survey results.

With respect to environmental justice, potentially affected populations within the analysis area include both minority and low-income communities. To qualify as a minority or low-income community, the respective community classification must exceed 50 percent of the population or be meaningfully greater (15 percent) than comparative populations (U.S. Department of Agriculture 1997). There are no communities in the project that meet the USDA criteria for environmental justice *low-income* communities.

In respect to environmental justice minority communities, with 65 percent of the Kake's population identifying as Alaskan Native (see Table 85), Kake meets the USDA definition (1997) of a minority population (U.S. Census 2018a). The share of minorities in other communities in the project area did not exceed 50 percent of the population or were not meaningfully greater in their share of minorities than Alaska's non-metropolitan minority population. Non-metropolitan counties are that do not have at least one urbanized area of 50,000 or more in population (OMB 2009). Kake is therefore considered an environmental justice community in this analysis because it qualifies as a *minority* population. To evaluate if the alternatives could result in disproportionate adverse risk to Kake, this analysis the distribution of risks related to cash and subsistence incomes in Kake as compared to other communities in the project area.

For information on the analysis assumptions see the socioeconomic resource report located in the project record.

Incomplete or Unavailable Information

CEQ regulations outline a process for dealing with incomplete or unavailable information: Agencies should acknowledge this is the case, summarize the existing credible and relevant scientific information, and evaluate impacts based on methods or approaches generally accepted in the scientific community (40 CFR 1502.22). CEQ also requires agencies to discuss responsible opposing views (40 CFR 1502.9(b)).

- It is unknown how risk to winter deer habitat directly affects deer population and therefore abundance of deer for subsistence harvest. Deer harvest survey data may not accurately represent the actual deer harvest or location. This data however is the best information available to evaluate hunting patterns by community and wildlife analysis area. The direct relationship of aquatic habitat conditions, salmon recruitment, survival and catch is unknown.

- There is limited up-to-date socioeconomic data at the community level available. Information in the Community Subsistence Information System, while dated in some cases, provides the most comprehensive assessment and best available data for community subsistence patterns for all species and is therefore used in this analysis.
- An economic impact analysis using industry standard Input-Output software IMPLAN was not used in this analysis. The limited development of markets and market interactions in the project area is insufficient to model regional economic impacts from the project using IMPLAN software.

Affected Environment

Existing Condition

Southeast Alaska is sparsely settled with an estimated 72,915 people living in more than 30 towns and villages located in and around the Tongass National Forest in 2017; most are located on islands or along the narrow coastal strip (Alaska Department of Labor [DOL] 2018). Four of these communities, Kake, Kupreanof, Wrangell and Petersburg, totaling around 6,300 people, live within or adjacent to the project area.

Regional Demographic Overview

Southeast Alaska is divided into eight boroughs and two census areas. The eight boroughs – Haines, Juneau, Ketchikan Gateway, Petersburg, Sitka, Skagway, Wrangell, and Yakutat – correspond with the county governments found elsewhere in the United States. The three largest boroughs – Juneau, Ketchikan Gateway, and Sitka – together accounted for 75 percent of total regional population in 2017 Population is discussed in more detail in the *Subregional Overview and Communities* section of the 2016 Forest Plan FEIS (USDA Forest Service 2016b, pp. 3-525 to 3-535). Communities in the project area are located within the Petersburg Borough, the Wrangell City and Borough and the Prince of Whales-Hyder Census Area and account for 3 percent of the Southeast Alaska's population. Demographic information for smaller communities such as Union Bay, Thoms Place, Olive Cove, Farm Island and Point Agassiz are included within Wrangell and Petersburg data sets.

Regional Economic Overview

Southeast Alaska employment in 2017 is summarized by sector in Table 84. Government and the visitor sector were the largest employers, accounting for 29 percent and 17 percent of total employment, respectively. The government sector is the main source of year-round employment in Southeast Alaska. State government employment has dropped significantly since 2012, with a loss of 850 state jobs in Southeast Alaska from 2012 through July 2018 (Southeast Conference 2018). Although timber represent a low portion of the total jobs in Southeast Alaska, the distribution of these jobs in rural communities provides for economic stability as these jobs are relatively high-paid positions employing local residents year round.

Table 84. Southeast Alaska employment by sector, 2017

Economic Sector	Total Employment (jobs)	Total Earnings ($M)	Percent of Total	
			Employment	Earnings
Government (includes Coast Guard)	13,256	769.0	29	35
Visitor	7,739	231.4	17	11

Economic Sector	Total Employment (jobs)	Total Earnings ($M)	Percent of Total	
			Employment	Earnings
Seafood	3,829	216.5	8	10
Retail and Wholesale Trade	4,474	145.2	10	7
Health Care (private only)	2,732	150.1	6	7
Construction	1,932	121.9	4	6
Financial	1,964	118.5	4	5
Professional and Business Services	2,869	118.5	6	5
Social Services	1,580	46.1	3	2
Mining	886	90.5	2	4
Information	571	23.9	1	1
Timber	354	18.7	1	1
Warehousing, Utilities, Transportation	903	53.9	2	2
Other	2,551	91.8	6	4
Total	45,640	2,195.9	100	100

Source: Southeast Conference 2018

Project Area Community Profile

Estimated population totals by community ranged from 21 to close to 2,900 in 2017. Communities in the project area include places that are predominantly Native such as Kake, communities that are predominantly non-Native, like Petersburg, and places with mixed ethnicity where Alaska Natives range from about one-fifth to one-third of the population, like Kupreanof and Wrangell (Table 85). The percent of people living below the poverty line ranged from zero percent in Kupreanof to 16 percent in Kake, which was 3 percent higher than other non-metropolitan Alaskan communities. Subsistence use was greatest in Kake and lowest in Wrangell.

Table 85. Demographics of the project area communities

Community	2017	Population		Median Household Income			Subsistence Use (lbs per capita)
		Percent Change 2010 to 2017	Percent Native in 2017	2017	Percent of State Median	Percent Below Poverty Line in 2017	
Kake	604	8	65	$52,500	69	16	179
Kupreanof	21	-22	33	na	na	0	na
Petersburg	2,896	-2	7	$64,201	84	8	161
Wrangell	2,387	1	22	$56,094	74	12	168
Combined Area	6,304	-6.9	14	na	na	10	na
Non-Metro State of Alaska	250,105	-0.6	24	$69,956	na	13	na

na = not available; table details and source information is located in the socioeconomic report.

Using standard socioeconomic indicators to characterize communities in Southeast Alaska is challenging due to the small population sizes, alternative lifestyle choices and values, and the mixing of cash and subsistence economies. Employment and business license data are presented for communities in the project area in Table 86. These measures, as explained in more detail in the socioeconomic report, provide different perspectives on the presence of natural resource- and visitor-related business activities by communities. An estimated total of 2,206 residents were employed in project area communities in 2016, with between to 2 to 4 percent of the total population employed in the natural resources and mining industry, which includes agriculture, forestry, fishing and hunting. Between 9 and 19 percent of project area residents were employed in the leisure and hospitality industry.

Table 86. Community employment and business license data

Community	Total Employment (2016)	Percent of Total Employed – Natural Resources and Mining Industry (2016)	Percent of Total Employed – Leisure and Hospitality Industry (2016)	Total Number of Business Licenses (2019)	Percent of Total Business Licenses - Forest Products Industry (2018)	Percent of Total Business Licenses - Visitor Industry (2018)
Kake	211	4	1	14	0	19
Kupreanof	na	na	na	2	0	0
Petersburg	1,113	2	8	402	2	9
Wrangell	882	2	7	258	2	11

na = not available; table details and source information is located in the socioeconomic report.

Kake (Kéex')

Kake (Kéex'), a predominantly Tlingit village, is located alongside Kupreanof Island's west side alongside Keku Strait and directly south of Admiralty Island. The population totaled 604 residents during 2017. Kake's economy is primarily based on government, education, tourism, and fishing employment. As of July 2019, there were 14 active business licenses issued in Kake, including from lodging, retail, eateries, automotive, communications, and arts and entertainment, and shellfish farming businesses (Alaska DCCED 2019a). Communications between Forest Service staff and tribal government indicate that there are two businesses in Kake related to forest products (Grewe 2019). Subsistence resources are also an important component of Kake's economy and community fabric. The Organized Village of Kake, a federally-recognized tribe, was established during 1947. A first-class city government, incorporated under the laws of the State of Alaska, was incorporated during 1952. Kake Tribal Corporation, an Alaska Native village corporation, was established pursuant to the *Alaska Native Claims Settlement Act* during 1971. Kake community members, the Kéex' Kwaan people, use Kuiu, Kupreanof, Admiralty, Horn Cliff and Baranof Islands and mainland's Hobart Bay for subsistence activities.

Community Subsistence Information System data are provided by the Alaska Department of Fish and Game, Subsistence Division and reflect community survey results for subsistence harvest at the community level, which differ from the subsistence resource section that references federal subsistence deer hunters by Game Unit. Information in this System, while dated in some cases, provides the most comprehensive assessment and best available data for community subsistence patterns for all species and is therefore used in this analysis.

Table 87 illustrates the top ten subsistence species harvested in Kake, which account for 90 percent of subsistence harvest by weight (ADF&G 1996). All other subsistence resources

harvested by Kake account for 10 percent of subsistence incomes. Deer is the largest single source of subsistence income, accounting for 28 percent of harvest by weight. The combined weight of all seafood harvested accounted for 54 percent of the subsistence harvest, with halibut and sockeye salmon accounting for the largest shares, at 19 percent and 17 percent respectively. The fishery is not only important to Kake's subsistence incomes but also for cash incomes. Twenty-five percent of halibut, 18 percent of sockeye salmon and 7 percent of chinook salmon caught for personal use, in other words, not caught on a commercial fishing vessel, were sold (ADF&G 1996) to provide a means to generate cash income.

Table 87. Kake estimated subsistence harvest by weight

Subsistence Resource	Percent Total Harvest
Deer	28
Halibut	19
Sockeye Salmon	17
Harbor Seal	6
Vegetation	5
Butter Clams	4
Berries	3
Chinook Salmon	3
Black (small) Chitons	3
Crabs	2
Other	10

Source: ADF&G 1996

Table 88 shows the top five wildlife analysis areas where the majority of subsistence deer harvests were recorded from 2000 to 2017 for the community of Kake. Close to 80 percent of subsistence deer harvest was from three wildlife analysis areas - the Kake Area (no. 5132), Hamilton Creek/Big John Bay (no. 5131), and North shore Kupreanof (no. 5135). Changes in high-value winter deer habitat within these areas are of interest as existing subsistence incomes are dependent upon deer populations in these areas.

Table 88. Kake subsistence deer harvest by Wildlife Analysis Area 2000-2017

Kake	Total Number of Deer Harvested (2000-2017)	Percent	Cumulative Percent Total
5132 Kake Area	169	48.5	48.5
5131 Hamilton Creek, Big John Bay	85	24.4	72.9
5135 North Shore Kupreanof Island	22	6.4	79.3
5138 Southern Lindenberg Peninsula.	22	6.4	85.8
5018 Rocky Pass/Kuiu Island	18	5.1	90.8
All other wildlife analysis areas	32	9.2	100

Source: ADF&G 2019

Kupreanof

The City of Kupreanof is located across the Wrangell Narrows from Petersburg, on the northeast shore of Kupreanof Island. Incorporated as a city in 1975, the municipality has no full-time staff, few services, and no public utilities. Kupreanof is a small, non-Native community, with a total estimated population of 21 residents in 2017. The community is built entirely on the waterfront; there are no roads. Residents use skiffs to travel to Petersburg for schooling, goods, and services. The majority of Kupreanof's working residents are self-employed, although some commute by boat to jobs in Petersburg. As of June 2019, there were three active business licenses issued in Kupreanof. The businesses included real estate and health care assistance, specifically dentistry (Alaska DCCED 2019b). The Community Subsistence Information System does not include community survey data on subsistence harvests for Kupreanof, nor was data available on deer subsistence harvest by Wildlife Analysis Area for the community. Although data are lacking, anecdotal evidence suggests that subsistence and recreation uses of resources around Kupreanof supplement household incomes; deer, salmon, halibut, shrimp and crab are favorites.

Petersburg

Petersburg is located on the northern tip of Mitkof Island, with an estimated population of 2,896 in 2017. Petersburg's economy is primarily based on the commercial fishing and timber industries. The city includes several fish processors operating cold storage, canneries, and custom packing services and the state-run Crystal Lake salmon hatchery. Petersburg also has active saw mills, and provides supplies and services for many of the area logging camps. Many residents also participate in subsistence gathering. While there is no deep-water dock suitable for large cruise ships, there are outfitters and guides who use National Forest System (NFS) lands who have businesses originating in Petersburg.

Table 89 illustrates the top ten subsistence species harvested by weight by Petersburg residents (ADF&G 2000a). These ten species account for 86 percent of the total subsistence harvest. All other subsistence resources for Petersburg account for 14 percent of subsistence incomes. Chinook salmon provides the largest contribution to subsistence incomes, accounting for 22 percent of harvest by weight. Within the ten species presented in Table 89, the combined weight of all seafood harvested accounted for 78 percent of subsistence incomes for Petersburg residents. Deer harvests play a much smaller role in the Petersburg community than in other project area communities, accounting for only 8 percent of subsistence harvest.

Table 89. Petersburg top ten subsistence harvest species

Subsistence Resource	Percent Total Harvest
Chinook Salmon	22
Halibut	12
Crabs	10
Shrimp	9
Deer	9
Coho Salmon	7
Herring	6
King Crab	4
Dungeness Crab	4
Sockeye Salmon	4
All Other Species	14

Source: ADF&G 2000a

Table 90 shows the top five wildlife analysis areas where the majority of subsistence deer harvests were recorded from 2000 to 2017 for Petersburg. The cumulative percent total shows that over 75 percent of deer harvested was from three wildlife analysis areas: 2007, 5138, and 1905. Changes in high-value deer winter habitat on these three islands are of interest as existing subsistence incomes from deer harvest may be affected by changes deer abundance.

Table 90. Petersburg subsistence deer harvest by wildlife analysis area 2000-2017

Petersburg	Total Number of Subsistence Deer Harvested (2000-2017)	Percent	Cumulative Percent Total
2007 Mitkof Island.	1,105	34.9	34.9
5138 Southern Lindenberg Peninsula.	871	27.5	62.4
1905 Zarembo Island.	455	14.4	76.8
5134 South Shore Kupreanof	233	7.3	84.1
5133 West Duncan Canal	132	4.2	88.3
All other wildlife analysis areas	370	11.7	100.0

Source: ADF&G 2019

Wrangell

Wrangell is located on the north end of Wrangell Island, near the mouth of the Stikine River, a historic trade route to the Canadian interior. Total estimated population was 2,387 as of 2017. Wrangell began as an important Tlingit site primarily because of its proximity to the Stikine River. In 1867, a military post named Fort Wrangell was established as part of the Alaska Territory. The community continued to grow as a fur trading center, and as an outfitter for gold prospectors between 1861 and the 1930s. The Wrangell economy is primarily based on commercial fishing, fish processing and tourism. As of July 2019, there were 258 active business licenses issued within Wrangell. A detail review of active businesses in 2019 finds that this last industry category is heavily weighted in fishing, as there are numerous businesses related to fishing, and one active business related to forest products (Alaska DCCED 2019b). Mike Allen Enterprizes is the project area's largest local purchaser of timber and producer of saw logs (USDA Forest Service 2019). With the purchase of 9.8 MMBF in 2016, harvests for the Three Sisters sales will continue through 2022.

Subsistence resource harvests surveyed by the State provides a snapshot estimate of subsistence harvests by Wrangell residents in 2000 (ADF&G 2000b). As shown in Table 91 the top ten subsistence species harvested by weight demonstrate the most significant contributions to subsistence incomes from fish and wildlife resources harvested by residents of Wrangell. All other subsistence resources for Wrangell only account for six percent of subsistence harvests by weight. Deer and shrimp harvests, at 17 percent each of subsistence species harvested, account for the largest single species harvest. Fish and crustaceans play a large role in sustaining the livelihoods of Wrangell residents, accounting for at least 63 percent of subsistence harvest. Land mammals, play are more limited role, as deer and moose combined only account for 23 percent of subsistence harvest by weight.

Table 91. Wrangell top ten estimated subsistence harvest species by weight

Subsistence Resource	Percent Total Harvest
Deer	17
Shrimp	17
Crabs	13
Halibut	10
Dungeness Crab	9
Chinook Salmon	9
Moose	6
Vegetation	5
Rockfish	5
Berries	4
Other	6

Source: ADF&G 2000b

Table 92 shows the top five wildlife analysis areas where the greatest amount of subsistence deer harvests were recorded from 2000 to 2017 for the community of Wrangell. Over 78 percent of deer harvested was from two wildlife analysis areas, numbers 1905 and 1903. Changes in high value winter deer habitat in these two areas are of interest as existing subsistence incomes are dependent upon deer populations in these areas.

Table 92. Wrangell subsistence deer harvest by wildlife analysis area 2000-2017

Wrangell	Total Deer Harvest (2000-2017)	Percent	Cumulative Percent Total
1905 Zarembo Island	2840	54.1	54.1
1903 Wrangell Island	1283	24.4	78.5
1901 Northern Etolin Island.	700	13.3	91.9
1904 Woronkofski And Stikine Mouth Island	202	3.8	95.7
1910 Southern Etolin Island	116	2.2	97.9
All other wildlife analysis areas	108	2.1	100.0

Source: ADF&G 2019

Subsistence Income Overview

Subsistence resource harvests surveyed by the State in project area communities in 1996 and 2000 (ADF&G 1996, 2000a, 2000b) provide a snapshot estimate of per capita subsistence harvests by species (Table 93). Overall Kake had the highest per capita harvest at 179 pounds per person, as well as the greatest diversity of species harvested. Conversely, Petersburg had the lowest per capita harvest rate at 161 pounds per person. The distribution of Petersburg's harvest is more heavily weighted to fish catch than any other community in the project area and also had the lowest per capita harvest of land mammals at 17 pounds per person. Wrangell was unique in that it had the lowest per capita harvest of fish at 60 pounds per person. Residents in Kake also relied more heavily on land mammal for subsistence than Wrangell and Petersburg residents.

Table 93. Per capita subsistence harvest by community

Community	All Resources (Pounds)	Fish (Pounds)	Land Mammals (Pounds)
Kake	179.1	85.3	52.0
Petersburg	161.4	102.4	17.3
Wrangell	167.5	59.6	38.9

Source: ADF&G 1996, 2000a, 2000b

Table 94 identifies the eight wildlife analysis areas where project area communities collectively harvested over 75 percent of their deer harvest. The "x" demonstrates the wildlife analysis area of relevance to each community or the combined population. Note that due to its relatively small population, the primary wildlife analysis areas for Kake's deer harvest were not included in the combined project area community harvest. Also note, when all community harvest data was combined, wildlife analysis area 1901 (Northern Etolin Island) is one of the primary areas where subsistence deer are harvested. Changes in high-value winter deer habitat in these areas are of interest as communities reliant upon subsistence deer harvest may be vulnerable to changes in the deer population in these areas.

Table 94. Wildlife analysis areas where over 75 percent of communities in project area harvest deer

Wildlife Analysis Area	Combined Harvest: Petersburg, Wrangell, Kake	Wrangell	Petersburg	Kake
1905 Zarembo Island	X	X	X	
1903 Wrangell Island	X	X		
2007 Mitkof Island	X		X	
5138 Southern Lindenberg Peninsula	X		X	
1901 Northern Etolin Island	X			
5132 Kake Area				X
5131 Hamilton Creek, Big John Bay				X
5135 North Shore Kupreanof				X

Source: ADF&G 2019

Natural Resource-Based Industries

Direct employment in natural resource-based industries in Southeast Alaska– timber, visitor, seafood, and mining – together accounted for an estimated 12,808 jobs in 2017, more than one-quarter (28 percent) of total employment in Southeast Alaska. The visitor industry accounted for more than half (60 percent) of this total, followed by the seafood sector, which accounted for almost one-third (30 percent). Mining accounted for 7 percent and wood products made up 3 percent in Southeast Alaska but does not contribute to jobs and labor income in the project area (Southeast Conference 2108). Therefore mining is not considered further in this analysis.

Industry-Specific Descriptions

Forest Products

Employment

Southeast Alaska timber is primarily purchased and harvested from Tongass NFS lands managed by the USDA Forest Service, from the State of Alaska (Division of Forestry, Alaska Mental Health Trust Land Authority, and University of Alaska Trust Land Office), and Alaska Native Village and Regional corporations (Alaska Native corporations). Sawmill employment has historically been supported by Forest Service timber sales, with state timber harvest also contributing. Logging employment is generated from all ownerships, including Alaska Native corporation lands. Tongass National Forest-related employment in logging and sawmilling declined from 199 jobs in 2003 to a low of 61 jobs in 2017 (Table 95). From 2002 to 2017 harvest activities on the Tongass supported about 41 percent of timber jobs in Southeast Alaska, on average. Harvest activities supporting employment have included pre-commercial thinning, generally defined as a silvicultural treatment to reduce stand density, primarily to improve forest health.

Table 95. Timber industry employment in Southeast Alaska, 2002-2017 (number of workers)

Year[1]	Tongass Logging	Tongass Sawmill	Total Tongass-Related Employment	Other Logging	Other Sawmill	Total Other Timber Employment	Total Timber Industry Employment
2002	63	110	173	299	40	339	512
2003	108	91	199	298	64	362	561
2004	82	95	177	220	53	273	450
2005	88	96	184	263	52	315	499
2006	81	77	158	217	46	263	421
2007	44	70	114	225	54	279	393
2008	52	70	122	118	24	142	264
2009	48	39	87	110	19	129	216
2010	61	43	104	133	7	140	244
2011	62	47	109	150	3	153	262
2012	42	47	89	144	11	155	244
2013	75	48	123	106	14	120	243
2014	86	60	146	96	7	104	249
2015	104	58	162	63	12	75	237
2016	81	70	151	76	1	77	228
2017	24	37	61	109	32	141	202

[1] Data are presented by calendar year. Source: USDA Forest Service 2018a

Timber Harvest

Timber harvest in Southeast Alaska peaked in the late 1980s, with harvest levels slightly below 1 billion board feet. Total harvest in 2017 was 89.9 million board feet (MMBF), about 10 percent of peak levels. As shown in Table 96 timber harvests on the Tongass varied over a three year period by 43.5 MMBF between 2015 (59.9 MMBF) to 2017 (16 MMBF). When considering all timber volume produced by all ownerships during this same period, this variability in harvest volume was reduced to 5.4 MMBF. In 2017 harvest volume on the Tongass accounted for about 18 percent (16.0 MMBF) of this total, with roughly half (52 percent, 46.4 MMBF) of the overall

total provided by Alaska Native corporation lands and 31 percent (27.51 MMBF) provided by the State of Alaska. Information on annual market demand, timber supply, and log exports is presented in the Issue 1: Timber section of this DEIS.

Table 96. Southeast timber harvest (MMBF) by ownership, 2002 - 2017

Year	Tongass National Forest (CY)	State of Alaska	Native Corporation	Total	Tongass proportion of total
2002	31.9	57.3	101.7	190.9	0.1671
2003	48.1	34.8	105.7	188.6	0.2551
2004	49.2	24.2	98.9	172.3	0.2855
2005	46.6	42.9	103.9	193.4	0.2409
2006	40.0	44.6	71.2	155.8	0.2570
2007	22.5	44.6	50.0	117.1	0.1920
2008	30.0	11.9	52.3	94.2	0.3185
2009	28.3	13.5	51.8	93.6	0.3026
2010	35.7	10.5	66.4	112.6	0.3168
2011	31.6	16.3	63.1	111.0	0.2850
2012	17.5	10.80	56.1	84.4	0.2071
2013	41.2	11.20	47.4	99.8	0.4126
2014	36.7	12.00	29.3	78.0	0.4702
2015	59.5	3.39	32.4	95.3	0.6244
2016	43.5	6.22	34.6	84.3	0.5160
2017	16.0	27.51	46.4	89.9	0.1775

Table details and source information is located in the socioeconomic report (Prescott 2019).

Timber Industry

Annual Mill Survey

The wood products industry in Southeast Alaska currently consists of individual- and family-owned sawmills and independent logging businesses. Table 97 summarizes processing capacity, raw material consumption, utilization rates, and employment for southeast Alaska sawmills from 2000 to 2017. Mill capacity has declined steadily since the high of 501.8 million board feet (MMBF) in 2000. Capacity fell to 113.6 MMBF by 2017, a loss of 75 percent resulting from the dismantling of half of the mills in the survey pool. Actual sawmill consumption fell by 86 percent between 2000 and 2017, from 87.1 to 15.5 MMBF. Volume not included in mill consumption includes products from logs that are not sawn at the mill. These products primarily include chips and bark manufactured from utility logs, but may also include firewood. Log exports to domestic or foreign destinations was discontinued in 2007. Utilization rates indicate all operating mills have been producing at a fraction of their capacity since the surveys began. After stagnating around 9 percent throughout the 2000s, utilization began to rise in 2013 has stabilized around 15 percent.

Table 97. Comparison of southeast Alaska sawmill assessment results, calendar year 2000 through 2017

Calendar year	Installed sawmill capacity[b]	Estimated sawmill consumption[c]	Volume not included in sawmill consumption			Sawmill utilization rate	Employees
			Manufactured products[d]	Log exports	Total		
	Thousand board feet (Scribner log scale)					Percent	Number
2000	501,850	87,117	46,079	27,522	73,601	17.4	321
2002	453,850	39,702	9,164	4,940	14,104	8.7	160
2003	369,850	32,005	763	17,030	17,793	8.7	155
2004	370,350	31,027	509	3,088	3,597	8.4	148
2005	359,850	34,695	0	3,541	3,541	9.6	136
2006	354,350	32,141	7,620	2,646	10,266	9.1	123
2007	292,350	31,717	4,015	NA	NA	10.8	133e
2008	282,350	23,666	3,513	NA	NA	8.4	94
2009	249,350	13,422	1,250	NA	NA	5.4	58
2010	155,850	15,807	385	NA	NA	10.1	64
2011	160,000	11,546	1,295	NA	NA	7.2	56
2012	120,400	13,842	899	NA	NA	11.5	58
2013	120,400	17,593	920	NA	NA	14.6	60
2014	119,400	18,830	570	NA	NA	15.8	54
2015	113,650	18,540	145	NA	NA	16.3	51
2016	113,650	17,912	1,300	NA	NA	15.8	58
2017	113,650	15,544	550	NA	NA	13.7	51

Source: USDA Forest Service 2018b
[a] The annual sawmill assessment was not conducted in 2001.
[b] Mill capacity includes sawmills that are idle but operable.
[c] Net sawlog volume, Scribner log scale, that received primary manufacture during the calendar year. This is the actual net sawlog volume used during the year to manufacture sawn products.
[d] Primary chips manufactured from utility logs (produced from logs that do not go through a sawmill). Can also include firewood.

The original list of mills to be surveyed identified in 2000 consisted of 20 sawmills that regularly operated and met established criteria for medium to large size classification. This total was subsequently increased to 22 in 2007. Annual mill capacity surveys are available on the Forest Service region 10 website (USDA Forest Service 2018b). The survey for 2017 found that eight of these sawmills (36 percent) were still active; three (14 percent) remained installed but were idle; and the remaining 11 (50 percent) were either decommissioned or uninstalled (Parrent and Grewe 2018). The eight active and three idle mills included in the survey are identified in Table 97 estimated production from the remaining active sawmills was 15.5 MMBF in 2017, approximately 14 percent of total active and idle capacity. The capacity utilization rate of the last operating medium-sized sawmill in Southeast Alaska (Viking Lumber) in 2017 was estimated at about 18 percent (Table 98). While Alcan Forest Products does not operate a mill, they are a major purchaser and exporter of young-growth timber harvested from the Tongass.

Table 98. Forest Service mill survey: Estimated mill capacity, production and utilization, 2017

Mill Name	Location	Estimated Capacity (MBF)	Estimated Production (MBF)	Percent Utilization
Viking Lumber Co.	Craig	80,000	14,000	18
Icy Straits Lumber & Milling Co.	Hoonah	3,000	500	17
Good Faith Lumber Co. LLC6	Thorne Bay	6,250	200	3
Western Gold Cedar Products	Thorne Bay	6,500	650	10
D&L Woodworks	Hoonah	1,750	60	3
Thuja Plicata Lumber	Thorne Bay	1,000	100	10
The Mill	Petersburg	6,000	24	0
Falls Creek Forest Products	Petersburg	3,000	10	0
Total Active	Southeast Alaska	107,500	15,544	14
Porter Lumber Co.	Thorne Bay	2,500	NA	NA
St. Nick Forest Products	Craig	1,150	NA	NA
Northern Star Cedar (NSC)	Thorne Bay	2,500	NA	NA
Total Idle	Southeast Alaska	6,150	NA	NA
Overall Total	Southeast Alaska	113,650	15,544	14

MBF = thousand board feet; NA = not applicable
Source: Parrent and Grewe 2018

The Tongass National Forest supplied about 8.4 MMBF or 54 percent of the total volume (15.5 MMBF) processed by the mills identified in Table 98 in 2017, with State lands responsible for most of the remaining volume (Parrent and Grewe 2018). The Tongass share of timber processed locally (8.4 MMBF) was equivalent to about 52 percent of the total (16.0 MMBF) harvested on the Tongass in 2017 (Table 96). Viking Lumber processed 14 MMBF, approximately 90 percent of the total (15.5 MMBF) processed in 2017 (Table 98).

Other Mills

The annual Forest Service mill survey is not a comprehensive inventory of all sawmills in Southeast Alaska. While no new sawmills of sufficient size have been established since 2000, many smaller sawmills operate across the region, often operating on a seasonal, part-time, or contingent basis. The number of active mills and timber operators in Southeast Alaska varies at any given time. A review of business licenses in December 2018, for example, identified 22 additional sawmills in Southeast Alaska, four of which are located in Petersburg, that are not included in the Forest Service survey (Table 99).

Table 99. Additional sawmills[1] in Southeast Alaska based on a review of business licenses, 2018

Mill Name	Location
Cedar Street Enterprises	Port Alexander
Chilkat Valley Sawmill	Haines
Crew Lumber	Edna Bay
CSL Farm & Services	Edna Bay
Cutting Edge Wood Products	Ketchikan
D and L Woodworks	Hoonah

Mill Name	Location
Dale R. Bakula Construction	Ketchikan
Dark Horse Lumber	Haines
Fair & Square Milling	Coffman Cove
Falls Creek Forest Products	Petersburg
Glacier Bay Woodcraft	Gustavus
K & D Lumber	Thorne Bay
Mud Bay Lumber Company, LLC	Haines
Peavey Log	Thorne Bay
Pitch Enterprises	Thorne Bay
Seakwood.com	Petersburg
Spruce Point Mill	Petersburg
Tenakee Logging Company	Tenakee Springs
Windy Point Sawmill and Bobcat Service	Craig
Wood Marine	Klawock
The Woodshed	Petersburg
Yakutat Supply	Yakutat

[1]Active Business Licenses by NAICS code 333243
Source: Alaska DCCED 2018

Recreation and Tourism

Recreation and Tourism in Southeast Alaska

Trends in Visitation

As noted above, an estimated 1.2 million people visited Southeast Alaska in 2016, with most of these visitors (86 percent) arriving by cruise ship (McDowell Group 2017).

Southeast Alaska Cruise Ship Visitor Volume

From 2000 to 2018, Southeast Alaska's total cruise passenger volume has averaged approximately 928,000 each year, with cruise ships visiting during the summer season (May to September). The number of cruise passengers visiting Southeast Alaska is expected to continue to grow with an estimated 1,361,400 cruise passengers anticipated for 2019 (Southeast Conference 2018). Wrangell was visited by 7,926 cruise passengers, respectively (Table 100). Trends in cruise visitation show a continued growth since recovering from the national recession when visitation reached a low in 2012.

Table 100. Southeast Alaska cruise passengers by community, 2007 - 2016

Year	Haines	Hoonah	Juneau	Ketchikan	Sitka	Skagway	Wrangell
2007	27,659	161,920	1,017,341	901,595	233,936	820,829	5,192
2008	50,121	126,381	1,032,274	941,910	289,753	781,676	4,002
2009	43,550	134,575	1,019,507	936,220	224,335	785,034	3,842
2010	32,259	122,974	879,310	828,929	144,383	697,060	3,869

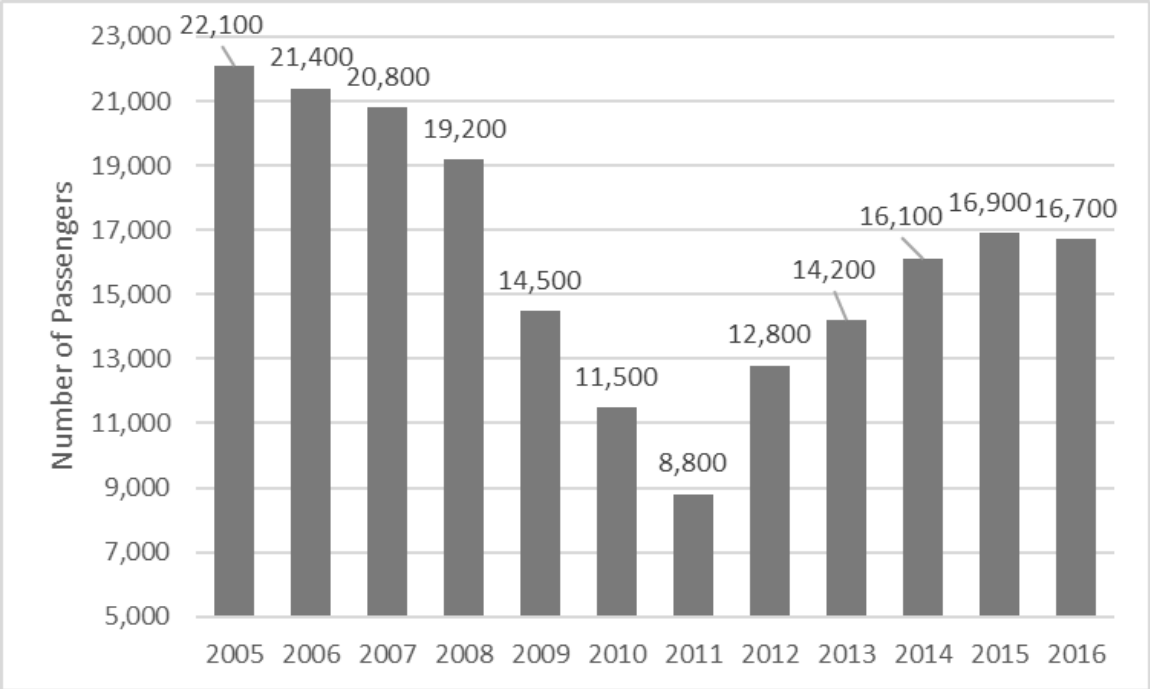
Year	Haines	Hoonah	Juneau	Ketchikan	Sitka	Skagway	Wrangell
2011	27,176	127,866	875,947	844,412	129,380	708,981	4,719
2012	31,007	120,786	927,941	894,320	110,714	755,681	678
2013	32,378	124,320	978,559	948,685	99,920	821,874	6,417
2014	29,133	142,416	953,055	884,503	90,182	819,239	5,171
2015	42,515	150,434	976,367	944,525	117,546	815,541	7,471
2016	41,685	159,132	1,004,774	947,972	122,944	817,308	7,926

Source: Alaska DCCED 2017

Small Cruise Market

Alongside the international cruise lines, several small- and mid-size cruise operators are active in the region, often taking their customers to smaller places such as Petersburg. Reliable community level data regarding the small cruise vessel industry are limited, but the Alaska Department of Economic Development (ADED) (2016) found that small cruise ships accounted for about 1.5 percent of Alaska's total cruise passengers in 2015. Although accounting for a small share overall, this segment of the cruise market is important for smaller communities that do not have the infrastructure to accommodate larger vessels. Capacity has gradually increased since a low of 8,800 estimated passengers in 2011, but remained below 2005 levels in 2016 (Source: ADED 2016

Figure 20). In 2015, Alaska's small cruise vessel fleet included 27 vessels (including vessels carrying fewer than 20 passengers), with a total of 344 scheduled sailings in 2015 (ADED 2016).



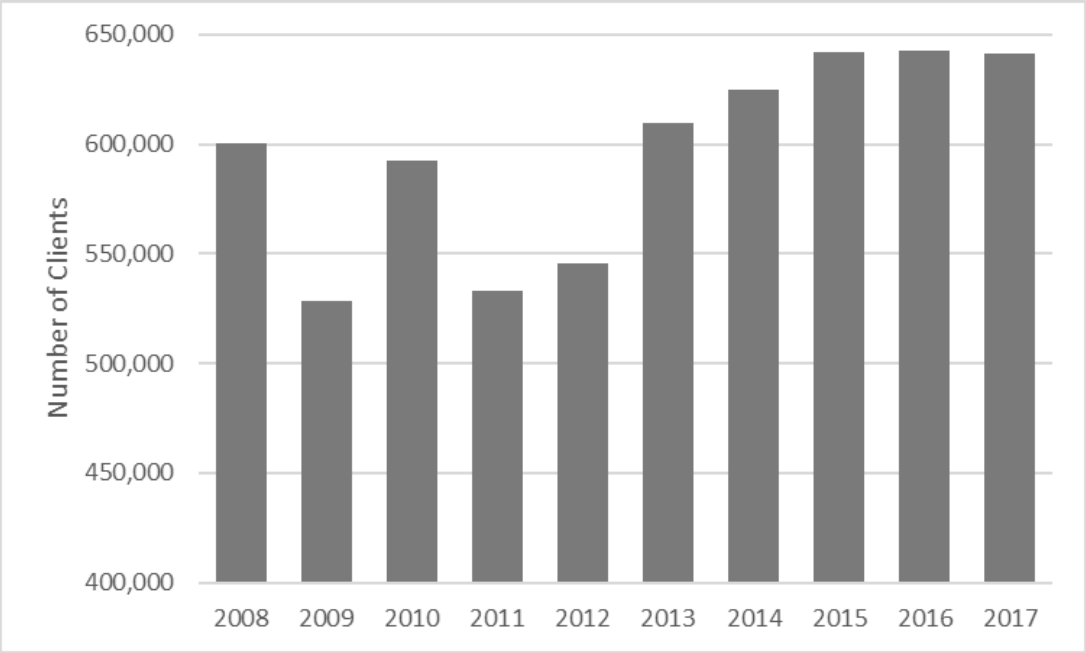
Source: ADED 2016

Figure 20. Southeast Alaska small cruise vessel passenger capacity, 2005-2016

Outfitter/Guide Use

A total of 242 permitted outfitter/guides provided services to Forest visitors during 2013 to 2017. Source: USDA Forest Service 2017a

Figure 21, which shows the number of clients by year from 2008 to 2017, demonstrates that the number of clients grew steadily from 2011 to 2015 and stabilized from 2015 to 2017. More than half of these operators (132) use the Forest consistently (at least 4 out of the 5 years). As discussed in the recreation section, outfitter and guide use makes up 20,000 service days in the project area. Seventy-five percent of visitation to Anan Wildlife Observatory is facilitated by outfitters and guides.



Source: USDA Forest Service 2017a

Figure 21. Tongass National Forest outfitter/guide use, 2008 to 2017

Employment and Contribution to the Regional Economy.

Recreation and tourism-related employment is difficult to accurately quantify because visitors spend their money throughout the local economy. Recreation and tourism is not classified or measured as a standard industrial category. A tourism report prepared by Headwaters Economics found that there were 1344 jobs in industries that support travel and tourism within the project area in 2016 (U.S. Census 2018b). This represents approximately 15 percent of employment within the project area. This estimate does not include those who are self-employed and only estimates direct employment. They include workers employed directly by the visitor industry (direct jobs and income), and do not include jobs and income supported elsewhere in the economy (indirect and induced jobs and income). A separate study prepared by the Alaska DOL (Bell 2015), found that the highest paying visitor-related occupations are also in the transportation sector, including captains and mates of water vessels (Bell 2015).

Nature-Based Tourism

A study prepared by the Institute of Social and Economic Research at the University of Alaska Anchorage provides insight into the contribution of nature-based tourism to the regional economy. This study, which involved field research focused on a limited number of communities and sought to provide insight into revenues generated, the types of nature-based activities attracting tourists, and the resulting flows of money through the economy (Dugan et al. 2009). The findings of the study indicate that nature-based tourism generates an estimated $4.4 million

in annual direct business revenues for nature based tourism activities in Petersburg and Wrangell (Dugan et al. 2009).

Recreation on the Tongass National Forest

The Alaska Region has been participating in the Forest Service's National Visitor Use Monitoring (NVUM) program since 2000. Based on the results of the NVUM program for 2010 to 2014 and coefficients developed by White and Stynes (2010), the Forest Service (2017b) calculated a visitation estimate of 2,874,000 annual visits to the Tongass National Forest. Spending profiles were estimated for residents and non-residents visiting the Forest based on data compiled during the NVUM surveys. Using coefficients developed by White and Stynes (2010), the Forest Service (2017b) estimated that the 2,874,000 annual visits generated about $382 million in spending and supported 3,947 direct jobs and an additional 1,110 jobs elsewhere in the regional economy. This overall estimate is equivalent to about 42 percent of the regional visitor estimate developed for Alaska DCCED in 2017 (McDowell Group 2018), and the direct component is about 51 percent of the direct visitor jobs estimated by Southeast Conference (2018).

Expenditures by non-local tourists introduce new dollars in the local economy and directly contribute to the development of jobs and labor income in visitor services, such as food, lodging, and entertainment industries, and indirectly affect businesses that service those businesses. Some of the most popular recreation opportunities in the project area that attract non-local tourists include viewing the Le Conte and Baird glaciers, viewing the Stikine River, wildlife viewing at Anan Wildlife Observatory, and hiking on the Raven and Rainbow Falls trail (Houser 2019, Rain Coast Data 2018). Nature and wildlife viewing is facilitated through cruises offered by outfitter and guide services to these locations. The Raven and Rainbow Falls Trails are located near Wrangell and Petersburg and are popular hiking routes for tourists. Impacts to popular tourist attractions may influence visitor's recreation experience and result in changes to long-term recreation and tourism trends as discussed in the methods section. More detailed information on recreation visitation and pattern on the Tongass is presented in the Recreation section of this EIS.

Commercial Fishing and Seafood Processing

In 2017, an estimated 302 million pounds of seafood was harvested in Southeast Alaska with an invoiced value of $289 million. Salmon accounted for more than half (56 percent) of the total value of the commercial catch in Southeast Alaska in 2017, with the remainder divided among black cod (16 percent), halibut (15 percent), crab (8 percent), herring (2 percent), and other (5 percent) (Southeast Conference 2018). Total pounds landed and invoiced in 2017 were similar to regional 10-year averages, and a substantial improvement over the 2016 season, which was the worst in more than a decade (Southeast Conference 2018).

Employment in seafood harvesting and processing varies from year-to-year. In 2015, there were 780 people employed in the project area in seafood processing (Alaska DOL 2016). Of this population, 69 percent were non-resident workers. The seafood processing sector is generally characterized by high seasonality and low resident hire, as well as low hourly wages, with a median annual wage of $24,689 in 2013 (Strong 2014). The industry does, however, have a number of higher paid occupations, including ship engineers, captains, mates, boat pilots, and general and operations mangers, which accounted for just 1.2 percent total employment, but 6 percent of wages, with a median annual wage of $66,720 (Strong 2014). Seafood harvesting and fish processing employment trends are shown for 2000 to 2013 in the 2016 Forest Plan FEIS (USDA Forest Service 2016b, pp. 3-501 to 3-503).

Environmental Effects

Alternative 1 – No Action Alternative

Direct and Indirect Effects

Jobs and Labor Income

Forest Products and Transportation Sectors

As described in the *Issue 1: Timber Supply and Economics Environmental Effects* section, Alternative 1 would not contribute to employment and income in logging, sawmill, or log exports. Alternative 1 would result in no direct economic effects for communities in the project area, however, it could result in indirect economic effects to existing businesses. Alternative 1 would not provide additional timber volume authorized for sale on the Wrangell and Petersburg Ranger Districts. Other businesses in the project area that rely on expenditures of forest product businesses and locals employed in forest product and transportation industries may also be indirectly affected by the low level of economic activity in forest product businesses.

Tourism Industry

For Alternative 1, the no action alternative, there would be no direct or indirect economic effect to employment and income related to recreation and tourism. Nature and wildlife viewing opportunities, which were identified as some of the most popular recreation activities on the Forest (USDA 2012), would continue to contribute to recreation opportunities that attract visitors to the project area. Under Alternative 1 existing conditions and trends in recreation and tourism would continue.

Salmon Populations – Cash and Subsistence Incomes

As discussed in the subsistence and aquatic resources sections of this EIS, Alternative 1 would have no effect on freshwater salmon habitat. Therefore there would be no effect to cash or subsistence incomes related to the salmon fishery.

Deer Populations - Subsistence Incomes

As presented in the Wildlife Report for the EIS, Alternative 1 would result in no direct or indirect effects on high-value winter deer habitat. The environmental conditions would remain as described in the *Existing Condition* section for Sitka black-tailed deer. Therefore project area community subsistence incomes dependent upon deer populations would not be affected by Alternative 1.

Environmental Justice

The primary industries for jobs and labor income in Kake are government, tourism and commercial fishing. Alternative 1 would not affect these industries in Kake, and would have no effect on jobs and labor income for Kake residents. Alternative 1 would not result in direct or indirect effects to subsistence resources that Alaskan Natives in Kake rely upon. Alternative 1 would not result in disproportionate adverse risks to the Alaskan Native population of Kake as there are no effects to community cash or subsistence incomes.

Cumulative Effects

As described in the *Issue 1: Timber Supply and Economics Cumulative Effects* section, there is a limited timber volume, less than 100 MMBF, previously approved for sale on the Wrangell and Petersburg Districts from previous projects. Projects on other districts of the Tongass provide the

majority of the existing timber volume approved for sale (USDA Forest Service 2019). Under Alternative 1, approved timber harvest projects on the Tongass would continue to provide a supply of timber products to purchasers and mills, however, the majority of these harvests would occur on Districts other than the Wrangell and Petersburg Districts. Hence, economic impacts would, for the most part, be located in communities outside of the project area.

Cumulative effects considered in the *Aquatics* section found that impacts to fish habitat are not likely to occur on a watershed scale, but rather are expected to be short-term, negligible to minor in intensity, and unlikely to have a long-term negative effect on fish populations. Therefore it is likely there would be no cumulative long-term risks to the commercial or subsistence salmon fishery from Alternative 1. See the *Aquatics, Environmental Effects, Cumulative Effects* section under Alternative 1 for more information on effects to fish habitat.

Alternatives 2 and 3 – Effects common to both action alternatives

Direct/Indirect Effects

Jobs and Labor Income

Forest Products and Transportation

This analysis tiers to the *Issue 1: Timber Supply and Economics, Environmental Effects* section. Both Alternatives 2 and 3 would provide enough timber volume to maintain flexibility in meeting market demand and support local businesses over the 15 year life of the project. Both Alternatives 2 and 3 would position the Wrangle and Petersburg Ranger Districts to package sales that meet changing market demand over time.

The direct effects on jobs and labor income in the timber industry due to old-growth and young-growth timber harvest is displayed in Table 15and Table 16 in the *Issue 1: Timber Supply and Economics* section of this EIS. The figures in these tables describe the average number of jobs supported annually over a 15 year period. Consistent with the 15 year transition strategy to a young-growth timber economy (USDA Forest Service 2016d, WEDC 2013), the production of old-growth harvest is expected to decline over the project lifecycle, while the production of young-growth harvest volume would increase. Currently, employment in the timber industry in project area communities is driven by old-growth timber harvest due the existing infrastructure. As the proportion of old-growth harvest declines, so too may the jobs and labor income associated from employment in forest products manufacturing. Conversely, jobs related to exporting may increase over the project life cycle as it is assumed that 100 percent of young-growth harvest will be exported. Local jobs related to logging may be relatively consistent through the 15 year transition as both forest product manufacturing and log exports require logging operations.

Wrangell, Petersburg and Kake have existing businesses in forest products that are positioned to capitalize on opportunities to sustain and increase employment in mills and other forest products manufacturing. Large timber volume purchasers, such as Alcan and Viking, that are located outside the project area, are also positioned to benefit from the increased timber sale volume that would be available under Alternatives 2 and 3. This would contribute to sustaining existing industry and potentially increasing employment in forest product manufacturing and exports in the Prince of Whales and Ketchikan. Both Alternatives 2 and 3 would result in positive indirect economic impacts on industries supporting forest product industries, including businesses within the project area, as well as, businesses throughout the region.

Induced economic impacts are the result of income expenditures on such things as lodging, food, gas and entertainment. The timber analysis areas, Mitkof, Wrangell and West Kupreanof, are all connected by a road system to the communities of Petersburg, Wrangell, and Kake, respectively. Timber harvests in these areas reduces logging costs by eliminating the need for to develop logging camps, as laborers can live in town and travel to the logging site on a daily basis. This strengthens the economic linkage between logging jobs and induced economic impacts to communities in the project area. Businesses not directly related to forest product industries may benefit from increased economic activity due to timber harvests authorized under Alternative 2 or 3.

Tourism Industry

Alternatives 2 and 3 may contribute positively to recreation and tourism industries in the project area communities. The addition of cabins accessible by vehicle in the project area may increase the number of visitor nights and result in increased non-local visitor spending in project area communities.

With respect to wildlife and nature viewing, there are no effects to fore or middle ground views at popular tourist attractions in the project area and negligible changes to views along popular tourist excursion routes currently designated as high scenic integrity. Therefore the project is unlikely to affect existing tourist patterns that depend upon high scenic integrity associated with wildlife and nature viewing, which are popular recreation activities for non-local visitors to the Tongass National Forest. For a more detailed explanation see the socioeconomic report.

Salmon Populations – Cash and Subsistence Incomes

Information presented in the *Aquatics* section of this EIS informs the consideration of risks to salmon populations and related subsistence harvest. Alternatives 2 and 3 propose the same degree of freshwater salmon habitat improvements to reduce risk related to existing salmon barriers and legacy sediment sources. This reduction in risk may positively influence salmon catch rates for both the subsistence and commercial salmon fishery and hence reduce risks to subsistence and cash incomes generated from the salmon fishery.

Environmental Justice

Alternative 2 would pose the greatest risk to deer and salmon of all the action alternatives. These are two of Kake's primary subsistence species. Other communities in the project area, however, are also reliant upon deer and salmon populations that are subject to increased risk. Given that other communities in the project area are subject to similar if not a higher degree of risk to household livelihoods, minority communities would not be exposed to a disproportionate adverse effect from project activities. Alternative 3 would be similar to Alternative 2; however, risks to salmon and deer populations may be less under Alternative 3 as compared to Alternative 2.

Cumulative Effects

As discussed in the *Issue 1: Timber Supply and Economics* section, much of the young-growth harvest has historically been exported as the sawmill infrastructure in the region is designed for old-growth harvest. If Kake becomes a designated export site, Kake would experience increased economic activity with the potential to create new jobs in transportation and shipping.

The Alaskan timber products export economy has been largely driven by log exports to Pacific Rim countries. In 2015, 76 percent of timber volume leaving Alaska was received by China, 16 percent by Japan and 7 percent by South Korea (Marcille et al. 2017). The timber export

economy can be highly volatile, as demonstrated by the rapid decline in exported timber volume between 2011 to 2015, where exports declined by over 50 percent (Marcille et al. 2017). Timber volume exported annually is subject to changes in global markets, international trade policy, international timber markets, currency exchange rates, and shipping costs.

Currently, trade wars between the United States and China, such as exhibited by the 10 percent timber tariff excised by China on wood product imports from the United States, creates uncertainty for both producers and purchasers (Stremple 2019). Such uncertainty and added costs affect the competitiveness of Alaskan timber in a global market. Hence export demand may soften, resulting in lower timber sale bids that may threaten the ability of young-growth timber to appraise positively. Should uncertainty in trade relations with China and the timber tariffs continue over the life-cycle of the project, there would be an increased risk to the economic viability of young-growth timber production. Such risk translates into risk to jobs and labor income generated through logging and export industries.

Over the course of this project the estimated delivery of old-growth sized timber is planned to decline in proportion to the amount of young-growth harvest. This is consistent with the 15 year young-growth transition strategy (USDA Forest Service 2016c, p. 6-9). If infrastructure and other manufacturing businesses designed to process young-growth timber into value-added products are developed over the transition period, then jobs and labor income in forest products may increase in communities such as Wrangell, and overall stabilize the project area's forest products industry.

It is unknown how forest product businesses, recently out of business, will respond to new market opportunities created by this project. Wrangell has historically had a robust forest product industry (Himes-Cornell 2013) which has declined significantly in the past fifteen years. The City and Borough of Wrangell have been working with the Forest Service and USDA Cooperative Extension to develop a long-term transition strategy to support, develop, and encourage growth of local forest product businesses. At the center of this strategy is the need for a long-term supply of suitable, economical timber that facilitates the transition from old-growth to young-growth timber processing (WEDC 2013).

The creation of jobs and related labor income in "new" forest products businesses will be influenced by many factors beyond the scope of this decision. For example, the creation of jobs in sawmills suitable for processing young-growth timber will be influenced by current and projected market conditions, capitalization costs, access to capital, existing business and entrepreneurial skills, and other socioeconomic factors. While these factors are outside the scope of this decision, this project plays a vital role in supporting the economic development strategy developed by the City and Borough of Wrangell.

Impacts of climate change including increased in prolonged periods of high temperatures, heavier precipitation, increases in wildfire frequency and size, increase in severity of drought, ocean rise, and ocean acidification may result in long-term changes to the availability and distribution of subsistence resources for communities in the project area. Risks to subsistence resources and the communities that rely upon them may be exacerbated by the effects of climate change. For more information on the likely effects on aquatic and terrestrial ecosystems of the Tongass National Forest (see the 2016 Forest Plan FEIS for detailed discussion).

Alternative 2 – Proposed Action – Activities that differ from Alternative 3

Direct and Indirect Effects

Jobs and Labor Income

Forest Products and Transportation Sectors

This analysis tiers to the Issue 1: Timber Supply and Economics analysis in this DEIS. For discussion of the economic impacts of Alternative 2 on the number of jobs supported in sawmills, logging, manufacturing and transportation industries and direct labor income generated see the *Timber Supply and Economics, Environmental Effects* section on *Projected Employment and Income*. For discussion of timber harvest, manufacturing and end selling costs see the *Environmental Effects, Factors Affecting the Economics of Timber Offerings* section within the *Issue 1: Timber Supply and Economic Analysis* section.

Tourism Industry

See the *Alternatives 2 and 3 - Effects Common to Both Action Alternatives* section.

Salmon Populations – Cash and Subsistence Incomes

The following discussion tiers to the Environmental Effects on risks to salmon populations presented in the *Aquatics* section of this EIS relevant. Fishing, including the commercial and sport fishing and shellfish farming, is an important industry for residents in all three of the communities in the project area (Alaska DCCED 2019, Wrangell 2015, Petersburg 2019, ADF&G 1996). Alternative 2 poses the greatest level of new risks to the quality of salmon habitat by increasing the likelihood of peak flows in seven watersheds and by proposing the greatest potential for increased sediment delivery with 712 new road crossings. Given Petersburg specialization in commercial fishing and relatively large reliance on salmon for subsistence, this community would experience the greatest risk to cash and subsistence incomes from risks to the salmon population.

Deer Populations - Subsistence Incomes

This analysis tiers to findings in the Wildlife Report for this project on changes to high-value winter deer habitat by wildlife analysis area. All communities in the project area would experience increased risk to livelihoods reliant upon subsistence deer harvest. Alternative 2 would result in increased risks to deer populations due to reductions in high-value deer habitat above where communities harvest over 75 percent of their deer. Of the project area communities, Kake relies heaviest on deer for their subsistence harvest, accounting for 28 percent by weight, followed by Wrangell at 17 percent, and Petersburg at 8 percent. Reductions in high-value winter deer habitat that are already below 50 percent of historic habitat conditions would increase risk to deer populations and hence subsistence incomes that households in Kake, Wrangell and Petersburg rely upon. More detailed and supporting information is located in the socioeconomic report.

Cumulative Effects

See the *Effects Common to Both Action Alternatives, Cumulative Effects* in this section.

Alternative 3 – Activities that differ from Alternative 2

Direct and Indirect Effects

Jobs and Labor Income

Forest Products and Transportation Sectors

This analysis tiers to the Issue 1: Timber Supply and Economics analysis in this DEIS. For discussion of the economic impacts of Alternative 3 on the number of jobs supported in sawmills, logging, manufacturing and transportation industries and direct labor income generated see the *Issue 1: Timber Supply and Economics, Environmental Effects* section on *Projected Employment and Income*. For discussion of timber harvest, manufacturing and end selling costs see the *Environmental Effects, Factors Affecting the Economics of Timber Offerings* section within the *Timber Supply and Economic Analysis* section.

Tourism Industry

See the *Effects Common to Both Action Alternatives* in this section.

Salmon Populations – Cash and Subsistence Incomes

The following discussion summarizes information presented in the *Aquatics* section of this EIS relevant to salmon populations important to the commercial and subsistence fishery. The nature of effects under Alternative 3 are the same as described Alternative 2, however, the magnitude and intensity of risks differ between Alternatives 2 and 3. Alternative 3 increases the likelihood of peak flows in the five watersheds versus seven in Alternative 2 and proposes stream road crossings on 625 streams versus 712 in Alternative 2. Overall the communities reliant upon the commercial or subsistence salmon fishery for income would be exposed to less risk from Alternative 3 than Alternative 2.

Deer Populations - Subsistence Incomes

The following discussion summarizes information presented in the Wildlife Report for this project relevant to subsistence deer populations. Wildlife analysis areas 1905, 1907 and 5132 currently have less than 50 percent of historic high-value deer winter habitat remaining and are some of the primary areas where communities in the project area harvest the majority of their deer. Under Alternative 3, these wildlife analysis areas would experience further reductions, however, these reduction would be less than Alternative 2 due to the design feature to protect high-value deer winter habitat in Alternative 3. Under Alternative 3 there are no wildlife analysis areas that are currently above 50 percent that would fall below the 50 percent threshold. The overall change in high-value winter deer habitat among these wildlife analysis areas represents one percent reduction. This is one-fourth the reduction in high-value winter deer habitat compared to Alternative 2. Due to the difference in community harvest patterns, the risks to Wrangell household livelihoods reliant upon the deer populations for subsistence incomes would increase slightly, whereas risks to households in Kake would not be affected. Deer comprise only eight percent of subsistence harvest for Petersburg, therefore risks to deer populations this community relies upon may result in a minor increase in risk to subsistence incomes. For more detailed and supporting information see the socioeconomic report.

Cumulative Effects

See the Effects Common to All Action Alternatives, Cumulative Effects in this section.

Soils

Soil productivity is the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be expressed in terms of volume or weight per unit area per year, percent plant cover, or other measures of biomass accumulation. Maintaining soil productivity and minimizing soil erosion are primary concerns when managing soil resources on National Forest System (NFS) lands.

Soil Quality Standards established definitions and some minimum size requirements for detrimental soil conditions. The standards state that 85 percent of an activity area should be maintained in a condition of acceptable productivity potential for trees and other managed vegetation. Activity areas are individual proposed young-growth stands, old-growth stands, and timber stands for restoration projects. The threshold value of 15 percent is established for assessing detrimental soil conditions at the stand or harvest unit scale. If detrimental soil conditions approach or exceed 15 percent of an activity area, soil restoration practices should be considered.

Summary

Effects to soils are similar between Alternatives 2 and 3. The most new road construction (not over decommissioned subgrades) occurs in Alternative 2. Alternative 2 also proposes the most old-growth timber harvest on slopes over 72 percent gradient and the most new road construction on slopes over 67 percent gradient. Cumulative acres of detrimental soil conditions are very similar between the action alternatives.

In young-growth stands where effects to soils may exist from past harvest activities, it is essential that soil conditions be assessed prior to new activities taking place following direction in the 2016 Forest Plan and Implementation Plan (Appendix A).

The acres of landslides across the project area do not differ appreciably between the alternatives. This is due to larger landslides but fewer in number in old-growth stands, and more landslides but smaller average size in harvested areas. Landslides will continue to occur in previously managed stands and unharvested areas and will be driven by storm events and soil saturation.

Application of the 2016 Forest Plan and Implementation Plan direction will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Overall, the effects of proposed herbicide applications on the soil resource are expected to be negligible although some adverse effects from these actions are unavoidable and include localized, short-term effects on soil microorganisms and soil productivity. Effects to soil microorganisms are associated with the inherent toxicity and persistence of chemical residues, which is negligible according to the information available. Changes to the vegetative cover or levels of soil disturbance from manual, mechanical or herbicide treatments can affect soil productivity and soil erosion.

Effects to the soil microbial communities, soils, and wetlands are minimized and soil productivity would be maintained as a result of project design features (Foss 2019, hereby incorporated by reference).

Methodology

Soil quality monitoring data collected over the last 25 years will be used to estimate effects to soils. For purposes of this analysis, the existing available soil quality monitoring data summarized in Landwehr (2018a) is the best available data for estimating detrimental soil impacts from the various activities.

Forest facilities including NFS roads (including cut, fill road bed and landings and log transfer facilities) trails, recreation sites, hydropower facilities, powerline corridors, right-of-ways and mines under an approved plan of operation are considered part of the Forest's infrastructure, and are not subject to soil quality standards. Activities within the productive land base are subject to soil quality standards and include timber harvest, stream or vegetation restoration, temporary roads and associated landings and rock quarries, and wildlife enhancement projects.

The best available landslide frequency analysis (Landwehr 2018b) will be used to estimate the effects of the alternatives on landslide production over a 20-year time period. One of the landslide studies cited in Landwehr (2018b) occurred in the Central Tongass Project area, and all of the studies include terrain and geomorphic landscapes similar to where activities are proposed on the Central Tongass project area.

Slope data will be overlaid with the unit pool for each alternative to estimate the amount of potential old-growth and young-growth harvest on slopes over 72 percent gradient and miles of road on slopes over 67 percent gradient.

Spatial and Temporal Context for Analysis

Direct, indirect, and cumulative effects to soils occur at the stand or harvest unit scale, therefore the estimates of effects to soils are completed at the stand or harvest unit scale. The analysis of cumulative effects will also summarize detrimental soil conditions and landslides at the project area scale.

The temporal bounds for the soil analysis dates to the time the initial management activity was accomplished. The temporal bounds for the landslide frequency analysis is within a 20-year period to coincide with available landslide frequency studies. The time frame for the effects analysis depends on the rate soils recover from a disturbance. Small soil disturbances typically do not have negative effects on soil productivity at the site, stand, or harvest unit scale. Larger, severe soil disturbances (where the topsoil is effectively displaced) can negatively affect soil productivity for decades or longer. Soil quality monitoring data is beginning to identify the recovery rates for soils from some levels of disturbance. Recovery rates have not been identified for all soils or groups of soils from all types of disturbances.

Analysis Methods and Assumptions

Units of Measure

To compare the effects to soils between the alternatives, the following measures are used:

- estimated acres of detrimental soil conditions,
- estimated acres of management-related landslides over a 20-year time period,
- estimated acres of proposed old-growth and young-growth harvest on slopes over 72 percent gradient, and
- estimated miles of road construction proposed on slopes over 67 percent gradient.

These measures align with the Region 10 Soil Quality Standards and the 2016 Forest Plan.

Incomplete or Unavailable Information

Data Limitations

The lack of a landslide frequency analysis since the 1997 Forest Plan Revision is a data limitation. The 1997 Forest Plan identified slopes over 72 percent as unsuitable pending an on-site analysis and recommends avoiding road construction on slopes over 67 percent gradient. The 1997 Forest Plan direction effectively limited timber harvest on steep or unstable slopes, yet the landslide frequency analyses summarized in Landwehr (2018b) were all conducted prior to the 1997 Forest Plan. The analysis uses the best available information and should be considered conservative because the 1997 Forest Plan and subsequent plans effectively limited timber harvest on slopes over 72 percent gradient, and as a result landslide frequencies for harvested lands should have decreased since the 1997 Forest Plan.

There is an extensive body of soil disturbance monitoring data and soil quality monitoring data available on the Forest. However, the lack of exact soil and vegetation response to soil disturbances is a data limitation. In the absence of precise response information, the analysis takes a conservative approach using the best available data summarized in Landwehr (2018a).

Affected Environment

Existing Condition

Soils on the project area range from very shallow to very deep, and very poorly drained to well drained. Mineral soils are primarily formed from glacial till deposits, with minor areas of post-glacial volcanic deposits, glacial outwash deposits, and uplifted beach deposits. Windblown or Aeolian soil deposits occur near the mouth of the Stikine River. Soils are typically less than a meter thick over bedrock on ridgetops and on upper mountain slopes due to localized glacial ice scouring. Valley bottoms and concave areas contain deeper soils often underlain by dense glacial till deposits.

Poorly and very poorly drained deep organic deposits (greater than 1 meter thick) commonly form over bedrock or dense till and support a variety of forested and non-forested wetlands. Poorly drained organic soils less than a meter thick over bedrock are often found on broad ridgetops and glacially scoured benches or rock knobs.

The cool maritime climate causes slow organic matter decomposition and organic duff layers 5 to 20 centimeters or more thick cover most mineral soils. Displacement of the duff layer would lead to soil erosion in most circumstances.

Most soils are coarse textured and not easily compacted. Rooting depth is usually less than a meter and often less than 50 centimeters but can vary by soil drainage class. A few well-drained soils display deeper rooting depth.

Landslides are a natural erosion process and are a common form of erosion on steep slopes within the project area. The most common landslides are debris avalanches and debris torrents. Debris avalanches and torrents are shallow, rapid failures driven by rainfall and saturated soil conditions. There are approximately 9,376 acres of landslides mapped on the project area.

Karst topography has developed in many areas underlain by limestone. Soils over limestone are often well drained (due to internal bedrock drainage) and are often more productive than similar soils over non-carbonate rocks.

Well-drained organic soils can be subject to soil displacement from management activities or windthrow. Well-drained organic soils commonly occur on broken convex rocky terrain and are often less than 50 centimeters thick over bedrock. Areas of these soils are often small and occur in complex with mineral soils.

Past Activities and Soil Conditions

Soil productivity has been affected by timber harvest yarding activities, temporary road construction, borrow pits, rock quarry development, landings, OHV use, past mining developments, and root-wad harvest for stream restoration. These activities have affected soil productivity through soil displacements or soil erosion, and rarely through other detrimental soil conditions. In most areas within young-growth stands, soils are productive and growing the desired vegetation at the desired rate. In some areas, detrimental soil displacements and detrimental soil erosion are affecting soil productivity.

As mentioned above, NFS roads, recreation facilities, hydropower developments, and other planned infrastructure are not subject to soil quality standards. By regulation, OHV use is confined to designated trails and play areas and those areas are not subject to soil quality standards.

Effects on soil productivity from proposed activities and landscape frequency was derived from soil quality monitoring information (Landwehr 2018a and Landwehr 2018b).

Soil monitoring data indicates that soil compaction on skid and access trails is limited and overall the trails are not detrimentally compacted. Soil bulk density data collected to date indicates that detrimental soil compaction is not a concern under normal, modern forestry practices (USDA Forest Service, 2016c).

Based on soil quality monitoring data summarized in the 2016 Forest Plan FEIS (USDA Forest Service, 2016c) and summarized in Landwehr (2018a), and based on reconnaissance of older young-growth stands in support of this and other projects (such as the Big Thorne Project EIS), soil scientists estimate less than 1 percent of the stands harvested prior to 1979 may not meet soil quality standards. These would be tractor-logged stands with high densities of primary skid trails or stands containing a high amount of temporary road, spar tree corridors, rock quarries, and/or post-harvest landslides. The monitoring data indicates stands harvested since 1979 would meet soil quality standards.

Abandoned and active mines occupy about 17 acres of the project area. Mines currently being operated under an approved plan of operations are not subject to soil quality standards. There are no active mines on the project area. Abandoned mines in areas where other ground-disturbing activities are proposed will be included in detrimental soil calculations for cumulative effects.

Root-wad removals for watershed restoration projects have resulted in approximately 5 percent off the affected stands in a detrimental soil condition, and only about 5 acres of root-wad harvest has occurred over the past 10 years. Soil quality monitoring at root-wad harvest sites is on-going.

With the exception of a very few young-growth stands harvested prior to 1979, existing soil conditions in the Central Tongass project area are within the Region 10 Soil Quality Standards.

Past Activities and Soil Erosion and Landslides

Past activities including mining, timber harvest, road construction, and pit development have caused soil erosion and landslides. The rate of erosion depends on the amount and intensity of rainfall, vegetative ground cover, erodibility of the soil, slope length, and steepness of slope.

Based on monitoring data, a minor amount of soil erosion is occurring along decommissioned temporary roads and along spar tree corridors in previously harvested areas.

Landslides (mass wasting) are the dominant erosion process on steep forested terrain with high soil water levels in Southeast Alaska (Swanston 1969). Topographic, geologic, and soil conditions in combination with high rainfall and soil saturation are the major factors that contribute to landslide events in Southeast Alaska.

According to the current landslide inventory, there are 9,376 acres of landslides in the project area. Approximately 325 acres of landslides are associated with past timber harvest and road construction. All management associated landslides are considered detrimental soil conditions, even if associated with NFS roads or other infrastructure developments. The landslide rate in young-growth areas is typically higher than in adjacent old-growth areas. As vegetation grows in previously harvested areas, the landslide rate declines.

The application of BMPs since the *Clean Water Act* (1972) and results from subsequent monitoring of BMPs on the Forest since 1990 have shown that soil erosion (including landslides) associated with management activities since 1990 is minimized.

Harvest on Slopes Greater than 72 Percent

Past harvest has included about 3,067 acres of slopes over 72 percent gradient (includes harvest on non-NFS lands). Proposed harvest on slopes over 72 percent will be used as one indicator to compare potential slope instability between alternatives.

Roads on Slopes Greater than 67 Percent

The digital elevation model for the project area, when overlain with the roads layer, identifies approximately 9 miles of existing roads on slopes greater than 67 percent gradient. Proposed roads on slopes over 67 percent gradient will be used as an indicator to compare slope stability between alternatives.

Environmental Effects

Effects Common to All Action Alternatives

All action alternatives propose similar activities but the amount of each activity varies between alternatives as described in Chapter 2.

Soil conservation practices and BMPs are designed to minimize effects to the soil resource given overall project objectives. Monitoring data collected since 1990 indicates that soil conservation practices and BMPs have been effective at minimizing detrimental soil conditions. While effects have been minimized, they have not been eliminated.

All estimates provided in Table 101 assumes modern or contemporary forest practices are used and all 2016 Forest Plan direction is followed.

Table 101. Estimates of detrimental soil conditions for proposed activities that must meet soil quality standards

Activity	Estimate of detrimental soil conditions (percent of stand)	Notes
Timber harvest in unharvested areas (old-growth harvest)	-Shovel on slopes less than 35% and partial suspension, use 3% -Full Suspension) <2% -Shovel on slopes over 35% gradient, use 9%	Sites and conditions are highly variable but available data accounts for the variability. Assumes detrimentally altered wetness.
Young-growth timber harvest	Same as old-growth timber harvest	
Thinning with log removal for wildlife habitat in young-growth	3% to 10%	Depends on the proposed treatment and unit layout. If corduroy shovel trails are left in place and not fluffed due to wildlife movement concerns, consider them detrimental and use up to 10 percent. Otherwise use 3%, like young-growth timber harvest.
Gap creation with ground based equipment in young-growth	1% to 9% of the gap acres (for the whole stand use 1%).	Gap acres only, not the whole stand. Monitoring was for all soil disturbance not just detrimental conditions.
Precommercial thinning of young-growth with equipment.	2% or less	
Root-wad harvest for stream restoration	5% in created openings or use the percentage of the stand impacted by the activity	With single tree or less than 2 tree groups discontinuous extractions the estimate would depend on the amount of root-wad trees extracted. Typically less than 1% of a stand.
Access trails for stream restoration	0%	If puncheon is used and fluffed after the activity.
Invasive plant treatment	Negligible	Effects to the soil microbial communities would be minimized and soil productivity would be maintained as a result of project design features.
Temporary roads	Use a 40-foot disturbed corridor width or 4.8 acres per mile	Assuming BMPs are followed and natural soil drainage is not impeded.
Landings (shot rock) Wood waste at landings Rock pits	0.25 acres per mile of road 0.42 acres per mile of road 0.45 acres per mile of road	Add 1.12 acres per mile of road (all roads) for landings, rock pits, and wood waste.

Estimates based on Landwehr 2018a.

Based on the data presented in Table 101, all of the activities, when considered alone, result in less than 15 percent detrimental soil conditions. When two or more ground-disturbing activities occur in the same activity area (stand or harvest unit), there is potential to exceed the 15 percent detrimental soil condition threshold set in the Region 10 Soil Quality Standards.

The analysis and Implementation Plan (Appendix A) consider activity areas where more than one ground-disturbing activity may occur, and require an assessment of existing detrimental soil conditions in young-growth stands. The 2016 Forest Plan provides guidelines and management approaches for assessing existing detrimental soil conditions in young-growth stands prior to proposing more ground-disturbing activities in those stands. The soil restoration activity may be used if detrimental soil conditions approach or exceed 15 percent of an activity area.

As mentioned in the Past Activities and Soil Condition section, up to 1 percent of stands harvested prior to 1979 may not meet Region 10 Soil Quality Standards in their current condition. In these stands, either no new activity would be allowed or the new activity would be accomplished in conjunction with the soil restoration activity.

Activities that historically have contributed to landslides are road construction, rock pit development, and timber harvest. In other areas of Southeast Alaska, foot trails have contributed to slope instability and landslides, but no landslides are associated with foot trails on the project area. Mining operations on steep slopes may contribute to landslide occurrence, but to date have not contributed to landslides on the project area, likely due to the gentler slopes where most existing mines are located on the project area.

Table 102 provides the recommended landslide frequency rates for timber harvest, roads and rock pits, naturally forested areas, and naturally non-forested areas.

Table 102. Landslide frequency rates for harvested lands, unharvested lands, non-forested and low productivity areas, and roads and rock pits on the large landscape assessment areas

Vegetation class	Landslide rate	Average landslide size	Notes
Non-forest or low productivity forested lands	1 slide per 19,720 acres per 20 years	1.5 acres	From fresh analysis of Landwehr (1998) data. 20-year time period. One slide was a rock fall and not included here.
Unharvested commercial forest lands	1 slide per 11,720 acres per 20 years	3.1 acres	From the 1985 to 1991 time period in Landwehr (1998).
Harvested lands	1 slide per 2,849 acres per 20 years	0.5 acre	From the 1985 to 1991 time period in Landwehr (1998).
Roads and Rock Pits	1 slide per 19.3 miles of new road construction.	0.5 acre	From the 20-year time period in Landwehr (1998).

Source: Landwehr 2018b

Effects due to invasive plant treatments are expected to be highest as continued treatments of previously treated sites are combined with initial treatments or places treated multiple times per year. However these effects would be negligible to minor because of the relatively small areas proposed for treatment by either herbicide or manual/mechanical methods and the efficacy of the project design features provided in Appendix A – Implementation Plan and Activity Guides. The level of negative impact would be expected to decline in relation to the progressive reduction in the total area of infestations that receive treatment over time. Effects would never be completely eliminated because surveys will likely reveal new infestations and additional treatments will occur (Foss 2019).

A minor effect to the soil resource is expected from using both manual and herbicide treatments because there is a risk of leaving large areas of soil bare from treatment. Bare soils are a source of sediment if they are not covered with plant residues, erosion control treatments, or native vegetation. The minor effect is expected to last until the site has been colonized by native vegetation.

The cumulative effects from manual, mechanical and chemical treatments would also be negligible considering the implementation of soil and water BMPs which are designed to avoid

any detrimental effects of mining, timber harvest, thinning, road building and maintenance, trail building and maintenance, renewable energy, and recreation activities on soil quality. Further, eradicating invasive plants would allow re-colonization of native plants and thus improvement of soil conditions and resiliency.

Alternative 1 – No Action Alternative

Direct and Indirect Effects

Under Alternative 1, no new timber harvest, road building, wildlife treatments, or watershed restoration activities would take place, therefore no soil disturbances would occur. No road storage or decommissioning would be completed on existing roads under this project. Roads in the project area will continue to receive routine maintenance and incidental use from hunters and other visitors.

Landslides would continue to occur in unharvested areas and existing harvested areas.

Vegetation in harvested areas would continue to grow and add stability to soils on those sites. Detrimental soil conditions would not change as a result of Central Tongass Project implementation.

At the project area scale, timber harvest activities and road construction would continue on non-NFS lands. Timber volume currently under contract would be harvested on NFS lands.

Under this alternative, existing herbicide, manual and mechanical treatments such as spot spraying, hand pulling and tarping would continue.

Cumulative Effects

Cumulative effects to soils occur at the stand or harvest unit scale. Since no areas are proposed for harvest and no new roads will be constructed, no cumulative effects will occur in those stands or areas.

At the project area scale, volume under contract on the Skipping Cow, High Tower, Zarkof Salvage, Three Sisters, Wrangell Roadside, Mitkof Firewood, and Frenchie projects will result in about 873 acres of timber harvest and about 0.7 miles of road construction. Reasonably foreseeable actions include an estimated potential 2,655 acres of timber harvest on non-NFS lands and up to 7 miles of road construction on non-NFS lands on the project area over the next 20 years. The Kake-Petersburg Intertie is estimated to impact 110 acres of soil. Reasonably foreseeable actions include an estimated 3,857 acres of timber harvest and about 18 miles of road on the Kuiu, Navy, Central Kupreanof, and Wrangell Island projects.

Other present, future, and reasonably foreseeable projects include stream restoration projects, communication sites, interties and road easements. Pat Creek, Hand Tool Restoration, East Ohmer Creek, Man Made Hole, and BITSU8 are estimated to impact about 2.4 acres of soil with stream restoration project design activities. Potential communication sites are estimated to impact about 0.05 acres of ground.

Soils detrimentally impacted by past actions (about 8,069 acres) will continue to slowly recover over decades and centuries. Volume under contract and potential future timber harvests on NFS and non-NFS lands could result in an estimated 227 acres of detrimental soil conditions on the project area. Landslides associated with past and reasonably foreseeable management activities will total about 333 acres by the end of the next 20 years. Total detrimental soil conditions at the

end of 20 years are estimated at 9,043acres including landslides, temporary roads, landings, rock pits, and soil conditions in harvest units. The detrimental soil conditions would occupy about 0.2 percent of the project area.

Landslides will continue to occur in both previously managed stands and unharvested areas and will be driven by storm events and soil saturation. Vegetation in previously harvested stands will continue to grow and add stability to the soils in those areas. Based on the recommended frequency analysis provided by Landwehr (2018b), all landslides, including natural and management related slides (past, present and foreseeable future actions) will occupy an estimated 9,882 acres after 20 years. Existing and estimated foreseeable landslides will occupy about 0.3 percent of the project area. The estimate is dependent on climatic events being similar to previous 20 year time periods. Climate change may increase landslide frequency as described above.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Application of the 2016 Forest Plan and the Implementation Plan and Activity Guides (Appendix A) will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Implementation of Alternative 2 would result in detrimental soil conditions increasing by an estimated 1,019 acres across the project area. The Implementation Plan requires an assessment of detrimental soil conditions in young-growth stands before an activity is implemented. If an activity will cause detrimental soil conditions to approach or exceed the 15 percent threshold, soil restoration activities should be considered.

Activities proposed under Alternative 2 may cause an estimated 7 acres of landslides over the next 20 year time period based on existing landslide frequency analyses.

An estimated 366 acres of old-growth on slopes over 72 percent gradient would be considered for timber harvest. An estimated 247 acres of young growth on slopes over 72 percent gradient would be considered for timber harvest. Slope stability investigations will be conducted prior to implementation following 2016 Forest Plan direction and the Implementation Plan and Activity Guides.

Based on available information, about 1.5 miles of road will be proposed for construction on slopes over 67 percent gradient. The overlay of roads and slopes in GIS indicates that the 1.5 miles occurs on approximately 16 segments, indicating an average segment length of 487 feet proposed on slopes over 67 percent gradient. The proposed road segments greater than 67 percent gradient will be reviewed prior to implementation to ensure that the road locations on steep slopes are avoided to the extent practicable.

Cumulative Effects

Cumulative effects to soils occurs at the stand or harvest unit scale. Based on the existing monitoring data, no old-growth harvest stands are expected to exceed the 15 percent threshold for detrimental soil conditions. In young-growth stands, detrimental soil conditions may exist from past harvest activities, and a small percentage of those stands may exceed the 15 percent threshold for detrimental soil conditions. If activities are proposed in these stands, soil

restoration may be prescribed (if practicable) to return the detrimental soil conditions to below the 15 percent threshold.

At the project area scale, volume under contract on the Skipping Cow, High Tower, Zarkof Salvage, Three Sisters, Wrangell Roadside, Mitkof Firewood, and Frenchie projects will result in about 873 acres of timber harvest and about 0.7 miles of road construction. Reasonably foreseeable actions include an estimated potential 2,655 acres of timber harvest on non-NFS lands and up to 7 miles of road construction on non-NFS lands on the project area over the next 20 years. The Kake-Petersburg Intertie is estimated to impact 110 acres of soil. Reasonably foreseeable actions include an estimated 3,857 acres of timber harvest and about 18 miles of road on the Kuiu, Navy, Central Kupreanof, and Wrangell Island projects.

Other present, future, and reasonably foreseeable projects include stream restoration projects, communication sites, interties and road easements. Pat Creek, Hand Tool Restoration, East Ohmer Creek, Man Made Hole, and BITSU8 are estimated to impact about 2.4 acres of soil with stream restoration project design activities. Potential communication sites are estimated to impact about 0.05 acres of ground.

Soils detrimentally impacted by past actions (about 8,069 acres) will continue to slowly recover over decades and centuries. Volume under contract and potential future timber harvests on non-NFS lands could result in and estimated 227 acres of detrimental soil conditions on the project area. Landslides associated with past and foreseeable future management activities will total about 340 acres by the end of the next 20 years. Total detrimental soil conditions at the end of 20 years are estimated at 10,056 acres including landslides, temporary roads, landings, rock pits, and soil conditions in harvest units. The detrimental soil conditions would occupy about 0.3 percent of the project area.

Landslides will continue to occur in previously managed stands and unharvested areas and will be driven by storm events and soil saturation. Vegetation in previously harvested stands will continue to grow and add stability to the soils in those areas.

All landslides, including natural and management related slides (past, present, and reasonably foreseeable future actions) will occupy an estimated 9,883 acres after 20 years. Existing and estimated foreseeable landslides will occupy about 0.3 percent of the project area. The estimate is dependent on climatic events being similar to previous 20-year time periods. Climate change may increase landslide frequency as described above.

Alternative 3

Direct and Indirect Effects

Application of the 2016 Forest Plan and the Implementation Plan and Activity Guides will ensure detrimental soil conditions remain within Region 10 Soil Quality Standards in all stands where project activities are proposed. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions.

Detrimental soil conditions will increase by an estimated 897 acres across the project area. No individual stand or harvest unit is expected to exceed Region 10 Soil Quality Standards for areal extent of detrimental soil conditions. The Implementation Plan requires an assessment of detrimental soil conditions in young-growth stands before an activity is implemented. If an activity will cause detrimental soil conditions to approach or exceed the 15 percent threshold, soil restoration activities should be considered.

Activities proposed under Alternative 3 may cause an estimated 5 acres of landslides over the next 20 year time period.

An estimated 233 acres of old growth on slopes over 72 percent gradient would be considered for timber harvest. An estimated 243 acres of young growth on slopes over 72 percent gradient would be considered for timber harvest. Slope stability investigations will be conducted prior to implementation following 2016 Forest Plan and Implementation Plan direction.

Based on available information, about 1.5 miles of road will be proposed for construction on slopes over 67 percent gradient. The overlay of roads and slopes in GIS indicates that the 1.5 miles occurs on approximately 16 segments, indicating an average segment length of 487 feet proposed on slopes over 67 percent gradient. The proposed road segments greater than 67 percent gradient will be reviewed prior to implementation to ensure that the road locations on steep slopes are avoided to the extent practicable.

Cumulative Effects

Cumulative effects to soils occurs at the stand or harvest unit scale. Based on the existing monitoring data, no old-growth harvest stands are expected to exceed the 15 threshold for detrimental soil conditions. In young-growth stands detrimental soil conditions may exist from past harvest activities, and a small percentage of those stands may exceed the 15 percent threshold for detrimental soil conditions. If activities are proposed in these stands, soil restoration would be prescribed to return the detrimental soil conditions to below the 15 percent threshold.

At the project area scale, volume under contract on the Skipping Cow, Three Sisters, High Tower, Zarkof Salvage, and Frenchie projects will result in about 873 acres of timber harvest and about 0.7 miles pf road construction. Reasonably foreseeable actions include an estimated potential 2,655 acres of timber harvest on non-NFS lands and up to 7 miles of road construction on non-NFS lands on the project area over the next 20 years. The Kake-Petersburg Intertie is estimated to impact 110 acres of soil. Reasonable foreseeable future actions include an estimated 3,857 acres of timber harvest and about 18 miles of road on the Navy, Central Kupreanof, Kuiu, and Wrangell Island projects.

Other present, future, and reasonably foreseeable projects include stream restoration projects, communication sites, interties and road easements. Pat Creek, Hand Tool Restoration, East Ohmer Creek, Man Made Hole, and BITSU8 are estimated to impact about 2.4 acres of soil with stream restoration project design activities. Potential communication sites are estimated to impact about 0.05 acres of ground.

Soils detrimentally impacted by past actions (about 8,069 acres) will continue to slowly recover over decades and centuries. Volume under contract and potential future timber harvests on non-NFS lands could result in and estimated 227 acres of detrimental soil conditions on the project area. Landslides associated with past and foreseeable future management activities will total about 338 acres by the end of the next 20 years. Total detrimental soil conditions at the end of 20 years are estimated at 9,936 acres including landslides, temporary roads, landings, rock pits, and soil conditions in harvest units. The detrimental soil conditions would occupy about 0.3 percent of the project area.

Landslides will continue to occur in previously managed stands and unharvested areas and will be driven by storm events and soil saturation. Vegetation in previously harvested stands will continue to grow and add stability to the soils in those areas.

All landslides, including natural and management related slides (past, present, and reasonably foreseeable future actions) will occupy an estimated 9,883 acres after 20 years. Existing and estimated foreseeable landslides will occupy about 0.3 percent of the project area. The estimate is dependent on climatic events being similar to previous 20-year time periods. Climate change may increase landslide frequency as described above.

Subsistence

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many residents of Kake, Kupreanof, Meyers Chuck, Petersburg, and Wrangell. Reasons given for the participation in subsistence activities include the ability to provide food or supplemental income, the perpetuation of cultural customs and traditions, and the importance of values associated with self-reliance (USDA Forest Service 2016c, p. 3-417).

The effects of landscape changes caused by timber harvest, road construction and improvement, and construction of marine access facilities (MAF) on the availability, competition for, and access to subsistence resources are important because the harvest of resources is a vital cultural practice and food source. Timber harvest may influence the abundance and distribution of subsistence resources through changes in suitable habitat, access to subsistence resources (through changes in habitat and through road development or management), and competition for subsistence resources (through changes in resource abundance, distribution, or access).

Commenters expressed concerns about timber harvest and road construction effects to subsistence use in the project area, especially Sitka black-tailed deer (deer). The cumulative effects of the proposed activities on subsistence resources and associated habitats from past, present, and reasonably foreseeable future activities on both NFS and non-NFS lands were noted concerns.

Summary

The Central Tongass Project encompasses Petersburg and Wrangell Ranger Districts (Unit 1B and 3) of the Tongass National Forest. The project proposes a wide range of activities to be implemented over the next 10 to 15 years. The rural communities most impacted by potential changes to subsistence resources would be the residents of Kake, Kupreanof, Meyers Chuck, Petersburg, and Wrangell as they most commonly harvest within the project area.

The direct and indirect effects from all alternatives associated with the project, as well as the potential cumulative effects associated with implementing the 2016 Forest Plan through the entire rotation period (including implementing Alternatives 1, 2, or 3 of this project) do not present a significant possibility of a significant restriction of subsistence uses of moose (*Alces alces*), fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, furbearers, brown bears (*Ursus acrctos*) and black bears (*Ursus americanus*) (bear), or marine mammals.

The direct and indirect effects and cumulative effects associated with any of the action alternatives for this project may present a significant possibility of a significant restriction of subsistence use of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) (deer) due to potential effects on abundance and distribution, and on competition.

Management Direction and Regulatory Framework

Subsistence resources are guided by applicable laws, acts, executive orders, and Forest Service management direction, as detailed in the 2016 Forest Plan and applicable manuals and handbooks. Pertinent laws, acts, and Forest Service management direction are listed below.

- National Forest Management Act (NFMA) (16 USC 1600 et seq.)
- National Environmental Policy Act (40 CFR 1502.2(b))

- USDA Departmental Regulation 9500-4
- Tongass National Forest Land and Resource Management Plan, December 2016 Specific Forest-wide direction for subsistence is found on pp. 4-65 to 4-66
- Title VIII of Alaska National Interest Lands Conservation Act (ANILCA) (Sec. 810, Sec 811)

Subsistence Resources

In accordance with Title VIII of the ANILCA of 1980, it is the policy of the Forest Service that:

- Consistent with the purposes for which National Forest System (NFS) lands in Alaska were established, sound management principles, and the conservation of healthy populations of fish and wildlife, the utilization of the NFS lands in Alaska is to cause the least adverse impact possible on rural residents who depend on subsistence.
- Provide for the continuation of the opportunity for subsistence uses by rural Alaskan residents, including both Natives and non-Natives.
- Cooperate with the State of Alaska, adjacent landowners, and land managers in managing subsistence activities and in maintaining the continued sustainability of all wild renewable resources on NFS lands.
- Seek to maintain abundance and distribution of subsistence resources necessary to meet subsistence user needs.

Methodology

As seen in ANILCA Section 803 above, the definition of subsistence resources is very broad. For the purpose of this analysis, subsistence resources were split into Sitka black-tailed deer and subsistence resources other than deer.

The effects to terrestrial subsistence species (excluding deer) were analyzed based on potential changes to the abundance and distribution of terrestrial subsistence food plants, firewood and personal use timber, upland game birds and waterfowl, moose, bears, marine mammals and furbearer species habitat. The analysis also factored in the relative changes in access to subsistence resources by road density.

For aquatic subsistence resources such as marine invertebrates, seaweed, and fish, the conclusions from the *Aquatics* section were used to analyze the effects of the proposed actions on the abundance and distribution of, access to, and competition for aquatic subsistence resources in the project areas.

The 2016 Forest Plan FEIS (p. 3-545) determined that among the subsistence resources of greatest importance (salmon, other finfish, marine invertebrates, and deer), deer have the highest potential of being significantly affected by the 2016 Forest Plan alternatives. Deer are considered an “indicator” for potential subsistence resource effects concerning the resources associated with old-growth forest habitat, and they are the most heavily used terrestrial component of subsistence food resources; therefore, they are addressed in detail in this analysis. The units of measure used for effects to deer as a subsistence resource are the same as those found in the *Issue 2: Wildlife Habitat* section:

- Habitat available in a deep snow winter - acres of high-volume POG less than or equal to 800 feet elevation;

- Average winter habitat - acres of POG less than or equal to 1,500 feet elevation;
- Summer habitat - all acres of terrestrial habitats, except stem exclusion forest, measured by percent of historical deer habitat remaining.

Additionally, road access was considered for the purpose of access to subsistence harvest.

Spatial and Temporal Context for Analysis

The spatial boundaries for analyzing the effects to wildlife subsistence resources are at the wildlife analysis area (WAA) and game management unit (GMU) scales. These were used because the Alaska Department of Fish and Game (ADF&G) analyzes and regulates wildlife at these scales. While ADF&G does not manage deer populations at the WAA scale, the harvest data is reported to ADF&G by WAA (see Wildlife section). State sport and federal subsistence regulations are managed at the GMU scale.

The spatial boundaries for analyzing the effects to aquatic subsistence resources are at the watershed and near-shore area scales within the project area. Watersheds were used because they are the boundaries of a drainage basin in which aquatic effects are contained. Near-shore areas were used because some aquatic species harvested for subsistence use are located in these areas.

The Central Tongass Project proposes activities within the Petersburg and Wrangell Ranger Districts over the next 10 to 15 years. Additionally, the subsistence analysis for deer uses the previous 10 years for harvest trend data. See the temporal boundaries in the *Aquatics* and *Issue2: Wildlife Habitat* sections for their respective analyses.

Analysis Methods and Assumptions

Abundance and Distribution of Resources

Terrestrial subsistence food plants occur in many locations within the project area including along roads, in previously harvested areas, and near beach and estuarine areas. Many wildlife subsistence species occur throughout the project area year round, including upland gamebirds; however, waterfowl occur primarily during spring and fall migration and primarily on lakes and estuaries. Marine mammals occur in the marine waters adjacent to the project area. Additional information on the abundance and distribution of marine mammals and designated critical habitat is included in the *Issue2: Wildlife Habitat* section.

Aquatic subsistence resources occur within many watersheds, coastline, and estuarine areas throughout the project area. Many species occur seasonally throughout the project area. However, salmon rely on streams year round for spawning and rearing. Many marine invertebrates can be found year round. Additional information on the abundance and distribution of aquatic species and designated critical habitat is included in the Biological Assessment/Biological Evaluation (BA/BE) in the project record.

Due to their association with old-growth forest habitat, which is the main terrestrial habitat type affected by the proposed alternatives, deer were chosen as the “indicator” for potential subsistence resource consequences concerning the abundance and distribution of the resources. The community-based subsistence analysis focuses largely on deer, which is the largest terrestrial component of subsistence food resources, and this in turn is based on the Sitka black-tailed deer effects analysis in this section. For analyzing effects on abundance and distribution it is assumed that reductions in deer habitat capability will result in decreased abundance and distribution of deer in the project area.

Sitka black-tailed deer are found throughout the project area and use a variety of habitat types throughout the year. During the winter and early spring deer are found at low elevations where there is less snow accumulation and forests provide increased foraging opportunities. In late May and early June, fawning occurs as vegetation increases. Some deer migrate into the alpine for the summer while others remain at lower elevations. In late fall and early winter, the migratory deer return to lower elevations as snow covers available forage. Optimum habitat during a deep snow winter is low-elevation old-growth forest on south-facing slopes. Deer populations fluctuate due to factors including available POG, hunting pressure/regulations, snow fall, and predation. Additional deer abundance and distribution information can be found in the Wildlife section.

Access to Resources

Road networks and shorelines provide access to subsistence resources within both the island and mainland portions of the project area, affecting subsistence both positively and negatively. Some of the areas, such as Mitkof, Wrangell, and Kupreanof Islands have NFS roads connected to communities. Other areas, such as Kuiu, Etolin, and Zarembo, Islands, as well as mainland locations such as Thomas Bay and Frosty Bay also have NFS roads, but these roads are not connected to any communities. Some islands also contain roads located on non-federal lands.

Roads and road building associated with timber harvest can provide access to previously inaccessible areas, providing greater opportunities for subsistence harvest, dispersing hunting and fishing pressure, and also creating the potential for increased competition for favored hunting areas among communities connected by the existing road system, including from non-resident hunters (USDA Forest Service 2016c, pp. 3-418 to 419). Changes in access can also affect the level of effort required, time involved, and the effectiveness of the hunt (USDA Forest Service 2009).

The existing road network is described in the *Transportation* section. If temporary roads are determined to remain open for a set period of time, then for that timeframe, this could result in a positive effect to subsistence users by allowing users access to new areas. Increased access could also result in a negative effect by increasing competition between subsistence users, as many users may seek to access the new areas.

Competition for Resources

Competition for subsistence resources may occur when access is available to local and non-local communities. Increased competition can occur between different subsistence user groups, as well as between subsistence harvesters and sport hunters. The existing road system in most of the project area has created relatively large areas that are easily accessed. Boat access is also widely used to access outlying islands, saltwater, and shoreline. The ferry system, commercial jets, and small planes allow relatively easy access from communities outside the project area, both rural and non-rural. Under ANILCA, in times of resource scarcity or when demand exceeds biologically sound harvest levels, subsistence harvest (rural) has priority over other use of resources, including non-rural harvest. Proposed recreation structures could increase opportunities for subsistence users by providing shelter. These same developments could also result in increased competition as more users may want to use these new sites.

Competition for aquatic subsistence resources is affected by many factors. For this analysis, it is assumed that:

- Competition would increase if access from surrounding communities increases.

- Project activities and protection measures should maintain or improve habitat capability for salmon.
- Restoration activities are intended to bring impaired channels back to a properly functioning state, which would improve its capability to support fish and other aquatic organisms over time.
- Fish habitat improvement and bioenhancement activities are intended to improve wild salmon runs in areas that historically produced more salmon.
- For barrier modification activities, federal subsistence regulations prohibit fishing within 300 feet of a fish ladder or similar structure, while State sport regulations allow this activity unless otherwise posted. Proposed fish passes are intended to improve/provide salmon access to spawning and rearing habitat.
- Fish passage improvement activities at road crossings would increase access to habitat that is currently inhibited by crossing structures that are not passable to fish at all flows.
- No-harvest buffers, BMPs, or 2016 Forest Plan direction will further minimize the effects of timber harvest and road building on the capability of fish habitat.
- New roads, trails, and MAF sites like boat launches might increase access to fishing locations, and could disperse competition for aquatic subsistence resources within the project area.
- While there would be new road construction, most of those roads are temporary, which means subsistence users would have to use high-clearance vehicles to access new fishing locations once a road is closed.

For analyzing effects on competition for **deer**, the following assumptions are made in the 1997 Forest Plan (USDA 1997b FEIS part 1, 3-226):

- New road construction adjacent to communities will result in increased competition from outside communities.
- Habitat reductions will result in increased competition as the same number of users seek fewer resources.
- The demand for resources will remain constant or increase slightly as the habitat capability declines over time.

Affected Environment

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many Southeast Alaska residents; some individuals participate in subsistence activities to supplement personal income and provide needed food. Nearly all rural Alaska communities depend on subsistence resources to meet some portion of their nutritional needs (Wolfe 2000). Others pursue subsistence activities to perpetuate cultural customs and traditions. For all these individuals, subsistence is a lifestyle reflecting deeply held attitudes, values, and beliefs.

Subsistence harvest occurs on land (deer, food plants, firewood and personal-use timber, game birds, waterfowl, bears, moose, and furbearers) and in the water and near-shore (salmon, other finfish, seaweed and beach greens, and marine invertebrates, marine mammals). However, deer make up the largest single component of subsistence harvest in the project area and are analyzed as in indicator for subsistence resources in this document. Refer to the Aquatics and Wildlife Habitat sections of this DEIS for a detailed description of affected environment.

Subsistence use areas and the levels of harvest are estimated using a variety of sources. ADF&G records the level of community harvests for selected wildlife species, such as deer, moose, black bear, Alexander Archipelago wolf (*Canis lupus ligoni*), and river otter (*Lutra canadensis*) (otter), within specific areas referred to as Wildlife Analysis Areas (WAAs). The ADF&G harvest data and Tongass Resource Use Cooperative Survey (TRUCS) maps reveal subsistence use areas for deer, marine invertebrates, marine mammals, salmon, and other fish within the project area.

The 1997 Forest Plan FEIS includes maps of "community use areas" for each of the 32 communities in Southeast Alaska (USDA Forest Service 1997b, pp. H-2 to H-63). These maps indicate the approximate extent of the areas that are commonly used by many of the residents of each community in their day-to-day work, recreational, and subsistence activities.

Effects Analysis

Subsistence Resources Other Than Deer

Moose

Federal subsistence moose harvest is very low in the project area with only 15 moose being harvested from 43 permits in Units 1B and 3 over a 14 year period (2003-2016) (USFWS 2019). Moose are primarily harvested under State sport regulations in the project area.

Moose habitat is known to decline as a result of stand succession (Lowell 2018). As succession occurs, deciduous stands may become dominated by coniferous vegetation, or vegetation reaches a size beyond what moose are capable of browsing. As a result, moose can benefit from stand disturbance, such as timber harvest. Timber harvest would have the beneficial impact of increasing shrub forage availability to moose over the short-term, until the stand reaches stem exclusion (generally within 25 years) in the resulting early-successional plant communities.

Timber harvest and road construction may temporarily increase subsistence moose harvest opportunity through access and increased visibility to harvesters. Increased road access could increase competition among local communities, particularly if increased access in currently accessible areas results in overharvest. These effects could be somewhat mitigated through road access management. All action alternatives would have direct/indirect effects on moose through habitat alteration, disturbance, and increased access to hunters.

Alternative 2 would have the greatest effect to moose habitat and access as it harvests the most acres of old growth overall and has a greater number of proposed road miles, followed by Alternative 3. However, because timber harvest would occur in only certain WAAs and would affect a relatively small proportion of moose habitat, these effects would not result in a significant possibility of a significant restriction to moose.

Food Plants, Firewood, and Personal Use Timber

None of the alternatives are expected to adversely affect the abundance or distribution of subsistence food plants because these resources are generally abundant along roads and in previously harvested areas. Food plants are expected to increase in harvested stands in the short term during the early successional stage, declining thereafter. Project design features described in the Implementation Plan address issues related to subsistence food and plants, and outline specific measures to mitigate short- and long-term negative effects on these resources.

The project would not preclude Alaska residents from obtaining personal use timber, including firewood. New roads under Alternatives 2 and 3 may temporarily increase access to areas where

food plants and personal use timber may be gathered. Temporary roads may remain open for a set period of time post-activities. These roads could provide increased access for subsistence users to food plants, firewood, and personal use timber.

Given the positive effect to the abundance and distribution of food plants, and that the effects to access would be both temporary and distributed throughout the project area over time, no changes in competition for food plants or personal use timber would be expected.

Upland Game Birds and Waterfowl

All action alternatives would reduce upland game bird habitat, Productive Old Growth (POG), and have the potential to increase vulnerability to harvest associated with increased access. The presence of old-growth reserves in the project area, and implementation of Forest Plan direction that maintains connectivity within matrix lands would help sustain local populations (see the *Other Wildlife* section).

No measurable effects to waterfowl are expected to occur, given that most species occur in the project area only during migration and on lakes and estuaries, except the Vancouver Canada goose which uses forested wetlands, and would not be affected by project-related activities (see Wildlife section).

No significant changes in the abundance or distribution of upland game birds and waterfowl are anticipated under any of the alternatives. The number of hunters may temporarily increase in the project area due to increased access along project roads, but competition would likely remain about the same because upland birds and waterfowl do not contribute a large percentage of the foods for the subsistence communities. Harvest activities proposed in the project area would affect POG habitat used by upland gamebirds. Alternative 2 would have the greatest effect to POG habitat as it harvests the most old-growth acres overall, followed by Alternative 3. However, this effect does not result in a significant possibility of a significant restriction to upland gamebirds.

Black and Brown Bears

Black bears are found throughout the project area. Brown bears occur on the mainland, Wrangell Island, Etolin Island, and there is a small resident or seasonal population on Mitkof Island. While bears can be utilized by subsistence harvester for fur, handicrafts, and meat (black bear are more commonly hunted for meat), harvest by subsistence users is thought to be minimal. Bear habitat use in the project area is discussed in detail in the Wildlife section.

Alternative 1 would not affect bear habitat, and Alternatives 2 and 3 would have minor effects to the highest quality black or brown bear habitats (see *Issue2: Wildlife Habitat* section). Deer fawns are a component of bear diet in the spring. Therefore, potential effects on deer populations through reductions in habitat capability resulting from timber harvest under Alternative 2 or Alternative 3 (refer to the *Issue2: Wildlife Habitat* section for more discussion) could result in less fawn productivity and thereby affect the prey available to bears. However, due to the variety of forage and prey species available to bears it is unlikely that this will have a substantial effect to the black or brown bear populations.

Timber harvest would have the beneficial impact of increasing shrub forage availability to bears over the short-term, until the stand reaches stem exclusion, generally within 25 years, in the resulting early-successional plant communities. Timber harvest and road construction may increase subsistence bear harvest opportunity through access and increased visibility of bears. However, as stand succession occurs it will reduce subsistence harvest opportunity by reducing

access and visibility of bears within the stand. Increased road access and reduction in bear habitat could increase competition among local communities, particularly if increased access in currently accessible areas results in overharvest. These effects could be somewhat mitigated through road access management. All action alternatives would have direct/indirect effects on bears through habitat loss, disturbance, and reduction in prey species.

Alternative 2 would have the greatest effect to bear habitat as it harvests the most acres of old growth overall, followed by Alternative 3. However, because timber harvest would occur in only certain WAAs and would affect a relatively small proportion of bear habitat as discussed in the Wildlife section, these effects would not result in a significant possibility of a significant restriction to bears.

Furbearers

Estuary, riparian, and forested coastal habitats receive the greatest use by furbearers, such as mink, river otter and ermine, and are included in the 2008 Forest Plan Conservation Strategy. Therefore, the project is not likely to affect the abundance or distribution of these species. Habitat use by furbearers in the project area is discussed in detail in the *Issue 1: Wildlife Habitat* section.

Timber harvest with removal of POG, and the associated fragmentation and road building which increases subsistence harvester access, could affect the local abundance and distribution of Pacific marten and American marten, and wolves. These species become more vulnerable to harvest due to increased access. This could increase competition among local communities, particularly if increased access in currently accessible areas results in overharvest of furbearers. These effects could be somewhat mitigated through road access management. However, all action alternatives would have direct/indirect effects on marten and wolves through habitat loss, disturbance, and reduction in prey species.

Effects to wolves are assessed by deer habitat capability (DHC) as determined by the interagency deer model, since deer are the primary prey for wolves in all biogeographical provinces in the project area. Effects to wolves are also assessed by road density. Detailed effects to these species are explained in the *Issue 1: Wildlife Habitat* section.

Alternative 2 would have the greatest effect to furbearer habitat as it harvests the most acres of old growth overall, followed by Alternative 3. These effects do not result in a significant possibility of a significant restriction to furbearing species.

Marine Mammals

Marine mammals have the potential to be exposed to disturbance and noise associated with marine access facility (MAF) activity, potential collisions with vessels, and fuel or oil spills associated with vessel traffic. All action alternatives have the potential to result in a minor increase in activity including vessels and the rafting of logs at the existing and proposed MAFs, and in association with the export of logs. However, this activity would be infrequent, and would be spread over 15 years.

Vessels used to transport logs are not likely to affect the abundance or distribution of marine mammals around the project area, given the transient nature of these species and the fact that such vessels typically operate at low, constant speeds, giving marine mammal species time for avoidance. Additionally, it is assumed that all vessels operating on marine waters related to Central Tongass Project activities would adhere to the requirements of the *Marine Mammal Protection Act*, *Endangered Species Act* (ESA), and National Marine Fisheries Service (NMFS)

guidelines for approaching marine mammals, as required under the 2016 Forest Plan. Therefore, no change in abundance and distribution, access to, or competition for, marine mammals are likely to occur as a result of the project. Affects to marine mammals are included in the Biological Assessment/Biological Evaluation in the project record. None of the project alternatives would present a significant possibility of a significant restriction of subsistence uses for marine mammals.

Subsistence/Personal Use Fish

Subsistence and personal use salmon fisheries in the waters, principally used by the residents of Petersburg and Wrangell, are under the management responsibility of the Division of Commercial Fisheries. Federal subsistence permits allow for harvest on waters in or adjacent to federal public lands. The primary federal subsistence harvesters in the project area are Petersburg and Wrangell. Although, all rural residents of Southeast Alaska and Yakutat have customary and traditional use designation for the area and may harvest fish and shellfish under federal subsistence regulations. Petersburg and Wrangell residents primarily utilize the federal general Southeast Alaska subsistence fishing permit (FFSE04) and the Federal Stikine River subsistence fishing permit (FFSE07). Both the ADF&G and the U.S. Forest Service combine all subsistence data, thus data for specific project area streams is not available. Data from 2016 was used for both state and federal harvest to be consistent with ADF&G's most recent subsistence report.

In 2016, residents of Petersburg harvested 749 salmon using federal subsistence permits, which was lower than the 2015 harvest (1,087) (Table 103). Wrangell harvested 1,720 salmon using federal subsistence permits, which was higher than the 2015 harvest (1,313) (Table 104). In 2016, residents of Petersburg harvested a total of 2,606 salmon in the State subsistence fishery, which was higher than the 2015 total (2,275) (Fall et al. 2018, 2019) (Table 105). Wrangell harvested a total of 2,579 salmon in the 2016 State subsistence fishery, which was also higher than the 2015 total (2,395) (Fall et al. 2018, 2019) (Table 106).

Table 103. Community of Petersburg Federal Subsistence Harvest 2016, Southeast Region. Permits issued were General Southeast Alaska subsistence fishing permits and Stikine River subsistence fishing permits.

Year	# Permits Issued	Sockeye	Pink	Chum	Chinook	Coho
2016	157	678	32	13	0	26

Source: Federal Subsistence Database, accessed 6/11/2019

Table 104. Community of Wrangell Federal Subsistence Harvest 2016, Southeast Region. Permits issued were General Southeast Alaska subsistence fishing permits and Stikine River subsistence fishing permits.

Year	# Permits Issued	Sockeye	Pink	Chum	Chinook	Coho
2016	224	1,590	41	20	0	69

Source: Federal Subsistence Database, accessed 6/11/2019

Table 105. Community of Petersburg State Subsistence Harvest 2016, Southeast Region

Year	# Permits Issued	Sockeye	Pink	Chum	Chinook	Coho
2016	173	1,989	84	46	16	471

Source: Fall et al. 2019

Table 106. Community of Wrangell State Subsistence Harvest 2016, Southeast Region

Year	# Permits Issued	Sockeye	Pink	Chum	Chinook	Coho
2016	191	2,248	85	107	60	79

Source: Fall et al. 2019

Harvesting salmon and other fish is an important activity in the area and an important part of the local culture. As noted in Table 107, during the most representative year for the community of Petersburg and Wrangell, reliance on salmon and non-salmon fin fish represented a large percent of subsistence harvests (ADF&G 2000).

Table 107. Subsistence Harvest All Resources, Salmon, and Non-Salmon Fin Fish by Community (Most Representative Year)

Community	Subsistence Use – All Resources (Pounds)	Subsistence Use of Salmon (Pounds)	% Salmon Relative to Total Subsistence Use	Subsistence Use of Non-Salmon Fin Fish (Pounds)	% Non-Salmon Fin Fish Relative to Total Subsistence Use
Petersburg	55,528	25,192	37.3	14,529	26.2
Wrangell	43,060	6,562	15.2	8,747	20.3

Source: Alaska Department of Fish and Game, Community Profile Database, 2000.

The Central Tongass Project would not affect the abundance or distribution of or competition for anadromous or other finfish and marine invertebrates. All action alternatives include fish passage improvement at road–stream crossings and riparian thinning. These activities would address fish habitat fragmentation and improve fish habitat, and therefore improve the abundance and distribution of salmon for subsistence use. All action alternatives also allow for some amount of fish habitat improvement including bioenhancement, and some amount of instream restoration. These activities would improve water quality, fish habitat, and/or access to fish habitat, and therefore improve the abundance and distribution of salmon for subsistence use. Alternatives 2 and 3 allows for fish habitat improvement, and barrier modifications.

Alternatives 2 and 3 include the use of at least 15 existing LTF (Log Transfer Facilities) with reconstruction of 8, and the construction of 3 new LTF site (Three Mile Arm, and Vank and Shrubby islands). Refer to the *Transportation* section for more details on these facilities. Effects to the abundance and distribution of aquatic subsistence resources would be minimized by following direction in the Implementation Plan, which outlines required best management practices (BMP), 2016 Forest Plan direction, and require identification of design features during implementation planning.

Alternative 2 proposes harvesting up to approximately 13,500 acres of timber and would result in 715 additional stream crossings, with an estimated 128 new stream crossings on Class I or Class II streams (see Aquatics section). Alternative 3 proposes harvesting up to approximately 11,725 acres of timber. Alternative 3 would result in 713 additional stream crossings, with an estimated 128 new stream crossings on Class I or Class II streams.

Direct and indirect effects of harvest activities are similar between action alternatives and would occur to the greatest extent in this Alternative 2 due to higher amounts of proposed timber harvest and road miles. Direct and indirect effects to the abundance and distribution of aquatic subsistence resources would be minor because buffers along fish streams preserve the riparian

portion of the stand needed for shade, nutrient input, and habitat complexity. Effects would be further minimized by following Implementation Plan direction which outlines required BMPs and 2016 Forest Plan direction, and requires identification of design features during implementation planning.

Roads can directly affect water quality, fish habitat, and access to fish habitat, especially if roads are built on steep slopes or within 300 feet of a fish stream. Alternatives 2 and 3 propose up to 63 miles of road reconstruction. Both action alternatives propose new and temporary road construction with alternative two proposing a greater number of road miles.

In both action alternatives the standards and guidelines for the designated RMAs would be followed as described above. RMA buffer design is site-specific and is expected to effectively protect water quality and fish habitat. Effects to lake and pond habitat are considered negligible due to lake riparian buffers and implementing 2016 Forest Plan Standards and Guidelines and BMPs.

Alternative 1 - No Action Alternative

Direct and Indirect Effects

With no action under this project, there would be no direct or indirect effects. The past, present, and reasonably foreseeable future activities would continue to influence the environmental conditions but the project would not contribute no cumulative effects.

Cumulative Effects

Since Alternative 1 does not result in any effects to abundance and distribution, access, or competition it would not contribute to the cumulative effects.

Alternatives 2 and 3

Direct and Indirect Effects

The Central Tongass Project would not result in a large reductions in abundance or major redistribution of subsistence resources, substantial interference with harvestable access to active subsistence-use sites, or major increases in non-rural resident hunting in the following subsistence resources: moose, food plants, marine invertebrates, salmon, other finfish, waterfowl, bears, furbearers and species that utilize estuary, riparian, or coastal habitats. The risk of project-related impacts to these resources from timber harvest, road construction, and other project activities would be unmeasurable because of *Tongass Timber Reform Act* (TTRA) stream buffers, 2016 Forest Plan beach and estuary, riparian, inventoried roadless areas, old growth reserve strategy, and Tongass National Forest standards and guidelines. Access to harvest areas through new trails, roads, and shelters could have a positive effect for subsistence harvesters, but may present an increase in competition for newly accessible harvest areas. Initial timber harvest will likely have temporary (25 year) benefits to moose forage. There would be direct/indirect impacts to bear, marten, and wolves through the reduction of POG habitat which will be discussed in the *Issue 1: Wildlife Habitat* section.

Aquatic subsistence resources include salmon, other finfish, seaweed and beach greens, and marine invertebrates. Timber harvest may influence the abundance and distribution of (through changes in suitable habitat), access to (through changes in habitat and through road development or management), and competition for aquatic subsistence resources (through changes in abundance and/or access). However, all action alternatives include some amount of fish passage

improvement at road–stream crossings, riparian thinning, fish habitat improvement projects including bioenhancement and barrier modifications, and instream restoration.

Invasive plant treatments, including the use of herbicide, are expected to have negligible to minor effects to wildlife and plant resources. The analysis included in the Northern Tongass Integrated Weed Management Wildlife and Subsistence Resource Report (Oehlers and Dunn 2019) and the Human Health Resources Report (Krosse 2019) applies to the Central Tongass project because the scope of the treatment activity is similar, and is thereby incorporated by reference. None of the exposure scenarios, which includes contact with contaminated vegetation and consumption of contaminated fish, fruit, vegetation or water indicate a level of concern for any of the herbicides in the manner applied in the project area (Krosse 2019; Oehlers and Dunn 2019). Invasive plant treatments are not anticipated to result in measurable effects to any subsistence resource.

Abundance and distribution: Under all action alternatives, POG habitat would be reduced which could have a minor effect on abundance and distribution of bear, a moderate effect on wolves, and a major effect on marten because of increased habitat fragmentation and potential den displacement for bears and wolves. The proposed project will authorize harvest of old-growth and young-growth timber types, standards and guidelines as defined by the 2016 Forest Plan for riparian and Class I and II stream buffers should reduce impacts to these species. New roads will also likely have a minor direct/indirect effect on moose, bear, marten, and wolves due to an increase in harvest through greater access. None of the alternatives would result in large reductions in abundance or major redistribution of these resources. Therefore, although this project would cause effects to habitat it would not result in a significant possibility of significant restriction to subsistent resources. For more information see the *Issue 1: Wildlife Habitat* section.

Access: New proposed roads or those closed through the Central Tongass Project activities do not represent a substantial interference with harvestable access to active subsistence-use sites and positively affect how subsistence resources are accessed. All action alternatives would increase access through new road construction, road reconstruction, and temporary road construction (*Transportation* section). The existing road network is described in the *Transportation* section. New and temporary roads could result in a positive effect to subsistence users by allowing users access to new areas, but it could also result in a negative effect by increasing competition between subsistence users, as many users may seek to access the new areas.

Competition: It is assumed through roads closures and reduction of habitat that competition for subsistence resources may increase, and be alleviated by, access to new areas. POG (habitat) will be reduced by the action alternatives for some furbearer species, but this reduction should be minimal and not negatively affect competition for these species. Action alternatives would increase the miles of open road and by doing so spread out the hunting and trapping pressure. Although competition may increase under action alternatives there would still be sufficient habitat for subsistence species to sustain subsistence users. No proposed actions would likely result in a major increases in non-rural resident hunting nor would they result in a significant possibility of significant restriction to subsistent resources.

Cumulative Effects

The Central Tongass Project would have no measurable effect on the abundance and distribution of, access to, or competition for food plants, marine invertebrates, salmon, other finfish, waterfowl, furbearers and species that utilize estuary, riparian, or coastal habitats. Exceptions are bear, marten, and wolves which would have effects through the reductions in POG habitat and/or

increased road densities and related effects associated with increased human access under all action alternatives (see the *Issue 1: Wildlife Habitat* section). Moose may benefit from increased browse due to timber harvest, but may be adversely affected by increased road densities and related effects associated with increased human access under all action alternatives. Ongoing and foreseeable project activities would contribute to these affects. Activities that have affected potential habitat and are cumulative with this project include: past timber harvest, road/trail construction, installation of utility corridors, and property development on non NFS land. Activities that have improved habitat include pre-commercial thinning.

Cumulative adverse effects to abundance and distribution of, access to, and competition for aquatic subsistence resources would increase in both of the action alternatives. During the implementation process, careful consideration of watershed-specific activities and characteristics will be necessary to ensure that fish habitat and water quality will not be degraded, and capability of habitat to support aquatic subsistence resources like salmon would be maintained. Alternative 3 modifications are only related to Sitka black-tailed deer and Pacific marten (only on Kuiu Island) so no difference in effects to aquatic resources is anticipated.

Past, present, and reasonably foreseeable future activities in the project area could affect aquatic subsistence resources and their users. Previous land management practices like harvesting riparian trees, yarding logs in streams, and building roads in floodplains have had adverse effects to water quality, fish habitat, and the capability of habitat to support aquatic subsistence resources like salmon. Timber harvest and road building on state, private, and federal land in the project area contribute to changes in peak flow rates which can affect the capability of habitat to support aquatic subsistence resources. Past and present road improvements for highway vehicle access in the project may increase competition for aquatic subsistence resources in some communities.

In total, Central Tongass Project activities may help offset adverse effects to aquatic resources from previous land management practices. Stream restoration, riparian thinning, fish habitat improvement activities including bioenhancement, and correcting fish passage issues at road crossings can all help improve habitat capability to support aquatic subsistence resources. Direction in the Implementation Plan outline BMPs, and provide 2016 Forest Plan direction, and other protections so that adverse effects to aquatic resources from project activities are minimized.

Abundance and distribution: The Central Tongass Project would result in temporary increases in the abundance and distribution of food plants, and temporary increases in access to food plants, firewood, personal use timber and freshwater fish. Present and foreseeable timber harvest from federal, state or non-NFS land would contribute to these affects. Past timber harvest has altered the distribution of some species through changes in the distribution of habitat types and road development. Ongoing and foreseeable timber harvests and associated road construction, as well as other development, would contribute to these affects. Therefore, the Central Tongass Project, in conjunction with past, present, and foreseeable actions, may further alter the abundance or distribution of some species, because of habitat loss and fragmentation. However, these actions would not represent a large reductions in abundance or major redistribution of these resources.

Access: Collectively, new proposed roads associated with the project in addition to those resulting from other projects would improve access and likely reduce competition for resources. However, newly accessible harvest areas may see increased competition. Any temporary road closures would have negligible impact over competition for subsistence resources. No proposed

actions would represent a substantial interference with harvestable access to active subsistence-use sites.

Competition: All action alternatives would increase the miles of open road and would be expected to alleviate competition for all subsistence resources, but newly accessible areas may see increased competition. Proposed actions are not expected to result in a major increases in non-rural resident hunting.

Sitka Black-tailed Deer

Units of measure pertinent to the issue

- Effects to abundance and distribution of deer winter habitat and elevation connectivity
- Relative changes in access to subsistence resources by road density

Subsistence Use of Black-tailed Deer

Deer are the largest terrestrial component of subsistence food resources in the project area. The primary deer harvesters in Units 1B and 3 are residents of Kake, Petersburg and Wrangell. Deer harvest survey data from ADF&G (2000 to 2017) show that of the total deer harvested in Unit 1B, 85 percent are harvested by residents of Petersburg (81 percent) and Wrangell (4 percent). State harvest data for the same years in Unit 3 shows that 84 percent of deer are harvested by residents of Petersburg (32 percent) and Wrangell (52 percent). In Unit 1B, federal subsistence deer harvest reported on designated hunter permits (2002-2017) show 100 percent of the deer harvested was by residents of Petersburg. Federal subsistence harvest in Unit 3, for the same years, show that 99 percent of deer were harvested by residents of Petersburg (21 percent) and Wrangell (76 percent). Community use is further discussed and displayed in the 2016 Forest Plan FEIS in the Communities portion of Chapter 3 (pp. 3-523 to 3-685) where a 1987 community census shows residents of Wrangell and Petersburg harvest an average of 164 and 200 pounds of subsistence foods per household each year, respectively.

Alternative 1 - No Action Alternative

Direct and Indirect Effects

With no action under this project, there would be no direct or indirect effects. The past, present, and reasonably foreseeable future activities would continue to influence the environmental conditions but the project would not contribute no cumulative effects.

Cumulative Effects

Since Alternative 1 does not result in any effects to abundance and distribution, access, or competition it would not contribute to the cumulative effects.

Alternatives 2 and 3

Direct and Indirect Effects

Effects to deer habitat have been addressed by looking at effects to abundance and distribution of deer winter habitat and elevation connectivity, and relative changes in access to subsistence resources by road density. Activities proposed under Alternatives 2 and 3 would result in the reduction of winter deer habitat, reduce deer habitat capability, and could reduce deer carrying capacity. At stem exclusion, DHC would be even further reduced as there is generally little or no forage at this stage. If unmanaged, stands in the stem exclusion stage may also reduce the ability for subsistence harvesters to spot deer, making them less available to harvesters.

The analysis of direct and indirect effects uses deer harvest by federally qualified subsistence users only and the cumulative effects analysis includes all users. The ADF&G data do not differentiate between NFS and non-NFS lands in WAAs so the analysis for the Central Tongass Project is done at the scale of all lands.

A deer population at carrying capacity is assumed to support a sustainable hunter harvest equal to approximately 10 percent of the deer habitat capability while also providing a reasonably high level of hunter success in the WAA (USDA Forest Service 2008b, p. 3-576). Although recent indications suggest deer populations in Units 1B and 3 are slowly rebounding from the severe winter induced die offs during the late 1960s and early 1970s, managers are still concerned that existing wolf and bear predation, as well as major habitat alterations in some WAAs are limiting the population from recovery. It is highly believed that a substantial die-off could result again in these GMUs with another severe winter (Lowell, 2015a; Lowell 2015b).

Abundance and Distribution: Alternative 2 proposes a greater amount of old-growth and young-growth timber harvest compared to Alternative 3, and therefore, would result in the greatest negative effect to deer habitat. Long-term, Alternative 3 would have less of a negative effect to deer habitat in that it changes harvest locations and strategies, particularly on Kuiu and Mitkof Islands where marten design features and the requirement of travel corridors in HPOG stands below 800 feet on south facing slopes will aid deer in winter movements.

Even-aged harvest of both old- and young-growth may result in a short-term increase in deer availability, but may decrease over the long term in the absence of any further treatments. Uneven-aged harvest would result in less of an increase in deer habitat in the short term, but also less of decrease over the long term.

The abundance and distribution of deer may be affected in Alternatives 2 and 3, mostly due to the loss of deep snow habitat that provides available forage and thermal cover in winter in some WAAs. Implementation of Alternative 2, and to a lesser extent Alternative 3, would reduce deer winter habitat capability in certain WAAs which, over the short or long-term, could result in a reduction in deer numbers, particularly if the project area experiences severe winters with high snow amounts that causes substantial deer mortality. The change in abundance and distribution of deer could have an effect on competition because as hunter efficiency and success decrease in areas that transition into stem exclusion, there is the potential for increased competition for deer in areas where habitat capability, and potentially deer abundance, is higher.

Access: Road building would result in an increase in access to subsistence resources. These road networks provide greater access to areas previously not accessible and can affect subsistence both beneficially and adversely by providing access, dispersing hunting pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (USDA Forest Service 2016c, pp. 3-418 to 419). The effect of the proposed road building would be expected to be similar across all action alternatives.

New road construction is likely to result in the development of new use patterns around some communities, but these changes are not likely to lead to a significant possibility of a significant restriction of subsistence access to the resources. New use patterns may, however, favor some subsistence groups and disadvantage others (USDA Forest Service 2016c, p. 3-428).

Roads remaining open could provide increased access for subsistence users to deer. This effect may be perceived as either positive, providing increased access to a new area, or negative, as increased access may lead to increased competition for resources. Potential effects are likely to

vary by community and may be perceived differently by members of the same or neighboring communities. Both Alternatives 2 and 3 propose up to 63 miles of road reconstruction. Both action alternatives propose new and temporary road construction with alternative two proposing a greater number of road miles.

Conditions in unmanaged young-growth stands can reduce access to deer, increase undesirable habitat for deer hunting (Brinkmann et al. 2009) and make them harder to see in these stands and therefore less visible to hunters. This could be perceived as a negative effect, by reducing access for hunters. Roads in the project area provide access to subsistence resources.

Competition: If hunter efficiency and success decrease in areas that transition into the stem exclusion stage, there is the potential for increased competition for deer in areas where habitat capability, and potentially deer abundance, is higher. All alternatives include the clearcut harvest of old-growth acres. In the short term (about 25 years) the clearcut acres result in a stand with more forage availability for deer, and the area being more open, with deer being more visible to hunters. This could result in an increase in both hunter efficiency and success in the short term. In the long term, as these stands move from stand initiation stage into the stem exclusion stage, hunter efficiency and success could decrease. Treatments of the young-growth stands that postpone the stem exclusion stage or at least open the stand enough to both increase forage availability to deer and visibility to hunters could help mitigate the effect to both deer and hunters.

Cumulative Effects

Because there would be direct/indirect effects from either action alternative there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Activities in the project area that have affected deer habitat and are cumulative with this project include: past timber harvest, road/trail construction, installation of utility corridors, property development on non-NFS land and any future timber sales proposed by federal, state or tribal organizations. Alternative 3 would have the least cumulative effects due to measures incorporating design features to commercial old growth and young growth timber harvest in order to mitigate effects to deer and Pacific marten (Kuiu Island).

Abundance and Distribution: Because there would be direct/indirect effects to the abundance and distribution of deer or their habitat from all action alternatives there would be cumulative effects, due to habitat loss, when combined with past, present, or reasonably foreseeable future activities. The combination of past and future timber harvest, especially stands entering the stem exclusion stage, will affect deer abundance and distribution. Alternative 2 will have the greatest potential cumulative effects on deer abundance and distribution as it proposes more timber harvest.

Access: It is assumed that road building will occur on non-NFS lands to facilitate timber harvest. Additional roads may increase the access for both subsistence and non-subsistence users to subsistence resources. These road networks provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access, dispersing hunting pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (USDA Forest Service 2016c, pp. 3-418 to 419). The cumulative effect of the potential road building on all lands would be expected to be similar across both action alternatives, although Alternative 2 proposes a greater number of new and temporary road miles.

Competition: Under all action alternatives, the combination of activities on both NFS and non-NFS lands may result in a short-term increase in deer availability, but may result in a long-term decrease in the overall deer availability based on habitat.

Hunter success could be further reduced through harvest restrictions or difficulty obtaining deer in the WAAs as these areas are still slowly recovering from the severe winter events. Hunter success rates in these WAAs may also be lower due to the availability of a growing moose population in the project area.

If hunter efficiency and success decrease in areas that transition into the stem exclusion stage of stand development, there is the potential for increased competition for deer in areas where habitat capability, and potentially deer abundance, is higher.

Conclusion

There is a significant possibility of a significant restriction for the subsistence use of deer. The risk of hunting restrictions could be reduced somewhat, through management (thinning) of the existing and future closed-canopy, young-growth forests. Indirect effects associated with increased competition for deer in subsistence use areas could also occur under all alternatives if hunters from other communities were displaced due to timber harvest activity (USDA Forest Service, 2016c, pp. 3-418 to 419).

Alternative 1 would have negligible direct impacts to subsistence because it would result in a negligible indirect reduction in deer habitat capability and no new road building. As young-growth stands age and move into the stem exclusion stage, deer may become more difficult for harvesters to spot. Acres currently in the stand initiation stage would continue to move into the stem exclusion stage over time. Alternative 1 would benefit from the improvement in deer habitat quality resulting from young-growth treatments on NFS lands that would likely continue to occur under other NEPA decisions. Under Alternative 1, there may be slight changes to the abundance and distribution of, competition for, and access to subsistence resources on NFS lands due to the slight decrease in the DHC as well as no new roads. The effects of activities on non-NFS lands could result in a change to abundance and distribution of, competition for, and access to subsistence resources.

The abundance and distribution of deer will be affected in Alternatives 2 and 3, mostly due to the loss of deep snow habitat in some WAAs. Design features limit old-growth harvest in Alternatives 3, including in WAAs with deep snow habitat concerns. For Alternative 3 old-growth harvest would be more limited with more partial harvest prescriptions, and identifies elevation corridors or no old-growth harvest to occur in south-facing stands below 800 feet in elevation meeting HPOG standards.

The change in abundance and distribution of deer could have an effect on competition because as hunter efficiency and success decrease in areas that transition into stem exclusion, there is the potential for increased competition for deer in areas where habitat capability, and potentially deer abundance, is higher.

It is unknown to what degree the amount of timber harvest of deep snow habitat will be on non-NFS lands; however, it can be assumed that most of the remaining deep snow habitat on these lands would be impacted. If so, the loss of deep snow habitat in some WAAs will result in an effect to deer habitat that may result in these areas not being capable to support deer in winter. This loss of deep snow habitat increases the importance of treating the young-growth acres on south-facing low-elevation stands to try to offset the effect that a severe winter could have to

deer in these areas. All action alternatives would include road construction. Roads provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access, dispersing hunting pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (USDA Forest Service 2016c, pp. 3-418 to 419). Both action alternatives propose 63 miles of road reconstruction in addition to new and temporary roads. However, Alternative 2 proposes a greater number of new and temporary road miles.

Subsistence Findings

Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of NFS land in Alaska, to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a possibility of a significant restriction of subsistence uses. The Alaska Land Use Council's definition of "significantly restrict subsistence use" is one guideline used in evaluation:

> A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions, or stipulations, if can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources.

It should be noted that the term "significant" as used in this context does not have the same definition as used in the implementing regulation for NEPA. See 40 CFR Section 1508.27 for definitions of "significant" in a NEPA context.

The U.S. District Court Decision of Record in Kunaknana v. Watt provided additional clarification. In part it states:

> Restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites, or major increases in non-rural resident hunting.

The direct and indirect effects from all alternatives associated with the project, as well as the potential cumulative effects associated with implementing the 2016 Forest Plan through the entire rotation period (including implementing Alternatives 1, 2, or 3 of this project) do not present a significant possibility of a significant restriction of subsistence uses of fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, moose, furbearers, bears, or marine mammals.

The direct and indirect effects and cumulative effects associated with any of the action alternatives for this project may present a significant possibility of a significant restriction of subsistence use of deer due to potential effects on abundance and distribution, and on competition.

The 2016 Forest Plan Amendment Final EIS (USDA Forest Service 2016c) included a cumulative effects analysis of resource development on subsistence resources. The finding was that full implementation of the 2016 Forest Plan "may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of these resources, and on competition for these resources." (Forest Plan ROD: USDA Forest

Service 2016b, p. 43). For this reason, timber harvest activities cannot completely avoid cumulative landscape effects to subsistence uses.

Section 810 (a)(3) of ANILCA requires that when a use, occupancy, or disposition of public lands may result in a significant possibility of a significant restriction, a determination must be made whether (1) such a restriction is necessary, consistent with sound management principles for the utilization of public lands, (2) the proposed activity involves the minimum amount of public lands necessary to accomplish the purposes of the use, and (3) reasonable steps will be taken to minimize adverse impacts on subsistence uses and resources resulting from the actions.

Necessary and Consistent with Sound Management of Public Lands: The alternatives proposed in this EIS have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard, the *National Forest Management Act*, the *Alaska National Interest Lands Conservation Act*, the *Tongass Timber Reform Act*, the *Wilderness Act*, the 2016 Forest Plan Amendment Final EIS, and the *Alaska State Forest Resources and Practices Act* have been considered.

National Forest land management plans are required by the *National Forest Management Act* and must provide for the multiple-use and sustained yield of renewable forest resources in accordance with the Multiple-Use Sustained Yield Act of 1960. Multiple-use is defined as "the management of all the various renewable surface resources of the NFS so that they are utilized in the combination that will best meet the needs of the American people" (36 CFR 219.3). The alternatives presented herein represent different ways of managing Tongass National Forest resources in combinations that are intended to meet the needs of the American people. The potential restrictions associated with each alternative are necessary and consistent with the sound management of public lands.

Amount of Public Land Necessary to Accomplish the Proposed Action: The amount of land necessary to implement each alternative is, considering sound multiple-use management of public lands, the minimum necessary to accomplish the purpose of that alternative. The entire forested portion of the Tongass is used by at least one rural community for subsistence purposes for, at a minimum, deer hunting. It is not possible to avoid all of these areas in implementing resource use activities, such as timber harvesting and road construction, under any alternative, and attempting to reduce effects in some areas can mean increasing the use of others. The current 2016 Forest Plan direction and LUD prescriptions provide for management or limit activities in many of the area's most important for subsistence uses, such as beaches and estuaries, and areas with high fish and wildlife habitat values.

Reasonable Steps to Minimize Adverse Impacts to Subsistence Uses and Resources: Subsistence use and subsistence resources are addressed specifically in 2016 Forest Plan direction for wildlife, fish, riparian areas, and biological diversity, among others. Fish and wildlife habitat productivity would be maintained at the highest level possible under all alternatives, consistent with the overall multiple-use goals of the current Forest Plan.

Transportation

Access Management includes 1) new National Forest System (NFS) road construction and reconstruction, 2) temporary road construction and decommissioning 3) aquatic organism passage and fish habitat connectivity, and 4) construction, reconstruction, and maintenance of marine access facilities (MAFs), such as log transfer facilities, docks, mooring buoys, boat ramps and boat launches. The Central Tongass Project also provides an opportunity to evaluate existing and proposed roads through the travel analysis found in Appendix B. The Central Tongass Travel Analysis provides an assessment of the existing condition of the current road system and where changes in road management could occur. The Travel Analysis also evaluates NFS road additions through proposed road construction. Not all roads affiliated with the gross unit pool will be constructed or needed; however, each proposed road is reviewed and its risks and benefits are rated.

Maintenance of NFS roads is completed routinely and will continue to occur in the project area. Typically this type of work is determined to fit the category of repair and maintenance of roads that do not individually or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (36 Code of Federal Regulations (CFR) 220.6(d)(4)). The timing of this work may coincide with this analysis, but is not part of this analysis. Any effects from ongoing road maintenance work are included in the cumulative effects analysis for this analysis.

Regulatory Framework

The management of NFS roads is regulated through the Code of Federal Regulations, including 36 CFR parts 212, 251, 261 and 295. Forest Service direction for management of transportation systems is found in Forest Service Manual (FSM) 7700, Forest Service Handbook (FSH) 7709. FSH 2509.22 and FS-990a provide the Alaska Region and National Core BMPs for water quality management related to Forest Service roads and other projects. The 2016 Forest Plan is the governing document for management activities that take place within the Tongass National Forest.

36 CFR §212.55 (a) provides direction and criteria for designation of NFS roads, trails, and areas on NFS lands. The Responsible Official shall consider effects on NFS natural and cultural resources, public safety, provision of recreational opportunities, access needs, conflicts among uses, the need for maintenance and administration of roads, and availability of resources for that maintenance and administration.

All roads are designed and constructed to comply with 2016 Forest Plan direction. In addition, all roads are constructed to American Association of State Highway Transportation Officials and Occupational Safety and Health Administration (OSHA) standards. Roads are also constructed to meet Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-14.

A discharge of dredge or fill material for normal silvicultural activities such as harvesting for the production of forest products is exempt from Clean Water Act Section 404 permitting requirements in waters of the United States, including wetlands (404)(f)(1)(A). Forest roads qualify for this exemption only if they are constructed and maintained in accordance with best management practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of the waters are not impaired (404)(f)(1)(E). The BMPs that must be followed are specified in Permits for Discharges of Dredged or Fill Material into Waters of the

United States (33 CFR 323.4(a)). Roads constructed for non-silvicultural activities are not exempt from Clean Water Act permitting requirements. All road construction would follow the applicable BMPs.

Executive Order 11990 (Wetland Protection) directs agencies to avoid to the extent feasible the destruction or modification of wetlands where there is a practicable alternative. It also directs agencies to preserve and enhance natural and beneficial values of wetlands in conducting land use planning. Alaska Department of Fish and Game (ADF&G) concurrence is required for any activities working within fish streams.

Methodology

Spatial and Temporal Boundaries

The spatial boundaries for the transportation system analysis includes all roaded areas and potential roaded areas within the Central Tongass Project area. The temporal boundary is the expected implementation timeframe of this project, about 15 years.

Analysis Methods and Assumptions

Information sources for the transportation analysis include the transportation GIS data layers which house the spatial data for road locations. An inventory of road attributes for NFS roads is maintained in a national database. A complete list of road attributes and definitions of these attributes is located in the project record. Cost estimates are derived from average engineer estimates. The amount of new temporary and NFS road assumed needed to meet action alternative design is based on trends from past timber sale project planning requiring road building.

Incomplete or Unavailable Information

Physical conditions of transportation resources are subject to change through natural occurrences and normal use. Road inventory records current conditions; changes are updated on a continual basis. Traffic counts are not routinely collected on NFS roads, though the roads are managed and designed for low volume.

Affected Environment

Existing Condition

The NFS roads in the project area were built for timber management; substantial recreational and subsistence use occurs on them. Road construction in support of logging activities began in the 1950s.

About 940 miles of NFS roads and 439 miles of temporary roads were built to support timber harvest on NFS lands within the project area. Of those, about 908 miles are currently managed as NFS roads and 37 miles are designated as NFS trails and managed as motorized trails during periods of road closure. NFS roads are constructed to provide access to NFS lands and are included in the Forest Development Transportation Plan (USDA Forest Service 2016a, Transportation Standards and Guidelines, pp. 4-76 to 4-83). With the exception of a few administrative sites and campgrounds, most forest roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads. Temporary roads have been decommissioned and the road is returned to a more natural state. These roads are blocked, tank trapped, waterbarred, or reclaimed with vegetation and not available for motor vehicle use

The project area encompasses ten timber analysis areas with existing NFS road systems and several isolated road systems confined to smaller islands and isolated timber harvest. NFS roads located on isolated road systems are closed (stored) between use, and only custodial maintenance occurs, or decommissioned and the road is not available for motor vehicle use.

Etolin Island – Anita Bay

The Anita Bay road system is located in the middle of Etolin Island, which is southeast of Wrangell Island and is not connected to any communities. The road system was built solely for timber harvest. About 50 miles of NFS road have been built with 45 miles open to motor vehicle use. There are two Marine Access Facilities (MAFs), Anita Bay North and Anita Bay South, in proximity of one another, located on the east side of the island. These include off-island log transfer capacity to off-island mills and export sites. Anita Bay North also serves as a boat and floatplane dock. This road system is used for subsistence use and recreation access mostly by residents from the nearby community of Wrangell. There is no developed recreation on this road system.

Etolin Island – Honeymoon

This remote road system is closed to motor vehicle use and no timber harvest is proposed along it. Prior to the 2001 Roadless Rule and later during the period when the Tongass was exempt from the Roadless Rule, about 9 miles of NFS road was constructed solely for timber extraction. This area is part of the North Etolin Inventoried Roadless Area. Honeymoon is excluded from the gross unit pool.

Etolin Island – Olive Cove

This remote road system is located on the eastern side of Etolin Island. About 7 miles of NFS road were built. The whole road system has been closed to motor vehicle use or decommissioned with the bridges and culverts removed.

Frosty Bay

This remote road system, constructed for timber harvest, is located on the mainland southeast of Wrangell Island, east of Seward Passage. About 12 miles of NFS road were built. All roads are closed to motor vehicle use. The MAF consists primarily of a log transfer facility that would need to be reconstructed if used.

Kuiu Island

Kuiu Island does not have any communities. This road system was solely constructed for timber harvest. It is located west of the community of Kake on Kupreanof Island. This road system consist of 200 miles of NFS road with about 122 miles currently open for motor vehicle use. There are two MAFs, Rowan Bay on the west side of the island and Skanax (formerly Saginaw) Bay on the northeast side. These include off-island log transfer capacity to off-island mills and export sites. Rowan Bay also serves as a boat and floatplane dock. Since these are located on the opposite side of the island as Kake, there is not much use from that community. Outfitter and guides use this road system for guided non-resident black bear hunts. There is a kayak portage between Port Camden and Bay of Pillars located towards the middle of the island.

Mitkof Island

This road system, constructed for timber harvest, consists of 130 miles of NFS roads, of which 108 miles are open for motor vehicle use. Another 5 miles are designated as motorized trail for OHVs less than 50 inches wide. The road system connects to the City and Borough of Petersburg, the most populated community within the project area, via State of Alaska Highway

7 (Mitkof Highway). Petersburg has a commercial airport, served by Alaska Airlines, charter flights and sometimes local commuter operators. The Alaska Marine Highway currently provides service to Petersburg on its mainline routes both north to Juneau, west to Kake and south to Wrangell, Ketchikan, Prince Rupert, BC and Bellingham, WA. This road system accesses developed recreation sites and trails and two MAFs. These MAFs, South Blind Slough (Olsen's Log Dump) and Woodpecker Cove, include log transfer capacity to off-island mills and export sites. Subsistence use, largely for deer harvest, freshwater fishing, berry picking and other plant foraging is done by the residents of Petersburg. Personal use timber and firewood collection is also a use of this road system.

Portage Bay

This remote road system, solely constructed for timber harvest, is located on both sides of Portage Bay on northern Kupreanof Island, east of Kake, but not connected to any community. Access is by boat and charter floatplanes. The road system consists of 61 miles of NFS roads, of which 48 miles are currently open for motor vehicle use. One marine access facility, Portage Bay, includes log transfer capacity to off-island mills and export sites and also serves as a boat and floatplane dock.

Thomas Bay

This remote road system, constructed for timber harvest, consists of 29 miles of NFS roads of which 17 miles are currently open for motor vehicle use. Another 12 miles are designated as motorized trail for OHVs less than 50 inches wide. It is located on the mainland northeast from Mitkof Island at the headwaters of Thomas Bay. There is one MAF which includes log transfer capacity to off-site mills and export sites, as well as boat and floatplane dock access. Subsistence and recreation use is largely for moose hunting mainly by the residents of Petersburg. Personal use timber and firewood collection are also a use of this road especially for the private land owners located at Point Agassiz. A private commercial gravel operation is authorized by the Forest Service to use the mainline road system for transport of material to the MAF to load onto a barge.

Tonka

This remote road system is located southwest from Petersburg on Kupreanof Island. The road system was built mostly for timber management however, about 6 miles of road was built from Duncan Canal to access the top of Tonka Mountain to service a long-removed United States Air Force telecommunication site. The site is occupied by Forest Service authorized communications equipment (radio and cell repeaters). The road system consists of 59 miles of NFS road of which 56 miles are open to motor vehicle use. Another 1 mile is designated as motorized trail for OHVs less than 50 inches wide. The road system is used for timber management, subsistence hunting, firewood, and personal use timber from the residents of Petersburg. No developed recreation sites are on this road system. The Tonka MAF includes log transfer capacity to off-island mills and export sites.

Western Kupreanof

This road system, constructed for timber harvest, consists of about 107 miles of NFS roads, of which 86 miles are open for motor vehicle use. It connects to the City of Kake, the third most populated community within the project area, and to the road system used for timber harvest on private lands. Kake has a commercial airport, served by charter flights and local commuter operators, who fly to Sitka and Juneau. The Alaska Marine Highway provides service to Kake on some routes north to Sitka or Juneau and east to Petersburg. This road system accesses recreation

sites, including Forest Service trails and the Seal Point Day Use Area, and two MAFs – a privately owned LTF located north of Kake and the Little Hamilton MAF, which provides log transfer capability to off-island mills and export sites. Subsistence use, largely for deer and moose harvest, freshwater fishing, berry picking and other plant foraging is done mainly by the residents of Kake. Personal use timber and firewood collection is also a use of this road system.

Wrangell Island

This road system, mainly constructed for timber harvest, consists of about 100 miles of NFS roads, of which 86 miles are open for motor vehicle use Another 8 miles are designated for OHVs less than 50 inches wide as motorized trail. The road system connects to the City and Borough of Wrangell, the second most populated community within the project area, via State of Alaska Highway 7 (Zimovia Highway). Wrangell has a commercial airport, served by Alaska Airlines and charter flights. The Alaska Marine Highway provides service to and from Wrangell on its mainline routes both north to Petersburg and Juneau and south to Ketchikan, Prince Rupert, BC and Bellingham, WA. This road system accesses developed recreation sites (a Forest Service cabin, Forest Service trails) and 2 MAFs. These MAFs, Pats Creek and Venus Cove (Earl West), include off-island log transfer capacity to mills and export sites. Other options for log transfer have been explored in the past using the old Silver Bay Mill site, the feasibility of this site is unknown. Subsistence use, largely for deer harvest, freshwater fishing, berry picking and other plant foraging is done mainly by the residents of Wrangell. Personal use timber and firewood collection is also a use of this road system.

Zarembo Island

The Zarembo Island road system does not connect to any communities and is west of the community of Wrangell and south of the community of Petersburg. It was constructed solely for timber harvest and is connected to two MAFs, St. John's Harbor and Deep Bay, which include log transfer capacity to off-island mills and export sites. Boat and floatplane docks are located at St John's Harbor, and Roosevelt Harbor. The road system consists of 133 miles of NFS roads, of which 108 miles are open for motor vehicle use. An additional 11 miles are designated as motorized trail for OHVs less than 50 inches. A Forest Service cabin is located on the road system near Roosevelt Harbor. Subsistence use, largely for deer, is mainly by the residents of Wrangell and Petersburg.

Bushy, Shrubby, Rynda Island

About 12 miles of NFS road were built on these three islands. All roads are closed to motor vehicle use. Bushy and Rynda are excluded from the gross unit pool.

Access and Travel Management (ATM)

In 2001, the Forest Service adopted a road management policy that requires the agency to maintain a safe, environmentally sound road network that is responsive to public needs and affordable to manage. The policy includes a roads analysis process designed to help better inform managers when making decisions on roads. The Forest completed a Forest-wide roads analysis for maintenance level 3, 4 and 5 roads in 2003. The Decision Notice for the Access and Travel Management Plan Environmental Assessments for Wrangell and Petersburg Ranger Districts were signed in 2007 and 2009, respectively and found in the project record. Project level decisions made since, designate roads and trails that are open to motor vehicles and road closure methods.

Road Maintenance Levels

All existing NFS roads have an assigned Maintenance Level. Maintenance Level defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives (RMOs) and maintenance criteria, such as requirements for the protection of adjacent resources, smoothness of the road surface, type of traffic, and season of use of the road. RMOs document the intended purpose of an individual road in providing access, as well as decisions about applicable standards for the road.

Maintenance Level 1 roads are considered closed to vehicle traffic. Maintenance Levels 2 through 5 are considered open and drivable. Decommissioning a road involves restoring roads to a more natural state. Convert means to designate a road to another use such as a hiking trail.

- Maintenance Level 1 (ML 1): Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities.
- Maintenance Level 2 (ML 2): Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.
- Maintenance Level 3 (ML 3): Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.
- Maintenance Level 4 (ML 4): Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced.
- Maintenance Level 5 (ML 5): Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-lane, paved facilities.

The Operational Maintenance Level (OPML) is the Maintenance Level assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. It reflects the current condition and the ability to drive on the road.

The Objective Maintenance Level (OBML) is the Maintenance Level to be assigned at a future date considering road management objectives, traffic needs, budget constraints, and environmental concerns. The OBML may be the same as, or higher or lower than, the OPML. The existing RMOs for the Central Tongass project area are summarized in Table 108.

Table 108. Road miles by operational maintenance level

	Operational Maintenance Level (INFRA database)					
OPML	**1**	**2**	**3**	**4**	**5**	**Total miles**
Miles	235	416	257	0.3	0.1	908

Table 109. Road miles by objective maintenance level

	Objective Maintenance Level (INFRA database)						
OBML	**1**	**2**	**3**	**4**	**5**	**Decommission**	**Total miles**
Miles	335	340	227	0.3	0.1	6	908

Motor Use Vehicle Map

Annually, each Ranger District prepares an updated Motor Vehicle Use Map (MVUM). The MVUM displays NFS routes (roads and trails) or areas designated as open to motorized travel. The MVUM also displays allowed uses by vehicle class (for example, highway-legal vehicles, vehicles less than 50 inches wide, and motorcycles), seasonal allowances, and distance allowances, and provides information on other travel rules and regulations. These routes not shown on the MVUM are not open to public motor vehicle travel. MVUM maps are located at the district offices, and online.

Descriptions of Travel Management Designations:

- Highway Vehicle only – These roads are open only to motor vehicles licensed under state law for general operation on all public roads within the state.
- Open to All Vehicles – These roads are open to all motor vehicles, including smaller off-highway vehicles that may not be licensed for highway use, but not vehicles that are oversized or overweight under state traffic law.
- Seasonal Designation – These roads are open only during certain portions of the year.
- Motorized Trail – These trails are open only to motor vehicles less than 50 inches in width at the widest point on the vehicle. These are Closed roads (Maintenance Level 1 roads) designated as a NFS motorized trail when not in use as a road.

Table 110. Open road on MVUM miles by current maintenance level and ATM designation

Operational Maintenance Level	Travel Management	Miles
1 – Basic Custodial Care	Motorized Trails	37
	Total	**37**
2 – High Clearance Vehicles	Open to all Vehicles	318
	Highway Vehicles Only	0
	Total	**318**
3 – Suitable for Passenger Cars	Open to all Vehicles	205
	Seasonal Designation	44
	Highway Vehicles Only	8
	Total	**257**
4 – Moderate Degree of User Comfort	Highway Vehicles Only	0.4
	Total	**0.4**
Grand Total Road Miles		**612**

Access needs for utilization and administration of NFS lands and resources result in establishment of NFS roads that are part of the Forest transportation system but are not designated for motor vehicle use by the general public, and therefore are not shown on an MVUM. These routes are associated with administrative use of roads.

Marine Access Facility (MAF)

A marine access facility (MAF) is an area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, Log Transfer

Facility (LTF), boat ramp, or a combination of these. Currently, these facilities can be placed into two categories: MAFs permitted for commercial log transfer, and MAF's not permitted for commercial use and generally associated with access to Forest Service trailheads, and saltwater waterways, and shoreline Forest Service cabins.

Boat Launch, Floats, Docks, and Mooring Buoys

Boat launch ramps provide opportunities to access marine waters with trailered boats. There are 10 launches in the project area. Launches are commonly associated with LTFs and barge ramp facilities. These launches are not maintained; at times, they may not provide suitable access due to tides, debris, commercial use, or other conditions. Boat launches on NFS lands exist on Etolin Island (Anita Bay LTF), Kuiu Island (Rowan Bay LTF), Kupreanof Island (Seal Point Day Use Area), Mitkof Island (South Blind Slough LTF, Woodpecker Cove LTF), Wrangell Island (Venus Cove/Earl West LTF, and Pats LTF), Zarembo Island (St. John's Harbor, and Deep Bay), and mainland (Thomas Bay LTF).

Floats and docks provide access and loading points for boats and floatplanes. Marine floats and docks are mostly associated with LTFs. The Forest Service maintains 9 marine floats and docks in the project area; located on Etolin Island (Anita Bay LTF), Kuiu Island (Rowan Bay LTF), Kupreanof Island (Portage Bay LTF, Tonka LTF), Mainland (Anan Bear Observatory, Berg Bay Cabin, Thomas Bay LTF), Zarembo Island (Roosevelt Harbor, St. John's LTF). Inland waterway docks and floats account for another 7. These are located at Virginia Lake Cabin, Petersburg Lake Cabin, Harvey Lake, Kah Sheets Lake Cabin, Middle Ridge Cabin, Chief Shakes Hot Tubs and Three Lakes Loop Trail lake access. At some recreation sites, floats are removed during part of the year when facilities are not in use.

Mooring buoys are associated with recreation sites and LTFs. Three Forest Service mooring buoys are within the project area located on Kupreanof Island (West Point Cabin), Etolin Island (Steamer Bay Cabin) and the mainland (Frosty Bay Cabin).

Log Transfer Facilities

The transport of harvested timber from within the project area requires land and water routes to reach processing facilities. LTFs are used for the movement of equipment needed for logging and road building, and facilitate transfer of logs to barges or rafts for towing. At least 27 LTFs have been constructed within the project area. Some of these have been dismantled or abandoned through lack of use. A list of LTFs can be found in the project record.

Aquatic Organism Passage at Road Crossings

Providing for aquatic organism passage (AOP) or fish passage at stream and road intersections is an important consideration when constructing or maintaining forest roads. Improperly located, installed, or maintained stream crossing structures can present a variety of potential obstacles to fish migration. The most common obstacles are perched culverts (the outlet or inlet of the culvert is not placed directly in the stream), debris blockages, and extreme water velocities that can inhibit fish passage, particularly smaller or juvenile fish, and can ultimately adversely affect fish populations.

Most fish stream crossings for existing NFS roads in the project area have been surveyed and categorized for their fish passage status. Additional information can be found in the Aquatics section of this DEIS. A subsample of culverts installed across the forest from 1998 to 2017 in fish streams are monitored annually. Monitoring indicates that 218 (87 percent) of the 252 culverts evaluated and assessed via the Alaska Region juvenile fish passage criteria matrix meet

State of Alaska passage standards and allow for unimpeded passage of juvenile fish (USDA Forest Service, 2016-2017 Tongass National Forest Monitoring and Evaluation Report, unpublished data). Between 1998 and 2018, the Tongass has re-installed, retrofitted, or removed approximately 637 structures that were not meeting current aquatic passage standards in fish streams and potentially impeding aquatic passage of some life forms at some flows. Of those stream crossings, 272 sites were remediated by structure removal and 365 sites were reinstallations. The estimated cost of this remediation is 20.4 million dollars, indexed to 2018 dollars. Approximately 79 percent of the reinstallations were replaced with culverts, 19 percent were replaced with bridges, and 2 percent were retrofits or maintenance occurred. Within the project area between 1998 and 2018, 208 sites have been replaced or removed. Of the 208 sites, 68 structures have been removed, 23 replaced with bridges, and 113 replaced with culverts, and 4 culverts retrofitted to provide aquatic organism passage.

Environmental Effects

The effects of roads on resources are discussed in their respective resource sections. The following paragraphs discuss the direct, indirect, and cumulative effects of the alternatives on transportation. Differences between the alternatives are detailed in tables using the following units of measure:

- Miles of New NFS Road, and Cost/Mile
- Miles of New Temporary Road, and Cost/Mile
- Mile of closed NFS Road to improve roads suitable for log haul, and Cost/Mile
- Number of Log Transfer Facilities (LTFs) and type of work and Cost (New Construction, Reconstruction, Maintenance)
- Number of New Rock Quarries

New Road Construction and Reconstruction

See NFS Road Construction and Reconstruction, and Temporary Road Construction Activity Guides (Appendix A). The need for road construction is mostly determined by the need to access timber units. The design features for each alternative sets the amount of timber to be offered. The total road miles needed for access will be determined by the specific harvest units offered and the needed transportation network.

The gross unit pool identifies potential stands for timber harvest and the roads needed for access. No alternative would harvest all potential stands identified within the gross unit pool, only the acreage needed to meet alternative volume would be harvested. Not all roads in the gross unit pool would be constructed, only those needed for access to harvest the selected stands. See the Issue 1: Timber Supply and Economics section for more information on gross unit pool development.

Road construction assumes each mile of new road would access about 117 acres of the gross unit pool. Based on this estimate, the miles of road needed to meet the alternative design are shown in Table 111 below. Building road on top of a decommissioned road bed is defined as new road construction. All temporary roads constructed would be decommissioned after the contract authorizing their use is over. Prior to decommissioning temporary roads, allowing the public 3-5 years access to harvest firewood and free use would benefit local residents.

Table 111. Miles of estimated new construction to meet alternative design volume

	Alternative 1	Alternative 2	Alternative 3
NFS road construction	0	25	22
Temporary road construction	0	93	82

The need to reconstruct a road depends on the need to improve or enhance the level of service provided above what it was originally constructed. For example, changing a NFS road built for log trucks (designed with low travel speed, no shoulder, and rough shot rock surfacing) to a road accommodating a passenger car and higher travel speed (by adding shoulders and a smooth crushed rock surface) is defined as reconstruction. There is an estimated 29 miles of existing NFS road common to both alternatives proposed to raise the OBML from a logging road OBML 2, to a road designed for passenger cars OBML 3 (see Appendix B - Travel Analysis). These roads are crushed rock surfaced road and located on road systems used by communities.

Road Maintenance

See the *Access Management* section in Appendix A – Implementation Plan and Activity Guides.

Road maintenance includes the repair or upkeep of a road necessary to perpetuate the road and provide for its safe use and restores a road to a useable level. Maintenance may include surface rock replacement, culvert repair and replacement, bridge replacement, slide removal, cleaning and reestablishing ditches, shoulders, and road driving surface, brushing, and other items that contribute to the preservation of the existing road and minimize adverse effects to water quality and other resources. Currently open roads used for hauling timber under a contract are maintained by the timber purchaser commensurate with their use.

Opening a stored road (ML 1) is normally considered maintenance. The road was built for a specific purpose, and when the road is reopened when needed again, the purpose for which it was built remains the same. Opening a stored road could include culvert installation, bridge installation, cleaning and reestablishing ditches, shoulder clearing, clearing the roadbed of trees and vegetation, and shaping the road surface. These roads are placed back into storage when no longer needed for access to accomplish project activities. Roads proposed through travel analysis to remain open (ML2) or to allow OHVs less than 50 inches on closed roads is identified in Appendix B and discussed further in the below sections *Travel Analysis* and *Road Closure* below.

The road miles shown in the road maintenance Table 112 are estimates for opening closed (OPML 1) roads and improving to timber haul standards (OPML 2).

Table 112. Road maintenance opening of OPML1 roads

	Alternative 1	Alternative 2	Alternative 3
Miles	0	82	71

Rock Quarries

See the *Access Management* section in Appendix A – Implementation Plan and Activity Guides.

Rock sources would be needed for the construction, reconstruction, and maintenance of roads and facilities including MAFs, sort yards, and recreational infrastructure within the project area. To the extent feasible, existing quarries would be used rather than developing new ones. There

are numerous rock quarries throughout the project area and usually there is one within a few miles of work sites. In some cases, new rock quarries may be needed. The size of an existing rock quarry is about 1.5 acres therefore it is assumed each mile of new road requires about 0.45 acres of new quarry development considering 3 miles of new road built (source Soils). The number of quarries needed to meet alternative design volumes are shown below. Quarry sites would be developed within 500 feet of a road and meet 2016 Forest Plan direction.

Development of rock quarries are an irreversible and irretrievable commitments of resources. The extraction of shot rock or gravel would be apparent and would modify the landscape, even with screening. The area footprint would generally not exceed 3 acres when expanding existing quarry or the development of new sites. Quarry Sites in Table 113 are assumed needed for road construction. Rock developed for new LTF sort yards is developed from nearby existing quarries, and when onsite rock is available. Rock needed for reconstruction or maintenance of MAFs and for other recreation facilities generally use rock from nearby existing quarries, but can be developed onsite as part of reconstruction activities.

Table 113. Number of potential new quarry development sites

Alternative 1	Alternative 2	Alternative 3
0	80	70

Aquatic Organism Passage at Road Crossings

See Activity Guide 11 – Aquatic Organism Passage in Appendix A and the *Aquatics* section in this chapter.

NFS roads in the project area will be surveyed and categorized for their fish passage status prior to construction. New road construction is planned and designed to provide aquatic organism passage. Road location takes into consideration the costs to provide aquatic passage, and effort is made to align roads to avoid crossing fish streams. When crossing fish streams is necessary, the type of stream crossing structure will depend on site specific conditions such as stream width, the type of road (temporary versus NFS), and the duration the road is planned for use. The average cost of an AOP structures can vary significantly depending on the type of structure and length of the stream crossing, ranging from a few thousand dollars for temporary log culverts and log stringer bridges, to hundreds of thousands of dollars for more permanent fabricated bridges and designed AOP pipes. For an estimated number of stream crossings by alternative requiring AOP see the *Aquatics* section.

Log Transfer Facilities

See Activity Guide 12 - Marine Access Facilities (Appendix A).

The transport of harvested timber from within the project area requires land and water routes to reach processing facilities. LTFs are used to facilitate transfer of logs to barges or rafts for towing and for the transferring equipment needed for logging and road building to various road systems not connected to communities.

An area for upland operations and storage adjacent to the LTF, called a sort yard, is required for staging logs as the log trucks unload. The space needed for upland operations is directly related to the type of facility, geography, harvest volume from the connected road system, and the life of the operation. LTFs used in this project are expected to require between 3 and 5 acres of uplands.

Fifteen existing LTFs and three new LTFs, are proposed for use for both action alternatives. Eight LTFs would require reconstruction to meet current use standards. Typically, LTFs are reconstructed to facilitate both log transfer to barges and directly to water. Reconstruction examples include improvements to a drive down ramp and/or bulkhead for loading and unloading logs and machinery and increasing upland log storage capacity on LTFs; improvements to floats, boat launch, mooring buoys, and docks.

Three LTFs (Shrubby Island, Three Mile Arm on Kuiu Island, and Vank Island) would require new construction. The estimated current cost of the required work for all LTFs is $6,070,000.

Other LTFs located on non-NFS lands, could be used if needed upon agreement with those landowners. A complete list of LTFs on Forest Service managed lands is in the project record. The 2016 Forest Plan, Appendix G – Log Transfer Facility Guidelines provides detailed information for LTF siting and development. Barge ramps incorporated into the design of new LTFs would add additional opportunity for boat launches.

Table 114. Project area log transfer facilities with expected use and required work for action alternatives[1]

Location	Required work
Etolin Island – Anita Bay North	Maintenance
Etolin Island – Anita Bay South	Reconstruction
Kuiu Island – Rowan Bay	Reconstruction
Kuiu Island – Skanax Bay (Saginaw Bay LTF)[2]	Reconstruction
Kuiu Island – Three Mile Arm	New Construction
Kupreanof Island – Hamilton Bay	Maintenance
Kupreanof Island – Portage Bay	Reconstruction
Kupreanof Island – Tonka	Maintenance
Mainland – Frosty Bay	Reconstruction
Mainland – Thomas Bay	Maintenance
Mitkof Island – South Blind Slough (Olson's)	Reconstruction
Mitkof Island – Woodpecker Cove	Maintenance
Shrubby Island	New Construction
Vank Island	New Construction
Wrangell Island – Pat Creek	Reconstruction
Wrangell Island – Venus Cove (Earl West)	Maintenance
Zarembo Island – Deep Bay	Maintenance
Zarembo Island – St. John's	Reconstruction

[1] Maintenance estimated at $10,000, Reconstruction estimated at $150,000, New Construction estimated at $1,600,000. Note: Costs are estimates but are not exact values; these values are presented to provide a relative comparison between the alternatives. All costs are subject to change.
[2] LTF Permit name is Saginaw Bay.

Boat Launch, Floats, Docks and Mooring Buoys

Up to 69 marine access facility not associated with log transfer, such as docks, boat ramps and floats, may be maintained, constructed or improved for public access. These sites are associated with access to Forest Service trailheads, recreation cabins, canoe/kayak portages, day use areas, or adjacent road systems within the project area.

Most existing recreation sites have no associated MAF other than those listed under Existing Conditions section Boat Launch, Floats, Docks and Mooring Buoys. Cost to install these structures vary significantly depending on site conditions, type of structure, and complexity of the design. Costs can range from several thousand dollars to install a mooring buoy or float, to the hundreds of thousands of dollars for a drive down boat ramp.

Travel Analysis Process

The project travel analysis and methodology is located in Appendix B – Travel Analysis and the project record. The desired condition for the Forest transportation system is guided in part by 36 CFR 212.5 – Road System Management.

The Travel Analysis Process of roads within the project area is a three level system of analysis. The first level is the Forest-wide Roads Analysis, which is an analysis for the entire Tongass National Forest (Tongass National Forest – Forest-Level Roads Analysis 2003). The Forest-wide Roads Analysis provided management recommendations for maintenance level (ML) 3, 4, and 5 roads.

The second level is the Access and Travel Management Plan Environmental Assessments for Wrangell and Petersburg Ranger Districts signed in 2007 and 2009, respectively. These decisions designated roads and trails open to public motor vehicles on the Petersburg and Wrangell ranger districts. A Motorized Vehicle Use Map (MVUM) was prepared based on these decisions. Designated routes and area identified on the MVUM are reviewed annually and revised as necessary to reflect changes in conditions, demand and other factors.

The third level is a project-level analysis found in Appendix B. A travel analysis for the Central Tongass Project was conducted in accordance with FSH 7709.55 for the proposed NFS roads to provide access to the gross unit pool. Not all roads of the gross unit pool may be constructed or needed, however, the travel analysis reviews each proposed road and rates the risks and benefits as if it were to be constructed. Risk and benefit ranking by proposed route and methodology used by resource is located in the project record. The estimated miles of proposed NFS road needed to meet alternative design is located in Table 111 (Miles of estimated new construction to meet alternative design volume).

Additionally, the estimated 176 miles of Road Management Objectives for the existing roads were reviewed to propose changes from the RMO to align with how roads are currently being used or existing conditions warrant proposed changes to the existing road system management and allowed use. These are:

- On an estimated 29 miles of existing NFS road, raise the level of service from a designated logging road, to a road designated for passenger cars.
- On about 19 miles of existing NFS road, designate the road as open instead of placing into closure.
- On another 128 miles of existing NFS road, evaluate the road management to allow the use of off highway vehicles (OHVs) less than 50 inches wide (ATVs/motorcycles) on currently closed roads, or roads to be closed or decommissioned at a future time. Those found suitable for public use would show on the Motor Use Vehicle Map as a motorized trail. Of these:
    - About 39 miles are currently managed open (OPML 2), but designated for closure at a future time.

- 86 miles are currently managed closed (OPML 1) road.
- 3 miles are currently managed open (OPML 2) but designated for decommission at a future time. Instead of decommissioning, convert to NFS trail; designate as a motorized trail.
- More details on which road or portions of a road proposed for change is listed in Appendix B.

Road Closure

Road closure can reduce annual and deferred road maintenance costs by removing drainage structures, installing water bars, or other means to stabilize the road surface until the road is needed again. Road closure methods either mechanical or natural revegetation may vary depending on road/ground condition, with natural revegetation likely to block motor vehicle useover 15 years. Information on level of road closure can be found in the Wrangell and Petersburg Ranger District ATMs (USDA Forest Service 2007 and 2009).

An estimated 103 miles of existing NFS roads needed by both alternatives is currently designated for road closure. The future desired condition of these roads is to close the road when no longer needed to meet resource management objectives. Alternatives 2 and 3 propose changing the designation of 19 miles from closure to open, as the desired condition as identified in Appendix B. This would allow use by high clearance vehicles to meet Central Tongass activity access and access for subsistence, firewood, and personal use timber.

A total of 128 miles of road common to both action alternatives are proposed to allow the use of OHVs less than 50 inches wide (such as ATVs or motorcycles). Of these125 are currently closed roads (Operational Maintenance Level 1) or roads planned to be closed under current designation (Objective Maintenance Level 1). Three miles are proposed on decommissioned road. After considering effects (see Appendix A, Activity Guide 5), roads found suitable for public use of OHVs less than 50 inches wide would be designated as motorized trails.

Decommissioning Road

Decommissioning a NFS road will remove road from the NFS inventory. When a road is decommissioned, work items may include a combination of the following: reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars, removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, or other methods designed to meet the specific conditions associated with the unneeded road.

Decommissioned roads can be converted to and designated as NFS trails. An estimated 6 miles of existing NFS road are already planned for road decommissioning within the project area. Travel analysis evaluates about 3 miles for designation as a motorized trail after the road is decommissioned. Roads suitable for public use of OHVs less than 50 inches wide would be designated as motorized trails and displayed on the district's MVUM after considering criteria (see Appendix A, Activity Guide 5).

Costs by Alternative

Road development costs are based upon regional average costs for constructing roads in Southeast Alaska. Costs are applied based upon an average cost per mile for different classifications of road construction and maintenance. Estimated costs shown below in Table 115

are for the road miles needed to meet the volumes for each alternative. These cost estimates do not include a $15,333 increase in Forest Service annual maintenance costs of roads by designating 19 mile of roads to remain open (Table 6, Appendix B).

Road construction and associated costs needed to access a project would be part of a contract. Timber harvest contracts would include the costs of road construction. Road construction is a factor when evaluating economical timber sale offerings. Project road costs are determined utilizing the Region's road cost guide. The road cost guide is derived from best available estimates of the labor, materials, and equipment necessary to perform particular road activity. The road cost guide is updated at least annually. Labor rates come from the Department of Labor and other sources. Equipment rates come from Equipment Watch, a cost reference guide for construction equipment, and other sources.

Table 115. Estimated road development costs under each alternative

	Alternative 1	Alternative 2	Alternative 3
NFS Road Construction[1]	$0	$5,000,000	$4,369,565
Temporary Road Construction[2]	$0	$13,987,500	$12,285,326
Road Maintenance[3]	$0	$2,852,771	$2,488,251
Totals	**$0**	**$21,840,271**	**$19,143,142**

[1] Estimated at $200,000 per mile.
[2] Estimated at $150,000 per mile.
[3] Road maintenance is the estimated cost to improve OPML 1 roads to OPML 2 level suitable for log haul, estimated $35,000 per mile
Note: Costs are estimated based on road miles using timber sale rates, but are not exact values; these values are presented to provide a relative comparison between the alternatives. All costs are subject to change.

Alternative 1 – No Action Alternative

Direct and Indirect Effects

No new NFS or temporary roads would be built in support of the Central Tongass Project. Existing NFS roads would continue to receive maintenance or be closed or decommissioned as currently designated and depending on the Objective Maintenance Level as funding allows.

No new MAFs would be built or reconstructed. MAFs would continue to receive maintenance as needed.

AOP remediation would continue as priority and available funding allows.

Alternatives 2 and 3

Direct and Indirect Effects

For alternative-specific comparison, see tables and narrative described under the *Environmental Effects* section above.

Both action alternatives require the use of LTFs described in Table 114 and both alternatives evaluate changing road management of up to 176 miles of existing NFS road.

Cumulative Effects

The cumulative effects area for the transportation system is the project area. Cumulative effects examines the impacts to transportation infrastructure from reasonably foreseeable activities on NFS lands and non-NFS lands over the 15 year timeframe proposed for this project.

Forest Service transportation projects completed will vary from year to year, based on available funding and need. These include maintaining or improving existing roads and bridges, placing roads in storage, and improving fish passage at road crossings.

Road construction for non-NFS lands includes roads needed for timber harvest. Plans that are known for other landowners are shown in the Catalog of Present and Reasonably Foreseeable Activities table in Appendix C. GIS indicates about 445 miles of roads on non-federal lands within the project area.

Section 4407 of Public Law 109-59, (SAFETEA–LU), as amended by Public Law 114-94 (FAST Act), granted the State of Alaska transportation and utility easements crossing Tongass NFS lands to connect communities of Southeast Alaska. These 50 year Rights of Way (ROW) and easements are located in various locations within the Central Tongass project area. Information on ROW easements can be found in the project record. Transportation and utility projects authorized under these easement may occur in any 300-foot-wide area located anywhere within any square-mile section listed in the narrative property description of each easement.

These easements include corridors linking the Wrangell road system to Fools Inlet, a corridor linking Tyee or Eagle River (Cleveland Peninsula to Ketchikan vicinity), a corridor linking the Bradfield Canal (located on the mainland east of Wrangell Island) with British Columbia, a corridor linking the Kake road system to the south end of Kupreanof Island, and a corridor linking the communities of Kake and Petersburg.

The State of Alaska Department of Transportation and Public Facilities has completed a DRAFT 2014 Southeast Alaska Transportation Plan (SATP). This shows alternatives for State transportation networks within the project area. Included in the SATP are recommendations to construct 22 miles of new single lane unpaved roadway and bridges and improve approximately 23 miles of existing logging roads between Kake and Petersburg on Kupreanof Island linking the two communities.

A Record of Decision authorizing the construction of a transmission power line between Petersburg and Kake was signed in 2016. The transmission line will be approximately 60 miles long, with approximately 34 miles following existing roads. Where poles will be located off the road by more than 20 feet, an access work pad will be created by extending the road fill to the site. Where the distance from the road makes this impractical, temporary matting will be used during construction. The Selected Alternative involves use of an estimated 7.6 miles of these types of access work pads and/or temporary matting. Access for construction along the remaining 23.6 miles (41 percent) of the overhead portion of the route will be via shovel trails supported by temporary matting panels. Shovel trails will be used for an estimated 21.6 miles, with temporary matting used for 2.0 miles. Effects to the existing road system would be confined to the shoulders adjacent to work pads where additional rock would be used. Should rock be needed, a quarry development plan will be reviewed prior to use of existing quarries or development of new rock quarries, and reviewed and approved by resource specialists and the District Ranger.

Wetlands

This section discusses the potential effects to wetlands in the project area. The objectives of wetland management for this project include conducting land management activities so that loss of wetland functions and values caused by harvest, road construction, and recreation development are minimized and/or avoided whenever practicable.

Summary

The wetlands analysis shows similar effects to and loss of wetlands from roads between both action alternatives. Alternative 1 proposes no new activities in wetlands. Alternative 2 involves more acres of timber harvest and more miles of road construction on wetlands; thus, impacts to wetlands from implementation of Alternative 2 are more than Alternative 3.

The 15 Federal Baseline Provisions and State Approved BMPs are used to avoid and minimize impacts to wetlands. The Implementation Plan and Activity Guide (Appendix A) incorporates 2016 Forest Plan direction for activities occurring in wetlands to minimize effects.

Recreation site developments and other developments not subject to the silvicultural exemption must go through the Army Corps of Engineers 404 permitting process. The permitting process provides further assurance that wetland impacts would be minimized or avoided.

Methodology

Effects to wetlands will be assessed by overlaying the soils layer using a wetland habitat interpretation with existing and proposed activities. The acres of wetlands impacted by existing and proposed roads, trails, recreation sites, mines, and other activities will be estimated. The number of acres of wetlands impacted by timber harvest will be estimated. Monitoring data and literature will be used to describe the effects the various activities on wetland function.

Units of Measure

The measures used to compare the effects of the alternatives include:

- acres of wetlands impacted by roads, trails, recreation sites, mines, and other developments; and
- acres of wetlands impacted by timber harvest.

Spatial and Temporal Context for Analysis

The spatial analysis area for the affected environment and direct, indirect, and cumulative effects is the same as the project area since all wetland effects are expected to be within the project's boundary. The temporal bounds of the cumulative effects analysis include all existing wetland disturbances since the beginning of land management in the project area to the reasonably foreseeable future. Past, present, and reasonably foreseeable projects are described in more detail in Appendix C of this DEIS.

Incomplete or Unavailable Information (Data Limitations)

The shoreline used for the Central Tongass project area boundary does not match the shoreline in the soils resource inventory database.

The differences in shoreline are mostly in the intertidal area, and in many cases consist of small offshore rocks, rocky shore, or other intertidal areas below mean high tide, where the only proposed activities are Marine Access facilities. Non-exempt activities like marine access facilities require U.S. Army Corps of Engineers permitting.

Approximately 10,738 acres of the project area have no wetland mapping. According to the most recent aerial imagery, these areas are slivers of saltwater, freshwater rivers, and lakes.

Affected Environment

Wetland Characterization

Wetlands are defined as "those areas that are inundated or saturated by surface water or groundwater with a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions." (40 CFR 230.41 (a) (1). Wetlands are valued for their physical, chemical, and biological functions. Wetlands moderate flooding, reduce runoff and sedimentation, provide wildlife and plant habitat, and may help sustain stream flow during dry periods. Physical functions may include flood conveyance, surface and ground water regulation, sediment retention, and temperature moderation. Chemical functions may include nutrient storage, and carbon storage. Biological functions include habitat for terrestrial, aquatic, and marine plants and animals. In addition, forested wetlands are an important component of the forest land base.

Wetlands have been affected by past timber harvest and associated activities (road construction and rock pit development), as well as recreation developments, hydropower, and mineral developments. Stream restoration has had negligible effects on wetlands and in some instances has enhanced wetland habitats and functions.

Data used for wetland analysis comes from existing resources such as the soil resource inventory. An explanation of different wetland types can be found in Demeo and Loggy (1989).

Existing Wetland Disturbances in the Project Area

Past timber harvest activities, road construction, mineral developments, trails, recreation sites, and other management activities have disturbed and displaced wetlands in the project area. Table 116 displays the acres of wetlands harvested and acres of wetlands impacted by past road construction. There are approximately 1,564,456 acres of wetlands mapped on the project area (about 42 percent of the project area).

Table 116. Wetland acres and existing wetland disturbances in the Central Tongass project area

Unit	Forested Wetland	Forested Wetland/ Emergent Short Sedge	Emergent Short Sedge	Moss Muskeg	Tall Sedge Fen	Alpine	Estuary
Total wetland (acres)	336,371	501,159	11,091	166,222	1,902	529,348	18,363
Percent of wetland type in project area	9	14	0.3	5	0.05	14	0.5
Harvested on federal, state,	12,425	3,858	0	0	0	0	0

Unit	Forested Wetland	Forested Wetland/ Emergent Short Sedge	Emergent Short Sedge	Moss Muskeg	Tall Sedge Fen	Alpine	Estuary
and private lands (acres)							
All roads on federal, state, and private lands (acres)	691	1,271	41	188	0	43	12
Impacted by facilities (recreation sites, trails and mines, hydropower sites) (acres)	30	70	5	28	0.2	11	22

Note: Calculation of roaded acres based on 40-foot wide disturbed soil road corridor. Sums may not match due to rounding. Timber harvest on non-forested sites is due to inclusions at the scale of mapping harvest units and wetlands. Hydropower sites convert wetlands to deepwater or seasonally inundated wetlands. Recreation sites and trails impacts were calculated using the estimates outlined in the Recreation section of Chapter 3.

About 12 percent of past harvest has occurred on forested wetlands and forested wetlands/ emergent short sedge. These wetland types are common across the project area, covering 23 percent of the project area. In areas of harvest, changes to wetland hydrology are temporary as vegetation regenerates and provides interception and evapotranspiration surfaces similar to pre-harvest conditions. Wetlands with timber harvest are expected to remain wetlands.

Road construction covers wetlands with road fill and hillslope hydrologic connectivity can be lost due to road ditches and road fills. Impacts to wetland hydrologic function is typically limited to a few meters on either side of the road corridor as long as proper drainage structures are installed to ensure hydrologic connectivity is maintained (USDA Forest Service, 2016c).

Wetland Avoidance

Wetlands are avoided to the extent practicable. On the project area, on a percentage basis, more roads and timber harvest occur on upland sites than on wetland sites. Approximately 41 percent of the existing Forest Service roads are on wetlands, and only about 12 percent of the existing harvest is on wetlands, whereas about 42 percent of the project area is mapped wetland. Interpretation of these numbers suggests that road construction has avoided wetlands to the extent practicable on the project area. The forested wetlands in the Central Tongass Project area often include stands of commercial timber and are managed for their timber resources. The most economical way to access the forested wetlands timber stands often involves building road. Within the context of overall project objectives, including economics and minimizing harm to the environment, past road construction has avoided wetlands to the extent practicable in the project area.

Environmental Effects

Activities common to all alternatives (such as invasive plant treatments, pre-commercial thinning treatments, and instream treatments to address water quality and habitat issues) would adhere to the 2016 Forest Plan, R10 Soil Quality Standards, and National and R10 Best Management Practices and are not expected to negatively affect wetland resources.

Effects Common to all Action Alternatives

All action alternatives propose some level of timber harvest and road construction on forested wetlands. The effects of timber harvest (primarily increased soil moisture levels) on forested wetlands are expected to be temporary. All harvested sites are expected to regenerate naturally based on many decades of regeneration surveys. Trees are expected to grow more slowly on wetland sites. No new effects to wetlands from young-growth harvest are anticipated unless new road construction is needed, which is analyzed as part of the effects of road building.

The effects of road building on wetland varies based on the substrate (soil type) and the landscape position of the wetland. Regardless of the type and location, road construction on wetlands results in a loss of wetland acreage. Based on research and monitoring conducted on the Tongass National Forest (much of it in the project area), hydrologic effects beyond the disturbed soil (road) corridor are expected to be limited to within a few meters of the road (Glaser 1999, Kahklen and Moll 1999, McGee 2000, and Landwehr 2011).

Due to the preponderance of wetlands and the interspersed nature of wetlands with uplands on the project area, complete avoidance of wetlands from proposed road construction activities is not practicable. All proposed roads would be constructed according to State-approved BMPs as required by 33 CFR 323. All roads through wetlands would also follow the 15 baseline provisions provided in 33 CFR 323.

The action alternatives also include potential trail and recreation site developments. Impacts to wetlands from trails and recreation sites are similar to roads if fill is used. Some trails are native tread, in which case the wetland remains wetland. If rock or gravel fill is used, wetland functions are lost in the filled areas.

Unlike most forest roads, which fall under the silvicultural exemption from the U.S. Army Corps of Engineers' 404 permitting activities, recreation sites and trails through wetlands would require a 404 permit. The permitting process further ensures that wetland losses will be held to the minimum feasible number.

Effects due to invasive plant treatments are expected to be highest as continued treatments of previously treated sites are combined with initial treatments or places treated multiple times per year. However these effects would be negligible to minor because of the relatively small areas proposed for treatment by either herbicide or manual/mechanical methods and the efficacy of the project design features provided in Appendix A – Implementation Plan and Activity Guides. The level of negative impact would be expected to decline in relation to the progressive reduction in the total area of infestations that receive treatment over time. Effects would never be completely eliminated because surveys will likely reveal new infestations and additional treatments will occur (Foss 2019).

The cumulative effects from manual, mechanical and chemical treatments would also be negligible considering the implementation of soil and water BMPs which are designed to avoid any detrimental effects of mining, timber harvest, thinning, road building and maintenance, trail building and maintenance, renewable energy, and recreation activities on soil quality. Further, eradicating invasive plants would allow re-colonization of native plants and thus improvement of wetland conditions and resiliency.

Alternative 1 – No Action Alternative

Direct and Indirect Effects

No wetlands would be impacted under Alternative 1 due to no timber harvest, road construction, trail construction, or other developments as a result of the Central Tongass Project.

Cumulative Effects

Approximately 16,283 acres of timber have been harvested from wetlands in the project area (all ownerships). Vegetation on forested wetlands harvested in the past would continue to grow toward hydrologic maturity (many stands have already reached this stage).

About 2,246 acres of wetlands have been converted to road surfaces, ditches, and fill slopes in the project area. Wetlands impacted by roads in the past would continue to be impacted. Vegetation would occupy ditch lines and, in the case of closed roads, the roadbed may be occupied by red alder or other vegetation. The road prism would remain in an upland condition. Road ditches, where present, support a variety of upland and wetland vegetation depending on local conditions and seed sources.

Under Alternative 1, an additional 617 acres of forested wetland and forested wetland/emergent short sedge could experience timber harvest on non-NFS lands within the project area, and 189 acres of timber from wetlands are under contract on NFS lands. Additionally, about 1 acre of wetland may be impacted from road construction activities under current Forest Service contracts.

With the implementation of present projects, an additional 16 acres of wetland could be roaded on non-NFS lands. Reasonably foreseeable projects may see an increase of 782 acres of wetland impacts from harvest and road construction under the Kuiu, Navy, Wrangell Island, and Central Kupreanof projects. Open, drivable roads in the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces.

Mines, trails, interties, hydropower facilities, and recreation sites currently occupy about 166 acres of wetlands. An additional 505 acres of wetland impacts may occur from the Kake-Petersburg Intertie, recreation sites, stream restoration, and communication sites. The Right-of-Way (ROW) easement roads (Kake to South Kupreanof ROW, Cleveland Peninsula Eagle River to Bradfield ROW, Swan-Tyee Intertie Electric ROW, Wrangell to Fools Inlet ROW, Kake to Petersburg Tie in ROW, and Tyee Wrangell Blake Channel ROW) are estimated to impact about 225 acres of wetlands.

Approximately 0.2 percent of wetlands are impacted by invasive plant infestations. If herbicides are used to treat invasive plants in wetland areas only aquatic formulations will be used. Following project design features and label instructions will minimize adverse impacts of chemicals to the values and functions of wetlands in the project area.

About 99 percent of wetlands in the project area would remain in a natural condition.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Direct and indirect effects to wetlands are described in the *Effects Common to all Action Alternatives* section above. Alternative 2 proposes to harvest old-growth timber from

approximately 1,968 acres of forested wetland. Road construction under this alternative would convert about 201 acres of wetland to road. LTF new construction and expansions may impact about 3 acres of forested wetland/emergent short sedge.

Cumulative Effects

Cumulative effects to wetlands from reasonably foreseeable actions are described in Alternative 1 and, following implementation of Alternative 2, cumulative timber harvest from all past, present, and reasonably foreseeable actions would impact approximately 19,839 acres of wetlands in the project area.

Roads, recreation sites, hydro facilities, mines, and other developments would fill or alter 3,400 acres of wetlands.

Under Alternative 2, about 98 percent of wetlands in the project area would remain in a natural condition.

Alternative 3

Direct and Indirect Effects

Direct and indirect effects to wetlands are described in the *Effects Common to all Action Alternatives* section above. Alternative 3 proposes to harvest old-growth timber from approximately 1,811 acres of forested wetland and forested wetland/emergent short sedge. Road construction under this alternative would convert about 178 acres of wetland to road. All LTFs (new and expansions) may impact about 3 acres of forested wetland/emergent short sedge.

Cumulative Effects

Cumulative effects to wetlands from reasonably foreseeable actions and following implementation of Alternative 3, timber harvest from all past, present, and reasonably foreseeable actions would impact approximately 19,681 acres of forested wetlands in the project area.

Roads, recreation sites, hydropower facilities, mines, and other developments would fill or alter 3,378 acres of wetlands.

Under Alternative 3, about 98 percent of wetlands in the project area would remain in a natural condition.

Wilderness

This section provides a summary of existing conditions and an analysis of environmental consequences for wilderness resources in the Central Tongass project area. The only activity proposed within congressionally designated wilderness is the treatment of invasive plant species.

Regulatory Framework

Wilderness designation is intended to preserve and protect certain lands in their natural state. The Wilderness Act of 1964 identifies wilderness uses and prohibited activities. The Wilderness Act's Statement of Policy, Section 2(c) states that wilderness should be managed "…in such manner as will leave them unimpaired for future use as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character…". The statutory language of the Wilderness Act is used to identify five qualities of wilderness character: Untrammeled, Undeveloped, Natural, Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation, and Other Features of Value, defined below (Landres et al. 2015).

- **Untrammeled:** Area is unhindered and free from intentional actions of modern human control or manipulation.
- **Natural:** Area appears to have been primarily affected by the forces of nature and are substantially free from the effects of modern civilization.
- **Undeveloped:** Area is essentially without permanent improvements or the sights and sounds of modern human occupation, and it retains its primeval character.
- **Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation:** Area provides outstanding opportunities for people to experience solitude or primeval and unrestricted recreation including the values associated with physical and mental inspiration, challenge, self- reliance, self-discovery, and freedom.
- **Other Features of Value:** Area may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Though not required of any wilderness, where they are present they are part of that area's wilderness character and must be protected as rigorously as any of the other four required qualities.

Activities prohibited under Section 4(c) of the Wilderness Act must go through a Minimum Requirements Analysis (MRA) before it can be determined whether and how to implement the activity. Accordingly the Forest Service has conducted a preliminary MRA in order to determine if the treatment of invasive plant species is necessary for the administration of wilderness, and, if so, the minimum activity to accomplish the action. The final MRA determination will be made by the Regional Forester.

Methodology

Spatial and Temporal Context for Analysis

The Central Tongass project area includes all NFS lands as well as non-federal lands (State, municipal, private, and Native Corporations) within the Petersburg and Wrangell Ranger Districts. The Wilderness analysis focuses on the five designated wilderness areas within the project area as described in Affected Environment, below.

The temporal boundary for direct, indirect, and cumulative effects is 15 years to align with the timeline of the project.

Affected Environment

There are five designated wilderness areas within the project area. The Petersburg Creek – Duncan Salt Chuck, Stikine – LeConte and Tebenkof Bay Wildernesses were designated in 1980 under the Alaska National Interest Lands Conservation Act (ANILCA). The Kuiu and South Etolin Wildernesses followed in 1990 through the Tongass Timber Reform Act (TTRA) with an amendment to ANILCA and are managed in concurrence with the provisions of ANILCA.

Approximately 705,787 acres (19 percent) of the project area are within designated wilderness.

All five wilderness areas are naturally functioning. The wilderness character baseline was established for the Kuiu, Petersburg Creek – Duncan Salt Chuck and Tebenkof Bay Wilderness Areas in 2018 according to the national standards. The baseline data indicates a stable trend in wilderness character. A baseline has not been established for the Stikine-LeConte and South Etolin Wilderness Areas therefore, no trends have been determined. At this time there are no significant impairments or noted concern with any of the qualities of wilderness character.

Environmental Effects

The direct and indirect effects an activity has on the wilderness resource are determined largely by the location and nature of the activity, and the effect of the activity and its component activities on the five qualities of wilderness character: untrammeled, undeveloped, natural, outstanding opportunities for solitude or primitive and unconfined recreation and other features of value. All alternatives that include management activities within or adjacent to designated wilderness have the potential to adversely affect one or more of the qualities of wilderness character. However, those same actions may also positively affect another quality, and therefore it is necessary to carefully consider effects and tradeoffs to ensure wilderness character is preserved. In addition to the five qualities of wilderness character defined above, the Wilderness Act mentions societal benefits to wilderness that go beyond recreational use. These “non-use values” are, for the most part, intangible aspects of wilderness character that are difficult or impossible to quantify.

The following terminology is used in describing the degree of effects to the five qualities of wilderness character. These terms are used only to compare the effects across alternatives and not to reach a conclusion about the significance of potential effects.

- **No Effect:** No effect to the quality.
- **Negligible:** Little or no impact to the quality; any change that might occur may be perceptible but difficult to measure.
- **Minor:** Change in the quality would occur, but no substantial impact would result. Change would be perceptible and measurable but not alter the quality’s condition.
- **Moderate:** Noticeable and measurable change would occur and would alter the quality’s condition; integrity of the quality would remain.
- **Major:** Substantial impact to the quality would occur; impact is easily defined, highly noticeable, and would measurably alter the quality’s integrity.

Alternative 1 – No Action Alternative

Direct and Indirect Effects

The No Action Alternative would not result in direct or indirect effects to wilderness resources because no new activities would occur and existing conditions would remain unaffected. Natural disturbances and current management of the project area would continue.

Cumulative Effects

Implementation of the No Action Alternative would not contribute to cumulative effects to wilderness resources because no new activities would occur.

Alternatives 2 and 3

Activities Proposed within Designated Wilderness

Alternatives 2 and 3 propose hand pulling, tarping and herbicide applications such as broadcast spraying, spot spraying, and hand/selective treatment of invasive plants. The treatment of invasive and non-native plant communities is proposed within all wilderness areas in the project area.

Direct and Indirect Effects

Effects on Untrammeled Character

Hand pulling would have a minor effect on the untrammeled quality due to the physical removal of invasive or non-native plants. Because seed banks can remain viable for a number of years before germination, repeated treatment would likely be required over a number of years.

Tarping would have a major effect on untrammeled quality due to the tarp remaining over the entire infestation for multiple years depending on the viability of the seed bank. Effects would be localized to the treatment site and would not measurably impact the untrammeled quality across the wilderness as a whole.

Broadcast herbicide spraying would have a moderate effect on the untrammeled quality as it would encompass the extent of the infestation rather than focusing on specific plants within the infestation and potentially have effects beyond the target plants themselves. However, the duration of the effect would be temporary and the need for repeated treatments would be less likely when compared to manual treatments. Effects would be localized to the treatment site and would not measurably impact the untrammeled quality across the wilderness as a whole.

Spot herbicide spraying would have a minor effect on the untrammeled quality. The manipulation that occurs with spot spraying would target individual plants and therefore would have less adverse effect on untrammeled character than that associated with broadcast spraying or tarping. However, the duration of the effect would be temporary and the need for repeated treatments would be less likely when compared to manual treatments alone.

Hand/selective herbicide use would have a minor effect on the untrammeled quality because the manipulation that occurs with selective herbicide use would be a much smaller foot print to either of the other herbicide uses and tarping. However, the duration of the effect would be temporary and the need for repeated treatments would be less likely when compared to manual treatments alone.

Mulching, seeding, and planting of competitive, desirable native vegetation may occur to restore treated sites, which would have additional long-term moderate effects.

Treatment of invasive or non-native plants, regardless of the type of treatment, will affect the untrammeled quality of wilderness character. The additional use of herbicide, mulching, seeding and planting, if implemented, may cause a short-term downward trend in the untrammeled quality if the treatments were to occur in more than 1 year over a 3-year period. The untrammeled quality would return to a stable trend as soon as the need for any repeated herbicide, mulching, seeding or planting activities is completed.

Effects on Undeveloped Character

Hand pulling and crew campsites would leave evidence of soil disturbance and trampling of vegetation in the area for a short duration following treatment resulting in a negligible effect. Because seed banks can remain viable for many years before germination, impacts to the undeveloped quality could occur year after year in the same area.

Tarping is a temporary installation, and could be accompanied by temporary signs and rope to temporarily close severely damaged sites during rehabilitation and restoration. This would have a major effect on the undeveloped quality during the time these developments are in place and tarps may need to remain in place for several years in order to be effective.

Broadcast and spot spraying herbicide treatments would have no effect on the undeveloped quality. However, while the type of treatment itself would have no effect, the presence of the spray equipment would be a reminder of modern civilization while it is being used on site, and would have a negligible effect. These effects would occur each time treatments are conducted at the site.

There would be no effect to the undeveloped quality from hand/selective herbicide treatment.

Access to areas by boat or float plane would have a short-term minor effect.

Effects on Natural Character

Treatment of invasive and non-native plant species would overall have a long-term positive effect on the natural quality regardless of treatment method.

Hand pulling could result in a negligible, localized, adverse effect to natural quality because some native plants and seeds could be removed along with the invasive plant species.

Tarping is indiscriminate and adversely affects any desirable native plants that are under the tarp. Until these areas recover, there is a localized moderate effect to natural character.

Broadcast herbicides would have a localized moderate effect on natural character until the areas recover because it would encompass the extent of the infestation rather than focusing on specific plants within the infestation and potentially have effects beyond the target plants themselves.

Spot spraying may have a negligible short term and localized effect on the natural quality if some desirable native plant species are inadvertently sprayed.

Hand/selective treatment may have a localized negligible short-term effect on the natural quality if some desirable native plant species are inadvertently treated.

Effects on Outstanding Opportunities for Solitude

Large crews of up to 12 people, their equipment and the presence of more and/or larger temporary structures (for instance, wall tents) for longer durations per visit associated with hand pulling treatments would have a major effect on solitude. Effects would be localized to the treatment site and would not measurably impact opportunities for solitude across the wilderness as a whole.

The presence of tarps and, if required, temporary signs and rope associated with temporary closures could have a major effect on the visitors opportunities for solitude for the duration the installations are in place. Effects would be localized to the treatment site and would not measurably impact opportunities for solitude across the wilderness as a whole.

The ability to use herbicides, regardless of the method, may reduce the amount of time that is spent in treatment areas thus decreasing the potential to have a negative impact on visitor's solitude expectations, resulting in a minor effect. Short-term, the presence of dead plants in the treatment site could adversely affect visitor's wilderness experiences and feeling of solitude in the local treatment area.

Access to areas by boat or float plane, regardless of treatment method, would also have a short term minor effect to solitude.

Effects on Outstanding Opportunities for Primitive and Unconfined Recreation

Large crews of up to 12 people, their equipment and the presence of more and/or larger temporary structures (for instance, wall tents) for longer durations per visit associated with hand pulling treatments would have a major effect on unconfined recreation. Effects would be localized to the treatment site and would not measurably impact unconfined recreation across the wilderness as a whole.

The presence of tarps and, if required, temporary signs and rope associated with temporary closures could have a major effect on the visitors unconfined recreation experience for the duration the installations are in place. Effects would be localized to the treatment site and would not measurably impact unconfined recreation across the wilderness as a whole.

The ability to use herbicides, regardless of the method, may require temporary closure of areas during and directly following spraying and could have a minor effect to the unconfined visitor experience.

There would be no effect to the primitive recreation experience with any treatment method.

Effects on Other Features of Value

Soil disturbance associated with hand pulling would have a localized temporary short-term minor effect on scenic value.

The presence of tarps and, if required, temporary signs and rope associated with temporary closures would have a major, localized effect on scenic value for the duration of time the installations are in place. Effects would be localized to the treatment site and would not measurably impact the scenic value across the wilderness as a whole.

The presence of large numbers of dead plants following broadcast spraying would have a major effect on the scenic value for a short term until the area recovered and revegetated. Effects would

be localized to the treatment site and would not measurably impact the scenic value across the wilderness as a whole.

The presence of dead plants following spot spraying and hand/selective treatments would have a localized negligible short-term effect on the scenic value compared to some of the other treatment methods as the plants would be interspersed with living vegetation and would not be expansive.

Effects on Non-Use Wilderness Values

Some people may be aware that the untrammeled quality of wilderness character would be degraded and the natural quality would be degraded in the short term but may improve. This realization could have indirect adverse impacts to certain non-use values. Both adverse and beneficial effects on non-use values would be negligible and localized to the affected individuals.

Activities Proposed Adjacent to Wilderness

Direct and Indirect Effects

Various projects including vegetation management, recreation and road construction/reconstruction are proposed either adjacent to or in proximity to the Petersburg Creek – Duncan Salt Chuck, Tebenkof Bay, South Etolin and Stikine - LeConte Wilderness Areas. As these activities would not occur within designated wilderness, an MRA is not required. However, activities associated with these projects would likely degrade the undeveloped and opportunities for solitude qualities of wilderness character along the wilderness area boundary during implementation. Options to minimize these effects, such as timing restrictions, would be considered during project development.

Indirect effects include those initiated by, and may be unintended consequences of, the activity. Examples include:

- Trees along the margins of timber harvest units are more likely to blow down in windstorms. Windthrow along or within the wilderness boundary would adversely affect untrammeled and natural qualities of wilderness character.
- Vegetation management adjacent to wilderness may also affect animal distribution and patterns of use within wilderness, which would adversely affect the untrammeled quality.
- The installation of new public recreation facilities and/or access into the Forest may increase or alter visitor use of wilderness areas resulting in further degradation of the undeveloped and opportunities for solitude qualities within the vicinity of the facility.
- Road construction/reconstruction which provides new or improved public access into the Forest may also increase or alter visitor use of wilderness areas likely resulting in further degradation of the undeveloped and opportunities for solitude qualities within the vicinity of the road or new access point.

Cumulative Effects

Cumulative effects analyses examine the impacts to wilderness character from the projects proposed within and adjacent to wilderness in conjunction with reasonably foreseeable activities on both National Forest System (NFS) and non-NFS lands, at the landscape level, over the 15-year proposed span of this project. The Catalog of Events (Appendix C) was reviewed for activities that could impact the wilderness resource.

Present and reasonably foreseeable vegetation management projects including Petersburg Ranger District Riparian Thinning, Central Kupreanof Timber Harvest, Sealaska Lands, Navy Timber Sale and Timber Stand Improvement (Etolin Island) that occur adjacent to or within sight and sound of a wilderness area will continue to affect the undeveloped and opportunities for solitude qualities of wilderness character. The sounds of harvest activities would occur only during implementation while the visual impacts of harvest adjacent to the wilderness would be longer term. Neither, at this point in time, would significantly impact any one wilderness area as a whole.

The Wrangell-Petersburg Weed Management Project EA would have the same effects to wilderness character as described above for this project, should treatments occur within or adjacent to wilderness.

Present and reasonably foreseeable road construction projects including the Kake-South Kupreanof Road, any road construction associated with vegetation management projects and road maintenance that occurs adjacent to or within sight and sound of a wilderness area would continue to affect the undeveloped and opportunities for solitude qualities of wilderness character. These effects may be long term if the roads are left open to public travel, increasing the frequency that someone would hear vehicles but would not at this point in time significantly impact any one wilderness area as a whole. Indirectly, roads left open to public travel may create new access points into wilderness and affect the current distribution of wilderness uses which could affect opportunities for solitude.

Special use authorizations, including outfitter and guide activities, crab pot storage, private and state agency cabins, tent platforms, communications sites and salmon surveys, dispersed recreation, and subsistence gathering would continue as currently allowed. But in conjunction with the proposed projects would not significantly impact any one wilderness area as a whole. Indirectly, these activities may create new access points into wilderness and affect the current distribution of wilderness uses which could affect opportunities for solitude.

Chapter 4. References and Lists

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Distribution of the Environmental Impact Statement

A letter or email with notification of the availability of this DEIS, either online or via electronic media, was sent to the following parties. These parties either commented on the project, requested a copy of the DEIS during scoping or at some other time during the NEPA process, or are part of the Tongass National Forest mandatory mailing list (Forest Service Handbook 1909.15, Sections 23.2 and 63.1). In addition, notification of the availability of the online copy was sent to emails on the self-subscribed email list for this project. A complete list of recipients is in the project record.

Federal, State, and Local Agencies

Alaska Department of Environmental Conservation
Alaska Department of Fish and Game
Alaska Department of Natural Resources
Alaska State Historic Preservation Office
City and Borough of Wrangell
City of Kake
City of Kupreanof
Federal Aviation Administration
Federal Highway Administration
NOAA National Marine Fisheries Service
Petersburg Borough
US Advisory Council on Historic Preservation
US Army Corp of Engineers
US Coast Guard
US Environmental Protection Agency
US Navy Energy and Environmental Readiness Division
USDA Animal and Plant Health Inspection Service
USDA Natural Resources Conservation Service
USDA National Agricultural Library
USDI Fish and Wildlife Service
USDI Office of Environmental Policy and Compliance

Tribes and Native Corporations

Petersburg Indian Association
Wrangell Cooperative Association
Organized Village of Kake
Kake Tribal Corporation
Central Council Tlingit and Haida Tribes of Alaska
Klawock Cooperative Association
Sealaska Heritage Institute
Sealaska Corporation

Businesses, Organizations, and Individuals

The Tongass National Forest emailed a notification with a link to the EIS electronically via the self-subscribed GovDelivery system to the businesses, organizations, and individuals who have requested to receive emails. Individuals may also have requested a hard copy or electronic copy of the document. The list of individual email addresses and names is in the project record.

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Index

access, 1, 5, 7, 13, 21-25, 29, 46, 52, 57, 64, 71, 86, 96, 97, 111, 114-116, 120, 124, 137-139, 168, 174, 177, 179, 182, 187, 188, 193, 195-198, 204, 226, 236-238, 245, 246, 263, 265, 269, 271-273, 280, 283, 285-287, 317, 323, 332-349, 351-354, 356-360, 362-366, 369, 378, 379
air quality, 48, 49, 50
Alaska yellow-cedar, 60, 65, 66, 68, 234
best management practices, 17, 47, 158, 341, 351
biodiversity, 25, 108, 121
biogeographic province, 44, 122, 137
black bear, 81, 118, 119, 136, 332, 337, 338, 353, 392
carbon, 48, 49, 50, 117, 172, 368
climate change, 45, 48,-51, 76, 122, 135, 158, 171-173, 178, 184-186, 193, 216, 228, 237, 317
communities, 1, 6, 13, 32, 45, 52, 53, 67, 68, 69, 71, 111, 131, 138, 144, 148, 159, 161, 162, 166, 183, 184, 193, 194, 195, 207, 216, 234, 241, 263, 273, 286, 287, 294-299, 301, 303, 304, 310, 312, 314-320, 325, 332, 335-337, 338, 339, 344, 346-349, 353, 355, 360, 361, 366, 375, 392, 393
connectivity, 6, 14, 15, 21, 23, 24, 74, 76, 86, 92, 96, 110, 121, 122, 136, 171-174, 185, 285, 286, 338, 345, 351, 369, 392
conservation strategy, 216
corridors, 20, 23, 24, 27, 29, 56, 61, 73, 74, 76, 77, 86, 92, 96, 104, 121, 138, 148, 159, 186, 197, 220, 236, 238, 241, 245, 257, 321, 323, 324, 344, 346-348, 366
elevational, 14, 23, 24, 27, 56, 61, 74, 77, 86, 121, 148
cultural resources, 47, 201-205, 351
deer, 14, 15, 20, 23, 24, 27, 32, 61, 74, 75-82, 84-86, 88-90, 92, 101, 104, 107, 116, 121, 122, 136-138, 140-142, 144, 146, 148, 272, 294, 296, 299, 300-304, 314, 316, 318, 319, 332-339, 344-350, 354, 355, 387-390
design criteria, 47, 61, 63, 66, 73
effects, 1, 7, 9, 17, 27, 28, 30, 33, 43, 44-56, 58, 60, 68, 70, 73, 75-77, 84-86, 88-90, 92, 96, 97, 100-104, 107, 112, 114-127, 130-138, 142, 144, 146, 148-163, 165, 166, 169-190, 194-199, 201-207, 211, 215, 218, 221-230, 232-234, 236, 237, 244-255, 257, 258, 259-264, 275, 276, 280, 283-286, 288, 291-296, 314-317, 319-321, 323, 324, 326-328, 330, 332-334, 336-339, 341-351, 359, 360, 364, 366-368, 370-376, 378, 379, 392
adverse, 17, 45, 47, 49-51, 58, 132, 134, 135, 158, 177, 179, 180, 186-188, 193, 195, 199, 204, 251, 252, 254, 258, 260, 261, 295, 296, 314, 316, 320, 333, 344, 350, 360, 371, 375, 376, 378
employment, 14, 55, 66-68, 70, 71, 294, 297, 299, 304-306, 312-315
fish passage, 6, 13, 18, 21, 29, 159, 166-168, 176, 180, 181, 296, 341, 342, 344, 358, 361, 366
fisheries, 18, 52, 126, 159, 160, 165, 176, 179, 182, 204, 283, 340
floodplain, 6, 18, 23, 28, 51, 108, 158, 159, 161, 169, 171-174, 177, 182, 185, 192, 204, 283
forest health, 207, 214, 218, 228, 230, 305
Forest Plan, 5, 7, 8, 9, 15-17, 19, 20, 25, 26, 31, 33, 43-45, 47-51, 53, 55-60, 63, 69-72, 78, 85, 93, 96, 97, 103, 108, 110, 111, 118, 121, 126, 127, 131, 132, 135-140, 158, 159, 163-165, 171, 172, 175-177, 179-181, 184, 186, 188, 191, 196, 201, 206, 209, 213, 254, 256-258, 261, 262, 265, 269, 271, 272, 280, 288-294, 297, 313, 317, 320, 322-325, 328, 329, 330, 332, 333, 336-345, 349-351, 361, 362, 367, 369, 381
game management unit, 334
hemlock, 65, 66, 68, 69, 72, 136, 207, 208, 214, 215-217, 221-230, 233, 234, 386, 392
herbicide, 19, 45, 113, 114, 116, 121, 160, 176, 179, 186, 190, 194, 196, 204, 236, 244, 248-253, 258-260, 320, 326, 327, 343, 370, 375, 376

human health, 49, 236, 249-253, 295
income, 1, 5, 6, 14, 66, 68, 72, 73, 294, 295, 296, 300, 304, 312-319, 332, 336
invasive species, 1, 6, 17-19, 29, 45, 53, 116, 117, 119, 121, 159, 169, 176, 177, 179, 183, 193, 194-198, 204, 236-242, 244-250, 253, 257-260, 283, 286, 326, 327, 369-371, 373, 375, 376, 386
inventoried roadless area, 44, 51, 52, 342
irreversible and irretrievable, 361
issues, 9, 13, 14, 15, 17, 45, 47, 48, 55, 159, 166, 167, 169, 180, 181, 226, 252, 337, 344, 369
karst, 30, 45, 254-261
land use designation, 5, 9, 17, 44, 189, 191, 192, 288
landing, 64, 177, 187
landslide, 45, 170, 321, 322, 324, 326, 328, 329, 331, 401
legacy, 93, 164, 204, 316
limited export policy, 14, 27, 55
log transfer facility, 71, 115, 124, 271, 353
logging systems, 26, 63, 69, 220, 289
marine access facilities, 6, 20, 22, 102, 113-115, 119, 120, 122, 188, 192, 239, 332, 351, 368
marine environment, 49, 122, 124, 127, 161, 166, 187, 389
marten, 14, 15, 23, 24, 61, 74, 75, 92-101, 103, 104, 116, 119, 120, 136, 159, 186, 339, 342-344, 346, 347, 389, 390-392
minerals, 47, 50, 52
mining, 51, 122, 123, 161, 299, 304, 323, 324, 327, 370
mountain goat, 118, 136, 137, 154, 391
National Forest System road, 20
old growth, 14, 15, 24, 26, 27, 55, 56, 64, 66, 68, 71, 74, 75, 84-86, 93, 96, 109, 132, 133, 137, 160, 192, 198, 208, 214, 219, 220, 221, 224, 234, 256, 258-261, 288, 290, 292, 330, 337, 339, 342, 347
openings, 64, 85, 96, 215, 219, 220-222, 224, 225, 228, 231-233, 237, 259, 325
outhouse, 113, 269, 271
past activities, 112
past harvest, 69, 122, 234, 255, 320, 328, 330, 369
productive old-growth, 109, 144, 391
project record, 16, 46, 58, 59, 63-65, 158, 165-168, 179, 181, 188, 196, 206, 257, 295, 296, 334, 340, 352, 355, 358, 362, 363, 366, 385
public involvement, 1, 57, 72, 73
purpose and need, 7, 9, 17, 23, 25, 26, 182
reasonably foreseeable, 46, 84, 89, 100, 125, 127, 131, 133, 135, 144, 202, 233, 253, 263, 286, 293, 327, 329, 330, 331, 332, 342, 344, 345, 347, 366, 367, 372, 378, 379
recreation, 5-7, 13, 17, 18, 21, 22, 25, 33, 43, 46, 50-52, 115, 118, 122, 123, 126, 159, 161, 171, 175, 182, 183, 187, 189, 193-195, 198, 203, 204, 236, 237, 239, 240, 245, 246, 262-265, 269, 270-272, 274, 275, 280, 281, 283-286, 289, 294-296, 301, 311, 313, 314, 316, 321, 323, 327, 335, 353-355, 358, 361-363, 367-374, 377-379
  cabins and shelters, 22, 283, 284
  campsites, 13, 22, 269, 270, 271, 280, 376
  kayaking, canoeing, boating, 52, 126, 264, 271, 274, 275, 285
Recreation Opportunity Spectrum, 262-264, 267
recreation places, 43
riparian management areas, 20, 164, 199, 238
road, 13, 21, 23, 25, 29, 30, 33, 46, 49, 50-52, 56, 57, 64, 71, 100, 111, 113, 115-117, 120, 137, 139, 158, 160, 162-164, 169, 171-174, 176, 177, 182-185, 193, 195, 202, 203, 233, 236, 238-241, 245-247, 254, 257, 259, 265, 270, 272, 276, 279, 283, 285, 301, 321, 323-328, 330, 334-338, 342-344, 347, 348, 35-361, 363-367, 369-371, 379
  construction, 6, 23, 25, 29, 44, 46, 47, 51, 52, 59, 64, 81, 97, 122, 138, 139, 144, 159, 163, 169, 175, 176, 181, 189, 195, 196, 198, 236-238, 245-247, 255, 256, 258, 264, 265, 270, 271, 276, 280, 286, 287, 289, 295, 320-322, 324, 326, 327, 329, 330, 332, 336-338, 342-344, 346, 349-352, 359-361, 364, 365, 367-371, 378, 379
  density, 97, 100, 101, 114, 120, 137-139, 144, 148, 163, 171, 172, 176, 184, 333, 339, 345
  maintenance, 50, 182, 199, 204, 245, 351, 360, 364, 379

miles, 160, 164, 183, 337, 341, 342, 347, 349, 359, 360, 365
temporary, 6, 20, 23, 25, 28, 30, 33, 116, 158, 176, 181-183, 198, 199, 264, 321, 323, 324, 328-330, 335, 342-344, 347, 349, 351, 352, 359, 365
rock quarries, 20, 23, 25, 47, 193, 198, 247, 257, 321, 323, 361, 366
salmon, 31, 32, 118, 137, 140, 148, 161, 165, 166, 168, 169, 171, 173, 174, 179-181, 186, 213, 294, 296, 300, 301, 314-316, 318, 319, 333, 334, 336, 337, 340-344, 379
scenery, 7, 8, 19, 26, 31, 55, 69, 218, 219, 228, 264, 269, 280, 288, 289, 291-293, 296, 316
scoping, 13-15, 385
silvicultural systems, 64, 218, 229
even-aged management, 7, 19, 20, 23, 33, 48, 62, 64, 70, 85, 171, 172, 178, 207, 218-222, 224, 227-229, 232-235, 288, 290-292
intermediate treatments, 6, 19, 20, 29, 115, 219-221, 224
two-aged treatments, 19, 20, 23, 64, 218-222, 224, 227, 229, 232
uneven-aged management, 19, 26, 64, 218, 220, 222, 224, 228, 229, 231, 232
soils, 23, 45, 47, 55, 108, 164, 175, 184, 209, 218, 238, 255, 320-323, 326-330, 367
species composition, 57, 59, 69, 121, 206, 207, 208, 218, 221-226, 234
spruce, 60-62, 65, 66, 68, 69, 72, 108, 136, 207-209, 215-217, 221-225, 227-230, 233, 386, 392
stand structure, 207, 208, 211, 214, 215, 218, 221, 392
standards and guidelines, 59, 93, 136, 199, 342, 343
stream buffers, 199, 215, 231, 342, 343
stream class, 33, 176
stream crossings, 21, 30, 158, 166-169, 178, 181-183, 192, 238, 239, 241, 245, 294, 341, 343, 358, 361
subsistence, 1, 5-7, 13, 18, 21, 25, 27, 44, 77, 126, 159, 161, 165, 176, 183, 195, 203, 245, 263, 272, 294, 295, 296, 297, 299-304, 314-319, 332-350, 352-354, 364, 379
timber, 1, 5, 6, 8, 13, 14, 19, 20, 21, 23-29, 33, 44, 46, 48, 50-52, 55-61, 63, 64, 66-77, 84, 86, 88-90, 93, 96, 97, 100, 107, 108, 111, 112, 115, 121, 122, 132, 133, 135, 138, 140, 142, 144, 145, 148, 150-152, 156, 158-166, 170,-172, 175-177, 180-183, 185, 186, 188, 189, 193, 195, 196, 199, 202, 206, 207, 209, 210-214, 217, 218, 227-229, 234, 245, 246, 247, 254-256, 258, 260, 261, 263-265, 270, 271, 276, 279, 280, 283, 285, 286, 288-295, 297, 301, 302, 304-308, 314-330, 332, 333, 335-339, 341-344, 346-350, 352-355, 358-361, 364-372, 378, 392
harvest, 6, 13, 14, 19-21, 23-33, 44, 46, 48, 50,-52, 55-78, 80-82, 84-86, 88-90, 92, 93, 96, 97, 100-103, 107-110, 112, 113, 115, 120-122, 126, 130, 132, 133, 135, 137-142, 144, 145, 148, 150-153, 155, 156, 158-166, 169-180, 182-186, 188, 189, 192, 193, 195, 196, 198, 199, 204, 206-211, 213-216, 218-224, 226-237, 245-248, 254-256, 258-261, 265, 270, 271, 276, 279, 280, 283, 285, 286, 288-296, 299-306, 315-330, 332, 334-348, 350, 352-355, 359, 361, 365-372, 378, 379, 387, 390
market, 26, 57, 58, 61, 63, 65, 66, 68, 70-73, 172, 207, 294, 297, 306, 310, 315, 317
supply, 13, 14, 26, 45, 55, 56, 58, 69, 71-73, 163, 215, 306, 315, 317
tourism, 1, 5, 6, 25, 47, 53, 122, 126, 273, 285, 294, 295, 299, 302, 312-314, 316
trail, 13, 17, 21, 22, 29, 52, 113, 159, 160, 161, 175, 181, 183, 184, 194, 197, 204, 244, 247, 264, 270-272, 275, 284, 313, 327, 344, 347, 353-357, 363, 364, 370, 371
travel management, 20
vegetation management, 112, 204, 233, 236, 237, 378, 379
water quality, 5, 6, 53, 122, 158-160, 162, 164, 169, 170, 176, 177, 179, 180-186, 188, 255, 259, 260, 341, 342, 344, 351, 360, 369
watershed, 5, 6, 18, 20, 44, 51, 53, 55, 158-161, 163-166, 169, 171-178, 180, 183-186, 189, 196, 198, 218, 236, 237, 241, 244, 246, 248, 255, 259, 315, 323, 327, 334, 344

improvement and restoration, 18, 20, 184, 189, 198, 236, 237, 244, 246, 248, 323, 327
wetlands, 5, 7, 45, 47, 116, 117, 163, 181, 236, 245, 320, 322, 338, 351, 352, 367-372
wilderness, 19, 44, 45, 50, 51, 199, 241, 275, 373-379
wildlife, 5-7, 14, 19, 20, 22, 24, 25, 29, 44, 45, 49, 52, 53, 55, 62, 63, 73-77, 85, 86, 101, 102, 104, 107-110, 112-114, 116-120, 122, 135, 136, 148, 151, 152, 159, 165, 177, 183, 193, 195, 207, 215, 218-220, 228, 245, 247, 252, 262, 264, 269, 274, 283, 286, 296, 300, 302-304, 313, 314, 316, 318, 319, 321, 325, 327, 333, 334, 337, 343, 350, 368, 380, 393
habitat improvement, 5, 6, 52, 53, 112, 116, 119, 159, 179, 316, 336, 341, 343, 344
wildlife analysis area, 296, 300, 302-304, 318, 319, 334
wolf, 59, 78, 81, 97, 101, 115, 116, 118-122, 136-140, 144, 148, 337, 339, 342, 343, 346
young growth, 5, 6, 14, 19, 31, 55, 56, 64-66, 68, 75, 85, 108, 163, 193, 198, 204, 209, 212, 213, 215, 220, 221, 224, 230, 233, 234, 256, 258-261, 288, 290, 328, 330, 347

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Cut and Sold (New) - CUTS203F

Cumulative FY 2015 Q1 to FY 2015 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/02/2015 08:24 AM

Region: R10, Alaska Region **Forest: 04 Chugach National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	4	0.00	0.00	300.00	0.00	0.00	280.00
3	< $300	0	0.00	0.00	0.00	0.00	0.00	0.00
4	$301 - $10,000	1	650.00	1,300.00	6,500.00	143.50	287.00	135.00
5	$10,001 - $100,000	0	0.00	0.00	0.00	0.00	0.00	0.00
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
8	> $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1004) Total :	**5**	**650.00**	**1,300.00**	**6,800.00**	**143.50**	**287.00**	**415.00**

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ASPN	Aspen	7	14.00	70.00	10.00	5.00	1.50	3.00	15.00
BRCH	Paper Birch	71	141.00	705.00	10.00	5.00	14.00	28.00	140.00
MH	Mountain Hemlock	210	420.00	2,100.00	10.00	5.00	49.50	99.00	495.00
S	Spruce (R,W,B)	363	725.00	3,625.00	10.00	5.00	78.50	157.00	785.00
	07 Fuelwood Total :	**650**	**1,300.00**	**6,500.00**	**10.00**	**5.00**	**143.50**	**287.00**	**1,435.00**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	3,000	150.00	3,000	150.00
			17 Non Conv. Total :		**150.00**		**150.00**

28 Transplant

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
09	Each	PLNT	PLANTS	650	130.00	650	130.00
			28 Transplant Total :		**130.00**		**130.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	0	.00
			42 Mushrooms Total :		**10.00**		**.00**

55 Other Plnt

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	0	.00

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES **NON-CONVERTIBLE** (Continued)

55 Other Plnt (Continued)

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
			55 Other Plnt Total :		**10.00**		**.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2015 Q1 to FY 2015 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/02/2015 08:24 AM

Region: R10, Alaska Region **Forest: 05 Tongass National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	1	0.00	0.00	50.00	0.00	0.00	20.00
3	< $300	20	73.27	142.08	1,135.12	119.63	238.92	1,481.95
4	$301 - $10,000	17	848.09	1,683.22	26,854.93	975.05	2,048.12	45,649.52
5	$10,001 - $100,000	4	1,907.78	4,156.34	125,401.78	2,572.59	5,906.78	206,548.68
6	$100,001 - $1,000,000	4	16,259.84	34,939.91	1,918,691.33	14,135.29	30,939.47	336,122.87
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	2,168.01	4,873.98	57,263.07
8	> $5,000,000	0	0.00	0.00	0.00	36,911.98	75,508.59	635,395.80
A	**ADDVOL Default Size Class	0	3,536.00	7,072.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1005) Total :	**46**	**22,624.98**	**47,993.55**	**2,072,133.16**	**56,882.55**	**119,515.86**	**1,282,481.89**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

01 Sawtimber

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
**A	**ADDVOL DEFAULT SPECIES	3,536	7,072.00	.00	.00	.00	.00	.00	.00
ALDR	Alder	0	.00	.00	.00	.00	5.00	15.69	10.90
H	Western Hemlock	5,356	12,070.30	164,744.41	30.76	13.65	12,769.82	28,505.58	129,333.38
RC	Western Red Cedar	3,668	8,940.10	698,347.25	190.37	78.11	4,915.18	11,660.03	431,263.84
RCC	Softwood - Other	0	.00	.00	.00	.00	.00	.00	-16,716.69
SS	Sitka Spruce	5,680	11,064.04	1,123,700.61	197.85	101.56	8,961.79	18,034.26	1,086,303.89
YC	Alaska Cedar	433	1,055.77	76,913.45	177.49	72.85	2,250.24	5,251.90	278,220.49
	01 Sawtimber Total :	**18,674**	**40,202.21**	**2,063,705.72**	**110.51**	**51.33**	**28,902.03**	**63,467.46**	**1,908,415.81**

02 Pulpwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
HU	Western Hemlock Utility	3,005	6,095.57	6,009.14	2.00	.99	22,097.65	45,386.72	44,195.30
SSU	Sitka Spruce Utility	891	1,592.44	1,781.96	2.00	1.12	5,817.84	10,542.54	11,635.68
	02 Pulpwood Total :	**3,896**	**7,688.01**	**7,791.10**	**2.00**	**1.01**	**27,915.49**	**55,929.26**	**55,830.98**

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	32	57.60	320.00	10.00	5.56	41.50	74.70	1,415.00
RC	Western Red Cedar	4	6.30	35.00	10.00	5.56	3.50	6.30	35.00
SS	Sitka Spruce	2	3.60	20.00	10.00	5.56	4.00	7.20	1,040.00
YC	Alaska Cedar	14	27.37	142.10	10.13	5.19	16.03	30.97	162.10
	07 Fuelwood Total :	**52**	**94.87**	**517.10**	**10.03**	**5.45**	**65.03**	**119.17**	**2,652.10**

14 Misc-Conv.

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
YC	Alaska Cedar	4	8.46	69.24	15.99	8.18	.00	.00	.00
	14 Misc-Conv. Total :	**4**	**8.46**	**69.24**	**15.99**	**8.18**	**.00**	**.00**	**.00**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES NON-CONVERTIBLE

29 Limb/Bough

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	0	.00	67	20.00
			29 Limb/Bough Total :		**.00**		**20.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	50.00	0	.00
			42 Mushrooms Total :		**50.00**		**.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2015 Q1 to FY 2015 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/02/2015 08:24 AM

CONVERTIBLE PRODUCTS

Alaska

Forest	Sold Number	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
Chugach National Forest	1	650.00	1,300.00	6,500.00	143.50	287.00	135.00
Tongass National Forest	45	22,624.98	47,993.55	2,072,083.16	56,882.55	119,515.86	1,282,461.89
Alaska Sub Total :	**46**	**23,274.98**	**49,293.55**	**2,078,583.16**	**57,026.05**	**119,802.86**	**1,282,596.89**
All State Total :	**46**	**23,274.98**	**49,293.55**	**2,078,583.16**	**57,026.05**	**119,802.86**	**1,282,596.89**

NON-CONVERTIBLE PRODUCTS

Alaska

Forest	UOM	Description	Sold Number	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
Chugach National Forest	09	Each	1	650.00	130.00	650	130.00
	10	Lbs	3	3,100.00	170.00	3,000	150.00
Tongass National Forest	10	Lbs	1	50.00	50.00	67	20.00
		Alaska Sub Total :	**5**		**350.00**		**300.00**
		All State Total :	**5**		**350.00**		**300.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2015 Q1 to FY 2015 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/02/2015 08:24 AM

NUMBER OF SALES MADE

Forest	Non Convertible Products	To $300	$301 To $10,000	$10,001 To $100,000	$100,001 To $1,000,000	$1,000,001 To $5,000,000	$5,000,001 and Over	Total Convertible Products	Total Number Of Sales
Chugach National Forest	4		1					1	5
Tongass National Forest	1	20	17	4	4			45	46
Region (R10, Alaska Region) Total :	**5**	**20**	**18**	**4**	**4**			**46**	**51**

REPORT LEGEND
Convertible Products

*** Legend for CUTS203 is Under Construction ***

Where Clause: Where (Region_Code = '10') and (report_date between to_date('10/01/2014 00:00:00','mm/dd/yyyy hh24:mi:ss') and to_date('09/30/2015 23:59:59','mm/dd/yyyy hh24:mi:ss')) and 1=1 and stewardship_indicator in ('N','Y')

Sorting Criteria:

End of Report

Cut and Sold (New) - CUTS203F

Cumulative FY 2016 Q1 to FY 2016 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/22/2016 07:31 AM

Region: R10, Alaska Region **Forest: 04 Chugach National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	6	0.00	0.00	235.00	0.00	0.00	170.00
3	< $300	0	0.00	0.00	0.00	0.00	0.00	0.00
4	$301 - $10,000	4	559.18	1,431.44	34,645.95	540.50	1,081.00	205.00
5	$10,001 - $100,000	0	0.00	0.00	0.00	0.00	0.00	0.00
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
8	> $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1004) Total :	**10**	**559.18**	**1,431.44**	**34,880.95**	**540.50**	**1,081.00**	**375.00**

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ASPN	Aspen	0	.00	.00	.00	.00	5.50	11.00	55.00
BRCH	Paper Birch	50	127.13	3,669.04	73.87	28.86	56.50	113.00	565.00
MH	Mountain Hemlock	153	392.00	6,925.19	45.22	17.67	180.50	361.00	1,805.00
S	Spruce (R,W,B)	356	912.31	24,051.71	67.49	26.36	298.00	596.00	2,980.00
	07 Fuelwood Total :	**559**	**1,431.44**	**34,645.95**	**61.96**	**24.20**	**540.50**	**1,081.00**	**5,405.00**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
04	Piece	HDWD	Hardwood - Other	3,000	150.00	0	.00
10	Lbs	MISC	MISCELLANOUS	500	25.00	3,000	150.00
			17 Non Conv. Total :		**175.00**		**150.00**

28 Transplant

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
09	Each	ALDR	Alder	100	20.00	0	.00
09	Each	PLNT	PLANTS	100	20.00	0	.00
			28 Transplant Total :		**40.00**		**.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	50	10.00
			42 Mushrooms Total :		**10.00**		**10.00**

55 Other Plnt

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES **NON-CONVERTIBLE** (Continued)

55 Other Plnt (Continued)

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	50	10.00
			55 Other Plnt Total :		**10.00**		**10.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2016 Q1 to FY 2016 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/22/2016 07:31 AM

Region: R10, Alaska Region **Forest: 05 Tongass National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	2	0.00	0.00	40.00	0.00	0.00	550.00
3	< $300	14	133.33	308.85	1,113.18	46.82	94.16	1,070.90
4	$301 - $10,000	21	447.11	1,066.68	34,130.66	228.57	514.77	18,208.81
5	$10,001 - $100,000	7	11,992.26	26,640.58	309,378.40	8,780.21	17,817.70	122,210.95
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	8,819.21	19,113.45	497,018.52
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	3,756.57	8,832.41	-31,854.87
8	> $5,000,000	0	0.00	0.00	0.00	23,743.88	50,877.99	2,163,955.88
A	**ADDVOL Default Size Class	0	962.00	1,924.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1005) Total :	**44**	**13,534.70**	**29,940.11**	**344,662.24**	**45,375.26**	**97,250.48**	**2,771,160.19**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

01 Sawtimber

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
**A	**ADDVOL DEFAULT SPECIES	962	1,924.00	.00	.00	.00	.00	.00	.00
ALDR	Alder	0	.60	.29	2.26	.49	.00	.00	.00
H	Western Hemlock	4,361	9,570.14	14,250.96	3.27	1.49	18,779.48	40,969.20	36,750.17
RC	Western Red Cedar	2,809	6,787.05	186,984.75	66.56	27.55	7,293.67	17,307.54	1,030,973.20
RCC	Softwood - Other	0	.00	.00	.00	.00	.00	.00	-91,722.88
SS	Sitka Spruce	1,558	3,500.50	60,217.57	38.64	17.20	11,631.42	22,451.88	1,830,074.76
YC	Alaska Cedar	1,075	2,704.15	77,406.85	72.00	28.63	3,130.21	7,582.55	318,603.08
	01 Sawtimber Total :	**10,766**	**24,486.44**	**338,860.43**	**31.48**	**13.84**	**40,834.78**	**88,311.17**	**3,124,678.33**

02 Pulpwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
HU	Western Hemlock Utility	2,491	4,962.75	5,023.82	2.02	1.01	3,635.06	7,344.26	7,270.12
SS	Sitka Spruce	2	3.20	4.00	2.00	1.25	2.00	3.20	4.00
SSU	Sitka Spruce Utility	256	449.22	519.00	2.03	1.16	882.25	1,551.20	1,764.50
	02 Pulpwood Total :	**2,749**	**5,415.17**	**5,546.81**	**2.02**	**1.02**	**4,519.31**	**8,898.66**	**9,038.62**

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
YC	Alaska Cedar	19	36.70	195.00	10.08	5.31	16.84	32.20	170.00
	07 Fuelwood Total :	**19**	**36.70**	**195.00**	**10.08**	**5.31**	**16.84**	**32.20**	**170.00**

14 Misc-Conv.

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ALDR	Alder	1	1.80	20.00	20.00	11.11	.00	.00	.00
YC	Alaska Cedar	0	.00	.00	.00	.00	4.33	8.46	69.24
	14 Misc-Conv. Total :	**1**	**1.80**	**20.00**	**20.00**	**11.11**	**4.33**	**8.46**	**69.24**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES NON-CONVERTIBLE

15 Xmas Trees

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
09	Each	O	Softwood - Other	0	.00	100	500.00
			15 Xmas Trees Total :		**.00**		**500.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	120	40.00	50	50.00
			42 Mushrooms Total :		**40.00**		**50.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2016 Q1 to FY 2016 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/22/2016 07:31 AM

CONVERTIBLE PRODUCTS

Alaska

Forest	Sold Number	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
Chugach National Forest	4	559.18	1,431.44	34,645.95	540.50	1,081.00	205.00
Tongass National Forest	42	13,534.70	29,940.11	344,622.24	45,375.26	97,250.48	2,770,610.19
Alaska Sub Total :	**46**	**14,093.88**	**31,371.55**	**379,268.18**	**45,915.76**	**98,331.48**	**2,770,815.19**
All State Total :	**46**	**14,093.88**	**31,371.55**	**379,268.18**	**45,915.76**	**98,331.48**	**2,770,815.19**

NON-CONVERTIBLE PRODUCTS

Alaska

Forest	UOM	Description	Sold Number	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
Chugach National Forest	04	Piece	1	3,000.00	150.00	0	.00
	09	Each	2	200.00	40.00	0	.00
	10	Lbs	3	600.00	45.00	3,100	170.00
Tongass National Forest	09	Each	0	.00	.00	100	500.00
	10	Lbs	2	120.00	40.00	50	50.00
		Alaska Sub Total :	**8**		**275.00**		**720.00**
		All State Total :	**8**		**275.00**		**720.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2016 Q1 to FY 2016 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/22/2016 07:31 AM

NUMBER OF SALES MADE

Forest	Non Convertible Products	To $300	$301 To $10,000	$10,001 To $100,000	$100,001 To $1,000,000	$1,000,001 To $5,000,000	$5,000,001 and Over	Total Convertible Products	Total Number Of Sales
Chugach National Forest	6		4					4	10
Tongass National Forest	2	14	21	7				42	44
Region (R10, Alaska Region) Total :	**8**	**14**	**25**	**7**				**46**	**54**

REPORT LEGEND
Convertible Products

*** Legend for CUTS203 is Under Construction ***

Where Clause: Where (Region_Code = '10') and (report_date between to_date('10/01/2015 00:00:00','mm/dd/yyyy hh24:mi:ss') and to_date('09/30/2016 23:59:59','mm/dd/yyyy hh24:mi:ss')) and 1=1 and stewardship_indicator in ('N','Y') and good_neighbor_auth_indicator in ('N','Y')

Sorting Criteria:

End of Report

Cut and Sold (New) - CUTS203F

Cumulative FY 2017 Q1 to FY 2017 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/03/2017 06:43 AM

Region: R10, Alaska Region **Forest: 04 Chugach National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	4	0.00	0.00	600.00	0.00	0.00	255.00
3	< $300	0	0.00	0.00	0.00	0.00	0.00	0.00
4	$301 - $10,000	1	203.50	520.96	17,114.35	444.50	1,136.52	25,584.48
5	$10,001 - $100,000	0	0.00	0.00	0.00	0.00	0.00	0.00
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
8	> $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1004) Total :	**5**	**203.50**	**520.96**	**17,714.35**	**444.50**	**1,136.52**	**25,839.48**

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
BRCH	Paper Birch	0	.00	.00	.00	.00	36.50	93.44	2,645.88
MH	Mountain Hemlock	0	.00	.00	.00	.00	142.00	362.68	5,960.16
S	Spruce (R,W,B)	204	520.96	17,114.35	84.10	32.85	266.00	680.40	16,978.44
	07 Fuelwood Total :	**204**	**520.96**	**17,114.35**	**84.10**	**32.85**	**444.50**	**1,136.52**	**25,584.48**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
04	Piece	HDWD	Hardwood - Other	10,000	500.00	3,000	150.00
10	Lbs	MISC	MISCELLANOUS	0	.00	500	25.00
			17 Non Conv. Total :		**500.00**		**175.00**

28 Transplant

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
09	Each	ALDR	Alder	0	.00	100	20.00
09	Each	PLNT	PLANTS	0	.00	100	20.00
			28 Transplant Total :		**.00**		**40.00**

29 Limb/Bough

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	S	Spruce (R,W,B)	1,000	20.00	1,000	20.00
			29 Limb/Bough Total :		**20.00**		**20.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES **NON-CONVERTIBLE** (Continued)

42 Mushrooms (Continued)

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	400	80.00	50	10.00
			42 Mushrooms Total :		**80.00**		**10.00**

55 Other Plnt

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	0	.00	50	10.00
			55 Other Plnt Total :		**.00**		**10.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2017 Q1 to FY 2017 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/03/2017 06:43 AM

Region: R10, Alaska Region **Forest: 05 Tongass National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	2	0.00	0.00	156.70	0.00	0.00	190.00
3	< $300	34	99.12	193.42	925.12	139.97	317.53	831.35
4	$301 - $10,000	9	221.61	512.50	20,338.35	327.91	727.26	23,708.68
5	$10,001 - $100,000	1	479.23	1,102.67	78,249.26	1,975.21	4,589.21	228,640.06
6	$100,001 - $1,000,000	1	30,008.12	73,219.81	921,777.92	7,822.38	18,240.74	765,855.37
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	6,042.66	13,966.90	296,463.67
8	> $5,000,000	0	0.00	0.00	0.00	3,703.17	7,930.71	-818,934.74
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1005) Total :	**47**	**30,808.08**	**75,028.40**	**1,021,447.35**	**20,011.30**	**45,772.35**	**496,754.39**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

01 Sawtimber

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ALDR	Alder	0	.00	.00	.00	.00	.10	.46	.23
H	Western Hemlock	5,445	13,273.92	15,477.58	2.84	1.17	9,255.94	21,273.34	98,836.51
RC	Western Red Cedar	273	642.46	69,705.09	255.45	108.50	4,129.08	10,244.71	789,792.25
RCC	Softwood - Other	0	.00	.00	.00	.00	.00	.00	-70,978.77
SS	Sitka Spruce	25,000	60,938.89	933,209.96	37.33	15.31	4,255.20	8,325.71	-59,546.77
YC	Alaska Cedar	11	27.15	2,095.86	191.05	77.20	2,142.01	5,300.87	-25,127.00
	01 Sawtimber Total :	**30,728**	**74,882.42**	**1,020,488.49**	**33.21**	**13.63**	**19,782.33**	**45,145.09**	**732,976.45**

02 Pulpwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
HU	Western Hemlock Utility	0	.20	.18	2.00	.90	549.61	1,191.12	1,141.72
SSU	Sitka Spruce Utility	1	1.78	1.98	2.00	1.11	-358.14	-631.39	-708.78
	02 Pulpwood Total :	**1**	**1.98**	**2.16**	**2.00**	**1.09**	**191.47**	**559.73**	**432.94**

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	32	57.60	320.00	10.00	5.56	11.50	20.70	115.00
RC	Western Red Cedar	3	5.40	30.00	10.00	5.56	3.00	5.40	30.00
SS	Sitka Spruce	7	12.60	70.00	10.00	5.56	2.00	3.60	20.00
YC	Alaska Cedar	36	66.60	360.00	10.05	5.41	20.00	36.00	200.00
	07 Fuelwood Total :	**78**	**142.20**	**780.00**	**10.02**	**5.49**	**36.50**	**65.70**	**365.00**

14 Misc-Conv.

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ALDR	Alder	1	1.80	20.00	20.00	11.11	1.00	1.80	20.00
	14 Misc-Conv. Total :	**1**	**1.80**	**20.00**	**20.00**	**11.11**	**1.00**	**1.80**	**20.00**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	134	6.70	0	.00
			17 Non Conv. Total :		**6.70**		**.00**

30 Foliage

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	100	150.00	100	150.00
			30 Foliage Total :		**150.00**		**150.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	0	.00	120	40.00
			42 Mushrooms Total :		**.00**		**40.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2017 Q1 to FY 2017 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/03/2017 06:43 AM

CONVERTIBLE PRODUCTS

Alaska

Forest	Sold Number	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
Chugach National Forest	1	203.50	520.96	17,114.35	444.50	1,136.52	25,584.48
Tongass National Forest	45	30,808.08	75,028.40	1,021,290.65	20,011.30	45,772.35	496,564.39
Alaska Sub Total :	**46**	**31,011.58**	**75,549.36**	**1,038,405.00**	**20,455.80**	**46,908.87**	**522,148.87**
All State Total :	**46**	**31,011.58**	**75,549.36**	**1,038,405.00**	**20,455.80**	**46,908.87**	**522,148.87**

NON-CONVERTIBLE PRODUCTS

Alaska

Forest	UOM	Description	Sold Number	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
Chugach National Forest	04	Piece	2	10,000.00	500.00	3,000	150.00
	09	Each	0	.00	.00	200	40.00
	10	Lbs	2	1,400.00	100.00	1,600	65.00
Tongass National Forest	10	Lbs	2	234.00	156.70	220	190.00
		Alaska Sub Total :	**6**		**756.70**		**445.00**
		All State Total :	**6**		**756.70**		**445.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2017 Q1 to FY 2017 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/03/2017 06:43 AM

NUMBER OF SALES MADE

Forest	Non Convertible Products	To $300	$301 To $10,000	$10,001 To $100,000	$100,001 To $1,000,000	$1,000,001 To $5,000,000	$5,000,001 and Over	Total Convertible Products	Total Number Of Sales
Chugach National Forest	4		1					1	5
Tongass National Forest	2	34	9	1	1			45	47
Region (R10, Alaska Region) Total :	**6**	**34**	**10**	**1**	**1**			**46**	**52**

REPORT LEGEND
Convertible Products

*** Legend for CUTS203 is Under Construction ***

Where Clause: Where (Region_Code = '10') and (report_date between to_date('10/01/2016 00:00:00','mm/dd/yyyy hh24:mi:ss') and to_date('09/30/2017 23:59:59','mm/dd/yyyy hh24:mi:ss')) and 1=1 and stewardship_indicator in ('N','Y') and good_neighbor_auth_indicator in ('N','Y')

Sorting Criteria:

End of Report

Cut and Sold (New) - CUTS203F

Cumulative FY 2018 Q1 to FY 2018 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 07/12/2019 10:24 AM

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region Forest: 04 Chugach National Forest

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	5	0.00	0.00	545.00	0.00	0.00	1,125.00
3	< $300	0	0.00	0.00	0.00	0.00	0.00	0.00
4	$301 - $10,000	2	328.51	840.98	43,136.87	324.50	828.48	30,322.35
5	$10,001 - $100,000	0	0.00	0.00	0.00	0.00	0.00	0.00
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
8	> $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1004) Total :	**7**	**328.51**	**840.98**	**43,681.87**	**324.50**	**828.48**	**31,447.35**

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region Forest: 04 Chugach National Forest (Continued)

PRODUCT & SPECIES - CONVERTIBLE

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
BRCH	Paper Birch	13	32.15	1,306.24	104.00	40.63	12.50	32.00	1,300.00
MH	Mountain Hemlock	224	574.13	32,295.91	144.00	56.25	16.00	39.28	1,382.00
S	Spruce (R,W,B)	92	234.70	9,534.72	104.00	40.63	296.00	757.20	27,640.35
	07 Fuelwood Total :	**329**	**840.98**	**43,136.87**	**131.31**	**51.29**	**324.50**	**828.48**	**30,322.35**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
04	Piece	HDWD	Hardwood - Other	6,000	300.00	16,000	800.00
10	Lbs	MISC	MISCELLANOUS	500	25.00	500	25.00
			17 Non Conv. Total :		**325.00**		**825.00**

28 Transplant

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
09	Each	S	Spruce (R,W,B)	100	40.00	100	40.00
			28 Transplant Total :		**40.00**		**40.00**

29 Limb/Bough

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	S	Spruce (R,W,B)	4,000	80.00	4,000	80.00
			29 Limb/Bough Total :		**80.00**		**80.00**

42 Mushrooms

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES **NON-CONVERTIBLE** (Continued)

42 Mushrooms (Continued)

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	0	.00	400	80.00
			42 Mushrooms Total :		**.00**		**80.00**

55 Other Plnt

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	500	100.00	500	100.00
			55 Other Plnt Total :		**100.00**		**100.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2018 Q1 to FY 2018 Q4

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region Forest: 05 Tongass National Forest

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	3	0.00	0.00	63.40	0.00	0.00	70.10
3	< $300	34	173.10	316.28	1,958.36	215.74	397.49	2,289.91
4	$301 - $10,000	11	1,013.23	2,290.01	79,761.21	298.69	689.60	22,183.43
5	$10,001 - $100,000	2	426.36	894.79	41,162.66	3,975.30	8,283.83	152,907.78
6	$100,001 - $1,000,000	1	7,598.79	17,255.00	1,080,970.46	927.94	2,139.44	239,899.49
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	4,104.68	9,646.38	195,388.13
8	> $5,000,000	0	0.00	0.00	0.00	10,384.13	21,527.79	244,698.03
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1005) Total :	**51**	**9,211.48**	**20,756.08**	**1,203,916.08**	**19,906.48**	**42,684.53**	**857,436.87**

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region Forest: 05 Tongass National Forest (Continued)

PRODUCT & SPECIES - CONVERTIBLE

01 Sawtimber

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	3,405	7,741.93	20,717.88	6.08	2.68	7,966.17	17,664.87	62,860.30
O	Softwood - Other	57	125.74	3,101.11	54.13	24.66	.00	.00	.00
RC	Western Red Cedar	2,999	7,262.52	749,404.50	249.92	103.19	2,566.83	6,170.00	386,257.05
RCC	Softwood - Other	0	.00	.00	.00	.00	.00	.00	-10,608.00
SS	Sitka Spruce	1,905	3,728.02	274,574.81	144.15	73.65	4,861.88	9,165.65	814,529.33
YC	Alaska Cedar	678	1,590.07	154,369.39	227.69	97.08	1,954.00	4,743.87	157,899.63
	01 Sawtimber Total :	**9,043**	**20,448.28**	**1,202,167.68**	**132.93**	**58.79**	**17,348.88**	**37,744.39**	**1,410,938.31**

02 Pulpwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
HU	Western Hemlock Utility	0	.00	.00	.00	.00	2,161.98	4,235.10	4,323.96
SSU	Sitka Spruce Utility	0	.00	.00	.00	.00	182.75	314.44	365.50
	02 Pulpwood Total :	**0**	**.00**	**.00**	**.00**	**.00**	**2,344.73**	**4,549.54**	**4,689.46**

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	38	69.20	380.00	10.02	5.49	58.42	106.10	585.00
SS	Sitka Spruce	3	5.40	30.00	10.00	5.56	8.00	14.40	80.00
YC	Alaska Cedar	127	233.20	1,275.00	10.03	5.47	145.45	268.30	1,460.00
	07 Fuelwood Total :	**168**	**307.80**	**1,685.00**	**10.03**	**5.47**	**211.87**	**388.80**	**2,125.00**

14 Misc-Conv.

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
ALDR	Alder	0	.00	.00	.00	.00	1.00	1.80	20.00
	14 Misc-Conv. Total :	**0**	**.00**	**.00**	**.00**	**.00**	**1.00**	**1.80**	**20.00**

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Region: R10, Alaska Region Forest: 05 Tongass National Forest (Continued)

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	268	13.40	402	20.10
			17 Non Conv. Total :		**13.40**		**20.10**

29 Limb/Bough

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	1,000	20.00	1,000	20.00
			29 Limb/Bough Total :		**20.00**		**20.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	30	30.00	30	30.00
			42 Mushrooms Total :		**30.00**		**30.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2018 Q1 to FY 2018 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 07/12/2019 10:24 AM

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

CONVERTIBLE PRODUCTS

Alaska

Forest	Sold Number	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
Chugach National Forest	2	328.51	840.98	43,136.87	324.50	828.48	30,322.35
Tongass National Forest	48	9,211.48	20,756.08	1,203,852.68	19,906.48	42,684.53	857,366.77
Alaska Sub Total :	**50**	**9,539.99**	**21,597.06**	**1,246,989.55**	**20,230.98**	**43,513.01**	**887,689.12**
All State Total :	**50**	**9,539.99**	**21,597.06**	**1,246,989.55**	**20,230.98**	**43,513.01**	**887,689.12**

NON-CONVERTIBLE PRODUCTS

Alaska

Forest	UOM	Description	Sold Number	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
Chugach National Forest	04	Piece	1	6,000.00	300.00	16,000	800.00
	09	Each	1	100.00	40.00	100	40.00
	10	Lbs	3	5,000.00	205.00	5,400	285.00
Tongass National Forest	10	Lbs	3	1,298.00	63.40	1,432	70.10
		Alaska Sub Total :	**8**		**608.40**		**1,195.10**
		All State Total :	**8**		**608.40**		**1,195.10**

Cut and Sold (New) - CUTS203F

Cumulative FY 2018 Q1 to FY 2018 Q4

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 07/12/2019 10:24 AM

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

NUMBER OF SALES MADE

Forest	Non Convertible Products	To $300	$301 To $10,000	$10,001 To $100,000	$100,001 To $1,000,000	$1,000,001 To $5,000,000	$5,000,001 and Over	Total Convertible Products	Total Number Of Sales
Chugach National Forest	5		2					2	7
Tongass National Forest	3	34	11	2	1			48	51
Region (R10, Alaska Region) Total :	**8**	**34**	**13**	**2**	**1**			**50**	**58**

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

REPORT LEGEND
Convertible Products

*** Legend for CUTS203 is Under Construction ***

*****Note: FY2018-4th Quarter Cut and Sold Report is first report using new version of forest products financial system (FPFS) in place of ATSA for Cut/Harvest data. *****

Where Clause: Where (Region_Code = '10') and (report_date between to_date('10/01/2017 00:00:00','mm/dd/yyyy hh24:mi:ss') and to_date('09/30/2018 23:59:59','mm/dd/yyyy hh24:mi:ss')) and 1=1 and stewardship_indicator in ('N','Y') and good_neighbor_auth_indicator in ('N','Y')

Sorting Criteria:

End of Report

Cut and Sold (New) - CUTS203F

Cumulative FY 2019 Q1 to FY 2019 Q4 as of 2019 4th quarter

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/25/2019 03:44 PM

Region: R10, Alaska Region **Forest: 04 Chugach National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	6	0.00	0.00	580.00	0.00	0.00	520.00
3	< $300	0	0.00	0.00	0.00	0.00	0.00	0.00
4	$301 - $10,000	1	42.50	108.80	7,242.85	213.00	544.44	30,982.83
5	$10,001 - $100,000	1	167.57	428.95	16,799.57	0.00	0.00	0.00
6	$100,001 - $1,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
8	> $5,000,000	0	0.00	0.00	0.00	0.00	0.00	0.00
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1004) Total :	**8**	**210.07**	**537.75**	**24,622.42**	**213.00**	**544.44**	**31,502.83**

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
BRCH	Paper Birch	27	69.82	2,734.59	100.24	39.17	.00	.00	.00
MH	Mountain Hemlock	86	220.92	11,633.74	134.81	52.66	212.50	543.44	30,977.83
S	Spruce (R,W,B)	96	247.01	9,674.09	100.26	39.16	.50	1.00	5.00
	07 Fuelwood Total :	**210**	**537.75**	**24,042.42**	**114.45**	**44.71**	**213.00**	**544.44**	**30,982.83**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
04	Piece	HDWD	Hardwood - Other	10,000	500.00	10,000	500.00
			17 Non Conv. Total :		**500.00**		**500.00**

29 Limb/Bough

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	S	Spruce (R,W,B)	3,000	60.00	0	.00
			29 Limb/Bough Total :		**60.00**		**.00**

42 Mushrooms

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	50	10.00
			42 Mushrooms Total :		**10.00**		**10.00**

55 Other Plnt

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	PLNT	PLANTS	50	10.00	50	10.00

Region: R10, Alaska Region **Forest: 04 Chugach National Forest** (Continued)

PRODUCT & SPECIES **NON-CONVERTIBLE** (Continued)

55 Other Plnt (Continued)

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
			55 Other Plnt Total :		**10.00**		**10.00**

Cut and Sold (New) - CUTS203F

Cumulative FY 2019 Q1 to FY 2019 Q4 as of 2019 4th quarter

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/25/2019 03:44 PM

Region: R10, Alaska Region **Forest: 05 Tongass National Forest**

SIZE CLASS INFORMATION

Size Class	Size Class Description	Sold Number of Sales	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
0	Size Class = 0, in TSA backfeed	0	0.00	0.00	0.00	0.00	0.00	0.00
1	Non-convertible	1	0.00	0.00	13.40	0.00	0.00	13.40
3	< $300	35	112.58	211.99	1,754.96	106.51	199.12	1,425.85
4	$301 - $10,000	10	345.81	717.11	33,245.78	363.93	807.81	58,474.33
5	$10,001 - $100,000	3	3,217.30	12,153.26	91,750.65	1,081.46	2,528.03	70,470.68
6	$100,001 - $1,000,000	1	1,750.53	4,009.10	286,171.09	3,899.08	8,906.58	456,486.48
7	$1,000,001 - $5,000,000	0	0.00	0.00	0.00	3,495.42	8,383.71	174,895.00
8	> $5,000,000	0	0.00	0.00	0.00	2,062.66	4,343.85	-50,586.07
A	**ADDVOL Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
N	**NONTIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
P	**PRETIM Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
R	**RPLCMT Default Size Class	0	0.00	0.00	0.00	0.00	0.00	0.00
	Forest (1005) Total :	**50**	**5,426.22**	**17,091.46**	**412,935.88**	**11,009.06**	**25,169.10**	**711,179.67**

Region: R10, Alaska Region **Forest: 05 Tongass National Forest** (Continued)

PRODUCT & SPECIES - CONVERTIBLE

01 Sawtimber

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	1,622	4,370.33	5,843.81	3.60	1.34	4,946.16	11,333.97	30,078.55
RC	Western Red Cedar	943	2,286.75	262,819.82	278.70	114.93	2,373.17	5,717.03	454,972.44
SS	Sitka Spruce	2,714	10,141.41	135,167.87	49.80	13.33	1,890.79	3,659.03	278,202.42
YC	Alaska Cedar	48	107.22	8,098.48	167.84	75.53	1,700.39	4,273.33	119,796.54
	01 Sawtimber Total :	**5,328**	**16,905.71**	**411,929.98**	**77.32**	**24.37**	**10,910.51**	**24,983.36**	**883,049.95**

02 Pulpwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
HU	Western Hemlock Utility	0	.00	.00	.00	.00	.00	.00	.00
SSU	Sitka Spruce Utility	0	.00	.00	.00	.00	.00	.00	.00
	02 Pulpwood Total :	**0**	**.00**	**.00**	**.00**	**.00**	**.00**	**.00**	**.00**

07 Fuelwood

Species Code	Description	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Sold ($) Per (MBF)	Sold ($) Per (CCF)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
H	Western Hemlock	57	106.34	571.90	10.06	5.38	56.85	106.34	571.90
RC	Western Red Cedar	1	1.80	10.00	10.00	5.56	1.00	1.80	10.00
SS	Sitka Spruce	1	1.91	10.60	10.00	5.55	1.06	1.91	10.60
YC	Alaska Cedar	40	75.70	400.00	10.09	5.28	39.63	75.70	400.00
	07 Fuelwood Total :	**99**	**185.75**	**992.50**	**10.07**	**5.34**	**98.54**	**185.75**	**992.50**

PRODUCT & SPECIES NON-CONVERTIBLE

17 Non Conv.

UOM	Description	Species Code	Description	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
10	Lbs	MISC	MISCELLANOUS	268	13.40	268	13.40
			17 Non Conv. Total :		**13.40**		**13.40**

Cut and Sold (New) - CUTS203F

Cumulative FY 2019 Q1 to FY 2019 Q4 as of 2019 4th quarter

Report Type: Quarterly
Filter: All Sales ,All Sales

Run Date: 11/25/2019 03:44 PM

CONVERTIBLE PRODUCTS

Alaska

Forest	Sold Number	Sold Volume (MBF)	Sold Volume (CCF)	Sold Value ($)	Cut Volume (MBF)	Cut Volume (CCF)	Cut Value ($)
Chugach National Forest	2	210.07	537.75	24,042.42	213.00	544.44	30,982.83
Tongass National Forest	49	5,426.22	17,091.46	412,922.48	11,009.06	25,169.10	711,166.27
Alaska Sub Total :	**51**	**5,636.29**	**17,629.21**	**436,964.89**	**11,222.06**	**25,713.54**	**742,149.10**
All State Total :	**51**	**5,636.29**	**17,629.21**	**436,964.89**	**11,222.06**	**25,713.54**	**742,149.10**

NON-CONVERTIBLE PRODUCTS

Alaska

Forest	UOM	Description	Sold Number	Sold Quantity	Sold Value ($)	Cut Quantity	Cut Value ($)
Chugach National Forest	04	Piece	2	10,000.00	500.00	10,000	500.00
	10	Lbs	4	3,100.00	80.00	100	20.00
Tongass National Forest	10	Lbs	1	268.00	13.40	268	13.40
		Alaska Sub Total :	**7**		**593.40**		**533.40**
		All State Total :	**7**		**593.40**		**533.40**

Cut and Sold (New) - CUTS203F

Cumulative FY 2019 Q1 to FY 2019 Q4 as of 2019 4th quarter

NUMBER OF SALES MADE

Forest	Non Convertible Products	To $300	$301 To $10,000	$10,001 To $100,000	$100,001 To $1,000,000	$1,000,001 To $5,000,000	$5,000,001 and Over	Total Convertible Products	Total Number Of Sales
Chugach National Forest	6		1	1				2	8
Tongass National Forest	1	35	10	3	1			49	50
Region (R10, Alaska Region) Total :	**7**	**35**	**11**	**4**	**1**			**51**	**58**

REPORT LEGEND
Convertible Products

*** Legend for CUTS203 is Under Construction ***

Where Clause: Where (Region_Code = '10') and (report_date between to_date('10/01/2018 00:00:00','mm/dd/yyyy hh24:mi:ss') and to_date('09/30/2019 23:59:59','mm/dd/yyyy hh24:mi:ss')) and 1=1 and stewardship_indicator in ('N','Y') and good_neighbor_auth_indicator in ('N','Y') and (SNAPSHOT_FISCAL_YEAR = '2019' AND SNAPSHOT_QUARTER = '4')

Sorting Criteria:

End of Report

United States
Department
of Agriculture

Forest Service

Washington Office

November 2000

Forest Service Roadless Area Conservation

Final Environmental Impact Statement Volume 1

Acronyms and Abbreviations

ANILCA	Alaska National Interest Lands Conservation Act
ASQ	Allowable Sale Quantity
BBF	Billion board feet
BLM	Bureau of Land Management
BMP	Best Management Practices
CAET	Content Analysis Enterprise Team
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DEIS	Draft Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FEMAT	Forest Ecosystem Management Assessment Team
GIS	Geographic Information System
ICBEMP	Interior Columbia Basin Ecosystem Management Project
LUD	Land Use Designation (Tongass National Forest)
MMBF	Million board feet
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System (includes national forests and grasslands)
NOI	Notice of Intent
NMFS	National Marine Fisheries Service
OHV	Off-highway Vehicle
RARE	Roadless Area Review and Evaluation
RARE II	Second Roadless Area Review and Evaluation
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SAA	Southern Applachian Assessment
TEP	Threatened, Endangered, and Proposed
TEPS	Threatened, Endangered, Proposed, and Sensitive
TLMP	Tongass Land Management Plan
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

United States Department of Agriculture | Forest Service | Washington Office | 201 14th & Independence, SW
Post Office Box 96090
Washington, DC 20090-6090

File Code: 1950-3
Date: November 9, 2000

Dear Citizen:

I am pleased to present the Roadless Area Conservation Final Environmental Impact Statement. These volumes describe a strategy for conserving National Forest System inventoried roadless areas and their important values. They contain an analysis of management options and the Forest Service's preferred alternative. I expect to render a final decision on this matter in no sooner than 30 days.

I want to thank all those who participated in this rulemaking. The wealth of insights and experience they provided contributed to improvements in development of the proposal and the analysis of social, economic, and environmental effects.

I remain confident that taking action now to conserve roadless areas through this national effort will result in these lands providing lasting values for future generations. I appreciate your participation in achieving this goal.

Sincerely,

Mike Dombeck

MIKE DOMBECK
Chief

Forest Service Roadless Area Conservation
Final Environmental Impact Statement

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Abstract: The Forest Service is proposing new regulations to protect inventoried roadless areas within the National Forest System. This final environmental impact statement (FEIS) responds to strong public sentiment for protecting roadless areas and the clean water, biological diversity, dispersed recreational opportunities, wildlife habitat, forest health, and other public benefits provided by these areas. This action also responds to budgetary concerns and the need to balance management objectives with funding priorities. Public comments on the DEIS were considered in development of this FEIS in order to refine the scope of the decision to be made, verify significant issues, modify alternatives, identify possible mitigation measures, and direct the analysis of effects. The preferred alternative would prohibit road construction, reconstruction, and timber harvest except for stewardship purposes in all inventoried roadless areas. Implementation of the preferred alternative on the Tongass National Forest would begin in April 2004 to provide those communities in Southeast Alaska most impacted by the decision a transition period in which to adjust to possible economic changes that may result. Eight alternatives were fully developed and considered, including 4 sets of prohibited activities (including no action), and 4 alternative methods for applying the prohibitions to the Tongass. The procedural alternatives described in the DEIS are not included in this FEIS, since the decision was made to include procedures for roadless area conservation in the final rule for the Land and Resource Management Planning Regulations at 36 CFR 219.

Forest Service
Roadless Area Conservation

Final Environmental Impact Statement
Volume 1

Table of Contents

SUMMARY OF CHANGES BETWEEN DRAFT AND FINAL EIS XI

EXECUTIVE SUMMARY ES-1

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION..... 1-1

INTRODUCTION 1-1
BACKGROUND..... 1-5
PUBLIC REVIEW AND COMMENT ON THE DRAFT EIS AND ISSUES CONSIDERED 1-7
PURPOSE AND NEED..... 1-16
DECISION TO BE MADE 1-19
THE PROPOSED ACTION 1-19
OTHER RELATED PLANNING EFFORTS 1-20
ORGANIZATION OF THE DOCUMENT..... 1-23

CHAPTER 2. ALTERNATIVES CONSIDERED..... 2-1

INTRODUCTION 2-1
ALTERNATIVES CONSIDERED IN DETAIL..... 2-3
Prohibition Alternatives..... 2-5
Alternative 1..... 2-6
Alternative 2..... 2-6
Alternative 3..... 2-8
Alternative 4..... 2-9
Tongass National Forest Alternatives..... 2-11
Tongass Not Exempt..... 2-11
Tongass Exempt..... 2-12
Tongass Deferred..... 2-12
Tongass Selected Areas 2-13
The Preferred Alternative 2-15
ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY 2-17
COMPARISON OF ALTERNATIVES 2-27

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 3-1

OVERVIEW OF INVENTORIED ROADLESS AREAS 3-1
DEMOGRAPHIC TRENDS 3-7
BALANCING DEMANDS 3-16
ACTIVE AND PASSIVE FOREST MANAGEMENT 3-19
EFFECTS OF THE PROHIBITION ALTERNATIVES 3-21
National Forest System Roads 3-21
Access 3-39
Ecological Factors 3-42
Physical Resources 3-44
Water Quantity and Timing 3-46
Water Quality and Drinking Water Source Areas 3-49
Channel Morphology 3-54
Soil Loss, Sedimentation, and Site Productivity 3-55
Landslides 3-58
Air Resources 3-62
Forest Health and Fire Ecology 3-72
Fuel Management 3-76
Fire Suppression 3-97
Burned Area Emergency Rehabilitation 3-117
Insects and Disease 3-118
Biodiversity 3-123
Ecoregions 3-126
Fragmentation 3-128
Size Considerations 3-136
Elevation Distribution 3-141
Terrestrial Animal Habitat and Species 3-142
Aquatic Animal Habitat and Species 3-160
Terrestrial and Aquatic Plant Species 3-173
Threatened, Endangered, Proposed, and Sensitive Species 3-179
Research, Monitoring, and Reference Landscapes 3-191
Human Uses 3-193
Timber Harvest 3-193
Recreation 3-207
Dispersed Recreation Activities 3-208
Developed and Road-based Recreation Activities 3-216
Recreation Special Uses 3-222
Dispersed Recreation Activities 3-222
Developed and Road-based Recreation Activities 3-225
Scenic Quality 3-228
Heritage Resources 3-232
Wilderness 3-237
Other Special Designated Areas 3-242
Real Estate Management 3-247
Boundary Management and Landownership Adjustments 3-247
Access to Non-Federal Ownership within the National Forest System 3-248

Non-recreation Special Uses 3-249
Minerals and Geology 3-252
Locatable Minerals 3-253
Leasable Minerals 3-254
Salable Minerals 3-260
Abandoned and Inactive Mines 3-261
Geological and Paleontological Resources 3-262
Social and Economic Factors 3-264
Non-commodity Values 3-265
Recreation, Scenic Quality,Wilderness, and Recreation Special Uses 3-271
Hunting and Fishing 3-280
Livestock Grazing 3-287
Non-timber Forest Products 3-290
Timber Harvest 3-295
Energy and Non-energy Minerals 3-308
Road Construction 3-324
Forest-dependent Communities 3-326
Local Involvement 3-351
American Indian and Alaska Native Issues 3-352
Civil Rights and Environmental Justice 3-355
Agency Costs 3-362
EFFECTS OF THE TONGASS NATIONAL FOREST ALTERNATIVES 3-371
SUMMARY OF CUMULATIVE EFFECTS 3-392
Effects of the Prohibition Alternatives Across Resources 3-392
Other Federal Policies 3-396
National Forest Management Act Planning Regulations 3-397
Forest Service Transportation Policy 3-397
Unified Federal Policy 3-399
Report to the President on the Wildland Fires of 2000 3-399
Cohesive Strategy 3-400
Forest Service Strategic Plan 3-401
Sierra Nevada Framework 3-401
Interior Columbia Basin Ecosystem Management Project 3-402
Lynx and Other Listings by the U.S. Fish and Wildlife Service 3-402
Land Management Planning 3-403
SHORT-TERM USES AND LONG-TERM PRODUCTIVITY 3-403
UNAVOIDABLE ADVERSE EFFECTS 3-404
MITIGATION OPTIONS 3-404
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES 3-406
OTHER REQUIRED DISCLOSURES 3-406

CHAPTER 4. CONSULTATION AND COORDINATION 4-1

PUBLIC INVOLVEMENT 4-1
PREPARERS AND CONTRIBUTORS 4-5
DISTRIBUTION OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT 4-15

APPENDIX A: Inventoried roadless area acreage summarized by State, region, and forest A-1

APPENDIX B: State-by-State summaries of key information for the preferred alternative. B-1

APPENDIX C: Summary of threatened, endangered, proposed and sensitive species..... C-1

APPENDIX D: Civil rights impact analysis population distribution maps D-1

APPENDIX E: Tongass National Forest land and resource management plan Prescriptions in Tongass Selected Areas Alternative E-1

GLOSSARY G-1

REFERENCES CITED R-1

INDEX..... X-1

List of Tables

Table 1-1. Comparison of related Forest Service rulemaking efforts. 1-21
Table 2-1. Comparison of key characteristics and effects by prohibition alternatives. 2-24
Table 2-2. Comparison of key characteristics and effects by Tongass National Forest alternatives. 2-33
Table 3-1. Summary of inventoried roadless areas. 3-4
Table 3-2. Past and projected United States population, by multi-State regions of the United States. 3-8
Table 3-3. Estimated 2000 United States population relative to inventoried roadless areas by geographic region. 3-11
Table 3-4. Amount of non-Federal land developed between 1982 and 1997. 3-13
Table 3-5. Miles of existing National Forest System roads by Forest Service region 3-25
Table 3-6. Miles of planned timber-related road construction activities, 2000-2004. 3-30
Table 3-7. Planned miles of non-timber-related road construction activities including estimates for roads under Forest Service jurisdiction, other public roads, and private roads in inventoried roadless areas, 2000-2004 (Alternatives 2 through 4)..... 3-32
Table 3-8. Planned miles of classified and temporary roads by resource area that would be prohibited under Alternatives 2 through 4 (2000-2004). 3-33
Table 3-9. States with more than 100,000 acres of inventoried roadless areas, with high landslide susceptibility..... 3-61
Table 3-10. Inventoried roadless areas near Class I air quality areas. 3-63
Table 3-11. Fire regime grouping based on coarse-scale data. 3-79
Table 3-12. Condition classes based on vegetation composition and structure conditions. 3-81
Table 3-13. Acres at risk from uncharacteristic wildfire effects for Condition Classes 1 through 3 in Fire Regimes I through V, excluding Alaska. 3-83
Table 3-14. Potential treatment areas, in thousands of acres, by State 3-85
Table 3-15. Potential treatment acres for Condition Classes 1 through 3 in Fire Regimes I and II on all National Forest System lands and in inventoried roadless areas, excluding Alaska. 3-86
Table 3-16. Percentage of land by ambient population density class within 1 mile of inventoried roadless area boundaries. 3-88
Table 3-17. Percentage of land by ambient population density class within 5 miles of inventoried roadless area boundaries 3-88
Table 3-18. Lightning- and human-caused fire occurrence by Forest Service region in essentially roadless and esssentially roaded National Forest System lands, 1986-1996 3-104
Table 3-19. Fire occurrence for human-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996. 3-105

Table 3-20. Fire occurrence for lightning-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996. ... 3-107
Table 3-21. Fire occurrence for large fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986-1996. ... 3-108
Table 3-22. Average size in acres of large fires by Forest Service region on National Forest System lands, 1986-1996. ... 3-109
Table 3-23. Comparative summary of direct and cumulative effects on fuel management under all alternatives by primary components ... 3-114
Table 3-24. Comparison between Federal land, State land, and inventoried roadless areas of annual average fire occurrence and annual acres burned ... 3-115
Table 3-25. Acres of inventoried roadless areas at combined risk of insect, disease, and fire ... 3-119
Table 3-26. Ecoregion area and protected status of inventoried roadless, Wilderness, and other special designated areas ... 3-130
Table 3-27. Increased protection for ecoregions under Alternative 2 prohibitions ... 3-132
Table 3-28. Relative impact of management activities on fragmentation and connectivity. ... 3-134
Table 3-29. Inventoried roadless areas adjacent to existing Wilderness. ... 3-137
Table 3-30. Acres of inventoried roadless areas within Grizzly Bear Recovery Areas. ... 3-140
Table 3-31. Distribution of inventoried roadless areas and Wilderness Areas by elevation class and geographic division. ... 3-143
Table 3-32. Total planned timber offer and miles of road construction and reconstruction for all activities through 2004, by alternative. ... 3-146
Table 3-33. Inventoried roadless areas in ICBEMP priority and high-priority watersheds. ... 3-162
Table 3-34. Pacific anadromous fish habitat in inventoried roadless areas ... 3-162
Table 3-35. Estimated number of established nonnative species in the United States. ... 3-174
Table 3-36. Estimated number and percent of threatened, endangered, proposed, and sensitive species within each Forest Service region affected by inventoried roadless areas. ... 3-180
Table 3-37. Estimated acres of forestland suitable for timber production in inventoried roadless areas, by Forest Service region. ... 3-195
Table 3-38. Changes in allowable sale quantity in recent land management plan revisions. ... 3-196
Table 3-39. National trends in National Forest System timber sale program. ... 3-198
Table 3-40. Projected timber offer and planned road construction in inventoried roadless areas for 5 years, by Forest Service region ... 3-200
Table 3-41. Recreation opportunity spectrum activity characterization. ... 3-209
Table 3-42. Recreation opportunity spectrum size criteria. ... 3-210
Table 3-43. Recreation opportunity spectrum setting characterization. ... 3-211
Table 3-44. Recreation opportunity spectrum remoteness criteria. ... 3-212
Table 3-45. Recreation opportunity spectrum experience characterization. ... 3-213
Table 3-46. Recreation opportunity spectrum social setting criteria. ... 3-216

Table 3-47. Recreation opportunity spectrum managerial setting criteria. 3-217
Table 3-48. Recreation opportunity spectrum evidence of human criteria. 3-218
Table 3-49. Special designated areas on National Forest System lands. 3-244
Table 3-50. Potential oil and gas resource acreage in inventoried roadless areas by Forest Service regions in the Rocky Mountain area. 3-255
Table 3-51. Known coal resources or reserves in inventoried roadless areas by forest 3-257
Table 3-52. Known phosphate resources in inventoried roadless areas by forest..... 3-258
Table 3-53. Number of Americans participating in outdoor recreation activities available on National Forest System lands, 1982-1983 and 1994-1995 3-271
Table 3-54. Acres of Wilderness and inventoried roadless areas available for Outdoor Adventure Activities in the lower 48 States, by Resources Planning Act assessment region 3-274
Table 3-55. Acres available for recreation on State and Federal lands, by Resources Planning Act assessment region 3-275
Table 3-56. Total average annual jobs, income, receipts, and Payments to States associated with timber harvest from National Forest System lands under Alternative 1 3-297
Table 3-57. Average volume harvested for commodity purposes and average net revenue per thousand board feet harvested 3-298
Table 3-58. Average annual harvest volume reductions in inventoried roadless areas associated with national prohibitions 3-300
Table 3-59. Estimated average annual economic impacts from a national Prohibition on road construction in inventoried roadless areas, Alternative 2..... 3-301
Table 3-60. Estimated average annual economic impacts from national prohibitions on road construction and commodity-purpose timber sales in inventoried roadless areas, Alternative 3 3-301
Table 3-61. Estimated average annual economic impacts from national prohibitions on road construction and all timber harvest in inventoried roadless areas, Alternative 4 3-302
Table 3-62. Percent change in timber harvest levels between 1990 and 1995 on all ownerships 3-303
Table 3-63. Estimated net revenue associated with reduced commodity harvest in inventoried roadless areas 3-304
Table 3-64. Estimated annual effects of harvest reductions in inventoried roadless areas on jobs, income, and Payments to States over the long-term..... 3-304
Table 3-65. Production of selected minerals from National Forest System lands in 1999 3-309
Table 3-66. Employment and labor income attributable to mineral production from National Forest System lands in fiscal year 1999 3-311
Table 3-67. Fiscal year 1999 United States Treasury receipts and Payments to States/Counties from mineral activities on National Forest System lands 3-311

Table 3-68. Annual economic impacts of prohibitions on road construction and reconstruction in inventoried roadless areas for selected mineral commodities and national forests 3-316
Table 3-69. Estimates at the 50th percentile of undiscovered resources of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas 3-318
Table 3-70. Estimates at the 50th percentile of the number of undiscovered deposits and the value of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas 3-319
Table 3-71. Mean estimates of undiscovered technically recoverable conventional resources of crude oil and natural gas for provinces containing inventoried roadless areas 3-320
Table 3-72. Estimates of coal resources, in million short tons, in the northern Rocky Mountains and Great Plains regions in Counties containing inventoried roadless areas 3-320
Table 3-73 Total jobs associated with average annual road construction and reconstruction for estimated timber harvest and planned activities in inventoried roadless areas 3-325
Table 3-74 Jobs affected by prohibitions on road construction and reconstruction in inventoried roadless areas 3-326
Table 3-75 National Forest System administrative units and communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years 3-331
Table 3-76. Resilience of Counties containing communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years 3-336
Table 3-77. Forest Service jobs potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years 3-342
Table 3-78. National Forest Counties that are also mining-dependent Counties 3-347
Table 3-79. Resilience of Counties containing a sample of communities potentially affected by prohibitions on road construction and on reconstruction leasable mineral exploration and development in the next 5 years 3-350
Table 3-80. Estimated average annual economic impacts from Tongass alternatives 3-381
Table 3-81. Tongass National Forest land-use designations by road construction prohibitions 3-384

List of Figures

Figure 1-1a. Inventoried roadless areas on National Forest System lands, Western United States 1-2
Figure 1-1b. Inventoried roadless areas on National Forest System lands, Eastern United States 1-3
Figure 3-1. Location of National Forest System lands by Forest Service region 3-2
Figure 3-2. Major categories of National Forest System land designations 3-3
Figure 3-3. Size and number of inventoried roadless areas by geographic region 3-5
Figure 3-4. Cities with more than 50,000 people within 60 miles of an inventoried roadless area 3-6
Figure 3-5. Multi-State regions used for population analysis 3-9
Figure 3-6. Distribution of the 1990 United States population relative to inventoried roadless areas 3-10
Figure 3-7. Geographic distribution of land development in the United States between 1982 and 1997 3-14
Figure 3-8. Miles of forest roads constructed from 1944 to the late 1990s 3-21
Figure 3-9. Types of vehicle use on National Forest System roads 3-23
Figure 3-10. Annual road maintenance costs 3-23
Figure 3-11. Types of road surfaces on roads that are open to public use on National Forest System lands 3-25
Figure 3-12. Typical National Forest System gravel road 3-26
Figure 3-13. Trends in road construction, reconstruction, and decommissioning for National Forest System roads 3-27
Figure 3-14. Range of possible National Forest System road miles based on funding .. 3-36
Figure 3-15. Impaired watersheds that contain inventoried roadless areas 3-51
Figure 3-16. Watersheds containing drinking water source areas within inventoried roadless areas on National Forest System lands 3-52
Figure 3-17. Areas with greatest soil loss and sedimentation potential 3-57
Figure 3-18. Generalized landslide susceptibility map for inventoried roadless areas. 3-60
Figure 3-19. Class I air quality protection areas 3-64
Figure 3-20. Photos taken at the same location over 71 years illustrate changes in condition class and vegetative structure due to wildfire exclusion 3-82
Figure 3-21. Potential risk from uncharacteristic wildland fire effects for inventoried roadless areas by Forest Service region in Condition Classes 1-3 and Fire Regimes I-V 3-86
Figure 3-22. Map of inventoried roadless areas overlaid with ambient population density near Tucson, Arizona 3-89
Figure 3-23. Acres burned by wildland fire on National Forest Systems lands, 1910 to September 14, 2000 3-100
Figure 3-24. Number and acres burned by large wildland fires on National Forest System lands, 1984 to 1995 3-100
Figure 3-25. Historical fire suppression costs 3-103
Figure 3-26. Ecoregions of the United States 3-129
Figure 3-27. Size class distribution of protected inventoried roadless areas under Alternative 1 3-137

Figure 3-28. Acreage of large protected areas in the Western United States from combining inventoried roadless areas and adjacent Wilderness 3-138
Figure 3-29. Example of inventoried roadless area contributions to the integrity of Grizzly Bear Recovery Areas 3-139
Figure 3-30. Size class distribution of protected inventoried roadless areas under Alternative 2 3-140
Figure 3-31. Long-term trend in volume of timber harvested from the national forests 3-198
Figure 3-32. Forest Service mineral production as a percentage of total United States production, 1998 3-309
Figure 3-33. Comparison of Alaska and Tongass National Forest to continental United States at equal scales 3-372

SUMMARY OF CHANGES BETWEEN DRAFT AND FINAL EIS

A number of changes, corrections, and clarifications to the Roadless Area Conservation Draft Environmental Impact Statement (DEIS) have been made based on public comments. The most notable changes are summarized by chapter. Minor edits and corrections are not included in this list.

Preface Material

- A list of abbreviations and acronyms commonly used in the FEIS has been added to the inside front cover of each volume.
- A summary of changes from the Roadless Area Conservation DEIS has been included.

Summary

- The stand-alone Summary of the DEIS has been updated and revised to reflect the Final Environmental Impact Statement (FEIS).
- An Executive Summary has been prepared for Volume 1 that identifies key information and components of the FEIS.

Chapter 1

- The Purpose and Need section has been expanded.
- The Public Involvement and Issues Considered section has been updated to reflect public comments and Agency reviews, and the decision made in the final Planning Regulations regarding procedures.

Chapter 2

- Standard provisions that would apply to any selected alternative concerning existing permits and contracts, land management plan amendments and revisions, and decisions made prior to issuance of a final rule, have been added.
- Alternatives no longer would apply to the “unroaded portion of an inventoried roadless area,” but to all NFS lands within an inventoried roadless area boundary.
- The description of timber harvest methods and practices (including types of equipment, skid trails, etc.) allowed under each prohibition alternative has been expanded and clarified.
- A discussion of road maintenance activities allowed under each prohibition alternative, as opposed to prohibited reconstruction activities, has been added.
- An exception to the prohibitions has been added to Alternative 4 that would allow timber harvest when necessary to improve or protect habitat for threatened, endangered, and proposed species.
- The procedural alternatives described in the DEIS have been removed from the FEIS because of the decision to incorporate the procedures in the final Planning Regulations.

- The Tongass alternatives have been modified and renamed as a result of the decision to incorporate the procedures in the final Planning Regulations.
- Application of the proposed rule to State Highways has been clarified, and included as an exception requiring approval by the Secretary of Agriculture.
- A possible exception to the prohibition alternatives that would allow road construction for mineral leasing activities has been added.
- A possible exception to the prohibition alternatives that would allow roads to be constructed in inventoried roadless areas to address road safety improvements based on accident potential or experience has been added.
- A possible exception to the Tongass Not Exempt alternative that would implement the prohibitions in April 2004 to provide a transition period for communities in Southeast Alaska that may experience economic changes as a result of the final rule has been added.
- The Alternatives Considered but Eliminated from Detailed Study section has been expanded.
- The Alternative Comparison tables have been revised for clarity and updated with new information.

Chapter 3

- The introduction has been revised to include an expanded discussion of demographic trends and balancing demands, and a new section describing active and passive forest management.
- Data related to miles of road construction and reconstruction have been updated, and estimates of roads closed after use have been revised.
- A discussion regarding temporary roads has been added.
- Sections describing the cumulative effects of the alternatives have been expanded for all resources.
- All sections have been revised to better explain the appropriate scale of analysis for national level proposals vs. site-specific projects.
- The section on air quality has been expanded to include discussions of the effects of road construction, timber harvest, and fire on global climate change and carbon sequestration.
- The section on the effects of fire on watershed health and emergency rehabilitation has been expanded and updated, with special attention to the current fire season.
- A new section on Fire Ecology has been added.
- Discussion of the environmental benefits of building roads has been expanded in resource sections when appropriate.
- The section regarding existing levels of protection provided through current forest plans has been expanded and clarified.
- Discussion of non-native invasive plants has been expanded.
- Additional discussion on effects to game species has been included.
- Additional discussion of the beneficial effects of timber harvest and road construction for some species has been added.
- Discussion of late successional habitat has been added.
- The effects of fire suppression and uncharacteristic, large-scale, high-intensity fire on species and their habitats has been expanded.
- A discussion of the effects of temporary road construction, use, and decommissioning on aquatic and terrestrial species has been added.
- The section on ecological effects and implications of the alternatives upon the Agency's Cohesive Strategy for prescribed fire has been expanded, including that of active vs. natural approaches to fuels management.

- Additional analysis and discussion of the interactions resulting from the Interior Columbia Basin assessment and the Cohesive Strategy on inventoried roadless areas has been included.
- The analysis of effects on timber harvest has been expanded from a discussion on volumes to include number of acres treated (or not treated).
- Additional discussion has been added regarding allowable sale quantity (ASQ) and suitable acres for timber harvest.
- Additional discussion has been added regarding substitution of private land timber volume for public land supplies, as well as imports from other countries.
- A new section has been added that describes "special designated areas," including a table of names, categories, and acreages.
- The section on the Recreation Opportunity Spectrum (ROS) has been expanded to more fully describe what it is and how it is used.
- The section on non-recreation special uses, including authorizations and easements, has been expanded and clarified.
- The section on RS2477 roads has been expanded and clarified.
- The discussion of the need for and impacts of temporary roads in mineral exploration has been expanded.
- The section on valid existing rights in the DEIS, as it relates to mineral exploration and development, has been clarified to address reasonable access.
- The section on leasable minerals, including coal and phosphate, has been expanded.
- A new section dealing with public access to NFS lands from a social perspective has been added.
- The section on wildland values has been revised and relabeled as "non-commodity values."
- A new section dealing with American Indian and Alaska Native concerns has been added.
- The discussion of American Indians has been removed from the Civil Rights and Environmental Justice section.
- A discussion of social and economic cumulative effects has been added.
- The discussion of social effects related to changes in timber harvest levels has been expanded and clarified.
- A discussion of the social effects of mining activities on rural communities has been added.
- A discussion of land conversion from rural to non-rural uses has been added.
- New population tables showing projections for the analysis periods of 5, 20, and 40 years have been included.
- A section has been added that discusses timber volume within inventoried roadless areas of the Tongass National Forest in the context of overall volume available for harvest and market demand projections.
- The section describing the combined cumulative effects of the prohibition alternatives on physical, biological, social, and economic resources has been expanded, with specific reference to benchmark dates.
- The section describing the combined effects of the several concurrent rulemaking efforts has been expanded to include discussions of the following: Planning Regulations, Roads Policy, Sierra Nevada Framework, Interior Columbia Basin, lynx and other threatened and endangered species, Cohesive Fire Strategy, Report to the President on the Wildland Fires of 2000, Unified Federal Policy (water), Forest Service Strategic Plan, and individual Forest Plans.

Chapter 4

- The section on public involvement has been updated to include a discussion of the public meetings for the DEIS, and the process of responding to comments (see also Volume 3).
- The list of preparers and contributors has been updated.
- The list of government agencies receiving copies of the FEIS has been updated.

Appendices

- Appendix A – (Proposed Rule in the DEIS) now contains the updated Inventoried Roadless Area Acreage Summarized by State, Region, and Forest (formerly Appendix B).
- Appendix B now contains State-by-State Summaries of Key Information for the Preferred Alternative (new material).
- Appendix C – Summary of Federally Listed Threatened, Endangered, and Proposed Species, has been updated.

Glossary

- Definitions have been revised for clarity and consistency, and new definitions have been added. First use of a term in each chapter has been highlighted in bold typeface.

References Cited

- Some references have been revised, and many references have been added.

Index

- New topic areas have been added.
- Page numbers have been updated.

Volume 2

- Updates and corrections have been made to the State and forest maps of inventoried roadless areas. Refer to Volume 2 for a more complete description of the changes (222 pages).

Volume 3

- A new volume, Response to Public Comments, has been prepared (over 1,200 consolidated concerns and their corresponding responses, 216 pages).

Volume 4

- A new volume, Letters from Federal, State, and Local Agencies and Elected Officials, has been prepared (1,400 scanned letters, reduced and printed landscape, 678 pages).

EXECUTIVE SUMMARY

Purpose and Need

Inventoried roadless areas comprise 58.5 million acres, or 31% of National Forest System (NFS) lands. These areas possess social and ecological values and characteristics that are becoming scarce in an increasingly developed landscape. While NFS inventoried roadless areas represent about 2% of the total landbase of the United States, they provide significant opportunities for dispersed recreation, large relatively undisturbed landscapes that provide privacy and seclusion, and are often sources of water that communities treat and distribute for public use. In addition, these areas provide a bulwark against the spread of invasive species, often provide important habitat for rare plant and animal species, conserve biological diversity, and provide opportunities for study, research, and education.

The Forest Service has the responsibility for resource use and conservation on all NFS lands. The public has expressed great interest in the conservation of roadless areas, and in recent years, roadless area management has been a major point of conflict in the adoption of land management plans on many forests and grasslands. Given the many benefits provided by these areas and the history of controversy surrounding their management, the Agency has determined that there is a need for national level rulemaking to conserve inventoried roadless areas.

The purpose of this action is to immediately stop activities that pose the greatest risks to the social and ecological values of inventoried roadless areas. To respond to this purpose and need, the Forest Service decided to limit the scope of the action to road construction, reconstruction, and timber harvest. These activities were selected because they occur on forests and grasslands throughout the nation, have the greatest likelihood of altering landscapes, often cause significant landscape fragmentation, and often result in immediate, long-term loss of roadless characteristics. In addition, the Forest Service developed alternatives ways for the Tongass National Forest because of its unique social and economic conditions.

Public Comment

To initiate a rulemaking on roadless area conservation, the Forest Service published a Notice of Intent (NOI) on October 19, 1999. The public provided over 517,000 comments on the scope of the initiative. On May 10, 2000, the Forest Service released a proposed rule and draft environmental impact statement (DEIS) on which the public provided over 1.1 million responses.

Using these comments, the Forest Service identified and summarized 6 major issue categories:

1. Public access;
2. Identification of other unroaded areas;
3. Exemptions and exceptions;
4. Environmental effects;
5. Local involvement; and
6. The effect on communities with strong natural resource affiliations.

A variety of opinions were expressed in each of these categories. For example, under Public Access, some suggested national prohibitions should be applied to all or certain activities in inventoried roadless areas while others advocated that decisions on access be made at the local level. These issues were used to guide the process in one or more of the following ways:

- To determine the scope of the proposal;
- To develop a range of alternatives;
- To direct the analysis of potential environmental, social and economic effects;
- To identify possible mitigation; and
- To ensure that the Agency is operating within legal authorities.

Based upon public comment and further analysis, the Forest Service developed and analyzed a number of alternatives.

Alternatives Considered

Public comments and the purpose and need led the Forest Service to develop the two sets of alternatives this final environmental impact statement (FEIS).[1] The first set includes four prohibition alternatives, including No Action, that cover the range of prohibited activities in inventoried roadless areas. The second set includes four alternative ways to apply the prohibitions to the Tongass National Forest.

The Agency also developed a third set of alternatives (procedural Alternatives A through D) in the DEIS. Analysis of comments on the DEIS for the Roadless Rule showed that there was confusion about how the procedural alternatives would be implemented. Public comments on the proposed Planning Regulations and Agency comments on the DEIS for the Roadless Rule also suggested that the procedures for roadless area protection were best suited for the Planning Regulations. Upon review, most of the roadless area characteristics identified in the DEIS and proposed Roadless Rule were similarly required by the Planning Regulations. Therefore, the Forest Service determined that the procedures contemplated in the Roadless Rule should be an explicit part of the plan revision process, and addressed them at 36 CFR 219.9(b)(8) of the final Planning Regulations. By making small changes to the Planning Regulations, the procedural alternatives discussed in the DEIS were not needed as a part of the Roadless Rule and were removed from the FEIS.

[1] The Forest Service also examined a number of other alternatives, but they were eliminated from detailed study for a variety of reasons. See Chapter 2.

Prohibition Alternatives

Alternative 1
No Action; No Prohibitions
Alternative 2
Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas
Alternative 3
Prohibit Road Construction, Reconstruction and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas
Alternative 4
Prohibit Road Construction, Reconstruction and All Timber Cutting Within Inventoried Roadless Areas

There are certain exceptions that apply to all the alternatives. These include situations where the responsible official may authorize road construction or reconstruction in an inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; or
- Realignment is needed to prevent irreparable resource damage by a classified road. The road must be deemed essential for public or private access, natural resource management, or public health and safety, and the resource damage associated with the road cannot be corrected by maintenance.

Several other optional exceptions were developed to mitigate the economic and social effects of the prohibition alternatives. Under these optional mitigation measures, if included in the final rule, road construction and reconstruction in any inventoried roadless area may be authorized when:

- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential;
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code is in the public interest or consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists; or
- A road is needed for prospective mineral leasing activities in inventoried roadless areas.

In conjunction with, but independent of this rule the Chief of the Forest Service intends to work with affected States and communities and to pursue funds to help them respond to economic changes that may result from implementation of the final Roadless Rule in the following ways:

- Provide financial assistance to stimulate local planning and plan implementation of community-led transition programs and projects in communities most affected by changes in roadless area management;
- Through financial support and action plans, attract public and private interest, both financial and technical, to aid in successfully implementing local transition projects and plans by coordinating with other Federal and State agencies; or
- Assist local, State, Tribal and Federal partners to work with communities most affected by the final roadless area decision.

Tongass Alternatives

Tongass Not Exempt
Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest

Tongass Exempt
Alternative Selected for the Rest of National Forest System Lands Would Not Apply to the Tongass National Forest

Tongass Deferred
No Alternative Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas on the Tongass as Part of the 5-Year Plan Review

Tongass Selected Areas
Prohibit Road Construction and Reconstruction in Old Growth Habitat, Semi-Remote Recreation, and Remote Recreation Land Use Designations, and LUD IIs[2] *within Inventoried Roadless Areas on the Tongass*

Under a mitigation measure developed as part of the Tongass Not Exempt alternative, the final rule may delay implementation of any prohibition alternatives on the Tongass National Forest until 2004 as an economic mitigation measure to ease the transition for communities most affected by changes in management of inventoried roadless areas.

[2] The LUD II designation is assigned to 12 areas that were allocated for special management by the Tongass Timber Reform Act. The desired condition in these areas is that of an extensive and generally unmodified natural environment that retains its original wildland character.

Environmental Consequences

Effects of The Prohibition Alternatives

Effects of the prohibition alternatives are summarized in Chapter 2, Table 2-1, and fully explained in Chapter 3 of this FEIS. Under the No Action Alternative (1), no rule prohibiting activities in inventoried roadless areas would be issued. Current management plans would continue to guide forest and grassland management. This alternative allows the most road construction, reconstruction, and timber harvest of all the alternatives. Over the next five years, 232 miles of road per year are planned to be constructed and reconstructed in inventoried roadless areas; 125 miles of these are planned for timber harvest purposes. The planned timber offer from inventoried roadless areas under this alternative is 220 million board feet, or 7% of the 3.3 billion board feet offered per year on all NFS lands. Of that 220 million board feet, 147 million board feet is expected to be purchased and harvested.

Road construction, reconstruction and timber harvest would lead to further roadless area fragmentation and loss of roadless characteristics. This may also have adverse effects on water quality and quantity, native plant and animal habitat, and dispersed recreation opportunities available to the public. Furthermore, this alternative could also lead to a loss of non-commodity values such as ecological values associated with ecosystem health and spiritual or aesthetic values such as one’s ability to experience solitude and personal renewal in wild areas.

At the same time, the No Action Alternative allows the most opportunities for stewardship activities that require road building to control insects and disease and reduce fuel loads, although the Forest Service plans to focus most treatment activities in areas that are already roaded. In addition, this alternative allows continuation of planned timber offer thereby avoiding any adverse economic impacts to communities dependent on timber harvest-related jobs in inventoried roadless areas.

Alternative 2 prohibits all road construction and reconstruction in inventoried roadless areas. Planned road miles would be reduced by 75%, with the remainder still allowed under the exceptions. Lack of road construction would decrease the projected timber harvest in inventoried roadless areas from 147 to 39 million board feet per year. This alternative would result in a one-time loss of 607 timber-related jobs and an associated $27.8 million in personal income per year. Alternative 2 would also have an effect on the number of planned stewardship activities in inventoried roadless areas to control insects and disease and reduce fuel loading, since roads may not be built to access areas for these purposes. This prohibition on road construction would limit the amount of future habitat fragmentation in these areas, have positive effects on biodiversity, water quality, and maintain current opportunities for dispersed recreation. Alternative 2 would also benefit spiritual and aesthetic values associated with inventoried roadless areas.

Alternative 3 would prohibit all road construction, reconstruction and non-stewardship timber harvest in inventoried roadless areas. However, since a large amount of timber harvest would already be foregone due to the road building prohibition, the effects of this combination would not be substantially different from the effects under Alternative 2. Timber harvest volume would be reduced from 147 to 20 million board feet per year. An additional 123 timber-related jobs and $5.3 million per year in personal income would be affected under this alternative compared to Alternative 2. This alternative would provide some incremental environmental benefits to watershed, air, and native plant and animal resources, since it allows only stewardship timber harvest. It may also provide additional dispersed recreation opportunities and protection of non-commodity values. There would be an anticipated incremental increase in the adverse social and economic impacts under this alternative compared to Alternative 2 due to the elimination of non-stewardship timber harvest.

Alternative 4 would prohibit all road construction, reconstruction and timber cutting for any purpose in inventoried roadless areas, with the sole exception of harvest needed for protection or recovery of threatened, endangered, or proposed species.[3] Under this alternative, no timber would be harvested and 886 timber-related jobs and $39.5 million per year in personal income would be affected. Limited tree cutting could occur incidental to other management activities, such as personal use firewood and Christmas trees, trail construction, hazard tree removal, fire line construction and maintenance of property boundaries. This alternative would result in additional but small increases in both environmental benefits and adverse social and economic impacts over Alternative 3, since all timber cutting would be prohibited. The potential also exists for some adverse environmental effects due to restrictions on stewardship harvest that may be needed for habitat restoration.

Effects of the Tongass Alternatives

Effects of the Tongass alternatives are summarized in Chapter 2, Table 2-2, and fully explained in Chapter 3 of the FEIS. Under the Tongass Exempt alternative, the Tongass would be exempt from the final Roadless Rule, and land management activities would continue as outlined in the 1999 Record of Decision for the Tongass Land Management Plan (TLMP). Projected risks to ecosystem health would remain unchanged, human uses would continue at levels projected under the TLMP, and social and economic values would be affected as described within the current TLMP. Under the current TLMP, the total projected timber offer within inventoried roadless areas on the Tongass is 108 million board feet per year, requiring 58 miles of road construction and reconstruction annually. Of the 108 million board feet, approximately 77 million board feet would be harvested each year. About two-thirds of the Forest’s planned timber volume offered in the next 5 years

[3] It is not anticipated that the exception for TEP species would be used frequently or for large-scale projects, but rather for conservation of specific habitat components necessary for conued species viability where a clear need is identified.

would be from inventoried roadless areas. This volume is approximately half of the total planned offer volume within inventoried roadless areas nationally.

Under the Tongass Not Exempt alternative, the alternative selected for other NFS lands would apply to the Tongass National Forest. The effects of implementing any of the prohibition alternatives would be more dramatic on the Tongass than other national forests or grasslands, since more roading in inventoried roadless areas is projected to occur on the Tongass than elsewhere. Under an optional mitigation measure developed for this alternative, the final rule may delay implementation of any prohibition alternatives on the Tongass until April 2004 to ease the transition for communities most affected by economic changes that may result from the final rule. For the various resources, no relevant differences in effects were identified among prohibition Alternatives 2, 3 and 4.

Applying Alternative 2, 3, or 4 would reduce risks to old growth ecosystems, species viability, and diversity, and would lower risk to fish and wildlife species that are valued for recreational hunting, fishing, and viewing and for subsistence. Similarly, the wild and unspoiled nature of many inventoried roadless areas would be maintained, thus conserving the remote and semi-remote recreational opportunities that are commonly sought on the Tongass. Application of any of these alternatives would also benefit those who value these areas for passive use values.

Prohibitions, however, would have substantial effects on the Forest's timber program and timber-related industry in Southeast Alaska, potentially resulting in a harvest reduction of 73 to 77 million board feet per year. Communities where the timber industry continues to be a cornerstone of the economy and where the Agency has a strong presence would especially be at risk of economic decline. The effect of applying Alternatives 2, 3, or 4 to the Tongass would be an estimated one-time loss of 364 to 383 timber-related jobs and an associated $16.7 to $17.6 million per year in personal income in Southeast Alaska. Additional impacts could occur from losses in Forest Service employment of 141 directly-related jobs and $7.1 million per year in personal income.

The Tongass Deferred alternative postpones the decision regarding prohibitions on the Tongass to the local level at the time of the 5-year Plan Review in April 2004. At such time an evaluation of inventoried roadless areas on the Tongass would be completed to determine whether road construction and reconstruction should be prohibited in inventoried roadless areas of the Tongass. Under this alternative the beneficial effects of prohibitions applied immediately to the Tongass would be foregone for some ecological resources.

Under the Tongass Selected Areas alternative, road construction and reconstruction would be prohibited only within inventoried roadless areas in the Old Growth Habitat, Semi-Remote Recreation, and Remote Recreation land use designations (LUDs), and LUD IIs. Under this alternative, the scheduled timber offer from fiscal years 2000 to 2004 would be reduced from 176 to 128 million board feet per year through 2004. The direct effect of the reduction in harvest would be the one-time loss of an estimated 170 timber-related jobs and an associated $7.8 million per year in personal income. Of the four selected areas addressed within this alternative, the most roading is projected to occur within the Old Growth Habitat LUD. Since these designations were specifically chosen for their value to old growth-dependent and disturbance-sensitive species, localized ecological benefits would be

expected under this alternative. Future recreational development, currently provided for in many land use designations on the Tongass, would likely occur along with the continued growth of the tourism industry in Southeast Alaska. The prohibition of roading within the Semi-remote Recreation land use designations could have detrimental effects on those future recreational developments.

Irreversible or irretrievable Effects

Implementation of any of the prohibition or Tongass alternatives does not require an on-the-ground action to occur. Therefore, the alternatives do not compel short-term uses, nor do they compel an irreversible or irretrievable commitment of resources.

Effect of the Roadless Rule with the Final Planning and Proposed Roads Policy Rules

Along with the proposed Roadless Rule (36 CFR §294), the Forest Service has developed two other rules, the final Planning Regulations (36 C.F.R. §219) and the proposed Roads Policy (36 C.F.R. §212). The Planning Regulations affirm sustainability as the overall goal for stewardship of the natural resources of each national forest and grassland consistent with the laws that guide the management of those lands. Sustainability entails meeting the needs of present generations without compromising the ability of future generations to meet their needs. The Roads Policy is designed to make the Agency's existing road system safe, environmentally sound, and affordable to manage. By developing these rules together, the Forest Service is able to ensure consistency in definitions and policy direction. The result of these rule-making efforts would be an efficient integration of the Agency's priorities and resources.

Preferred Alternative

The preferred alternative is designed to protect the increasingly important uses, values, and benefits of inventoried roadless areas, and to achieve the following objectives:

- Prevent activities that can most directly threaten inventoried roadless areas;
- Provide opportunities for achieving multiple-use benefits, such as dispersed recreation and vegetative treatments to reduce the risk of uncharacteristic wildfire effects, insect and disease infestations; and
- Accommodate the transition in the timber program in Southeast Alaska under the recent decision on the Tongass National Forest Land and Resource Management Plan.

The preferred alternative combines:

Alternative 3 with
Selected Social and Economic Mitigations
Prohibit Road Construction, Reconstruction and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas, While Excepting Road Reconstruction Needed for Road Safety Improvement and Federal Aid Highway Projects
Tongass Not Exempt with
Selected Social and Economic Mitigation
Prohibition Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest Beginning in April 2004

Effects of the preferred alternative are summarized in Chapter 2, Table 2-1. The following exceptions and mitigations would apply. The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty;
- Realignment is needed to prevent irreparable resource damage by an essential classified road that cannot be corrected by maintenance;
- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential; or
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code, is in the public interest or consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists.

Finally, in conjunction with, but independent of this rule, the Chief of the Forest Service would work with affected States and communities and pursue funds to assist them in dealing with any economic changes resulting from implementation of the final rule. The Record of Decision and the final rule for Roadless Area Conservation will be published no sooner than 30 days after the publication of the Notice of Availability for this FEIS.

CHAPTER 1
PURPOSE OF AND NEED FOR ACTION

Introduction

The Forest Service is responsible for resource use and conservation on all National Forest System (NFS) lands to meet people's increasingly diverse needs. One common theme in all Agency initiatives is that our **stewardship** should result in a legacy of healthier **landscapes**. The preferred alternative, described in Chapter 2, is the Agency's recommendation for achieving a balance of use as it relates to future management of **inventoried roadless areas.**[1] By maintaining and restoring the health of our **ecosystems** and watersheds, we can help ensure a safe, healthy, and productive environment today and for future generations.

Inventoried roadless areas account for approximately 58.5 million acres,[2] or roughly a third of all NFS lands (Figure 1-1 and Appendix A). Although inventoried roadless areas comprise only 2% of the land base in the continental United States, they are found within 661 of the more than 2,000 **major watersheds** in the nation (U.S. EPA 1997, Sedell and others 2000). These areas provide clean, fresh water to millions of people, and important habitat to numerous fish and wildlife species.

One of the primary reasons for establishment of the national forests and grasslands was to "secure favorable conditions of water flows" (Organic Administration Act 1897). Many communities across America depend on the clean water that originates in or flows through inventoried roadless areas and into facilities that treat and distribute water for drinking and other uses (U.S. EPA 1997, Sedell and others 2000, Elliot in press). Because inventoried roadless areas remain largely undisturbed, it is less likely that erosion, **sedimentation**, and disruption of water flows will occur in those locations.

Lakes, streams, and rivers within inventoried roadless areas can also function as **biological strongholds** for many fish species. These considerations are particularly important given the wide range and broad decline of species such as salmon, steelhead, bull trout, native cutthroat trout, and other aquatic species that depend on habitat in NFS lands for their continued survival. Numerous studies show that watersheds with fewer **roads** are often associated with healthier fish populations, and roads may have unavoidable effects on streams, regardless of how well they are located, designed, or maintained (USDA Forest Service and USDI Bureau of Land Management 1995).

Inventoried roadless areas also support a diversity of aquatic and terrestrial habitats, species, and communities. These areas provide habitat for or affect more than 220 **threatened, endangered, and proposed species (TEP)** and 1,930 **sensitive species**.

[1] Words and phrases defined in the Glossary are shown in bold typeface the first time they appear in each chapter.
[2] This figure has been revised from the 54.3 million acres shown in the DEIS. Refer to Comparison of Alternatives in Chapter 2 (p. 2-23) for an explanation of the factors involved. All acreage figures include the Tongass National Forest unless specified otherwise. Minor discrepancies among figures cited in the text, tables, or database are due to rounding.

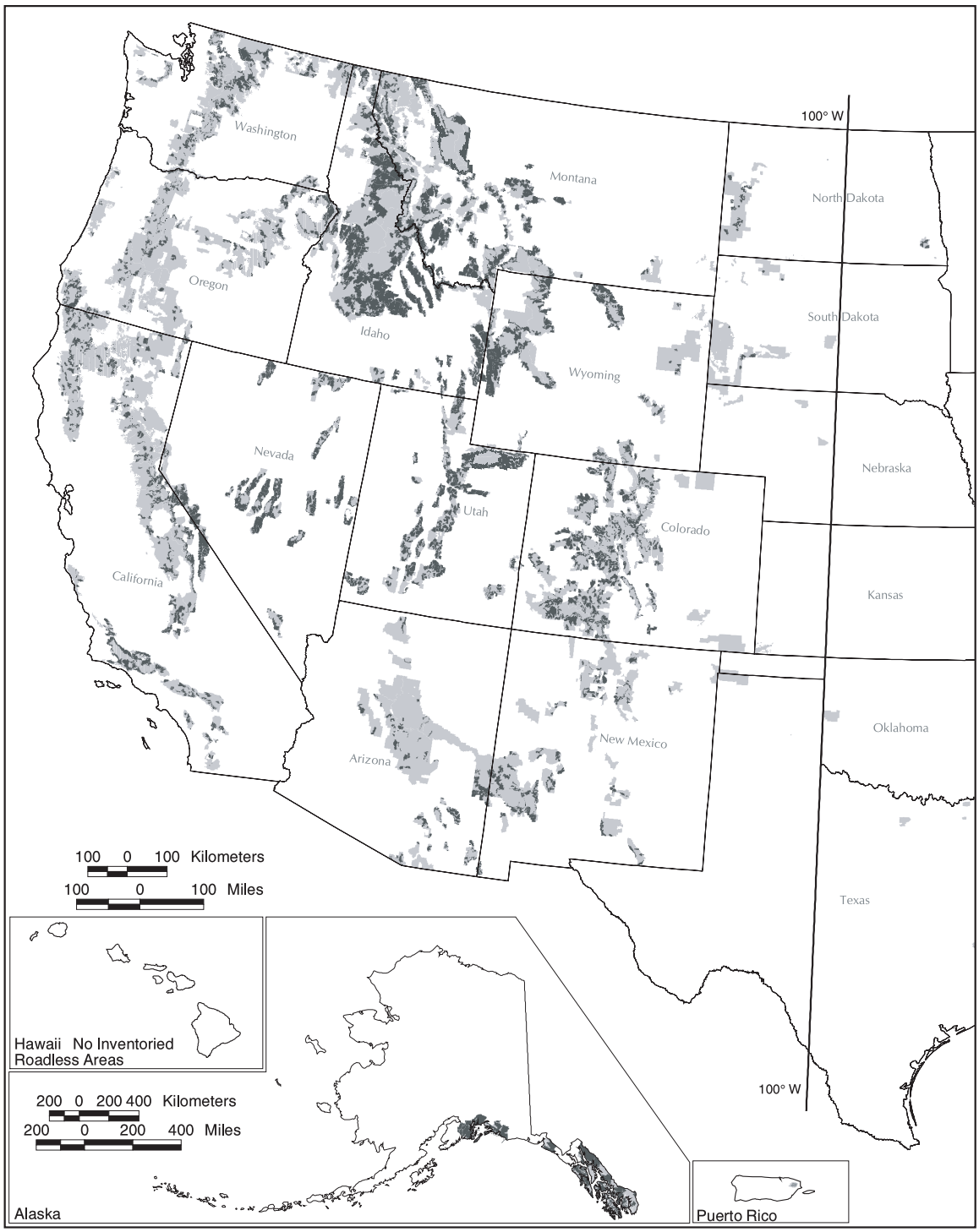


Figure 1-1a. Inventoried roadless areas on National Forest System lands, Western United States. [3]

[3] Acreage summaries of the inventoried roadless areas are included in Appendix A. Detailed maps of the areas included in this proposal are displayed in Volume 2 of this FEIS, and are also available at the Forest Service website **(roadless.fs.fed.us).** The maps included in both volumes were compiled from the best available geospatial data. For a list of data sources used in their preparation, please refer to "Roadless Database References" in the References Cited section.

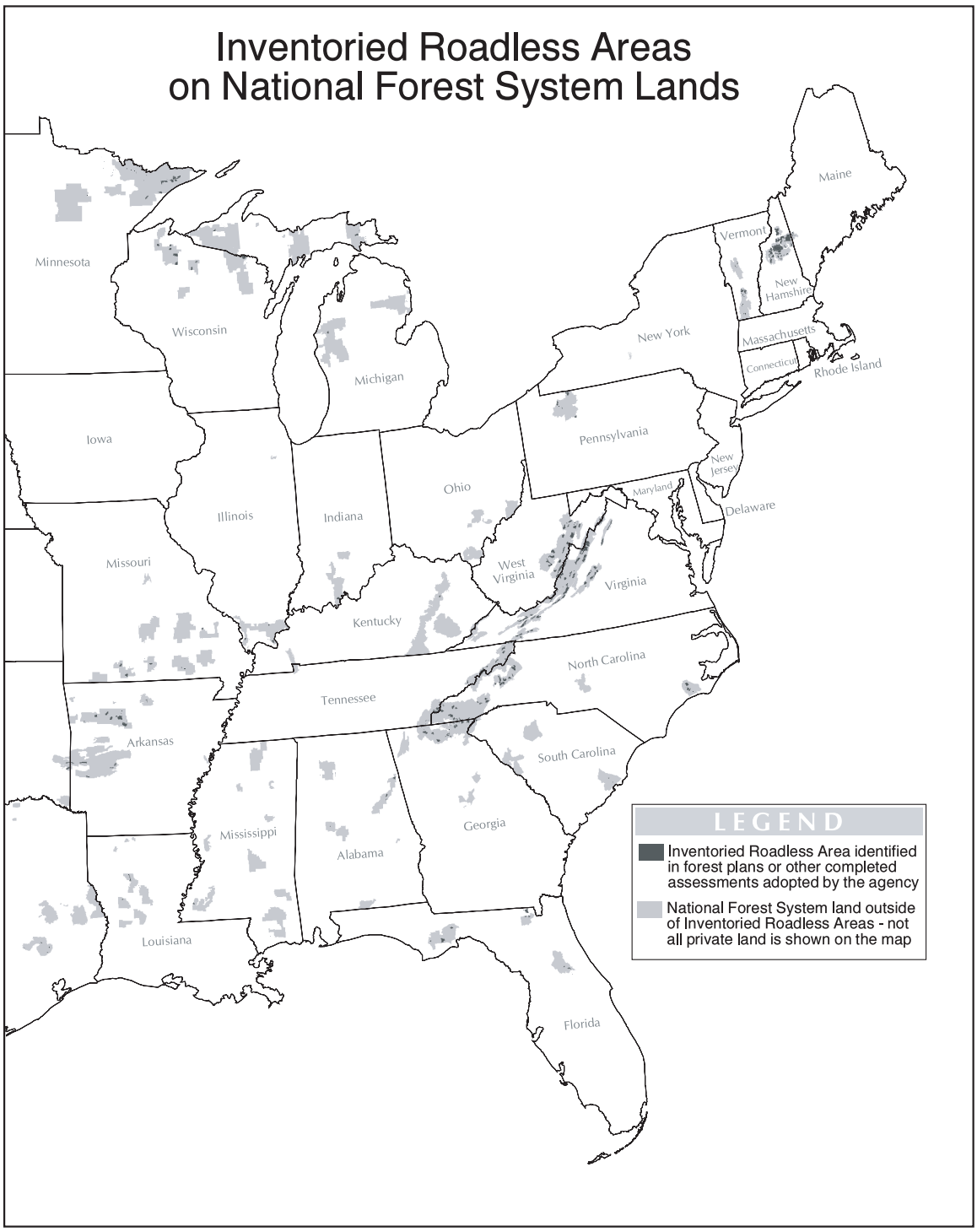


Figure 1-1b. Inventoried roadless areas on National Forest System lands, Eastern United States.

As with aquatic species, inventoried roadless areas function as biological strongholds and places of refuge for many terrestrial animal species from wide-ranging large mammals, such as grizzly bears, to narrowly distributed bird species, and other small animals such as snails. As such, these areas play an important role in helping to conserve native plant and animal communities and **biological diversity**. When roads divide large landscapes

into smaller patches**,** populations may become isolated from each other. This reduces genetic mixing, which is necessary for species diversity and health (Noss and Cooperider 1994). In evaluating 91 vertebrate species in the Interior Columbia Basin, Wisdom and others (2000) found that factors associated with roads negatively affected over 70% of those species. These negative effects include loss of large trees and logs needed by cavity dependent birds and mammals, direct and indirect species mortality, and reductions in breeding productivity.

Inventoried roadless areas also provide large, relatively undisturbed blocks of habitat for a wide variety of native plants. Competition by **nonnative invasive species** is one of the leading reasons that native plant species are listed as endangered or threatened. Relative to roaded areas, native plant communities in inventoried roadless areas are more intact because nonnative species, which often spread through **road construction** and use, are less likely to be introduced or become established.

These same areas also provide people with unique recreation opportunities. When activities such as hiking, camping, hunting, wildlife viewing, and cross-country skiing take place in areas with roads, the experience will include more interactions with people, more sights and sounds of development, and more restrictions. Recreation in inventoried roadless areas produces experiences that are usually difficult to replicate in roaded areas.

The Forest Service is the single largest provider of outdoor recreation opportunities in the United States, and the demand for most recreation activities is growing (Cordell and others 1999b). However, the land available for outdoor recreation (**dispersed recreation** in particular) is dwindling, and will continue to decline as development encroaches upon available open space. Between 1992 and 1997, nearly 16 million acres of non-Federal forest, cropland, and open space were converted to urban and other uses. This is twice the rate of the previous 10 years in the United States (Natural Resource Conservation Service, NRI Inventory, 1982-1997).

President Clinton emphasized the value of lands without roads at the George Washington and Jefferson National Forest on October 13, 1999:

> *"Within our national forests there are large parcels of land that don't contain roads of any kind, and in most cases, never have…these areas represent some of the last, best, unprotected wildland anywhere in our nation. They offer unparalleled opportunities for hikers, hunters, and anglers. They're absolutely critical to the survival of many endangered species…and I think it's worth pointing out they are also very often a source of clear and fresh water for countless communities."*

Inventoried roadless areas provide clean water, biological diversity, healthy forests, and recreation opportunities. The United States Department of Agriculture (USDA) Forest Service has prepared this final environmental impact statement (FEIS) to analyze alternatives that would conserve and protect the important values and characteristics of these areas.

Background

In 1972, the Forest Service initiated a review of NFS **roadless** areas larger than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. The second and final review process, known as Roadless Area Review and Evaluation II (**RARE II**), resulted in a nationwide inventory of roadless areas. In the 21 years since the completion of RARE II, Congress has designated some areas as Wilderness. Additional reviews have been conducted through the land management planning process and other large-scale assessments. The 58.5 million acres of inventoried roadless areas used as the basis for this analysis are the result of both RARE II and these assessments.

On many national forests and grasslands, roadless area management has been a major point of conflict in land management planning. The controversy continues today, accompanying most proposals to harvest timber, build roads, or otherwise develop inventoried roadless areas. The volume of appeals, litigation, and congressional debate over the last 20 years illustrates the importance that many Americans attach to the remaining roadless portions of NFS lands.

Integral to the debate over inventoried roadless areas is the dispute over management of the extensive Forest Transportation System. Millions of dollars are required each year to maintain roads to Federal and State safety and environmental standards. Many people inside and outside the Forest Service question the wisdom of building new roads, particularly in inventoried roadless areas, when each year's uncompleted maintenance increases the backlog as existing roads deteriorate and the cost of repair continues to rise.

A 1998 survey of **road maintenance** and capital improvement needs within the Forest Service showed that the Agency has an $8.4 billion backlog in deferred maintenance, **road reconstruction,** and bridge and culvert maintenance and replacement on the more than 386,000 miles in the Forest Transportation System (USDA, Forest Service 1999h). Recent updates to the inventory used in this survey suggest that these figures are conservative, and will increase as better data is collected and validated. The Forest Service receives less than 20% of the funding needed to maintain its existing road infrastructure, so the backlog grows greater every year. In addition, the Agency conservatively estimates that 60,000 miles of unauthorized and **unclassified roads** exist on NFS lands, creating additional safety and environmental problems as the roads deteriorate from use and lack of maintenance.

To respond to these concerns**,** in January 1998, Forest Service Chief Mike Dombeck proposed to temporarily suspend road construction and reconstruction in certain **unroaded areas**, and provided advance notice of revisions to the regulations governing the management of the Forest Transportation System. After analyzing public comments on the proposal, the Agency published *Administration of the Forest Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas; Interim Rule; 36 CFR Part 212; 64 Federal Register 7290; February 12, 1999* (also known as the Interim Roads Rule).

The Interim Roads Rule suspended road construction and reconstruction in certain inventoried roadless areas for 18 months (March 1999 through August 2000), while a long-term forest transportation policy was developed. Publication of the final Roads Policy is expected in Fall 2000. During the public comment period for the Interim Roads Rule, the Agency received approximately 119,000 public comments, many of which mentioned the need for "permanent protection" of inventoried roadless areas.

In his memorandum to the Secretary of Agriculture dated October 13, 1999, President Clinton provided direction to the Forest Service stating:

> *"I have determined that it is in the best interest of our Nation…to provide strong and lasting protection for these forests…Specifically, I direct the Forest Service to develop, and propose for public comment, regulations to provide appropriate long-term protection for most or all of these currently inventoried "roadless" areas, and to determine whether such protection is warranted for any smaller "roadless" areas not yet inventoried."*

The Forest Service is addressing management of existing roads, inventoried roadless areas, and other unroaded areas in three separate rulemaking efforts. The first, management of the existing road system on NFS lands, is addressed in the *National Forest System Road Management and Transportation System; 36 CFR Parts 212, 261, and 295, and Associated Forest Service Manual 7700 Revisions; 65 Federal Register 11676,* (collectively known as the Roads Policy). The Roads Policy shifts the emphasis from building new roads to a system that supports management activities in an environmentally sound and affordable way.

The second rulemaking, the proposed Roadless Rule *(Special Areas; Roadless Area Conservation; 36 CFR Part 294; 65 Federal Register 30276; May 10, 2000)* described in the Draft Environmental Impact Statement (DEIS), had two parts:

- Prohibitions that precluded road construction and reconstruction in most inventoried roadless areas; and
- Procedures that required evaluation of the quality and importance of **roadless characteristics**;[4] and a determination of whether and how these characteristics should be conserved during land management plan revision in the context of overall multiple-use objectives.

It also proposed postponing a decision regarding conservation of inventoried roadless areas located on the Tongass National Forest until April 2004.

The third, and recently completed, rulemaking effort is the *National Forest System Land and Resource Management Planning Rule (36 CFR Parts 217 and 219),* also known as the Planning Regulations. The Planning Regulations provide direction for implementing the National Forest Management Act (NFMA) in a way that addresses ecological, economic, and social sustainability, including procedures for roadless area protection.

[4] These characteristics are described starting on page 3-3.

Public Review and Comment on the Draft EIS and Issues Considered

The Notice of Intent (64 FR 56306, October 19, 1999) to prepare these regulations to conserve inventoried roadless areas drew about 16,000 people to 187 public meetings, and elicited more than 517,000 responses by the time the DEIS was published. On May 10, 2000, the proposed Roadless Rule and DEIS were released for public review, initiating a comment period that closed July 17, 2000. Public involvement during the comment period was designed to accommodate the already high level of nationwide interest in the proposal.

Maps, brochures, and other information were developed to address public concerns and questions. Before release of the proposal, news releases and letters were sent to news media, other government agencies, libraries, and Forest Service units to explain how to obtain the DEIS and proposed Roadless Rule in a variety of electronic and printed formats. The proposed action and other alternatives, background information, and a schedule of public meetings were posted at the internet site specifically designed to obtain public input: **(roadless.fs.fed.us).** Forest Service personnel across the country were briefed and informed so they could discuss the proposal and its impacts with their local publics.

The Forest Service hosted two cycles of public meetings during the comment period – one for information sharing and discussion, the other to collect oral comments from those who wished to speak for the record. More than 430 meetings were held. About 230 meetings were held for the purpose of sharing information on the DEIS and proposed Roadless Rule. More than 200 additional meetings were held to hear public comment. Many units held daylong or double sessions so that all commenters could speak. Additional sessions in Texas, and even one session in Hawaii, were scheduled as a result of public requests. Meetings were held in every Forest Service region and in Washington, DC. Every national forest and grassland office with affected inventoried roadless areas hosted at least two meetings, and those locations with high public interest hosted more.

The meetings drew more than 23,000 people nationwide. About 7,000 attended information meetings and about 16,000 attended comment meetings. At the comment meetings, 45% of the attendees, nearly 7,000 people, chose to speak. Written public comments were also collected at the meetings, by postal and electronic mail, and by telefax. By the end of the official comment period on July 17, responses totaled about 1,155,000. This included about 1 million postcards or other form letters; 60,000 original letters, 90,000 electronic mail messages, and several thousand telefaxes.

All responses were sent to the Content Analysis Enterprise Team (CAET). This is a team of Forest Service employees that specializes in content analysis of public comments. They objectively compile, organize, analyze, and summarize the full range of viewpoints and concerns received about a proposal. As CAET categorized and summarized the public comments on the DEIS, they sent this information to the Forest Service Roadless Team. A summary of the comment analysis process, along with the Agency's responses showing how the comments were used to clarify and adjust alternatives or the technical analysis in the FEIS, are provided in Volume 3 – Agency Responses to Comments.

Respondents to the Roadless Rule and DEIS generally expressed two very different sets of strongly held values and viewpoints (Content Analysis Enterprise Team 2000b). To broadly summarize, one group believes roadless areas should be conserved for their intrinsic values and for benefits to humans. In their view, roadless areas should be allowed to evolve naturally through their own dynamic processes, although some proponents would condone very limited stewardship activity. The other group generally identifies with the land through forest product-dependent industries, motorized recreation (either by preference or need, based on age or disability), or through the public land management profession. They express the view that these ecosystems, with active and prudent management, can provide many benefits for humans and wildlife.

One group stresses that human desires for forest products and some uses must be secondary to human needs for a healthy environment, both locally and globally, for quiet natural places, for spiritual and mental regeneration, and to meet the needs of other living things. They believe the needs of forest-dependent users can be met through retraining, restoration-related employment, and by designating less sensitive areas for motorized recreation.

Most of these proponents say the proposed rule identified in the DEIS does not go far enough. They believe the final rule should immediately prohibit **timber harvest**, other commodity uses, and motorized recreation on roadless areas 1,000 acres or larger, and should not defer conservation of these areas to future land management planning processes. They also stress that the Tongass National Forest should be included immediately in this conservation effort.

The other group stresses that maintaining a healthy environment should not preclude resource production, motorized access, and **developed recreation** opportunities. These commenters see the forest as an ecosystem capable, under proper management, of providing people with a host of goods and services, and numerous recreational opportunities. They believe conservation requires active land management. To this group, **active management** means roads for fuelwood **thinning**, insect and disease treatment, resource use, and development of recreation facilities. This viewpoint stresses that failure to actively manage forests and grasslands could result in threats to human livelihoods and increased insect infestations and uncharacteristically severe fire, while prudent management would benefit people and wildlife.

The two viewpoints are separated by a difference in perceptions and values regarding the fundamental nature and role of public lands. However, there are also differences in their perceived relationships with the Forest Service and in the role of government. Respondents who feel the rule goes too far express resentment over a perceived condescending attitude by environmental groups. These commenters feel discriminated against and disenfranchised. They believe their voices do not count, that the only voices that do count are those of the environmentalists. They see national directives as an assault on their freedom. Many believe the government has imposed too many restrictions on the American people already. They believe the proposed rule will be the start of more closures. Often these commenters do not oppose the proposed rule because of what it actually proposes to do, but rather because they perceive it would institutionalize or initiate further restrictions.

Those favoring roadless conservation do not express the same level of distrust toward land management agencies or toward government involvement. They believe only a national directive will adequately protect these lands. These respondents fear that local managers will sacrifice roadless values to influential, local commercial interests. They often distrust local forest management more than national level management. Without a centralized directive requiring local forest managers to conserve roadless areas, they believe these areas will not be protected.

Respondents expressed these competing views within the context of several broad categories. The Forest Service summarized the comments received during the scoping process under six major headings. An analysis of the public comments received during the DEIS comment period indicated that the following major issue categories remain valid.

1) Public access;
2) Identification of other unroaded areas;
3) Exemptions and exceptions;
4) Environmental effects;
5) Local involvement; and
6) The effect on communities with strong natural resource affiliations (forest dependent communities).

These issues have been used to guide this process in one or more of the following ways:

- To determine the scope of the proposal (type of decision to be made);
- To develop a range of alternatives;
- To direct the analysis of potential environmental, social, and economic effects;
- To identify possible mitigation measures; and
- To ensure that the Agency is operating within legal authorities.

More specific statements of public concern and the Agency's responses are presented in Volume 3. Representative quotations from both the Notice of Intent scoping period and the DEIS comment period are included below to provide a sense of the public's response.[5] After public comments on the DEIS were evaluated, decisions about identification and management of other unroaded areas were incorporated in the final Planning Regulations.

1) **Public Access**: Some respondents stated that limiting access in roadless areas, including off-highway vehicle (OHV) use, is appropriate and long overdue, and that the resultant effects on these activities are acceptable when weighed against the perceived benefits of reduced access. Perceived positive effects of the limitations include:

- Maintaining habitat for fish and wildlife;
- Buffers against invasive species;
- Protection of drinking water supplies;
- More opportunities for dispersed non-motorized recreation; and
- Reduced noise and resource degradation from motorized recreation.

[5] Detailed information on the public comments is contained in the Roadless Area Content Analysis Report, and at the Forest Service Roadless website **(roadless.fs.fed.us)**.

"Exclude ORVs from roadless and unroaded areas. ORVs contribute to disturbance of sensitive wildlife, pollution of streams through erosion, and disturbance of non-motorized recreation." (NOI Response #43634, Individual, Prescott, AZ)

"It is time for public lands to be preserved for future generations, even if this means limiting access to people like myself who have a disability and cannot hike (old polio) like they once managed to do." (DEIS Response #1321, Individual, Waynesville, NC)

Others felt that limiting road construction and reconstruction or other management actions in roadless areas might restrict the delivery of goods, services, and activities that these areas might otherwise provide. Perceived negative effects include:

- Reduced ability to adequately protect public health (natural disaster response, hazardous waste removal, smoke management), safety (**fire suppression**, property protection, search and rescue), and law enforcement;
- Restricted access to private lands and **inholdings**;
- Limited use by persons with disabilities; and
- Restricted use or increased cost of off-road vehicle and other motorized recreation, ski area development, and commodity activities such as timber harvest, livestock grazing, and oil and gas development.

"The public managers should manage our land, not lock it up and lock us out. They should continue to be business partners with timber, mining, grazing, and other users. They should protect our lands and commodities by using them wisely and rebuilding damaged areas." (NOI Response #40893, Individual, Lakewood, CO)

"We believe that the American people are entitled to reasonable access to their national forests, regardless of the management prescription assigned to the land within the forest boundary. After all, even Designated Wilderness, the most restrictive of prescriptions, includes the direction that Wilderness Areas shall be managed for the use and enjoyment of the American people. We also believe it is the responsibility of your Agency to provide that reasonable access, and to discourage exclusive use of our national forests." (DEIS Response #3830, Wise Use or Land Rights Organization, Billings, MT)

2) **Identification of Other Unroaded Areas**: The public suggested various criteria and processes for addressing the protection and management of other unroaded areas. These areas were considered under the procedural Alternatives A through D in the DEIS. Since the close of the DEIS comment period on July 17, the Agency determined those requirements were more appropriately addressed in the 36 CFR 219 Planning Regulations. Comments received on the DEIS about the procedures were shared with the Planning Regulations team, and were incorporated into that rulemaking.

3) **Exemptions and Exceptions**: Respondents expressed considerable disagreement over allowing geographic exemptions from the proposed action or activity exceptions, such as public health and safety and mineral leasing activities, to the prohibitions. Some feel exemptions similar to those in the Interim Roads Rule for the Tongass National Forest, the area of the Northwest Forest Plan, and other completed planning efforts are appropriate. Others feel no exemptions or exceptions are appropriate for an action of this significance, and that the proposed action should apply equally to all NFS lands. Still, others believe a transition period should be allowed for those forests with recently revised plans.

> *"Issue a nationwide directive that immediately prohibits road building and logging in all national forest roadless areas. Please do not allow areas such as the Tongass National Forest, forests covered by the Northwest Forest Plan or unsold roadless area timber sales to be exempted." (NOI Response #41228, Individual, Corvallis, OR)*
>
> *"The proposed policy should not apply to the Tongass for the additional reason that the forest has recently updated its Land Management Plan, and the plan has carefully considered the effects of any new road construction." (NOI Response #18244, Individual, Anchorage, AK)*
>
> *"I urge you to issue a final policy that provides for exemptions or waivers." (DEIS Response #4903, Individual, Great Falls, MT)*
>
> *"Maintain Alternative 2 in the DEIS, but exempt from the prohibition national forests within the coverage of the management directives established in the Interior Columbia Basin Ecosystem Management Project." (DEIS Response #18645, State Elected Official, Boise, ID)*

4) **Environmental Effects**: Many respondents commented on the type and degree of physical and biological resource impacts that could be expected from the proposed action. Perceived positive effects include:

- Water Resources: high levels of water quality, compliance with State water quality standards, consistent quantity delivery, runoff timing that maintains base flows, reducing flood peaks, and lowering water treatment costs for local communities;
- Soil Resources: maintenance of soil loss/sedimentation rates within normal ranges, and continued levels of soil quality and productivity;
- Air Resources: high levels of air quality and maintenance of visibility goals;
- Biodiversity and Wildlife/Fisheries: reduced habitat **fragmentation**, resulting in maintenance of **connectivity** and biodiversity, protection of species' strongholds and **viability**, and maintenance of quality stream habitat;
- Nonnative Invasive Species: reduced opportunities for introduction of non-native invasive plant and animal species, resulting in maintenance of native plant and animal communities;
- Threatened, Endangered, and Proposed Species: reduced levels of habitat **disturbance**, resulting in more protection, greater likelihood of recovery, and fewer listed species;
- Forest Health: greater acreages with limited development opportunities, resulting in intact healthy forests; and
- Fire Prevention: reduced occurrence of accidental person-caused fires and arson fires, resulting in fewer acres burned.

"Watershed condition should be our primary concern. Prevent uses that are contributing to their detriment, and then permit only limited access into country based on its need to accomplish quality resource management; [This should be] spelled out in a forest management plan that has had full public participation in its adoption." (NOI Response #20101, Individual, Internet email)

"More importantly, these roadless areas have become critical habitat for a myriad of endangered species and other wild creatures that require undisturbed areas in order to complete their life cycles. You must take stronger action to protect these areas." (DEIS Response #1621, Individual, Sonoma, CA)

Perceived negative effects include:

- Fuel Management: prohibiting road construction may limit managers' abilities to reduce fuel loadings on landscapes prone to uncharacteristic wildfire effects;
- Fire Suppression: prohibiting road construction may hamper fire suppression efforts, resulting in uncharacteristic wildfire effects;
- Forest Health*:* prohibiting road construction may limit available options to manage insect, disease, and other **forest health** problems; and
- Use Shifts: limiting various land uses in roadless areas may shift use to other roaded Federal land or onto other ownerships.

"The draft EIS must address and provide specific management alternatives that provide for road construction on national forest lands particularly vulnerable to catastrophic wildland fire…[it] must address the social, economic, and environmental consequences on forest health, forest management options, fire prevention and suppression activities." (NOI Response #13205, Elected County Official, Markleeville, CA)

"Another concern I have is the weed control and the control of the pine beetle on the national forests. Canadian thistle alone is taking over much land and if it isn't controlled, will take everything. Leafy spurge and Hounds Tongue are also noxious weeds needing control. These areas need access to control problem areas." (DEIS Response #597, Individual, Newcastle, WY)

5) **Local Involvement**: Respondents disagreed on the effect of the proposed action on local involvement in decision-making. Some feel the proposed action would reduce local involvement, with the following effects:

- Negate collaboration agreements on land management plans and local projects; and
- Undermine trust between the Agency and local citizens, business, and elected officials.

"One national decision does not adequately address the unique conditions of each roadless area. I strongly oppose a unilateral decision to "Protect" all roadless areas, which is the obvious intent of this rulemaking process. Decisions on roadless areas must be made at the local National Forest level." (NOI Response #29213, Individual, Colville, WA)

> *"Local level forest planning has worked in developing forest plan decisions by the people most knowledgeable about the forestlands. The proposed one size fits all proposal undermines the cooperative dialogue that takes place during each forest plan revision and cancels out years of hard work and studies." (DEIS Response #6353, Individual, Indian Mound, TN)*

Others believe the failure of local planning to resolve the long running and controversial roadless debate lends itself to national resolution. It is thought that once the larger issues are resolved, the remaining issues can be more successfully resolved at the local level.

> *"We are in complete agreement with this Forest Service rulemaking initiative that will result in the protection and management of unroaded values on inventoried as well as uninventoried lands within the National Forest System." (NOI Response #49422, State Agency, Jefferson City, MO)*

> *"The four Procedural Alternatives are flawed because they all leave the future management of roadless areas in the hands of local Forest Service Administrators. This simply leaves the door open for confusion and mismanagement. What administrators need is a uniform set of guidelines with clear, strong protections for roadless areas." (DEIS Response #11425, Individual, Portland, OR)*

6) **Forest-Dependent Communities**: Many of those who commented believed that the proposed action would have significant impacts, both economically and socially, on local communities that depend economically on NFS lands. Perceived negative effects include:

- Lost job income, and related indirect effects;
- Reduced employment opportunities; and
- Reduced payments to counties in lieu of taxes, with effects on local schools and infrastructure.

> *"Rural economies already suffer from the recent drastic decreases in available sale quantities of timber by decreased job availability, decreased dollar turnover from the logging industry, and increased unemployment." (NOI Response #41223, Individual, Robertson, WY)*

> *"It is very clear that the USFS has not considered the economic impact of the proposed rule on mining revenues in areas where the proposed rule would increase the cost of mineral extraction beyond the return of the market prices for the minerals. Since the state of Nevada's and many rural counties' budgets in Nevada depend upon taxes on mining to support their budgets, there must be analysis for impacts on mining and local economies which depend on mining that is equal to or better than the economic impact analysis supplied in the DEIS and cost-benefit analysis for logging communities potentially affected by the proposed rule." (DEIS Response #44188, Individual, Reno, NV)*

Others believe these effects would be limited, and that local communities can rapidly offset such effects with other employment and income opportunities generated through conservation of roadless areas and the values they represent. Perceived positive effects include:

- Clean drinking water;
- Less erosion;
- Healthy wildlife and fish habitats;
- Maintenance of attractive landscapes;
- Increased tourism and related new businesses; and
- A broader, more diverse business environment.

"Maintaining the resource creates more stable economies than the typical boom-bust cycle of resource extraction. Much of the decrease in jobs in the area is not a result of environmental protections, but because of automation and dwindling of the resource." (NOI Response #60593, Individual, Takoma Park, MD)

"The effect of prohibiting roadless area timber sales on the timber industry and employment would be minimal. Forgoing the entire 220 million board feet of annual timber sale offering in roadless areas over the next five years would result in only 7% reduction in the Forest Service's planned timber sale program. The impact on total U.S. timber production, which averages about 83 billion board feet per year, would be miniscule – about ¼ of 1%. Similarly, the DEIS estimates that a prohibition on roadless area logging would theoretically result in a loss of just 820 timber jobs, which is 3% of all national forest-based direct timber jobs and less than one-tenth of 1% of all U.S. wood products employment." (DEIS Response #55101, Environmental/Preservation Organization, Eugene, OR)

Purpose and Need

The purpose of this action is to conserve and protect the increasingly important values and benefits of roadless areas by: 1) prohibiting activities that have the greatest likelihood of degrading desirable characteristics of inventoried roadless areas and 2) ensuring that ecological and social characteristics of inventoried roadless areas are identified and evaluated through local land management planning efforts.[6]

Given the history of controversy surrounding the management of inventoried roadless areas and the level of interest expressed by the public, the Agency has determined that there is a need for national-level direction for roadless area management. The Forest Service developed a proposed action and several alternatives in the DEIS with the intent of meeting the need to protect the values prevalent in inventoried roadless areas.

This action is needed because:

- Road construction, reconstruction, and timber harvest activities in inventoried roadless can directly threaten the fundamental characteristics of these areas by altering natural landscapes, including habitat fragmentation and changes in native plant and animal communities;

[6] This part of the need for action has since been addressed in the final Planning Regulations. See page 1-16.

- Budget constraints permit only a small portion of the Agency road system to be effectively managed; and
- National concern over roadless area management continues to generate controversy, including costly and time-consuming appeals and litigation.

Local land management planning efforts may not always recognize the cumulative national significance of inventoried roadless areas and the values they represent, especially given the increasing development of the nation's landscape. Urbanization, reduction in the size of forest tracts, habitat fragmentation, and other forest **ecosystem health** issues are concerns at local, regional, national, and global levels. When managing inventoried roadless areas, it is important to recognize that decisions made at finer scales (that is, project, watershed, or forest level), must be considered in a broader context. While individual decisions to build roads may achieve local management objectives, collectively they may result in a continued net loss of the quality and quantity of inventoried roadless areas nationally.

Regardless of how well informed individual decisions may be at the local level, any new road building in inventoried roadless areas still results in a loss of **roadless characteristics**. When local officials evaluate the impacts of their decision to build a road into an inventoried roadless area, the incremental effect of the decision is considered. However, when these individual decisions are aggregated over time, and throughout the country, the resulting ecological and social outcomes resulting from the loss of roadless areas may become substantial.

Even though 24.2 million acres (41%) of inventoried roadless areas currently have land management plan **prescriptions** that prohibit road construction, these prescriptions are subject to change at the next plan revision. The prohibitions presented in this FEIS would elevate the certainty of long-term protection for all inventoried roadless areas.

The Notice of Intent and public comments received during scoping, set the stage for determining the range of actions the Agency would consider in addressing these concerns in the proposed rule, other alternatives, and in the effects analysis. Subsequent comments on the DEIS have been used to reexamine the appropriateness of the scope and scale of the analysis, refine the alternatives, and develop mitigation measures.

The process for determining the scope of the environmental analysis and alternatives included a review of factors such as complexity of analysis, urgency of the issue, national applicability, level of public interest, and relationship to other regulatory or administrative mechanisms. The Agency considered a full range of activities that might occur within the proposal, such as road construction, timber harvest, motorized recreation, grazing, and other activities that might affect the national significance of roadless area characteristics. After careful review of public responses to both the Notice of Intent and the DEIS, the Agency determined that it was appropriate to consider prohibiting some activities through national rulemaking. Furthermore, the Agency determined that only those uses and activities likely to significantly alter landscapes, including habitat fragmentation and changes in native plant and animal communities on a national scale, would be considered for prohibition in this proposal.

As a result of this review, the Agency decided to analyze a range of alternatives to limit road construction, reconstruction, and timber harvest, because these activities:

- Occur on forests and grasslands throughout the nation;
- Have the greatest likelihood of altering landscapes;
- Often cause substantial landscape fragmentation and adverse changes to native plant and animal communities; and
- May result in immediate, irretrievable, and long-term loss of roadless characteristics.

Timber harvest and access for fire suppression has historically generated the need for most road construction on NFS lands. Furthermore, these activities occur throughout the National Forest System. Other activities identified by the public, such as motorized vehicle use, grazing, mining, and developed recreation facilities, were determined by the Agency to either not pose the same level of national risk for adversely impacting inventoried roadless areas, as do road construction, reconstruction, and timber harvesting, or the impacts are not as widespread. This same holds true for utility corridors, power lines, pipelines, water developments, and other special uses.

Another reason for not addressing certain uses and activities at the national level is that they are either not directly permitted by the Agency, or they cannot be effectively analyzed at the national level because the level of activity is unknown and therefore impacts to roadless characteristics are uncertain. For example, data on the use of motorized vehicles and their impact to inventoried roadless areas are not collected consistently throughout the National Forest System. It is currently not possible to display the effects of prohibiting such use in inventoried roadless areas at a national level.

As a result, in the DEIS the Agency proposed to develop procedures to evaluate and conserve roadless characteristics during land management plan revisions (procedural Alternatives A through D). Analysis of comments on the DEIS for the Roadless Rule showed that there was confusion about how the procedural alternatives would be implemented. Public comments on the proposed Planning Regulations and Agency comments on the DEIS also suggested that the procedures for roadless area protection were best suited for the Planning Regulations. Upon review, most of the roadless area characteristics identified in the DEIS and proposed Roadless Rule were similarly required by the Planning Regulations. Therefore, the Forest Service determined that the procedures contemplated in the Roadless Rule should be an explicit part of the plan revision process, and addressed them at 36 CFR 219.9(b)(8) of the final Planning Regulations. By making small changes to the Planning Regulations, the procedural alternatives discussed in the DEIS were not needed as a part of the Roadless Rule and were removed from this FEIS.

The Notice of Intent identified the Tongass National Forest as deserving special attention in formulating alternatives. Public responses to the DEIS confirmed the importance of this issue in the analysis process. The Tongass National Forest is unique among national forests for the following reasons:

- The Tongass National Forest Land and Resource Management Plan was revised in 1999, leading to 82% of the forest having land use designations that prohibit or limit road construction and reconstruction;
- The Southeast Alaska economy continues to change from dependence on long-term Forest Service **timber sale** contracts to competitively bid timber sales;
- Two-thirds of the total timber offer planned on the Tongass National Forest over the next 5 years is in inventoried roadless areas; and
- Consideration of the requirements of the Tongass Timber Reform Act.

The Agency determined it was necessary to address the Tongass National Forest separately because of these unique social and economic conditions.

Decision to be Made

The Forest Service has decided to examine possible road construction, reconstruction, and timber harvest restrictions in inventoried roadless areas at the national level. The Forest Service also decided to examine the unique situation of roadless area management on the Tongass National Forest. The decisions to be made by the **responsible official** include:

- Should road construction, reconstruction, and timber harvest be prohibited in National Forest System inventoried roadless areas?
- Should the proposed national prohibitions be applied to the Tongass National Forest or modified to meet the unique situation on the Tongass?

In this context, the Forest Service developed and analyzed the effects of various alternatives (refer to Chapters 2 and 3). The final Roadless Rule will either be the same as the preferred alternative described in Chapter 2, or it will be modified based on the other alternatives and on public comments summarized in Volume 3. The final Roadless Rule will be documented in a Record of Decision, and the final rule published no sooner than 30 days after the Notice of Availability of the FEIS appears in the Federal Register.

The Proposed Action

The Agency's original proposed action is the proposed Roadless Rule displayed in Appendix A of the DEIS and published in the *Federal Register*. The Forest Service designed the proposed action to achieve the following objectives:

- Prevent activities that can most directly threaten inventoried roadless areas by implementing national prohibitions against road construction and reconstruction;
- Create national procedures that enable local Agency managers to identify, evaluate, and conserve or enhance the characteristics of inventoried roadless areas through the land management planning process;
- Provide opportunities for achieving other multiple-use benefits, such as dispersed recreation, and vegetative treatments to reduce the risk of wildland fire and insect and disease infestations; and
- Accommodate the transition in the timber program in Southeast Alaska under the recent decision on the Tongass National Forest Land and Resource Management Plan.

Based upon public comments on the DEIS and additional internal considerations, the decision was made in the final Planning Regulations regarding the procedural aspects of roadless area conservation. As a result, the Agency has modified the Preferred Alternative which is described in Chapter 2 of this FEIS.

Other Related Planning Efforts

As discussed previously, the Forest Service recently published the final Planning Regulation (36 CFR Parts 217 and 219). While the action proposed here would immediately protect inventoried roadless areas and the increasingly important values and benefits they provide, the Planning Regulations will guide the long-term conservation and management of inventoried roadless areas and unroaded areas (see Table 1-1). In addition to the Roadless Rule and Planning Regulations, the Forest Service has one other directly related ongoing rulemaking effort: the *National Forest System Road Management and Transportation System; 36 CFR Parts 212, 261, and 295, and Associated Forest Service Manual 7700 Revisions; 65 Federal Register 11676,* (collectively known as the Roads Policy).[7] The three rules are summarized in Table 1-1.

The Planning Regulations implement the National Forest Management Act to address ecological, economic, and social sustainability. They build on the recommendations of an eminent committee of scientists and more than 20 years of experience with land management planning, and provide the overarching framework for implementing the Roads Policy and the Roadless Rule. Specifically, the Planning Regulations:

- Base land management planning on the principles of the interrelated ecological, economic, and social elements of sustainability;
- Require the Forest Service to actively engage the public and other Federal, State, local, and Tribal partners in the management of NFS lands;
- More effectively integrate science into the planning process and require the Agency to manage ecosystems rather than single outputs or outcomes;
- Integrate planning and management activities more closely so that the Forest Service can respond to new information and opportunities in a timely manner; and
- Identify and evaluate roadless areas based on sustainability requirements of the Planning Regulations, and consider protection for inventoried roadless areas and unroaded areas in addition to those protections required by the Roadless Rule, Roads Policy, and other applicable laws and policy.

[7] Rulemaking is an open, public process that allows government officials to make decisions after due consideration of competing interests. All rulemaking is carried out under existing laws and regulations governing the Forest Service. The authority to promulgate regulations ``*to regulate the occupancy and use and to preserve the forests thereon from destruction''* dates back to the passage of the Organic Act of 1897. Congress elaborated on this responsibility in the Multiple-Use Sustained-Yield Act of 1960, which directs the Secretary of Agriculture to administer the National Forest System to achieve multiple-use and sustained yield of renewable resources without impairment of the productivity of the land (16 U.S.C.528-531). The Secretary has issued regulations for management of forest development roads and trails under 23 U.S.C. 201, 205 (36 CFR Part 212). The Secretary has been granted broad authority to establish such rules as determined necessary and desirable to manage the national forests (16 U.S.C. 1613).

Table 1-1. Comparison of related Forest Service rulemaking efforts.

	Planning Regulations 36 CFR Parts 217 & 219	**Roads Policy (proposed) 36 CFR Part 212**	**Roadless Rule (proposed) 36 CFR Part 294**
Proposal	Bases land and resource planning on sustainability. Emphasizes collaboration, integrates science. Planning becomes problem solving. Includes planning direction for consideration of appropriate uses and activities in roadless areas.	Identifies needed and unneeded roads. Gives emphasis to: Rehabilitating needed roads; **Decommissioning** unneeded roads; Carefully considering adding roads; Integrates **road analysis** with land management plan revisions or amendments.	Prohibits road construction and reconstruction in inventoried roadless areas.
Focus	Site specific and land management planning within the context of sustainability.	Science-based road analysis at various scales coordinated with ecosystem assessments and public involvement.	Inventoried roadless area conservation.
Applicability	Applies to all NFS lands and resources.	Applies to all NFS lands and resources.	Applies to NFS inventoried roadless areas.
Definitions	Defines *inventoried roadless area* and *unroaded*.	Defines *road*, *classified road*, *unclassified road,* ***temporary road****, inventoried roadless area, and unroaded areas*.	Uses same definitions as the Planning Regulations and the Roads Policy.
Relationship to Roadless Issues	Provides overall framework for identification and management of unroaded values. Requires consideration of protection for roadless areas during plan revisions.	Provides interim protection for inventoried roadless areas and other unroaded areas until plan amendment.	Proposes conservation and management for inventoried roadless areas.

The Roads Policy for the Forest Transportation System addresses management of existing roads. The proposed Roadless Rule, the subject of this FEIS, addresses inventoried roadless areas. The proposed rule for the Roads Policy is scheduled to be completed in Fall, 2000. The policy is intended to:

- Make the existing **forest road** system safe, responsive to public needs, environmentally sound, affordable, and efficient to manage;
- Be implemented through public involvement and analysis at the local level;
- Implement a scientific analysis procedure to help land managers and the public identify heavily used roads that need to be maintained or upgraded, and roads that are unused or environmentally damaging that can be decommissioned or converted to other uses;
- Place a new emphasis on maintaining and reconstructing existing roads rather than building new roads, given the extensive road system that is already in place in most national forests, and to carefully consider any proposals for new roads; and
- Provide interim protection for inventoried roadless and certain unroaded areas.

All three rules seek to provide long-term environmental sustainability, ensure collaboration with the public, integrate science into planning and management of NFS lands, and incorporate new information and opportunities.

As noted in Table 1-1, the Planning Regulations contain provisions that allow responsible Forest Service officials to consider inventoried roadless areas and unroaded areas as special areas. These regulations also require responsible officials to identify and evaluate roadless areas based on sustainability requirements, and consider protection for inventoried roadless areas and unroaded areas in addition to those protections required by the Roadless Rule, Roads Policy, and other applicable laws and policy. The Planning Regulations also contains criteria for analysis of roadless characteristics.

Completion of the Roads Policy is reasonably foreseeable. It contains interim requirements that provide a temporary level of protection for roadless areas. Until a national forest or grassland has completed a forest-level roads analysis and incorporated it into its land management plan, road building in inventoried roadless areas and specific unroaded areas would require a specific and compelling need, a science-based **local roads** analysis, an EIS, and regional forester approval. While the Roads Policy would provide some interim protection, it would not achieve the same level of certainty as provided by the alternatives in this FEIS, and therefore would not meet the stated purpose and need.

These rules work in a complementary fashion. For example, the prohibition action alternatives in this FEIS, would overlay the compelling need test of the proposed Roads Policy in inventoried roadless area. At the same time, projects that could move forward under an exception in this FEIS would still be subject to the compelling need test and other analyses required by the proposed Roads Policy, while the interim requirements apply. Proposed activities in unroaded areas **contiguous** to inventoried roadless areas, as defined in the proposed Roads Policy, would not be subject to the prohibitions of the Roadless Rule. However, they would still be subject to the compelling need test of the proposed Roads Policy before roads could be constructed or reconstructed.

The Agency has also released for public comment the Draft Forest Service Strategic Plan (draft Strategic Plan), in conformance with the Government Performance and Results Act. The Planning Regulations, Roads Policy, and Roadless Rule are consistent with the draft Strategic Plan, which outlines the long-term goals and objectives that set the course for budgeting and accountability. Additional information may be obtained at the Strategic Planning and Resource Assessment website (www.fs.fed.us/plan/). The following goals and objectives are especially relevant to the proposed action because of their emphasis on ecosystem health including water quality, soil productivity, and habitat integrity:

Goal 1: Ecosystem Health: Promote ecosystem health and protection using a collaborative approach to sustain the nation's forests, rangelands, and watersheds.

- Objective 1.a - Improve and protect watershed conditions to provide the water quality and quantity and soil productivity necessary to support ecological functions and intended beneficial water uses.
- Objective 1.b - Increase the amount of habitat capable of sustaining viable populations of all native species and support desirable levels of selected species.

Goal 4: Effective Public Service: Ensure the acquisition and use of an appropriate corporate infrastructure to enable the efficient delivery of a variety of uses.

- Objective 4.b - Improve the safety and economy of Forest Service roads, **trails**, facilities, and operations, and provide greater security for the public and employees.

Organization of the Document

This FEIS is organized into four volumes.

Volume 1

Chapter 1 Purpose and Need: describes the reasons for proposing and completing this FEIS.

Chapter 2 Alternatives Considered: describes alternative methods of achieving the stated purpose. This discussion includes a range of alternatives, a discussion of other alternatives that were eliminated from detailed study, and possible mitigation measures. Chapter 2 also includes comparisons of these alternatives based on the environmental, social, and economic effects disclosed in Chapter 3.

Chapter 3 Affected Environment and Environmental Consequences: describes the physical, biological, social, and economic environments relevant to the proposed action, and the changes that may occur to those environments as a result of implementing the proposed action or other alternatives. This analysis is organized under several main headings such as Ecological Factors, Human Uses, and Social and Economic Factors. Within each resource section, the affected environment is described first, followed by the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

Chapter 4 Consultation and Coordination: provides an overview of the public involvement process used to develop the FEIS, a list of preparers, and list of agencies and organizations receiving copies of the FEIS.

Appendices: provides more detailed information to support the analyses presented in Chapters 1 through 3. The FEIS also includes a glossary and a list of the references cited.

Volume 2

Volume 2 of this FEIS contains maps of the inventoried roadless areas. A map is provided for each State that contains inventoried roadless areas, followed by detailed maps for each forest or grassland located in that State.

Volume 3

This volume includes a detailed description of the public involvement and comment analysis process, and the Agency's responses to those comments.

Volume 4

Volume 4 includes copies of all letters received from Federally-recognized Tribes, Federal, State, and local agencies and elected officials.

CHAPTER 2
ALTERNATIVES CONSIDERED

Introduction

The Notice of Intent for the proposed rule identified two possible methods to conserve **inventoried roadless areas.**[1] These methods (prohibitions and procedures) were incorporated into the alternatives analyzed in the draft environmental impact statement (DEIS). Since publication of the DEIS, the *National Forest System Land and Resource Management Planning Regulations Final Rule (36 CFR 219)* has been issued. Those regulations include procedures that would require the evaluation of inventoried roadless and other **unroaded** areas, identification of areas that warrant further protection, and based upon the results determine the level of protection to be afforded. Therefore, all procedural alternatives described in the DEIS have been removed from this FEIS since a decision on procedures is no longer needed under this rulemaking.

The terms central to understanding the alternatives described in this chapter are defined below. These terms and others used in the analysis are also defined in the glossary.

- **Inventoried roadless areas -** Areas identified in the set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps.
- **Prohibitions -** Activities that would not be allowed in inventoried roadless areas.
- **Tongass Alternatives -** Alternative methods of applying prohibitions on the Tongass National Forest.

The Forest Service used prohibitions, procedures, and Tongass National Forest alternatives as the framework for the proposed rule in the DEIS. This FEIS incorporates the prohibition and Tongass alternatives described in this chapter to conserve inventoried roadless areas.

Public comments on the Notice of Intent identified a variety of suggestions for alternatives, including different types and combinations of prohibitions, procedures, and **exemptions** (Content Analysis Enterprise Team 2000a). In responding to the DEIS, the public suggested a variety of ways to modify the proposed alternatives (Content Analysis Enterprise Team 2000b). Summaries of the public comments on both the Notice of Intent and DEIS are in the project record, and at the Roadless Area Conservation website **(roadless.fs.fed.us)**. The following examples are representative of the range of comments received:

[1] Words and phrases defined in the Glossary are shown in bold typeface the first time they appear in each chapter.

"A consideration of Alternatives that would include and permit new roads, based on forest plan reevaluations, or any other site-specific consideration, would make the proposal more NEPA compliant." (Notice of Intent Response #39086, Individual, Delta, CO)

> *"I support the initiative to prohibit all activities that do not maintain or enhance the ecological values of inventoried roadless areas with no exceptions. Special scrutiny should also be given to off road-motorized vehicles, motorboats, airstrips, and other motorized equipment." (Notice of Intent Response #32239, Individual, Idaho Falls, ID)*

"The preferred alternative (#2 in the brochure) does not go far enough in protecting the forests as such. Timber harvest except for stewardship purposes must be eliminated. Thus alternative #3 is preferred (#4 is too extreme). Add to alternative #3 what will be and what won't be allowed. What low impact activities (such as hiking and cross-country skiing) will be allowed? The Tongass National Forest should be included in alternative #3 now." (DEIS Response #1258, Individual, Sun River, OR)

> *"I support the Forest Service's roadless initiative and I would very much like to see the preferred alternatives (prohibition alternative #2, procedural alternative B, and Tongass National Forest alternative #T3) adopted into the final rule." (DEIS Response #1301,Individual, Ewen, MI)*

"Alternative 4 is the best alternative listed, but it should also prohibit all future activities which are detrimental to the environment, including all logging, mining, grazing, ORV usage, and commercial development. Absolutely no future road-building or reconstruction should be allowed for any reason." (DEIS Response #1006, Individual, Richland, WA)

> *"There is no scientific basis to exclude roadless areas of the Tongass National Forest from the proposed protections. Excluding the Tongass would severely compromise the scientific legitimacy of any national policy on the protection of roadless areas in our national forest system." (DEIS Response #114, Individual, Millersville, PA)*

"I ask the Forest Service to develop and evaluate one or more "access for all" alternatives in the EIS which would allow roads access and the full range of multiple uses of some or all of the roadless areas. The EIS should include a range of alternatives that vary the amount of roadless acres, or the number of roadless areas, for which environmentally sensitive multiple use road construction is allowed." (DEIS Response #13704, Individual, Hayden, ID)

> *"I support procedural alternative D because it provides the lowest risk of loss of roadless characteristics and values of all the alternatives." (DEIS Response #8319, Individual, Bozeman, MT)*

The Forest Service has considered all comments received on the Notice of Intent and the DEIS in developing and modifying the alternatives described in the FEIS, and in refining the analysis of their effects. Other alternatives considered but eliminated from detailed study are also addressed in this chapter. The alternatives considered in detail and those eliminated from the detailed study cover all issues relevant to the proposed action.

Alternatives Considered in Detail

The following section describes two sets of alternatives: 1) four alternatives, including a No Action Alternative, that cover the range of possible prohibited activities in inventoried roadless areas consistent with the stated purpose and need; and 2) four alternative ways to apply the prohibitions to the Tongass National Forest. All alternatives were developed in response to the issues identified in Chapter 1.

The Agency also developed a third set of alternatives (procedural Alternatives A through D) in the DEIS. Analysis of comments on the DEIS for the Roadless Rule showed that there was confusion about how the procedural alternatives would be implemented. Public comments on the proposed Planning Regulations and Agency comments on the DEIS for the Roadless Rule also suggested that the procedures for roadless area protection were best suited for the Planning Regulations. Upon review, most of the **roadless characteristics** [2]identified in the DEIS and proposed Roadless Rule were similarly required by the Planning Regulations. Therefore, the Forest Service determined that the procedures contemplated in the Roadless Rule should be an explicit part of the plan revision process, and addressed them at 36 CFR 219.9(b)(8) of the final Planning Regulations. By making small changes to the Planning Regulations, the procedural alternatives discussed in the DEIS were not needed as a part of the Roadless Rule and were removed from the FEIS.

In the Record of Decision and final rule, the **responsible official** will select one prohibition alternative and one Tongass alternative. If the responsible official chooses to treat the Tongass the same as every other national forest, the official would select the alternative that does not exempt the Tongass (Tongass Not Exempt). If the decision is to treat the Tongass differently than other national forests, one of the other Tongass alternatives would be chosen. Mitigation measures have also been identified that could be used to reduce economic and social impacts of the various alternatives. Any of these mitigation measures could be chosen to mitigate the effects of the selected alternative.

The following provisions would apply to any alternative selected in the Record of Decision and documented in the final rule:

- The rule would not suspend or modify any existing permit, contract, or other legal instrument authorizing the occupancy and use of National Forest System land;
- The rule would not compel the amendment or revision of any land and resource management plan; and
- The rule would not suspend or modify any project or activity decision made before the effective date of the final rule.

[2] These characteristics are described starting on page 3-3.

These provisions are essential to avoid disruption and confusion among Forest Service officials and the public. First, **road construction** or **reconstruction** associated with ongoing implementation of long-term special use authorizations would not be prohibited. Second, land and resource management plan amendments or revisions would not be required when the final rule becomes effective. Just as development and approval of plans must conform to existing laws and regulations, they can also be superceded by new laws or regulations without going through a redundant "conforming amendment" process. Finally, any project or activity decision signed prior to the effective date of the final rule would be allowed, but not required to proceed.

Local responsible officials' discretion to initiate land and resource management plan amendments, as deemed necessary, would not be limited by this provision. There may be instances where local officials elect to initiate amendment or revision of forest and grassland plans following final promulgation of this rule. Forest Service officials have several mechanisms that allow for evaluation of forest and grassland plan implementation, including plan-specific monitoring requirements, the amendment and revision process, and, of course, project-level decisionmaking. A determination to amend or revise a land and resource management plan is based on a variety of factors. Forest Supervisors and Regional Foresters have substantial discretion in determining whether or not to initiate plan amendments or revisions.

Exceptions Common to All Action Alternatives

The following **exception**s were developed in part from public comments received on the Notice of Intent and were used in Alternatives 2 through 4 in the DEIS. These exceptions have been incorporated into the FEIS without substantive change. Based on comments from the U.S. Fish and Wildlife Service and National Marine Fisheries Service, an additional exception has been added to Alternative 4 that would apply if that prohibition alternative is selected.

In all action alternatives, including the Tongass alternatives, the responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; or
- Realignment is needed to prevent irreparable resource damage by a **classified road**. The road must be deemed essential for public or private access, natural resource management, or public health and safety, and the resource damage associated with the road cannot be corrected by **maintenance**.

The effects of the prohibition and Tongass alternatives, their combined effects, and potential mitigation measures, are described in Chapter 3. In that analysis and in the comparison tables in this chapter, the above exceptions common to all action alternatives are included in Alternatives 2 through 4. Other exceptions that were developed as social and economic mitigation measures are evaluated as separate components that can be added to each alternative.

Prohibition Alternatives

The following alternatives describe the activities that would not be allowed on approximately 58.5 million acres of inventoried roadless areas (fewer acres, if the Tongass National Forest is not included in the final rule), identified in the Volume 2 maps. As described in Chapter 1, the Agency determined the scope of this analysis should consider national prohibitions against road construction, road reconstruction, and **timber harvest**.

Depending on which alternative is selected, the prohibitions would apply to the entire area within the boundaries of inventoried roadless areas, including portions that contain existing roads.[3] Some projects or activities may be allowed within those boundaries, if they qualify under one of the exceptions described previously.

Alternative 1

No Action; No Prohibitions

Alternative 2

Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas

Alternative 3

Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas

Alternative 4

Prohibit Road Construction, Reconstruction and All Timber Cutting Within Inventoried Roadless Areas

Effects of the prohibition alternatives, including their application to the Tongass National Forest, are discussed in the environmental, social, and economic analysis of Chapter 3. Alternatives that include modified circumstances for the Tongass National Forest are described later in this chapter, and their effects are also described in Chapter 3.

[3] As described in the DEIS, the prohibition alternatives would have applied to the "unroaded portion of an inventoried roadless area." Public comments indicated that this concept was confusing and would be difficult to apply and administer consistently. The effects analysis in the DEIS was actually based on application of the prohibitions to entire inventoried roadless areas, since data was not specific to roaded or unroaded portions. Therefore, both the concept and the definition of "unroaded portion" were deleted from the alternatives and analysis in this FEIS.

Alternative 1

No Action; No Prohibitions

No rule prohibiting activities in inventoried roadless areas would be issued. Road construction and reconstruction would continue to be restricted only where land management plan **prescriptions** prohibit such action (approximately 24.2 million acres).[4] Future proposals for road construction and reconstruction, where allowed by current land management plans, would be considered on a case-by-case basis at the project level with public comment and following the requirements of the National Environmental Policy Act (NEPA). There would be no restrictions on timber harvest under this alternative.

Both **even-aged** and **uneven-aged silviculture** management could be used if needed and allowed by the existing land management plans. **Precommercial thinning, commercial thinning**, and **regeneration harvest**, as well as the harvest of trees damaged by fire, insects, disease, or other natural **disturbance**, could be used to achieve both even- and uneven-aged forest **stands** when consistent with other resource needs. Logging is likely to include the use of ground-based equipment (for example, tractors and **forwarders**), cable systems, and helicopter.

In addition to meeting NEPA requirements for considering the effects of no action, this alternative also establishes a benchmark against which the effects of the other alternatives are compared.

Alternative 2

Prohibit Road Construction and
Reconstruction Within Inventoried Roadless Areas

Road construction and reconstruction, including **temporary road** construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. There would be no restrictions on timber harvest under this alternative. Road reconstruction activities are those that result in **realignment** or **improvement** of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to **developed recreation** site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

[4] The **land allocations** and **management prescriptions** for these areas could be reconsidered during plan revision.

Both even-aged and uneven-aged silviculture management could be used if needed and allowed by the existing land management plans. Precommercial and commercial thinning, and regeneration harvest, as well as the harvest of trees damaged by fire, insects, disease, or other natural disturbance, could be used to achieve both even- and uneven-aged forest stands when consistent with other resource needs. Logging is likely to include the use of ground-based equipment (for example, tractors and forwarders), cable systems, and helicopter. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

Alternative 3

Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas

Road construction and reconstruction, including temporary road construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. Road reconstruction activities are those that result in realignment or improvement of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to developed recreation site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

Timber harvest would be prohibited except for **stewardship** purposes. Stewardship purpose timber harvest can only be used where it maintains or improves roadless characteristics[5] and:

- Improves **threatened**, **endangered**, **proposed** or **sensitive** species habitat;
- Reduces the risk of uncharacteristically intense fire; or
- Restores ecological structure, function, processes, or composition.

Logging for stewardship purposes is likely to include the use of ground-based equipment (for example, tractors and forwarders), cable systems, and helicopter. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

Personal-use harvest, including firewood and Christmas trees, would be permitted. Tree cutting could occur incidental to other management activities, such as **trail** construction or maintenance, removal of hazard trees adjacent to classified roads for public health and safety reasons, fire line construction for **wildland fire suppression** or control of prescribed fire, or survey and maintenance of property boundaries. Mechanical fuel treatments, such as crushing, piling, or limbing, would be permitted.

[5] These characteristics are described starting on page 3-3.

Alternative 4

Prohibit Road Construction, Reconstruction and All Timber Cutting Within Inventoried Roadless Areas

Road construction and reconstruction, including temporary road construction, would be prohibited in inventoried roadless areas upon implementation of the final rule. Road reconstruction activities are those that result in realignment or improvement of an existing road. Examples of prohibited reconstruction activities include, but are not limited to:

- Improving a road to increase its capacity (for example, number of lanes, higher speeds, number of vehicles);
- Improving a road to change the original design function (for example, from fire access to developed recreation site access);
- Increasing the traffic-service level (for example, from use by high clearance pickups to low clearance passenger cars); and
- Realigning an existing road to a new location.

Timber cutting would be prohibited for both commodity and stewardship purposes. Personal-use harvest, including firewood and Christmas trees, would be permitted. Limited tree cutting could occur incidental to other management activities, such as trail construction or maintenance, hazard tree removal adjacent to classified roads for public health and safety reasons, fire line construction for wildland fire suppression or control of prescribed fire, or survey and maintenance of property boundaries. Mechanical fuel treatments, such as crushing, piling, or limbing, would be permitted, but under this alternative, area-wide tree cutting for fuel reduction purposes would be prohibited. Road construction and reconstruction in support of these activities would be prohibited in inventoried roadless areas.

The responsible official may authorize an exception to the prohibition on timber harvest if it is determined that such harvest is necessary: 1) to prevent degradation or loss of habitat, to the extent that such loss or degradation would increase the risk of extinction for a threatened or endangered species, or for a species that has been proposed for listing as threatened or endangered under the Endangered Species Act; or 2) to promote recovery of a threatened or endangered species. In all cases, agreement that the proposed action is warranted must be obtained from the National Marine Fisheries Service or United States Fish and Wildlife Service, as applicable.

Social and Economic Mitigation Measures

Several new exceptions were developed as the result of public comment on the DEIS. While similar to the exceptions proposed in the DEIS (see p. 2-4 in this chapter), their purpose is to mitigate some potential social and economic impacts the various alternatives may cause. The final rule may or may not include some or all of these mitigation measures. An analysis of their effects is included in Chapter 3.

These exceptions could be applied to any of the action alternatives. The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential;
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code is in the public interest or is consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists; or
- A road is needed for prospective mineral leasing activities in inventoried roadless areas.

The first exception was added to allow for the realignment or improvement of roads in situations where the current location or design is unsafe. For example, if there is an unsafe hairpin turn on a road which connects two communities, the road can be realigned to eliminate the unsafe hairpin turn. The second exception was added in response comments regarding the effects this rule could have on State highway projects proposed as part of the National Highway System. Under current regulations, State highway projects on NFS lands have to be approved by the Secretary of Agriculture. This exception maintains the Secretary's discretion as it already exists. The third exception was added in response to comments regarding the impacts the prohibition on road construction may have on future mineral leasing.

In conjunction with, but independent of this rule, the Chief of the Forest Service intends to work with affected States and communities and to pursue funds to help them respond to economic changes that may result from implementation of the final Roadless Rule.

In all action alternatives the Chief of the Forest Service may implement one or more of the following provisions of an economic transition program for communities most affected by changes in management of inventoried roadless areas:

- Provide financial assistance to stimulate **community**-led transition programs and projects in communities most affected by changes in roadless area management;
- Through financial support and action plans, attract public and private interest, both financial and technical, to aid in successfully implementing local transition projects and plans by coordinating with other Federal and State agencies; and
- Assist local, State, Tribal and Federal partners to work with those communities most affected by the final roadless area decision.

Tongass National Forest Alternatives

The following alternatives describe four alternative ways to apply the prohibition alternatives to the Tongass National Forest:

Tongass Not Exempt

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest

Tongass Exempt

Alternative Selected for the Rest of National Forest System Lands Would Not Apply to the Tongass National Forest

Tongass Deferred

No Alternative Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas on the Tongass as Part of the 5-Year Plan Review

Tongass Selected Areas

Prohibit Road Construction and Reconstruction in Old Growth, Semi-Remote Recreation, Remote Recreation Land Use Designations, and LUD IIs within Inventoried Roadless Areas on the Tongass

Alternatives T1 and T4 in the DEIS have been renamed (Tongass Exempt and Tongass Selected Areas, respectively), and incorporated without any substantive change into this FEIS. Because of the decision to include the procedures in the final Planning Regulations, the other Tongass alternatives (T2 and T3) have been modified from their original form in the DEIS, combined and redescribed as Tongass Deferred. In addition, an alternative named Tongass Not Exempt has been added to describe the decision maker's option of applying the selected prohibition alternative to the Tongass without any modification. This alternative (Tongass Not Exempt) includes an optional economic mitigation measure that would delay implementation of the prohibition alternatives on the Tongass until 2004.

Tongass Not Exempt

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest

This alternative is intended to clarify that under prohibition Alternatives 2 through 4, the Tongass would be treated the same as all other forests in the National Forest System. It is not a new alternative, but a clarified and reformatted description of an action that was implied on page 2-10 of the DEIS. Public comment showed some confusion about the intended incremental effects of applying the prohibitions to the Tongass. Under this alternative, the inventoried roadless areas on the Tongass would not be exempt from the prohibitions selected in the final rule.

Also as the result of public comment on the DEIS, the following optional mitigation measure was developed for this alternative. This delay in implementation would allow communities most affected by the final roadless area decision to adjust to changes in management of inventoried roadless areas.

In Tongass Not Exempt, the final rule may include the following social and economic mitigation measure to provide a transition period for communities most affected by changes in management of inventoried roadless areas:

- If this mitigation is included in the final rule, the prohibition alternative selected for inventoried roadless areas on all other NFS lands would be applied to inventoried roadless areas on the Tongass in April 2004.

Tongass Exempt

Alternative Selected for the Rest of National Forest System Lands Would Not Apply to the Tongass National Forest

This alternative was labeled Alternative T1 in the DEIS. Under this alternative, the Tongass National Forest would be exempt from the prohibitions in the final Roadless Rule. Future proposals for road construction and reconstruction would be considered on a case-by-case basis where allowed by the current land management plan, with roadless characteristics and values analyzed at the project level and raised as an issue. Under this alternative, land management would continue as outlined in the April 1999 Record of Decision for the Tongass Land and Resource Management Plan (TLMP). [6]

Tongass Deferred

No Alternative Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas on the Tongass as Part of the 5-Year Plan Review

This alternative is a modification and combination of Alternatives T2 and T3 in the DEIS. When the decision was made to include procedures for the evaluation of roadless characteristics in the final Planning Regulations, all procedural alternatives were removed from this FEIS. Since the prohibitions included in Tongass Alternatives T2 and T3 were the same, once the procedures were removed, there was no need to maintain them both.

No alternative would be applied on the Tongass National Forest at this time. Rather, the responsible official for the Tongass would determine whether the prohibition against road construction and reconstruction should apply to any or all of the inventoried roadless areas on the Tongass. The responsible official's evaluation would be conducted in association with the 5-year review of the 1999 TLMP (beginning in April 2004).

[6] The land allocations and management prescriptions for these areas could be reconsidered during plan revision.

In making that determination, the responsible official must consider, among other things, the provisions of Section 101 of the Tongass Timber Reform Act. This section, amending Section 705 of the Alaska National Interest Lands Conservation Act, requires the Agency to seek to provide a supply of timber from the Tongass National Forest that meets market demand, consistent with providing for the multiple use and sustained yield of all renewable resources, subject to appropriations, other applicable laws, and requirements of the National Forest Management Act of 1976.

Roading and timber harvest within inventoried roadless areas would continue as outlined in the 1999 Record of Decision for the TLMP until a determination is made on whether or not to apply the prohibitions as part of the 5-year plan review in 2004.

Tongass Selected Areas

Prohibit Road Construction and Reconstruction in Old Growth, Semi-Remote Recreation, Remote Recreation Land Use Designations, and LUD IIs within Inventoried Roadless Areas on the Tongass

This alternative was labeled Alternative T4 in the DEIS. Under this alternative, road construction and reconstruction activities, including temporary road construction, would be prohibited within inventoried roadless areas in the Old Growth, Semi-Remote Recreation, Remote Recreation, and LUD II[7] land use designations. Roading and timber harvest within other inventoried roadless areas would continue as outlined in the 1999 Record of Decision for the TLMP.

This alternative is a modification of Alternative 2, Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas. A complete description of the goals, objectives, and desired future condition for these four specific land use prescriptions is found in Appendix E of this volume.

[7] The LUD II designation is assigned to 12 areas that were allocated for special management by the Tongass Timber Reform Act. The desired condition in these areas is that of an extensive and generally unmodified natural environment that retains its original wildland character.

The Preferred Alternative

Based on responses received during the public comment period, the preferred alternative described in the DEIS has been modified, and it now includes:

Alternative 3 with Selected Social and Economic Mitigations

Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes Within Inventoried Roadless Areas, While Excepting Road Reconstruction Needed for Road Safety Improvements and Federal Aid Highway Projects

Tongass Not Exempt with Selected Social and Economic Mitigation

Alternative Selected for the Rest of National Forest System Lands Would Apply to the Tongass National Forest Beginning in 2004

Alternative 3, with Selected Social and Economic Mitigations - Road construction and reconstruction (including temporary road construction) and timber harvest except for stewardship purposes would be prohibited on 49.2 million acres of inventoried roadless area upon implementation of the final rule. This would increase to 58.5 million acres in April 2004 as the alternative is implemented on the Tongass. Stewardship purpose timber harvest could only be used where it maintains or improves roadless characteristics[8] and:

- Improves threatened, endangered, proposed or sensitive species habitat;
- Reduces the risk of uncharacteristic wildfire effects; or
- Restores ecological structure, function, processes, and composition.

Exceptions to the prohibitions would be allowed in the following circumstances:

The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, section 311 of the Clean Water Act, or the Oil Pollution Act;
- A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; or
- Realignment is needed to prevent irreparable resource damage by a classified road. The road must be deemed essential for public or private access, natural resource management, or public health and safety, and the resource damage associated with the road cannot be corrected by maintenance.

The following social and economic mitigation measures, in the form of additional exceptions, have also been incorporated.

The responsible official may authorize road construction or reconstruction in any inventoried roadless area when:

- Reconstruction is needed to implement road safety improvement projects on roads determined to be hazardous on the basis of accident experience or accident potential; or
- The Secretary of Agriculture determines that a Federal Aid Highway project authorized pursuant to Title 23 of the United States Code is in the public interest or is consistent with the purposes for which the land was reserved or acquired, and no other feasible alternative exists.

In conjunction with, but independent of this rule, the Chief of the Forest Service intends to work with States and communities and to pursue funds to help them respond to economic changes that may result from implementation of the final Roadless Rule. The Agency's success in securing appropriations for these purposes would have a direct bearing on its ability to actually implement the following programs.

The Chief of the Forest Service may implement one or more of the following provisions of an economic transition program for communities most affected by changes in management of inventoried roadless areas:

- Provide financial assistance to stimulate community-led transition programs and projects in communities most affected by changes in roadless area management;
- Through financial support and action plans, attract public and private interest, both financial and technical, to aid in successfully implementing local transition projects and plans by coordinating with other Federal and State agencies; and
- Assist local, State, Tribal and Federal partners to work with those communities most affected by the final roadless area decision.

Tongass Not Exempt, With Social and Economic Mitigations - The Tongass would be treated the same as all other forests in the National Forest System. Inventoried roadless areas on the Tongass would not be exempt from the final rule. However, as the result of public comment on the DEIS, implementation of the prohibitions would begin in April 2004, as provided below:

In Tongass Not Exempt, the final rule would include the following social and economic mitigation measure to provide a transition period for communities most affected by changes in management of inventoried roadless areas:

- The prohibition alternative selected for inventoried roadless areas on all other NFS lands would be applied to inventoried roadless areas on the Tongass in April 2004.

[8] These characteristics are listed on pages 3-5 through 3-6 in this EIS.

Following publication of this FEIS, the final Roadless Rule could be the same as this preferred alternative, or it could be a different combination of the alternatives and social and economic mitigation measures. The final decision will be documented in a Record of Decision and final rule, published no sooner than 30 days after the Notice of Availability of the FEIS.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Notice of Intent did not explicitly describe alternatives based on the issue categories upon which the DEIS was organized (see Chapter 1). The development of alternatives proposed during the scoping process was not a simple task given the wide variety of factors that were considered in detail (prohibitions, procedures, and Tongass National Forest alternatives).

Since the DEIS was released, many additional suggestions have been offered and explored in arriving at the set of alternatives considered in detail. Various components of alternatives, such as mitigation, geographical scope, and exemptions for specific inventoried roadless areas were suggested. Addressing each of these factors individually would create an unmanageably large number of alternatives. Also, some issues raised were outside the scope of conserving and protecting inventoried roadless areas, already represented by one or more of the alternatives considered in detail, or it was determined that they would cause unnecessary environmental harm.

The individual alternatives considered but eliminated have been organized into the following categories: 1) processes other than rulemaking for attaining the purpose of this action, 2) land use designations, 3) prohibitions, 4) geographical definitions, 5) durations for prohibitions and procedures, and 6) exemptions and exceptions.

Alternative Processes Other Than Rulemaking

Alternative methods were suggested for accomplishing the purpose of this proposal other than through the rulemaking process, such as an executive order, the existing land management planning process, the existing project planning process, and legislation.

Executive Order

The President did not elect to establish direction for the conservation of inventoried roadless areas with an executive order. Instead, the President's memorandum to the Secretary of Agriculture (White House 1999) directed development of a rule in a manner

that required full public notice and comment on this policy. In addition, the potential environmental consequences of establishing the use of prohibitions that make up the proposed action are not affected by the particular legal mechanism used. Therefore, an alternative where conservation of inventoried roadless areas would be established by Presidential action is not considered in detail.

Enactment of Legislation

Some comments suggested that the Forest Service develop a legislative proposal alternative. The President did not direct the Agency to prepare such a legislative proposal. On June 18, 1999, 166 Members of Congress requested that the President "take decisive action to protect the remaining roadless areas in our national forests." The Agency has adequate statutory authority to undertake this initiative without additional legislation. Therefore, a legislative proposal alternative is not considered in detail.

Provide More Local Flexibility

Alternatives were suggested that would allow more flexibility and discretion to local land managers than permitted by a national prohibition. These alternatives are essentially the selection of Prohibition Alternative 1 (No Action), along with the procedures incorporated into the final Planning Regulations. Since these local flexibility alternatives fall within the existing range of alternatives, they were not further developed.

Alternative Land Use Designations

A number of alternatives were considered that would designate inventoried roadless areas to prescriptions such as **Primitive**, and **Semi-primitive** classes of recreation, limited roading, fire access only, fully available for development, Research Natural Areas, National Monuments, and **Wilderness**. The Agency decided not to apply such prescriptions by national rule because such land use designations are best addressed through established land management planning. The purpose of the proposed action is to prevent the alteration and **fragmentation** of natural landscapes by limiting roading and possibly timber harvesting.

Designate Inventoried Roadless Areas As Primitive, Semi-Primitive, Limited Roading, Fire Access Only, Or Research Natural Areas

Designation of inventoried roadless areas as Primitive, back country recreation, or similar designation does not meet the purpose and need of the proposed action and would restrict uses beyond those necessary to meet the purpose and need. The designation of an area does not, in and of itself, limit or address uses that affect alteration and fragmentation of natural landscapes or other goals stated in the need for this proposal.

Designate All Inventoried Roadless Areas as National Monuments

The President has the authority under the Antiquities Act to designate National Monuments. However, the President did not elect to establish direction for conservation of inventoried roadless areas though the designation of National Monuments. The President's memorandum to the Secretary of Agriculture directed the development of roadless area conservation with authorities available to the Secretary. Therefore, designating inventoried roadless areas as National Monuments was dismissed from detailed study.

Recommend All Inventoried Roadless Areas for Wilderness or Other Special Designations

This alternative would recommend to Congress additions of approximately 58.5 million acres to the National Wilderness Preservation System. Prohibited activities would include those specified in the Wilderness Act of 1964 and others as determined by Congress in final legislation.

This alternative was eliminated from detailed consideration because: 1) most of the inventoried roadless areas in question have already been evaluated for Wilderness designation, and 2) the Agency uses the National Forest Management Act planning process as the mechanism for making future recommendations to Congress for Wilderness consideration.

Make All Inventoried Roadless Areas Fully Available for Development

This alternative would allow and encourage development activities, including road construction, in all inventoried roadless areas. It goes beyond the No Action Alternative by allowing full consideration of road construction in project- and forest-level planning, including inventoried roadless areas with land use prescriptions that currently prohibit road construction.

This alternative was eliminated from detailed study because it does not meet the intent of Presidential direction or the stated purpose and need of the proposed action. Additionally, the No Action Alternative would permit consideration of this expanded development alternative during the land management planning process where more site-specific implications of development could be most appropriately addressed.

No Net Loss and Rotation of Roadless Areas

These alternatives would provide that the current amount of roadless acres be maintained. Existing roadless areas could be roaded provided new roadless areas are created through **decommissioning** or **obliteration** of temporary and classified roads. One approach would involve rotating the roaded and unroaded areas on different parts of each national forest in a one-for-one exchange to maintain the same amount of roadless areas. As an example, after timber harvest activities are completed and the area planted with trees, the roads in the area would be closed or decommissioned returning it to a roadless status. Roads would then be allowed for access to timber in other areas. In this manner, roadless areas would be restored, timber harvest from current roadless areas would continue at the current level, and overall road miles on NFS lands would neither increase or decrease.

These various alternatives were eliminated from detailed study, as they could have the same effects as the No Action Alternative. These options do not meet the purpose and need of the proposed action. The use of temporary roads may have the same long lasting and significant ecological effects as permanent roads, such as the introduction of non-native vegetation and degradation of stream channels. Vegetation recovery after timber harvest can take decades to restore **structure** and **composition**. These alternatives would postpone roaded entry to harvest unroaded areas until the vegetation in the in neighboring harvested areas was sufficiently recovered to mitigate anticipated effects caused by the new entry. Additionally, no-net-loss programs can lead to complicated systems of monitoring, excessive procedural requirements, and complex definitions and criteria.

Return Treaty-Ceded Lands

There was a request for alternatives to return treaty-ceded lands back to American Indian Tribes to be held in perpetuity as natural ecological and wildlife reserves. This is a legal matter that is outside the scope of this proposal.

Alternative Sets of Prohibitions Applicable To Inventoried Roadless Areas

A list of possible prohibitions could include off-highway vehicles (OHVs), rights-of-way, grazing, special uses, developed recreation, trails, mineral withdrawal, and other uses in addition to road construction, reconstruction, and timber harvesting. Another possibility is the closure or decommissioning of all roads in inventoried roadless areas.

Prohibit More Activities than Road Construction, Reconstruction, and Timber Harvesting

The scope of prohibition actions considered in detail has been limited to road construction, road reconstruction, and timber harvesting because these activities pose disproportionately greater risk of alteration and fragmentation of natural landscapes than other activities as discussed in Chapter 1 and Chapter 3. In addition, these activities are more widespread on the landscape, and information exists for this level of national decision-making.

A suggested alternative to those analyzed in the DEIS would confine OHV use only to roads and trails that have been specifically designated for that purpose. This alternative was considered but not further developed because the limited data on OHV uses in inventoried roadless areas have not demonstrated that this activity poses widespread or disproportionate risks of altering natural landscapes to the same extent as roads and timber harvesting. If there are local problems with current OHV, local managers have existing authorities to regulate this use by orders under 36 CFR 261.50 and 261.53.

Mineral Withdrawal

Withdrawal of inventoried roadless areas from mining was considered but was dismissed from detailed study. The potential impacts to roadless values from mining activities can be severe in localized areas, but are not believed to be significant and widespread on a national level. Furthermore, specific requirements must be followed for mineral withdrawals, which would be difficult to accomplish in a proposal of national scope. However, mineral withdrawals for specific inventoried roadless areas could be proposed in compliance with Department of the Interior rules and procedures.

Restore Roaded Portions of Inventoried Roadless Areas

In addition to alternative sets of prohibitions, an alternative was considered that would go beyond prohibitions and require removal of any existing roads from inventoried roadless areas through closure or decommissioning. Under this alternative, future road construction and reconstruction would be prohibited in all portions of inventoried roadless areas. In addition, all existing roads would be scheduled for closure and removal in a timely manner.

The Agency determined that it would not consider closure and decommissioning of any roads as part of this national proposal. The need to decommission roads will be examined at the local level as part of the roads analysis process described in the proposed Roads Policy. A decision to close all roads would preclude activities that have already been approved, and activities that the Agency has determined are more appropriately addressed at the local level.

Provide Road Construction for Stewardship Harvesting

This alternative would allow road construction and reconstruction, temporary or permanent, for stewardship treatment of vegetation including commercial removal of trees. Except for the Tongass National Forest, the resulting outcome and environmental effects could approach those discussed for the No Action Alternative. The outcomes of the No Action Alternative do not satisfy the stated purpose and need. Therefore, this alternative to permit road construction and reconstruction for stewardship harvesting would also not satisfy the purpose and need and was not considered in detail.

Alternative Geographical Definitions of Unroaded Areas

Public comments suggested applying the rule to other areas in addition to inventoried roadless areas. For example, many people suggested applying the prohibitions to all unroaded areas 1,000 acres or greater in size.

As discussed in Chapter 1, data are unavailable on the extent or location of unroaded areas other than those roadless areas inventoried through current public planning processes. It is not the intent nor is it appropriate that management of areas currently uninventoried be subject to a national prohibition.

Land management planning and other assessments of roadless areas were subject to public comment before inventoried roadless boundaries were established. There is no need to undertake an inventory at the national level, nor to make decisions on delineation of such areas until they have first been subjected to local consideration.

Alternative Durations for Applying Prohibitions

Suggestions were offered during the scoping period and the comment period for the DEIS regarding alternative durations for applying prohibitions. The prohibitions in Alternatives 2 through 4 would remain in effect unless the rule is revised. Other options suggested were a 1-year or 18-month period similar to the Interim Roads Rule. Another suggestion was to issue temporary prohibitions until land management plans are revised or amended to address the management of roadless areas consistent with the purpose and need stated in Chapter 1.

Alternative duration options were not considered as fulfilling the purpose and need for the long-term protection of roadless areas. The No Action Alternative, with the reasonably foreseeable completion of the Roads Policy, would provide a temporary level of protection for roadless areas, and constitutes an optional duration alternative.

The proposed Roads Policy would require a science-based roads analysis for any road construction proposals, thus requiring a closer look at the environmental, social, and economic factors than might have occurred without the Roads Policy. As such, it would provide a level of protection, but not with the same level of certainty as the alternatives described in this FEIS. At best, this assumes completion of the final Roads Policy. Any temporary prohibition, however, would not meet the stated purpose and need.

Alternative Exemptions and Exceptions

There exists an infinite number of potential exemptions and exceptions, including consideration of many specific roadless areas (see Content Analysis Enterprise Team 2000a and 200b). Examples include exempting the Tongass National Forest, other national forests where land management plan revisions are complete, and national forests exempted under the Interim Roads Rule (64 FR 7289). In addition, certain activities could be excepted.

Geographic Area Exemptions

Land management planning, including the Pacific Northwest Forest Plan, the Tongass Forest Plan and other recently revised land management plans, has not specifically addressed the need to protect roadless areas nor responded to the purpose and need described in Chapter 1. Therefore, exempting specific forests, other than the Tongass, or specific areas was not considered justified.

The Tongass National Forest is unique among national forests as discussed in Chapter 1. Because of the economic and social situation on the Tongass National Forest, specific roadless area alternatives are considered in this FEIS.

An alternative was considered that would limit application of the prohibitions to those inventoried roadless areas identified in current land management plans as having an allocation that prohibits road construction and reconstruction, or recommends the area for Wilderness. Under this alternative, the prohibitions would add permanence to what is currently taking place on approximately 24.2 million acres. The Agency determined that this alternative is a subset of Alternative 2 which essentially would have the same effects as the No Action Alternative therefore, it was not developed in detail.

An alternative was considered that would limit application of the prohibitions only to municipal watersheds that supply drinking water. Although this alternative would respond to an important criteria for protecting inventoried roadless areas, limiting the prohibitions to that portion of inventoried roadless areas that provide water to facilities that treat and distribute drinking water would protect only a small number of roadless areas and does not satisfy the purpose and need of the proposed action.

Activity Exceptions

Exceptions to permit road construction or reconstruction for activities not specified by law were considered but dismissed from detailed study. Specifically, considerations were given for hazardous fuel reduction treatments, insect and disease treatments, and **forest health** management. An exception for these activities could lead to widespread road construction in many roadless areas that would be incompatible with the stated purpose and need. Therefore, only exceptions for activities that are limited in scope and could have local significant environmental benefits, respond to legal requirements, or mitigate certain social and economic impacts were considered in detail. Specifically, these are exceptions for road construction and reconstruction in inventoried roadless areas needed to protect public health and safety, respond to CERCLA, comply with treaty, statutory, reserved or outstanding rights, prevent irreparable resource damage, correct unsafe road conditions, accommodate Federal Aid Highway projects, allow mineral leasing activities, and protect or restore Threatened, Endangered, and Proposed species and habitat.

Alternative Exemption for the Tongass

Commenting on the DEIS, an alternative was suggested that would lead to a revision of the 1997 Land Management Plan for the Tongass National Forest (TLMP) and its 1999 Record of Decision. This suggestion was made, in part, on the premise that some of the younger stands removed from the suitable timber base in the 1999 decision could be put back into the suitable timber base and the 200-year rotation plan could be lowered. The Agency believes that it is not feasible to single out a revision of the TLMP through this national rule. These types of alternatives are best left to the Agency's land management planning procedures where specific land capabilities and suitability can be accurately evaluated at the local level.

Comparison of Alternatives

The following tables in this section provide a summary of the environmental consequences described in Chapter 3. They are not intended to be all inclusive. Information in the tables is focused on activities or resources where measurable effects are most likely to occur and where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. For ease of comparison and greater consistency, outputs and effects in the following tables are displayed as annual averages whenever possible.

Table 2-1 compares the key characteristics of Alternatives 2 through 4 against No Action (Alternative 1) and the Preferred Alternative (Alternative 3 with Selected Mitigation Measures and Tongass Not Exempt with Delayed Implementation). Table 2-2 compares the key characteristics of Tongass Not Exempt (with and without the Delayed Implementation), Tongass Exempt, Tongass Deferred, and Tongass Selected Areas.

The maps and acreage information in this FEIS were revised after publication of the DEIS. These revisions have resulted from: 1) separate identification of all inventoried roadless areas that were previously included within special designated areas, 2) inclusion of updated and approved roadless area inventories associated with land management planning, and 3) cartographic adjustments and corrections to inventoried roadless areas to match NFS lands planning record information. Mainly as a result of items 1 and 2, the total inventoried roadless area acreage increased from 54.3 million acres in the DEIS to 58.5 million acres in the FEIS (Appendix A)[9].

An additional change was made to end the confusion about the “roaded portions of inventoried roadless areas.” The DEIS estimated that 2.8 million acres of inventoried roadless areas had been roaded during the previous 20 years, and proposed to treat them differently than the “unroaded portions.” Because the Agency believes it would be difficult to identify the “roaded portions” in a manner that would be ecologically meaningful and administratively consistent, the term and concept have been deleted in this FEIS. The selected prohibitions would now apply to the entire area within the boundaries of an inventoried roadless area.

The alternatives described in this FEIS have been retained in comparable form to those displayed in the DEIS. However, because of the acreage changes described above and clarification that the area of applicability for prohibitions includes roaded and unroaded portions of inventoried roadless areas, the estimates of road mileage, timber harvest, and other measures in the following comparison tables also changed.

[9] This information is found in the project record and is hereby incorporated by reference.

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. *The effects summarized in this table[A] would occur in inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	**Alternative 1** No Action; No Prohibitions	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	**Alternative 2** Prohibit Road Construction and Reconstruction Within Inventoried Roadless Areas	**Alternative 3** Prohibit Road Construction, Reconstruction, and Timber Harvest Except for Stewardship Purposes[B] Within Inventoried Roadless Areas	**Alternative 4** Prohibit Road Construction, Reconstruction, and All Timber Cutting Within Inventoried Roadless Areas
Inventoried Roadless Areas with Permanent Prohibition on Road Construction and Reconstruction	0 acres	49,178,000 acres until 2004 58,518,000 acres after 2004[C], when prohibitions would be implemented on the 9,340,000 acres of inventoried roadless area on the Tongass National Forest.	58,518,000 acres		
Inventoried Roadless Areas with Permanent Prohibition on Commodity-Purpose Timber Harvest	0 acres	49,178,000 acres until 2004 58,518,000 acres after 2004, when prohibitions would be implemented on the 9,340,000 acres of inventoried roadless area on the Tongass National Forest; Stewardship timber harvest not requiring road construction or reconstruction would continue.	0 acres	58,518,000 acres; Stewardship timber harvest not requiring road construction or reconstruction would continue.	58,518,000 acres

[A] For ease of comparison and greater consistency, outputs and effects in these tables are displayed as annual averages whenever possible. In Chapter 3 the analysis of effects are often shown as 5 year totals for the period 2000 to 2004. Any discrepancies between these figures and those cited in the text, other tables, or in the database are due to rounding.
[B] Stewardship-purpose timber harvest includes timber sales made primarily to help achieve desired ecological conditions or to attain some non-timber resource objective requiring manipulation of the existing vegetation (for example, reducing forest fuels by constructing a fuel break). Refer to the Glossary for a complete definition.
[C] When used in reference to the Tongass, 2004 means April 2004, the date of the scheduled plan revision.

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur in inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Short Term Average Annual Timber Related Road Construction and Reconstruction Planned in Inventoried Roadless Areas From 2000 to 2004	125 miles/year	58 miles/year until 2004 0 miles/year after 2004, when road construction would also be prohibited in inventoried roadless areas on the Tongass National Forest.	0 miles/year		
Short Term Average Annual Non-Timber Related Road Construction and Reconstruction Planned In Inventoried Roadless Areas From 2000 to 2004	107 miles/year	63 miles/year until 2004 60 miles/year after 2004 when road construction would also be prohibited in inventoried roadless areas on the Tongass National Forest; this includes those roads associated with Federal Aid Highway Projects	59 miles/year		
Short Term Average Annual Acreage Planned for Timber Harvest in Inventoried Roadless Areas From 2000 to 2004	18,000 – 19,000 acres/year	7,200 acres/year until 2004 4,400 acres/year after 2004	8,000 acres/year	4,400 acres/year	0 acres/year

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur in inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** Alternative 3 – with Selected Social and Economic Mitigations *And* Tongass Not Exempt Beginning in 2004	Alternative 2	Alternative 3	Alternative 4
Short Term Average Annual Timber Volume Offered[A] on All NFS Lands From 2000 to 2004 (MMBF = million board feet)	3,300 MMBF/year	3,214 MMBF/year until 2004 3,112 MMBF/year after 2004	3,140 MMBF/year	3,112 MMBF/year	3,080 MMBF/year
Short Term Average Annual Timber Volume Offered in Inventoried Roadless Areas From 2000 to 2004 (MMBF = million board feet)	220 MMBF/year	140 MMBF/year until 2004 32 MMBF/year after 2004	60 MMBF/year	32 MMBF/year	0 MMBF/year
Short Term Average Annual Timber Volume Harvested[B] in Inventoried Roadless Areas From 2000 to 2004 (MMBF = million board feet)	147 MMBF/year	98 MMBF/year until 2004 21 MMBF/year after 2004	39 MMBF/year	21 MMBF/year	0 MMBF/year

[A] Volume Offered is an estimate of timber volume that will be advertised for sale. Refer to the Glossary for a complete definition.
[B] Volume Harvested is an estimate of timber volume that will actually be cut, and is usually less than the volume offered. Refer to the Glossary for a complete definition.

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur in inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Short Term Average Annual Timber Related Employment From All NFS Timber Harvest From 2000 to 2004 (direct timber-related jobs)	26,957 jobs/year	26,610 jobs/year until 2004 26,227 jobs/year after 2004	26,350 jobs/year	26,227 jobs/year	26,071 jobs/year
Short Term Average Annual Income From All NFS Timber Harvest Related Employment From 2000 to 2004 (direct timber-related job income)	$1053.2 million/year	$1037.7 million/year until 2004 $1020.1 million/year after 2004	$1025.4 million/year	$1020.1 million/year	$1013.7 million/year
Short Term Average Annual Payments to States From All NFS Timber Receipts From 2000 to 2004	$135.0 million/year	$133.0 million/year until 2004 $131.3 million/year after 2004	$132.0 million/year	$131.3 million/year	$130.5 million/year

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Agency Costs	Overall agency costs would continue at current levels.	Prohibiting road construction would reduce future maintenance costs for roads that might have been built. Forest health treatments may be more costly in inventoried roadless areas. No additional planning costs would be incurred, although savings in appeals and litigation costs related to inventoried roadless area management are anticipated. Overall agency costs are expected to remain the same.			
Inventoried Roadless Areas At Risk From Uncharacteristic Wildfire Effects	In inventoried roadless areas, 7 million acres are at moderate risk and 4 million acres are at high risk from wildfires that could potentially cause uncharacteristic wildfire effects. A majority of NFS lands with the highest priority for fuel treatment are located outside inventoried roadless areas. Little fuel treatment work is anticipated in inventoried roadless areas unless there is a threat to the wildland urban interface, threatened and endangered species habitat, and readily accessible municipal watersheds. Fire risk, either from wildfires or hazardous fuels, is not a concern on the Tongass National Forest.				Acreage burned by large wildland fires in inventoried roadless areas, as on other NFS lands, is expected to increase slightly in the next 20 years; potential exists for a few more large fires than in Alternatives 1 – 3.
Locatable and Leasable Minerals in Inventoried Roadless Areas	No change from current management policies.	Prohibiting road construction would preclude future leasable mineral exploration and development when reliant on road construction in inventoried roadless areas. Total economic impacts associated with current operations seeking to expand into inventoried roadless areas could directly affect 546 jobs and $35.8 million per year in associated income beginning sometime after 2003. No change from current management policies for locatable minerals.			

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Developed Recreation Opportunities	Development would continue consistent with existing policies and management direction.	Similar to Alternatives 2 – 4, with some new opportunities for developed and road-based recreation in inventoried roadless areas on the Tongass National Forest until 2004 based on existing policies and management direction, and in areas where social and economic mitigation measures are applied	Opportunities for future developed recreation would decline in inventoried roadless areas, which may cause additional impacts on existing developed and road based recreation as overall demand increases.		
Dispersed Recreation Opportunities	Land base for dispersed recreation would be maintained on 24.2 million acres of inventoried roadless areas where land management plan prescriptions prohibit road construction. The remaining 34.3 million acres (59%) would be available for road based and developed recreation based on project and forest level planning.	Similar to Alternatives 2 – 4, with potential for some loss of dispersed recreation opportunities in inventoried roadless areas on the Tongass National Forest until 2004, and in areas where social and economic mitigation measures are applied.	Land base for dispersed recreation would be maintained on all 58.5 million acres of inventoried roadless areas.		

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Hunting And Fishing Opportunity In Inventoried Roadless Areas	Quality of opportunities potentially reduced by degradation of habitat for fish and some game species.	Similar to Alternatives 2 – 4, with potential for some reduction in quality of hunting and fishing opportunities in inventoried roadless areas on the Tongass National Forest until 2004, and in areas where social and economic mitigation measures are applied	Maintains current quality of roadless hunting and fishing opportunities. Protects habitat important for some fish and wildlife species, particularly for those sensitive to human disturbance, or those with large home ranges, with associated benefits to hunting and fishing.		
Impacts to Designated or Potential Wilderness Near or Adjacent to Inventoried Roadless Areas	Roading in inventoried roadless areas may increase potential risk to adjacent or nearby wilderness values.	Similar to Alternatives 2 – 4; with potential for increased risk to wilderness values in adjacent or nearby Wilderness areas or potential wilderness areas on the Tongass until 2004, and in areas where social and economic mitigation measures are applied	Prohibiting road building in inventoried roadless areas would reduce potential risk to wilderness values in adjacent or nearby designated Wilderness or potential Wilderness areas.		

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Watershed Resources in Inventoried Roadless Areas	Localized, short-term effects to water quantity and quality where high levels of roading and timber harvest are planned; increased risk of mass wasting and erosion in localized areas.	Similar to Alternative 2; with potential for some increased risk in inventoried roadless areas on the Tongass until 2004 of limited local short-term changes to water quantity and quality, small risk of mass wasting and erosion.	Beneficial effects to those forests where high levels of roading would have occurred; limited benefits elsewhere; limited local short-term changes to water quantity and quality, reduced risk of mass wasting and erosion.	Beneficial effects to those forests where high levels of roading and commodity timber harvest would have occurred; limited benefits elsewhere; limited local short-term changes to water quantity and quality, reduced risk of mass wasting and erosion.	Substantial benefits to those forests where high levels of roading and timber harvest would have occurred; limited benefits elsewhere; water quantity generally near undisturbed levels; water quality, mass wasting, erosion same as Alternative 3 except in areas burned by wildfire.
Air Resources in and Adjacent to Inventoried Roadless Areas	Small risk of gradual air quality deterioration from dust, smoke and emissions associated with road construction, reconstruction, and use.	Lower risk of air quality deterioration from dust, smoke and emissions.			Lower risk of gradual air quality deterioration from dust, smoke and emissions. Increased risk relative to Alternatives 1, 2,and 3 from wildfire smoke due to inability to cut trees to reduce fuels.

Table 2-1. Comparison of Key Characteristics and Effects by Prohibition Alternative. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the entire National Forest System, including the Tongass National Forest.*

Issue, Objective, or Measure	Alternative 1	***Preferred Alternative*** **Alternative 3 – with Selected Social and Economic Mitigations** *And* **Tongass Not Exempt Beginning in 2004**	Alternative 2	Alternative 3	Alternative 4
Biological Diversity in and Adjacent to Inventoried Roadless Areas	Greatest risk from roading and ground disturbance; highest potential for increased fragmentation, loss of connectivity, introduction of non-native invasive species, habitat degradation and disruption; least acres protected.	Similar to Alternative 3; with potential for some increased risk of human disturbance activities in important fish, wildlife, and plant habitats in inventoried roadless areas on the Tongass until 2004.	Beneficial effects due to reduced level of human disturbance activities and increased conservation of important fish, wildlife, and plant habitats.	Somewhat lower potential for ground disturbance relative to Alternative 2, but effects not substantially different given relatively small difference in projected timber offer volume.	Lowest levels of ground disturbance and habitat disruption, but effects essentially the same as Alternative 3. Limited potential for localized adverse effects from restriction on stewardship harvest, but not detectable at national scale.
Threatened, Endangered, And Proposed (TEP) Plant and Animal Species Protected	Greatest potential loss of habitat and adverse effects to TEP species from highest level of road construction and ground disturbance.	Important benefits to over 220 TEP species with habitat in or affected by inventoried roadless areas. Substantially reduced risk relative to Alternative 1; Slightly reduced risk relative to Alternative 2.	Important benefits to over 220 TEP species with habitat in or affected by inventoried roadless areas. Substantially reduced risk relative to Alternative 1.	Slightly reduced risk relative to Alternative 2, with less ground disturbance and habitat disruption.	Least amount of ground disturbance, but effects essentially the same as Alternatives 2 and 3.
Non-native Invasive Species (NIS)	Greatest risk for increased introduction and establishment of NIS from road construction and use, and other associated ground disturbance.	Slightly less ground disturbance than Alternative 2, but effects not substantially different given relatively small difference in projected timber offer volume.	Substantially reduced relative risk locally with prohibition on road construction.	Slightly less ground disturbance than Alternative 2, but effects not substantially different given relatively small difference in projected timber offer volume.	Slightly less ground disturbance than Alternative 2 and 3; greatest relative degree of protection against future introduction and establishment of NIS.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	**Tongass Not Exempt** Alternative Selected for Other NFS Lands Applies to the Tongass National Forest Upon Implementation of the Final Rule	**Tongass Not Exempt Beginning in 2004** Alternative Selected for Other NFS Lands Applies to the Tongass National Forest in April 2004	**Tongass Exempt** Alternative Selected for Other NFS Lands Does Not Apply to the Tongass National Forest	**Tongass Deferred** Alternative Not Selected at This Time; Determine Whether Road Construction Should be Prohibited in Inventoried Roadless Areas as Part of 5 Year Plan Review in 2004	**Tongass Selected Areas** Prohibit Road Construction and Reconstruction in the Old Growth, Semi-Remote Recreation, Remote Recreation Land Use Designations, and LUD IIs Within Inventoried Roadless Areas on the Tongass National Forest
Inventoried Roadless Areas with Prohibitions	9,340,000 acres	0 acres until 2004 9,340,000 acres after 2004	0 acres	No permanent prohibitions unless and until decided upon during the 5-year plan review	6,989,000 acres
Average Annual Timber Related Road Construction & Reconstruction Planned in Inventoried Roadless Areas From 2000 to 2040	0 miles/year	58 miles/year until 2004; 0 miles/year after 2004	58 miles/year	58 miles/year until 2004; Depending on the decision made during the 5-year plan review in 2004; fewer roads may be constructed or reconstructed after that date.	There would be a short term reduction in road construction due to 13 cases where road segments were planned to cross these 4 LUDs to access timber sales; in the long term, road construction is expected to return to an average annual 58 miles/year

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	Tongass Not Exempt	Tongass Not Exempt Beginning in 2004	Tongass Exempt	Tongass Deferred	Tongass Selected Areas
Average Annual Non-Timber Related Road Construction and Reconstruction Planned In Inventoried Roadless Areas From 2000 to 2040	0 miles/year	3 miles/year until 2004 0 miles/year after 2004	3 miles/year	3 miles/year until 2004; Depending on the decision made during the 5-year plan review in 2004; fewer roads may be constructed or reconstructed after that date.	3 miles/year
Average Annual Acreage Planned for Timber Harvest in Inventoried Roadless Areas From 2000 to 2040	0 acres/year	2,800 acres/year until 2004 0 acres/year after 2004	2,800 acres/year	2,800 acres/year until 2004 Depending on the decision made during the 5-year plan review in 2004; fewer acres may be planned for timber harvest after that date.	2,000 acres/year until 2004 2,700 acres/year after 2004
Average Annual Timber Volume Offered by the Tongass From 2000 to 2040 (MMBF = million board feet)	68 MMBF/year	176 MMBF/year until 2004 68 MMBF/year after 2004	176 MMBF/year	176 MMBF/year Depending on the decision made during the 5-year plan review in 2004; fewer acres may be planned for timber harvest after that date.	128 MMBF/year until 2004 166 MMBF/year after 2004
Average Annual Timber Volume Offered by the Tongass in Inventoried Roadless Areas From 2000 to 2040 (MMBF = million board feet)	0 MMBF/year	108 MMBF/year until 2004 0 MMBF/year after 2004	108 MMBF/year	108 MMBF/year Depending on the decision made during the 5-year plan review in 2004; fewer acres may be planned for timber harvest after that date.	60 MMBF/year until 2004 98 MMBF/year after 2004

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	Tongass Not Exempt	Tongass Not Exempt Beginning in 2004	Tongass Exempt	Tongass Deferred	Tongass Selected Areas
Average Annual Timber Volume Harvested by the Tongass in Inventoried Roadless Areas From 2000 to 2040 (MMBF = million board feet)	0 MMBF/year	77 MMBF/year until 2004 0 MMBF/year after 2004	77 MMBF/year	77 MMBF/year Depending on the decision made during the 5-year plan review in 2004; fewer acres may be planned for timber harvest after that date.	43 MMBF/year until 2004 70 MMBF/year after 2004
Average Annual Tongass Timber Harvest Related Employment (timber-related jobs per year)	242 jobs/year	625 jobs/year until 2004 242 jobs/year after 2004	625 jobs/year	625 jobs/year until 2004 Depending on the decision made during the 5-year plan review in 2004; the timber program may support fewer jobs after that date.	455 jobs/year
Average Annual Income From Tongass Timber Harvest Related Employment (direct timber-related job income)	$11.0 million/year	$28.6 million/year until 2004 $11.0 million/year after 2004	$28.6 million/year	$28.6 million/year until 2004 Depending on the decision made during the 5-year plan review in 2004; there may be less annual income from timber harvest related jobs after that date.	$20.8 million/year
Annual Payments to State (Alaska) from Timber Receipts	$1.0 million/year	$2.7 million/year until 2004 $1.0 million/year after 2004	$2.7 million/year	$2.7 million/year until 2004 Depending on the decision made during the 5-year plan review in 2004; there may be a reduction in Payments to State from timber harvest related jobs after that date.	$2.0 million/year

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	Tongass Not Exempt	Tongass Not Exempt Beginning in 2004	Tongass Exempt	Tongass Deferred	Tongass Selected Areas
Agency Costs	Greatest reduction of future costs for roads that would have been built, planning costs, and overall timber program costs. Greatest savings in appeals and litigation costs related to inventoried roadless area management are anticipated.	Overall agency costs would continue at current levels until 2004. After 2004, costs would decline in a similar fashion to Tongass Not Exempt.	Overall agency costs would continue at current levels.	Depending on local decisions made during the 5-year plan review in 2004, there may be reduced road maintenance, planning, and appeal/litigation costs after that date.	Will reduce future maintenance costs for roads that would have been built in the 4 LUDs. As a result, reduced planning costs would be incurred; some savings in appeals and litigation costs related to inventoried roadless area management are anticipated.
Dispersed Recreation Opportunities and Scenic Quality	Greatest amount of land conserved for dispersed recreation and high scenic quality.	Some loss of dispersed recreation opportunities and scenic quality in inventoried roadless areas until 2004. After that date, remaining opportunities are likely to be conserved.	Land base available for dispersed recreation activities and maintaining high scenic quality would continue to decline incrementally.	Some loss of dispersed recreation opportunities and scenic quality in inventoried roadless areas until 2004. Depending on local decisions made during the 5-year plan review, remaining opportunities could be conserved.	Dispersed recreation opportunities and high scenic quality in the 4 land use designations would be maintained at current levels.
Developed Recreation Opportunities	Reduced opportunity for some types of recreational development in inventoried roadless areas in all land use designations.	Continued opportunities for developed recreation in inventoried roadless areas consistent with current TLMP until 2004. Reduced opportunities after that date.	Development could continue consistent with current TLMP.	Continued recreation development consistent with current TLMP until 2004. Depending on local decisions made during the 5-year plan review, opportunities for new recreation sites in inventoried roadless areas could be reduced after 2004.	Reduced opportunity for some types of recreational development in the 4 land use designations.

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	Tongass Not Exempt	Tongass Not Exempt Beginning in 2004	Tongass Exempt	Tongass Deferred	Tongass Selected Areas
Hunting And Fishing Opportunity in Inventoried Roadless Areas	Maintains current level of quality for hunting, fishing, and subsistence opportunities in all land use designations.	Some reduction in quality of hunting, fishing, and subsistence opportunities until 2004. Opportunities that exist in inventoried roadless areas in 2004 are likely to be maintained.	Quality of opportunities are potentially reduced by loss or degradation of habitat that could affect commercial, recreational and subsistence species; among the alternatives, has the greatest potential to increase human competition for subsistence species.	Current levels of quality may be incrementally reduced until 2004. Depending on local decisions made during the 5-year plan review, future reductions in quality may be minimized.	Maintains quality of hunting, fishing, and subsistence opportunities in the 4 LUDs. Opportunities in other land use designations would likely decline incrementally over time.
Locatable and Leasable Minerals in Inventoried Roadless Areas	Prohibiting road construction may reduce exploration and development activity in response to higher access costs. No effect on future mineral leasing reliant on road access.	No effect to current programs until 2004. Prohibition of roading at that time may reduce exploration and development activity. No effect on future mineral leasing reliant on road access.	No effect to current programs. No effect on future mineral leasing reliant on road access.	No effect to current programs until 2004. Depending on local decisions made during the 5-year plan review, there may be reduced exploration and development activity in response to higher access costs. No effect on future mineral leasing reliant on road access.	May be some reduced exploration and development activity in response to higher access costs in the 4 LUDs. No effect on future mineral leasing reliant on road access.
Watershed Resources in Inventoried Roadless Areas	Provides less risk in all land use designations. Provides greatest opportunity to reduce impacts among the alternatives.	Current level of risks exist until 2004. After that date, lower level of risk in all LUDs.	Greatest level of risk relative to all other alternatives from roading and ground disturbance; highest level of risk to water quality, soil loss, mass wasting, soil productivity, and sedimentation.	Current level of risk until 2004. Depending on local decisions made during the 5-year plan review, there could be fewer impacts to water quality, soil loss, mass wasting, sedimentation, and soil productivity after that date.	Provides less risk to watershed resources in 4 LUDs

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

Table 2-2. Comparison of Key Characteristics and Effects by Tongass National Forest Alternative[A]. (cont.) *The effects summarized in this table would occur on inventoried roadless areas throughout the Tongass National Forest.*

Issue, Objective, or Measure	Tongass Not Exempt	Tongass Not Exempt Beginning in 2004	Tongass Exempt	Tongass Deferred	Tongass Selected Areas
Biological Diversity; Threatened, Endangered, And Proposed (TEP) Plant and Animal Species Protected	Provides less risk in all land use designations. Provides greatest opportunity to reduce impacts among the alternatives.	Current level of risks exist until 2004. After that date, lower level of risk in all LUDs.	Greatest risk relative to all other alternatives from roading and ground disturbance; highest potential for increased fragmentation, loss of connectivity, habitat degradation and disruption; least acres protected.	Current level of risk until 2004. Depending on local decisions made during the 5-year plan review, impacts could be reduced after that date.	Provides less risk to biological diversity in 4 LUDs.
Impacts to Wilderness from Management Decisions on Adjacent Inventoried Roadless Areas	No future threats to wilderness values from potential roading in adjacent or nearby inventoried roadless areas.	Similar to Tongass Exempt until 2004. After that date, no future threats to wilderness values from roading in inventoried roadless areas.	Potential for road building and associated activities in inventoried roadless areas would continue at current level of risk, and could increase threats to wilderness values in adjacent or nearby Wilderness areas and potential wilderness areas.	Similar to Tongass Exempt until 2004. Depending on local decisions made during the 5-year plan review, has a higher likelihood of reducing threats from roading in inventoried roadless areas after that date.	May slightly reduce threat to wilderness values since the 4 LUDs where prohibitions would apply are frequently adjacent to wilderness areas. Reduction is expected to be minimal as road building in portions of these 4 LUDs that are adjacent to wilderness is highly unlikely.

[A] For purposes of comparing Tongass alternatives, the effects of applying prohibition Alternative 3 with Selected Mitigations are displayed. The outcomes are nearly identical to those resulting from applying Alternatives 2 and 4.

CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the physical, biological, social, and economic environments relevant to the alternatives, and the potential changes to those environments because of the alternatives.[1] This effects analysis is structured around the two sets of alternatives described in Chapter 2: the prohibition alternatives and alternatives specific to the Tongass National Forest. The effects of the prohibition alternatives are divided into major resource sections including: Ecological Factors, Human Uses, and Social and Economic Factors. Specific resource categories are identified within each of those sections. In each case, the affected environment is described first, followed by the effects of Alternative 1 – No Action Alternative, which provides a baseline for evaluation and comparison of the other prohibition alternatives.

The effects of the Tongass National Forest alternatives are organized and described in a manner similar to the prohibition alternatives. The combined effects of these three sets of alternatives are described at the end of this chapter. For the effects analysis, a short-term time frame of 5 years (to 2004) has been used. Quantifiable data for proposed **road construction**[2] projects and planned **timber sales** is available for this period. For long-term effects, benchmark dates of 2020 and 2040 were selected. These dates coincide with the end of revision cycles for land management plans. The long-term effects are largely qualitative.

Overview of Inventoried Roadless Areas

The affected environment described in this chapter focuses primarily on the 31%[3] of the 192 (USDA Forest Service 2000b) million acres of National Forest System (NFS) lands (Figure 3-1) that are included in **inventoried roadless areas**. Figure 3-2 shows that 18% of NFS lands are designated as **Wilderness** that already prohibit or restrict roading. Approximately 51% of NFS lands are managed for a wide variety of other uses and activities. All NFS lands are managed under the concept of multiple-use, including Wilderness.

Environmental effects under each alternative may differ substantially in different parts of the country. These environmental effects are important to disclose and discuss. Forest Service administrative regions are typically used to display the effects of national policies and programs. In addition, this FEIS relies on these administrative regions to display environmental effects where they differ geographically. Throughout this chapter, Forest Service regions are referred to by their numeric identifier (1 through 6 and 8 through 10; there is no Region 7). Forest Service regions are shown in Figure 3-1.

[1]This chapter is based on resource specialist reports, which are available from the Roadless Area Project Team, USDA Forest Service, and P.O. Box 96090, Washington, DC 20090-6090 and online at **roadless.fs.fed.us**. Each resource specialist's education and experience is listed in Chapter 4.
[2]Throughout this document, at first reference in each chapter, terms defined in the Glossary are in bold typeface.
[3]Minor discrepancies among figures cited in the text, tables, or database are due to rounding.

The inventoried **roadless areas** analyzed in this FEIS encompass 58.5 million acres in 120 national forests located in 38 States and the Commonwealth of Puerto Rico. Within these areas, **road construction** and **reconstruction** are already prohibited on about 24.2 million acres under current land management-plan decisions. Most of the analysis in this chapter is directed at the remaining 34.3 million acres of inventoried roadless areas where road construction and reconstruction might occur under current land **management direction**. The locations of these areas are displayed in Volume 2 of this FEIS in a series of State-, and forest-level maps. Acreages of the inventoried roadless areas by State and national forest are summarized in Appendix A.

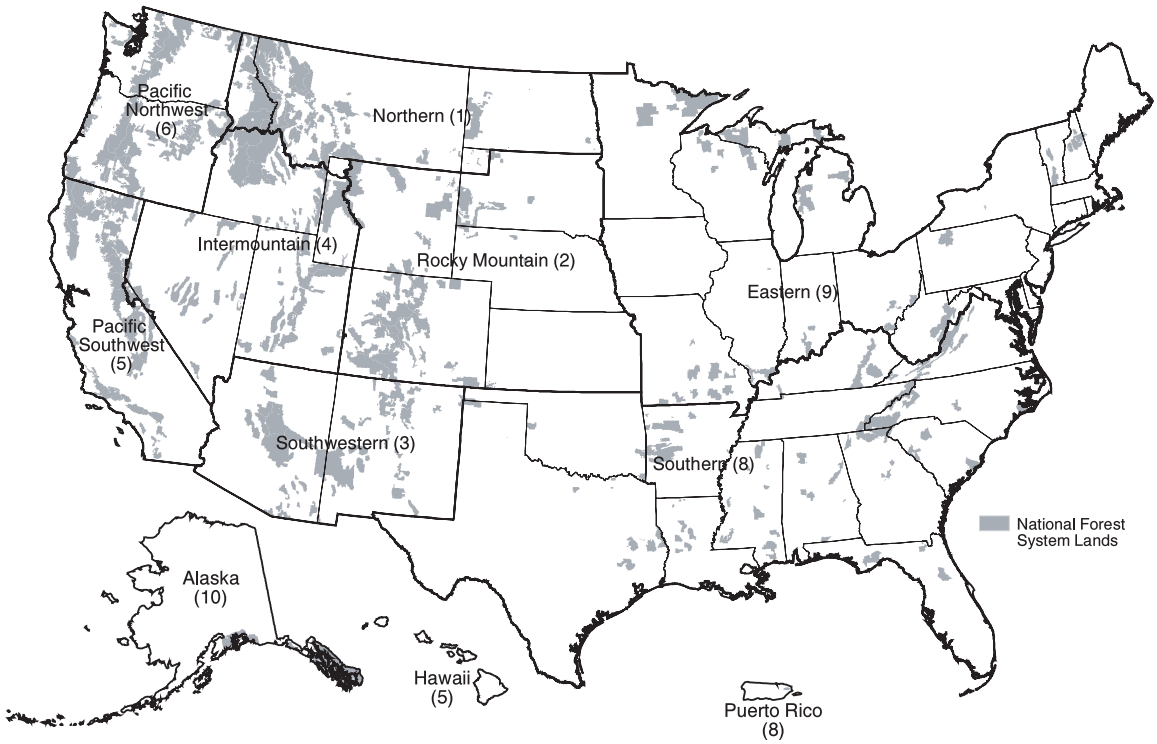


Figure 3-1. Location of National Forest System lands by Forest Service region. Numbers in parenthesis indicate the region number.

(Roadless Database 2000)

Approximately 3.6% of all inventoried roadless areas are in the Eastern United States. As shown in Table 3-1, more than 96% of all inventoried roadless areas are located in 12 Western States. Most of the areas are concentrated along the Coast and Cascade Mountain Ranges of Northern California, Oregon, and Washington; the Rocky Mountains from New Mexico to Idaho; and the Alexander Archipelago of Southeast Alaska.

Because of their locations, inventoried roadless areas are characterized by a smaller set of ecological regions than the nation or the National Forest System. Approximately 60% of the 58.5 million acres of inventoried roadless areas occur at elevations ranging from 5,000 to 11,000 feet above sea level. Mixed conifer forest is the predominant vegetation cover type, with minimal hardwood forest represented.

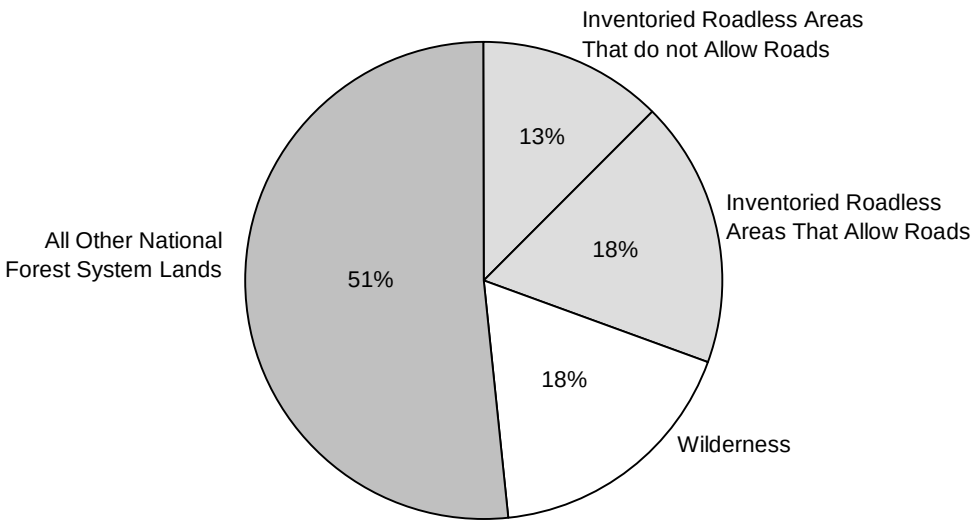


Figure 3-2. Major categories of National Forest System land designations.
(Roadless Database 2000)

There are 2,827 inventoried roadless areas in the National Forest System. Although the majority of these areas are larger than 5,000 acres, 20% are smaller. These smaller areas are generally the remaining portions of larger **RARE II** areas that were not designated as Wilderness, or parcels identified under a different set of criteria mandated by the Eastern Wilderness Act of 1975 (P.L. 93-622). Variation in size is closely tied to geographic location. Figure 3-3 shows the small size and number of inventoried roadless areas in the East compared to the West and Alaska. More than 2,300 of the 2,827 inventoried roadless areas are in the Western United States.

According to 1990 census data, 192 of the 555 cities in the United States having 50,000 or more people (slightly less than 35%) are within 60 miles of an inventoried roadless area. However, only 10% of the 2,827 inventoried roadless areas fall within this radius. These 192 cities contain approximately one-third of the nation's **urban** population. Thus, a small percentage of inventoried roadless areas likely receive a disproportionate level of use. Inventoried roadless areas that are closest to large urban populations occur in California, the Pacific Northwest, along the front range of the Rocky Mountains, near Phoenix, AZ, and near Salt Lake City, UT (Figure 3-4).

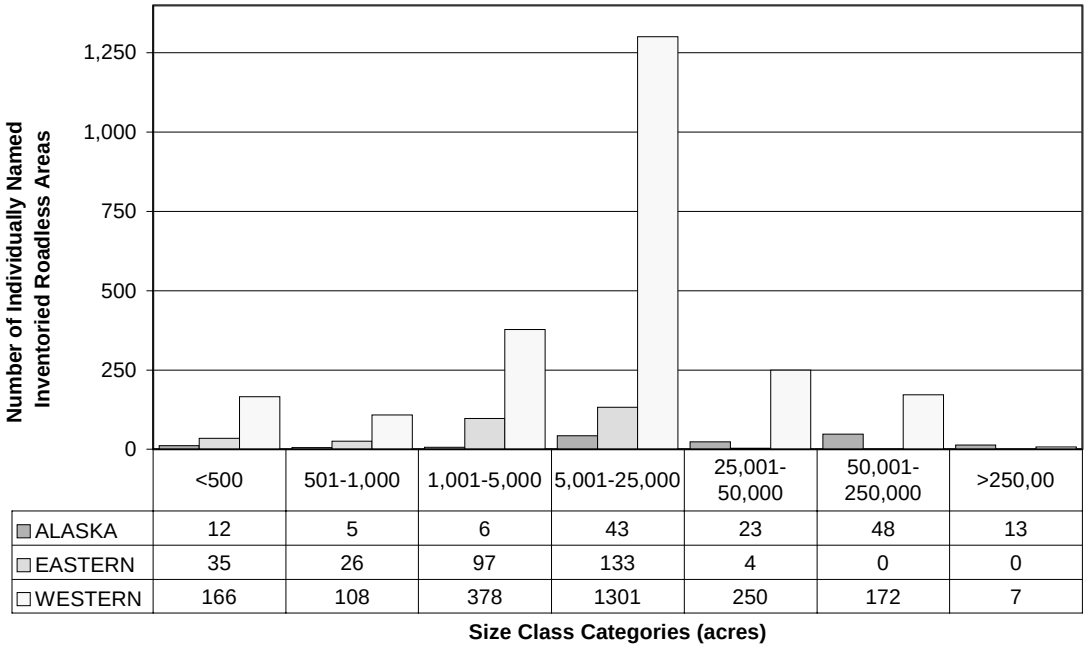
Many inventoried roadless areas contain characteristics summarized in the following list:

Soil, water, and air – These three key resources are the foundation upon which other resource values and outputs depend. Healthy watersheds provide clean water for domestic, agricultural, and industrial uses; help maintain abundant and healthy fish and wildlife populations; and are the basis for many forms of outdoor recreation.

Table 3-1. Summary of inventoried roadless areas.

State	Acres (thousand)	Percent of total
Alaska	14,779	25.3
Idaho	9,322	15.9
Montana	6,397	10.9
Colorado	4,433	7.6
California	4,416	7.5
Utah	4,013	6.9
Wyoming	3,257	5.6
Nevada	3,186	5.4
Washington	2,015	3.4
Oregon	1,965	3.4
New Mexico	1,597	2.7
Arizona	1,174	2.0
Subtotal	**56,554**	**96.6**
Virginia	394	0.7
North Dakota	266	0.5
New Hampshire	235	0.4
West Virginia	202	0.4
North Carolina	172	0.3
Arkansas	95	0.2
Tennessee	85	0.2
South Dakota	80	0.1
Wisconsin	69	0.1
Georgia	63	0.1
Minnesota	62	0.1
Florida	50	0.1
Subtotal	**58,327**	**99.8**
Missouri	25	<0.1
Pennsylvania	25	<0.1
Vermont	25	<0.1
Commonwealth of Puerto Rico	24	<0.1
Michigan	16	<0.1
Oklahoma	13	<0.1
Alabama	13	<0.1
Illinois	11	<0.1
Indiana	8	<0.1
South Carolina	8	<0.1
Louisiana	7	<0.1
Maine	6	<0.1
Texas	4	<0.1
Kentucky	3	<0.1
Mississippi	3	<0.1
Total	**58,518**	**100.0**

(Roadless Database 2000)



	<500	501-1,000	1,001-5,000	5,001-25,000	25,001-50,000	50,001-250,000	>250,00
ALASKA	12	5	6	43	23	48	13
EASTERN	35	26	97	133	4	0	0
WESTERN	166	108	378	1301	250	172	7

Figure 3-3. **Size, in acres, and number of inventoried roadless areas by geographic region.**
(Roadless Database 2000)

Sources of public drinking water – NFS lands contain watersheds that are important sources of public drinking water. Careful management of these watersheds is crucial in maintaining the flow of clean water to a growing population.

Diversity of plant and animal communities – Unroaded areas are more likely than roaded areas to support greater **ecosystem health**, including the diversity of native and desired nonnative plant and animal communities, due to the absence of **disturbances** caused by roads and accompanying activities. Inventoried roadless areas also conserve native biodiversity, by providing areas where **nonnative invasive species** are rare, uncommon, or absent.

Habitat for **threatened**, **endangered**, **proposed**, candidate, and **sensitive species** and for those species dependent on large, undisturbed areas of land – Inventoried roadless areas function as **biological strongholds** and refuges for many species. Of the nation's species currently listed as threatened, endangered, or proposed for listing under the Endangered Species Act, approximately 25% of animal species and 15% of plant species are likely to have habitat within inventoried roadless areas on NFS lands.

Primitive, ***Semi-Primitive Non-Motorized***, *and* ***Semi-Primitive Motorized*** *classes of recreation opportunities* – These areas often provide outstanding recreation opportunities such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing. While they may have many Wilderness-like attributes; unlike Wilderness, the use of mountain bikes, and other mechanized means of travel is often allowed.

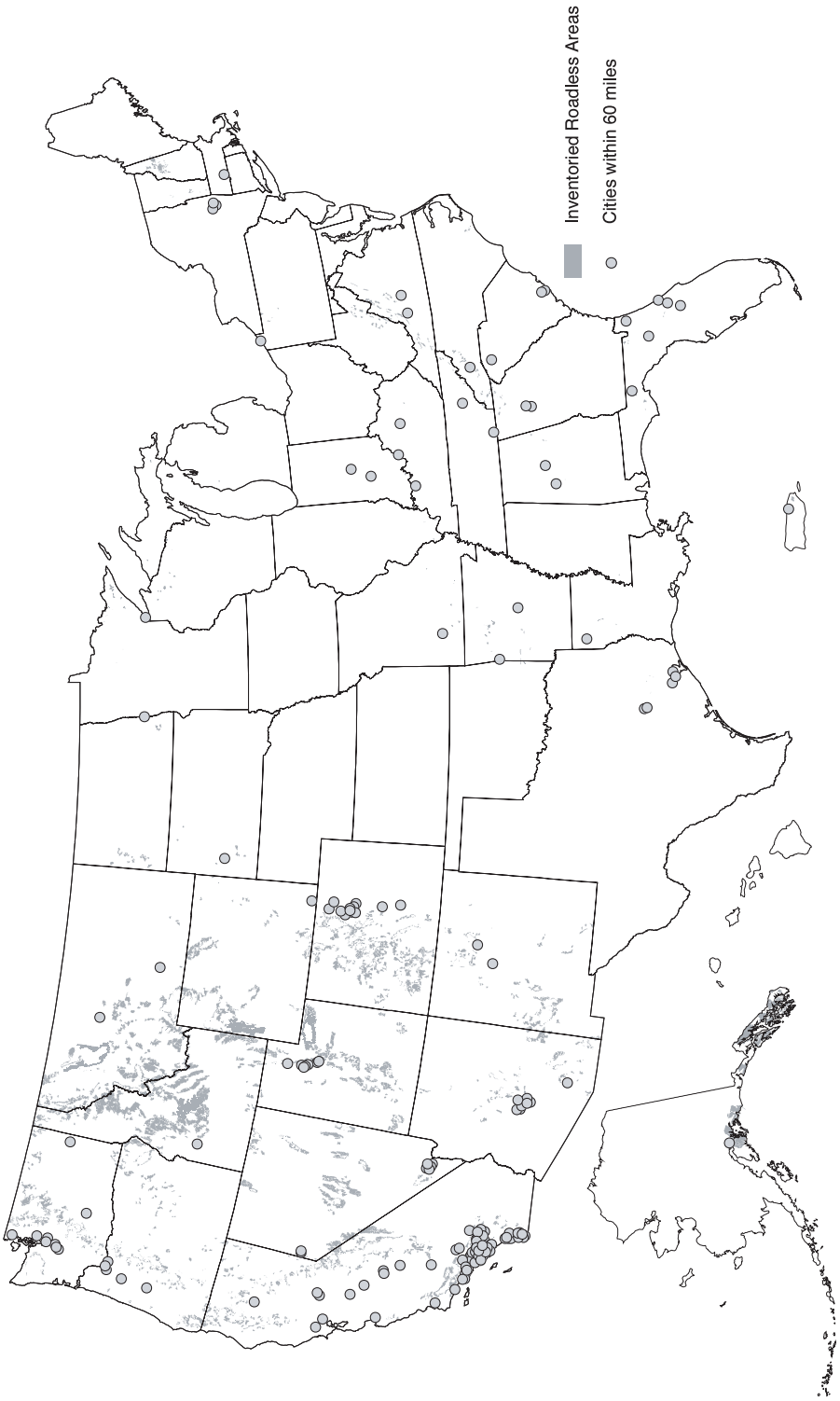


Figure 3-4. Cities with more than 50,000 people within 60 miles of an inventoried roadless area.
(Roadless Database 2000)

Reference landscapes – The body of knowledge about the effects of management activities over long periods of time and on large **landscapes** is very limited. Reference landscapes can provide comparison areas for evaluation and monitoring. These areas provide a natural setting that may be useful as a comparison to study the effects of more intensely managed areas.

Landscape character and scenic integrity – High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate. In addition, quality scenery contributes directly to real estate values in neighboring communities and residential areas.

Traditional cultural properties and sacred sites – Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group. Sacred sites are places that have special religious significance to a group. Traditional cultural properties and sacred sites may be eligible for protection under the National Historic Preservation Act. However, many of them have not yet been inventoried, especially those that occur in inventoried roadless areas.

Other locally identified unique characteristics – Inventoried roadless areas may offer unique characteristics and values that are not covered by the other characteristics. Examples include uncommon geological formations, which are valued for their scientific and scenic qualities, or unique wetland complexes. Unique social, cultural, or historical characteristics may also be dependent on the roadless character of the landscape. Examples include ceremonial sites, places for local events, areas prized for collection of non-timber forest products, or exceptional hunting and fishing opportunities.

Demographic Trends

The number of people in the United States has grown about 1% per year since 1980, and it continues to increase at a steady rate. In 2000, the United States population is estimated at 278.5 million (USDC Bureau of the Census 2000). This is an increase of 10.4% from the 252.3 million persons recorded by the 1990 U.S. Census. Table 3-2 shows past and projected United States population figures for 10 geographic regions of the country, illustrated in Figure 3-5.

Population growth in the United States has not been evenly distributed across the country. Over the last two decades, overall population growth has been greatest in the Southeast and Pacific Southwest. Population in the South Central United States is also increasing rapidly. However, eight of the 10 States with the fastest percent increase in population between 1990 and 1998 are in the West. They are Nevada, Arizona, Idaho, Utah, Colorado, Washington, Texas, and Oregon (USDC Bureau of the Census 1999).

Figure 3-6 shows the distribution of the United States population in 1990 in relation to inventoried roadless areas. Between 2000 and 2005, the United States population is expected to increase by 4.2%; between 2000 and 2020, it is expected to increase by 17.5 %; and, between 2000 and 2040, the United States population is expected to increase by

37.4%, to a total of 377.4 million people. This represents an average annual population growth rate of 0.8 % between 2000 and 2040. While the population will continue to increase steadily over the next 40 years, the rate of increase is expected to be slightly lower than it was during the preceding two decades.

Table 3-2. Past and projected United States population, in millions, by multi-State regions of the United States.

Region	1980 population	1990 population	2000 population	2005 population	2020 population	Population increase 1980-2020	2040 population[a]
Northeast	67.3	69.5	71.8	72.8	77.2	9.9	
North Central	42.8	43.4	46.4	47.4	50.0	7.2	
Southeast	29.6	35.7	41.7	44.3	51.0	21.4	
South Central	38.4	41.9	47.5	49.9	56.7	18.3	
Great Plains	5.3	5.4	5.8	6.0	6.5	1.2	
Intermountain	11.4	13.7	17.7	19.2	22.0	10.6	
Pacific Northwest	6.8	7.7	9.3	9.9	11.6	4.8	
Pacific Southwest	24.6	30.9	33.8	35.8	47.0	22.4	
Alaska	0.4	0.6	0.7	0.7	0.8	0.4	
Puerto Rico	3.2	3.5	3.8	4.0	4.3	1.1	
Total	**229.4**	**252.3**	**278.5**	**290.0**	**327.1**	**97.3**	**377.4**

[a] The U.S. Census Bureau does not project population estimates by State beyond the year 2025.
(USDC Bureau of the Census 2000)

The composition of the population will also change in the future. The average age in the United States is increasing. By 2030, 20% of the American population will be over 65, compared to 12% in 1990 (USDA Forest Service 1999d). The ethnic diversity of the American population is also increasing as minority populations grow, largely because of immigration. By 2050, racial and ethnic minorities will comprise nearly 50% of the United States population, compared to 18% in 1999 (USDA Forest Service 1999d).

Table 3-3 compares the estimated 2000 United States population to the acreage of inventoried roadless areas by the multi-State regions of the United States illustrated in Figure 3-5. In general, the regions with the highest populations and/or densities have the least amount of inventoried roadless area. The most noteworthy include the Northeast, North Central, Southeast, and South Central regions, and Puerto Rico.

Most of the United States population is concentrated in **urban areas**. Between 1950 and 1990, the percent of the United States population residing in urban areas rose from 64% to 75.2%, while the percent of rural residents fell from 36% to 24.8% (USDC Bureau of the Census 1996). This shift was the result of population migration to urban areas, and land conversion in rural areas, causing some rural land to become reclassified as urban.

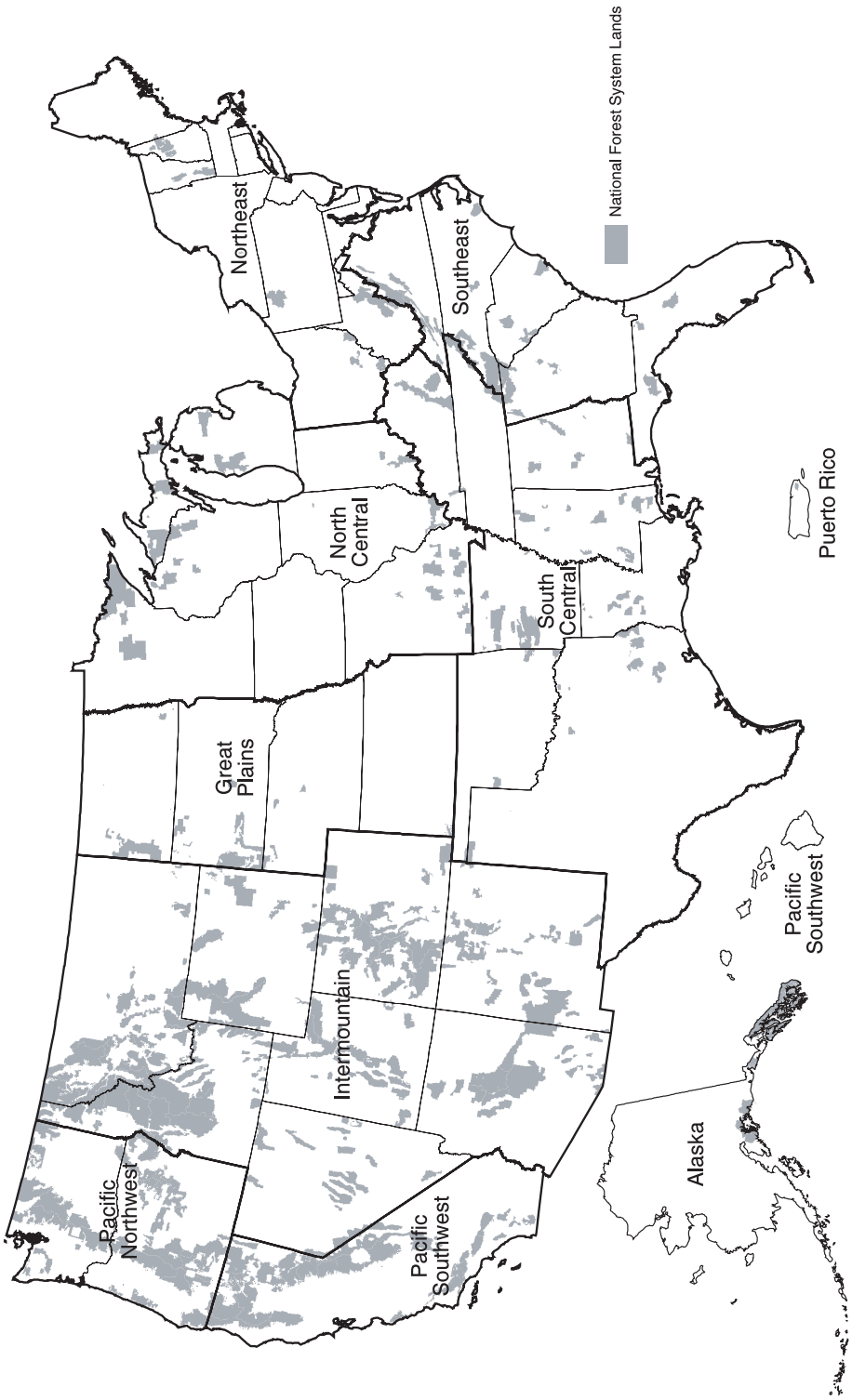


Figure 3-5. Multi-State regions used for population analysis.

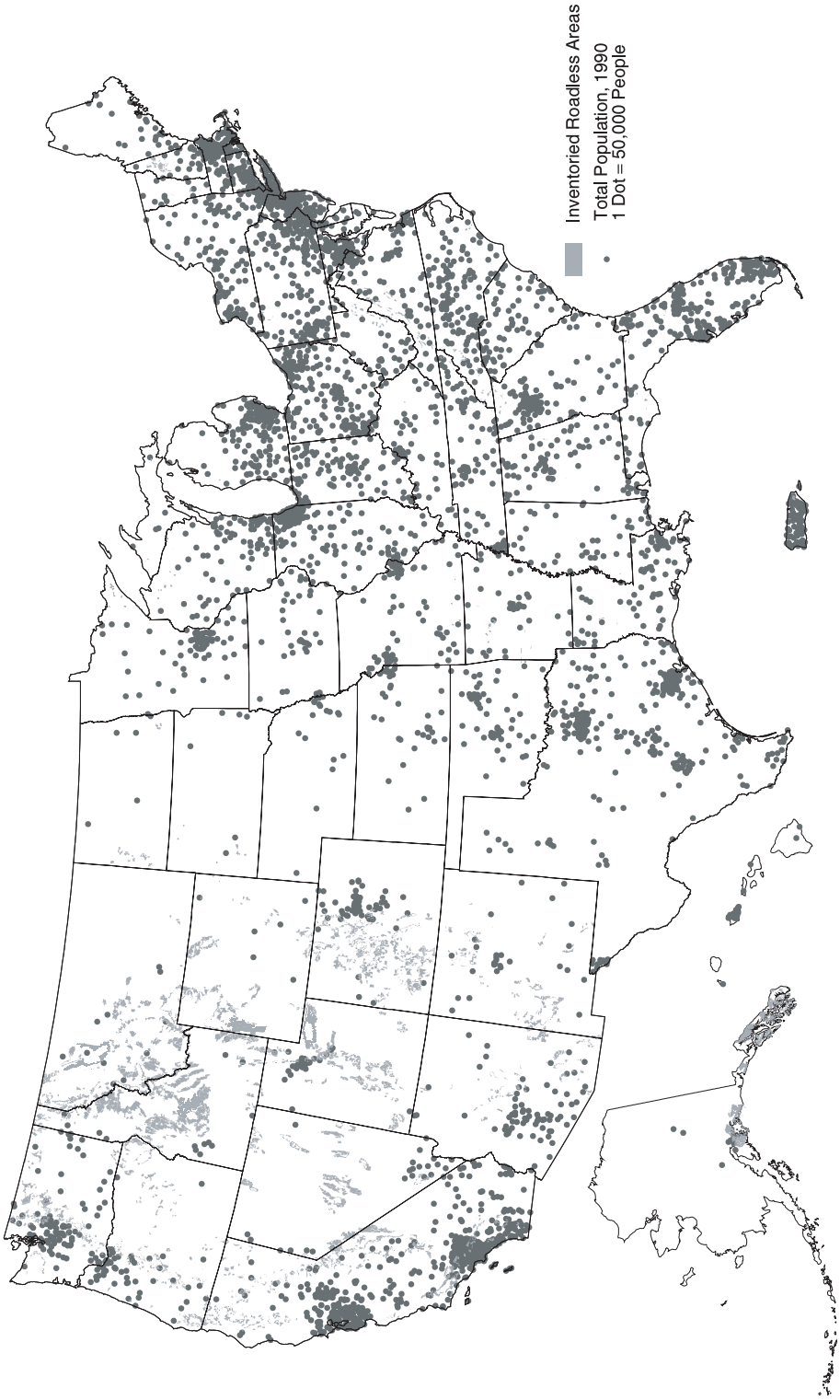


Figure 3-6. Distribution of the 1990 United States population relative to inventoried roadless areas.
(Roadless Database 2000)

Table 3-3. Estimated 2000 United States population relative to inventoried roadless areas by geographic region.

Region	Total population (millions)	Average population density (people/sq mile)	Inventoried roadless areas (acres)
Northeast	71.8 (26%)	299	493,000 (0.8%)
North Central	46.4 (17%)	113	191,000 (0.3%)
Southeast	41.7 (15%)	178	687,000 (1.2%)
South Central	47.5 (17%)	78	223,000 (0.4%)
Great Plains	5.8 (2%)	19	346,000 (0.6%)
Intermountain	17.7 (6%)	20	33,379,000 (57%)
Pacific Northwest	9.3 (3%)	56	3,980,000 (6.8%)
Pacific Southwest	33.8 (12%)	211	4,416,000 (7.5%)
Alaska	0.7 (<1%)	1	14,779,000 (25.2%)
Puerto Rico	3.8 (1%)	1,125	24,000 (0.04%)
Total	**278.5 (100%)**	**77**	**58,518,000 (100%)**

(USDC Bureau of the Census 2000; Roadless Database 2000)

The percent change in urban population was greater from 1950 to 1970 than between 1970 and 1990. In the year 2000, 80% of the United States population is estimated to live in urban or suburban areas (USDA Forest Service 1999d). Urban growth has been most pronounced in Alaska, the Intermountain West, the Southeast, the South Central, and the Great Plains regions. The Bureau of the Census does not project future urban vs. rural population growth. However, if past trends continue, the percentage of the American population living in urban areas will keep growing. As urban centers expand in response to population growth and urbanization, surrounding private forestlands will come increasingly under pressure for conversion to more urban or developed uses (Cohen 1999).

Although the percentage of rural populations has been declining overall, many rural Counties containing NFS lands have been increasing in population. This is particularly true in the West. Approximately one-third of the total population increase that occurred in the United States between 1980 and 1999 occurred in Counties that contain NFS lands.

This trend is expected to continue. One reason for rapid population growth in rural areas close to NFS lands is that these areas have many **natural amenities**. Population growth in these Counties is often linked to their appeal as retirement and recreation destinations (McGranahan 1999).

Over the last decade, urban residents of all ages have been moving to or building second homes in rural communities in the West that are high in natural amenities (such as good climate, variable topography, and surface water bodies) (McGranahan 1999; Thrush 1999). These migrants are seeking a better quality of life in a physically attractive environment. Three factors behind this trend are the retirement of baby boomers, technological advances that enable people to work remotely, and economic diversification in rural communities, meaning that other jobs are increasingly available (Thrush 1999). This phenomenon is also taking place in the Northeast (Egan and Luloff 2000).

Meanwhile, as urban populations grow, forest, pasture, rangeland, and cropland continue to be converted to urban and developed areas, and rural infrastructure (such as roads, airports, and railways). Table 3-4 indicates the amount of non-Federal land that was developed between 1982 and 1997. An average of 3.2 million acres per year were developed between 1992 and 1997. In comparison, 1.4 million acres per year were developed between 1982 and 1992. The rate of land development between 1992 and 1997 was more than twice the rate in the previous decade, while the population growth rate remained constant. This rapid development expansion can be explained by the unprecedented growth of the United States economy that occurred in the 1990s.

As with population growth, land conversion from undeveloped to developed uses has not been distributed evenly across the United States. Figure 3-7 shows the geographic distribution of land development in the United States between 1982 and 1997. Most of this development has been concentrated in the Eastern United States. The Northeast, Southeast, and South Central regions have experienced the most rapid land development in the country. However, the Northeast, Southeast, and Pacific Southwest have undergone the highest percentage of change in land development. While the Southeast and South Central Regions are also undergoing relatively rapid population growth, land conversion trends do not necessarily correspond geographically to population growth trends.

Population growth, combined with economic growth, leads to increasing demands for natural resources. Economic growth has outpaced population growth in the last decade. Between 1970 and 1995, per capita disposable income grew by 50%, while population grew by 28% (Cinnamon and others 1999). As a result, there is more income to spend on goods and services. Disposable income and gross domestic product are both projected to increase more rapidly than population growth in the future.

The demand for goods and services continues to increase as population and income grow. The United States accounted for about one-third of total world materials consumption (by weight) in 1995, although the United States population accounts for only 5% of total world population. World consumption grew at nearly double the rate of United States consumption (Cinnamon and others 1999). In the future, the growing population will

demand more goods that depend on natural resources such as timber, mineral, water, and other forest products. At the same time, demand for recreation, open space, scenic quality, clean air and water, and **biological diversity** is also increasing. These demands must be met from a finite land base.

Table 3-4. Amount of non-Federal land, in million of acres developed between 1982 and 1997. [a]

Region	Total surface area [b]	Total non-Federal land 1997	1982	1987	1992	1997	1982 to 1997	Non-Federal developed land 1997 (%)
Northeast	159.3	147.7	14.3	15.5	16.6	20.3	6.0	13.7
North Central	267.1	247.6	14.9	15.8	16.6	18.7	3.8	7.6
Southeast	156.0	134.1	11.5	13.1	15.2	19.0	7.5	14.2
South Central	398.0	370.9	16.1	17.7	19.2	22.8	6.7	6.2
Great Plains	196.8	187.8	5.6	5.7	5.9	6.3	0.7	3.4
Intermountain	552.7	283.5	5.9	6.6	7.2	8.3	2.4	2.9
Pacific Northwest	106.2	60.6	2.6	2.7	3.0	3.5	0.9	5.8
Pacific Southwest	105.7	56.6	4.3	4.6	5.2	5.9	1.6	10.4
Total	**1,941.8**	**1,488.9**	**75.2**	**81.7**	**89.0**	**104.8**	**29.6**	**7.0**

[a] Data unavailable for Alaska or Puerto Rico.
[b] Excludes surface water.

Conversion of non-Federal undeveloped lands to developed uses reduces the non-Federal land base available to meet growing demands for forest and rangeland resources, amenity uses, and other values. These conversions have been concentrated in areas with a relatively small Federal land base (the Eastern half of the United States) and are increasing the importance of Federal lands in these areas.

At the same time that demands are increasing for most natural resources, some people do not want to see resources from public lands used for commodity purposes. The increasing value placed on the non-commodity benefits provided by NFS lands (such as recreation, **ecosystem** services, scenic quality, and wildlife habitat) are viewed by some as more important than commodity uses, which are often viewed as being harmful to other forest and rangeland values. This view is often strongly held for roadless areas. However, if resources are not obtained from NFS lands, they will be obtained from other ownerships in the United States or in other countries, since demand for these products continues to increase. If commodity production continues to decline on NFS lands, there will be displacement effects on non-NFS lands. These effects are addressed in the Timber Harvest and Energy and Non-energy Minerals sections of the Social and Economic Factors section.

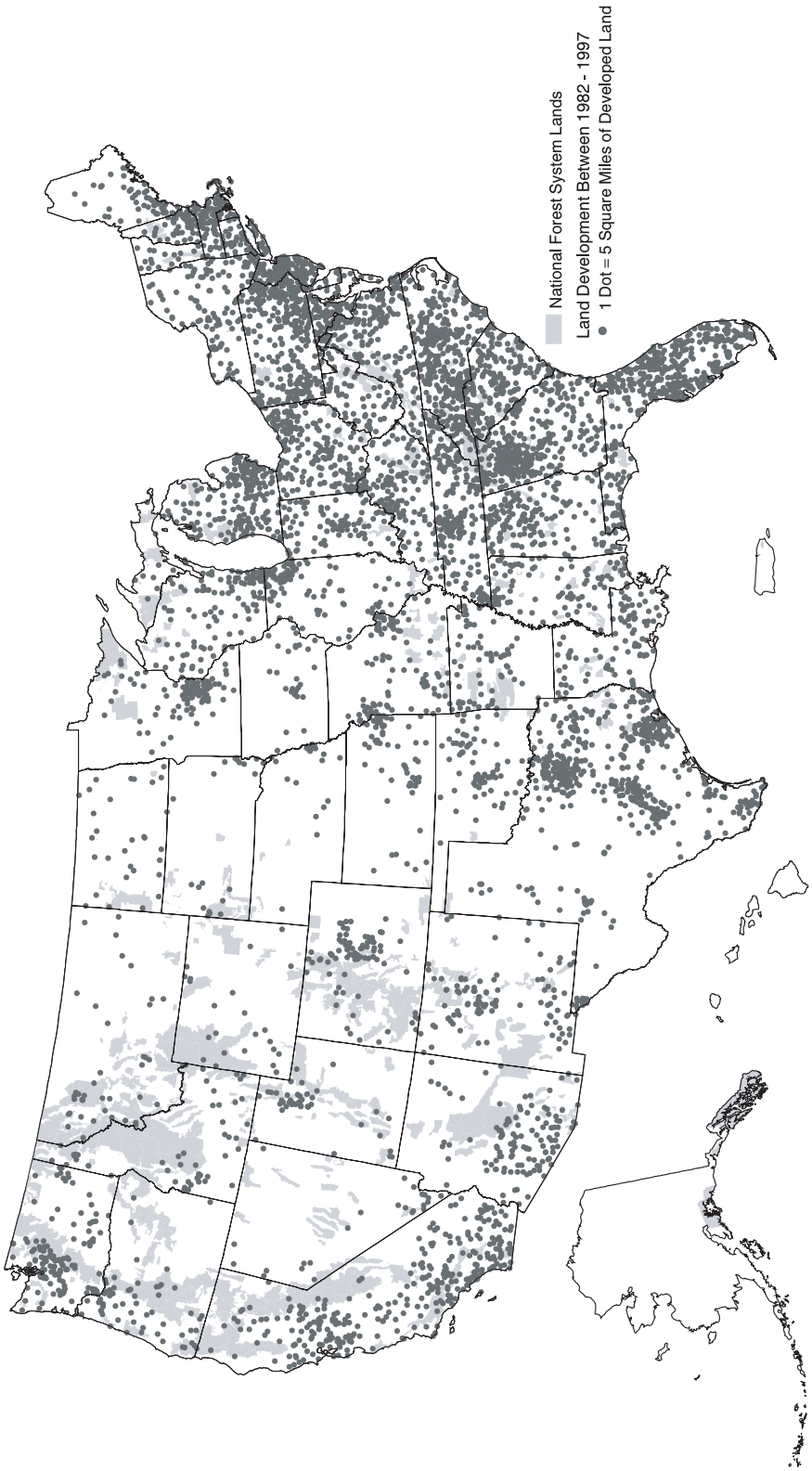


Figure 3-7. Geographic distribution of land development in the United States between 1982 and 1997.

The demographic changes described earlier will affect demands on resources on NFS lands. For example, the growing percentage of senior citizens will likely demand **developed recreational** opportunities, amenities, and services associated with roads (Ewert 1999). Also, the growth in the population of ethnic minorities will likely result in increased demands for the kinds of uses preferred by them, such as the harvest of non-timber forest products, **subsistence** hunting and fishing, and developed recreation (Cinnamon and others 1999; USDA Forest Service 2000e).

Population growth and the spatial distribution of the United States population are important variables that will affect the use and management of roadless areas. The Northeastern and Southeastern United States (Figure 3-5) have a high population density, a small amount of public land, and only about 2% of the inventoried roadless areas. These regions are also experiencing the highest rate of land conversion from rural to urban uses in the United States. As a result, one can expect high demand for the variety of benefits provided by roadless areas in the East, which are not readily available in alternate locations. Conversely, the Western States (including Alaska) have a relatively low population density (with the exception of California), a high percentage of public land, and 96.4% of the inventoried roadless areas. The supply of roadless areas in the West is high relative to the demand for the benefits they provide.

Urban population growth means that demand for recreation in forested areas close to cities will be increasing at the same time that land conversion adjacent to cities is increasing. Time and money are the two most limiting factors to outdoor recreation participation (Cordell and others 1999b). Because local forests are close, accessible, and low cost, urban forests will see increasing use (Ewert 1999). The result is likely to be increasing pressure for both developed and **primitive** recreational opportunities on NFS lands close to urban areas.

Because the United States population is largely urban, urban values regarding forest use and management often predominate. Specifically, urban dwellers tend to prefer management of Federal lands for ecological, recreational, and spiritual and aesthetic values, rather than for the uses that are valued by rural people who engage in commodity production (i.e., logging, grazing, and mining) (Vaske and Donnelly 1999; Ewert 1999). In rapidly growing rural areas, the immigration of exurbanites that bring urban environmental values with them is likely to cause tension with historic residents that depend on extractive industries for employment.

The expansion of urban areas into adjacent forested lands, combined with migration to rural areas containing NFS lands, leads to the spread of development around NFS boundaries. Increasing development at the **wildland-urban interface** can lead to high levels of congestion and high natural resource impacts on and around NFS lands (Ewert 1993). It also creates challenges for fire management, including increased risk of fires, increased threats to people and damage to structures, and growing challenges for fire protection (Chase 1993). People living at the wildland-urban interface also tend to value preservation and recreation as forest management priorities. High recreation impacts on NFS lands are particularly evident in this zone. As population numbers increase at the wildland-urban interface, there will be increasing demands on an increasingly limited and impacted resource.

Balancing Demands

One of the central questions that frame the debate over roadless area management is how commodity and non-commodity uses of these lands should be balanced. Since the earliest days of land management, the Forest Service has managed NFS lands according to the principle of multiple use. However, this management approach was not codified into law until 1960, with the passage of the Multiple-Use Sustained-Yield Act (Public Law 104-333). This Act specified that the national forests should be managed for a variety of purposes, including outdoor recreation, range, timber, watershed, and fish and wildlife (16 U.S.C. 528). Under the Act, the Forest Service was to manage resources to best meet the needs of the American public, with flexibility to respond to changing needs and conditions (Snow 1997).

The balance of multiple uses and the emphasis on commodity versus non-commodity uses on NFS lands has shifted over time in response to changing public values. There has been an evolution in the public's conception of the purpose of national forests in America over the last century. Whereas many people once valued national forests primarily as sources of commodities, such as timber, minerals, water, and rangeland, the majority now values them for their recreational, ecological, and scenic values (Hays 1998; Shands 1988).

Commodities produced from NFS lands provide benefits to society in a variety of products. These include lumber, minerals, beef, gasoline, heating oil, herbs, decorative boughs, and other greens. NFS lands also provide a variety of non-commodity benefits to society. Ecosystem services, recreation opportunities, and biodiversity protection are examples. While individuals recognize and enjoy a range of values associated with NFS lands, there is often disagreement over how the various uses should be managed.

Some people believe that commodity production is appropriate on NFS lands, and that it is not detrimental to protecting the non-commodity values associated with these lands. Many of these people appreciate both the commodity and non-commodity values of NFS lands. They recognize humans as users of the land, trying to make use of natural resources on a sustained yield basis to meet their needs (Grumbine 1999). They view NFS lands as providing goods and services for people.

Commodity use was embodied in the "wise use" conservation vision espoused by Gifford Pinchot, founder of the Forest Service. Pinchot emphasized three principles of conservation: development (the use of natural resources for the benefit of people), prevention of waste, and the conviction that natural resources should be developed and conserved for the benefit of the greatest number of people (Cawley 1993). Pinchot believed that this conservation philosophy would bring about economic prosperity. The concept of sustained yield accompanies the commodity use orientation: maximize the stream of outputs of renewable resources to the extent possible, without compromising long-term resource productivity (Kennedy and others 1998). The belief that resources should be protected for future generations accompanies the sustained yield management philosophy.

Non-commodity values can be grouped into three general categories, following Bengston and others (1999): recreation values, ecological values, and spiritual and aesthetic values. Recreation values are associated with developed and primitive, motorized and non-motorized uses of the natural forests and grasslands. People who hold these values appreciate the recreational and tourism opportunities that NFS lands provide, and their associated social and personal benefits. People who hold ecological values view NFS lands as valuable because of the life-supporting environmental functions and services they provide. Spiritual and aesthetic values toward forests include the belief that NFS lands have intrinsic value, and a right to exist; that current generations have an obligation to pass on healthy wild lands to future generations; that forests have heritage and cultural values; that forests are sacred; that forests have spiritual value; and that they have scenic and aesthetic values. People also have personal emotional attachments to NFS lands, and value them for this reason (Bengston and others 1999). Most people share a mix of values and perspectives and do not fall into any one category. Again, many people believe that both commodity and non-commodity values can be accommodated on NFS lands. Others, however, view them as being mutually exclusive.

Research, polls, and surveys indicate that the American public cares about ecologically sound management of NFS lands and in general supports multiple-use management of these lands. Most studies indicate that the majority of the American public places a higher priority on non-commodity uses than on commodity uses of public lands. Nevertheless, commodity uses are an important component of public land management to many members of the public.[4]

In 1994, a random sample of the American public was questioned about their views concerning NFS lands management (Hammond 1994). This poll found that the over-riding concern of the public was that the Forest Service maintains healthy public forests and grasslands. The public also felt strongly that creating recreation opportunities on NFS lands was important, and that the Federal government should balance the wilderness and recreation uses of public land with logging, mining, and grazing. Respondents thought the Forest Service should increase regulation of commercial uses, and ensure that the long-term health of the forests is not sacrificed for short-term natural resource demands. They also believed that the consumer needs of the American public should not be satisfied at the expense of forest and grassland health. There was low support for the statement that natural resources on NFS lands should be made available for commodity production.

In 1991, Cramer and others (1993) conducted a survey of Forest Service line officers (forest supervisors and district rangers) that asked them to rank what they thought the priorities of the public were regarding the multiple-use management of NFS lands. Line officers perceived the public's priorities as follows, on a scale of 1 to 10 (with 10 being the highest priority): recreation - 9, wildlife habitat - 8.7, water - 7.6, timber - 4.8, grazing - 2.8.

[4]The limitations of poll and survey data are discussed in the Socioeconomic Specialist Report.

Bengston and others (1999) have used content analysis of the news media to examine how frequently different forest values are expressed in news stories. This method hasbeen shown to produce results very similar to attitude surveys and opinion polls. These researchers found that during the 5-year period 1992 through 1996, non-commodity benefits and values of forests were expressed in news media stories 68% of the time nationwide, and commodity values were expressed 32% of the time. Of the non-commodity values, recreation benefits and values of forests were expressed most frequently, and increased in frequency over time from about 30% to 42%. Ecological benefits accounted for about 22% of the total and showed no trend over time. Spiritual and aesthetic forest values were expressed in news stores least often (about 10% of the time), increasing only slightly over time. Commodity values declined in frequency from about 38% to 23% during the 5-year period.

A social assessment conducted by the Forest Service for the Ozark-Ouachita Highlands in Missouri, Oklahoma, and Arkansas summarizes the findings of opinion surveys regarding public attitudes, values, and opinions towards land and resource management in that region (USDA Forest Service 1999s). The assessment found that most people believe forests should be managed for multiple uses, and to provide a range of goods, services, experiences, and values. They also believe that forest benefits should not come at the expense of long-term **forest health** and environmental quality. Some surveys found that 40% to 50% of respondents did not support timber cutting for commodity purposes on public lands. **Timber harvest** on public land for **stewardship** purposes, or with environmental protection measures accompanying it, was supported by as many as 70% of the respondents in other surveys. A study from Missouri found however that 40% to 50% of the population might be opposed to logging, regardless of how or where it occurs (USDA Forest Service 1999s).

A survey of environmental attitudes toward forests that administered to residents of the Southern Appalachian region as part of a Forest Service-sponsored social assessment found that 72.1% of those surveyed believed that there should be no more timber harvesting on national forests (Southern Appalachian Man and the Biosphere 1996b). Furthermore, 72.5% of the respondents believed that land that provides critical habitat for plant and animal species should not be developed. Finally, 68.6% of the population believed that more land that is public should be set-aside as Wilderness.

In the Pacific Northwest, a study of forest values among the Oregon public found that the majority of people did not believe that Federal forests should be used primarily for the production of timber and wood products, or products that are useful to humans (Steel and others 1994). Research from this region reported in USDA Forest Service and others (1993) indicated a consistent pattern of support for environmentally oriented management policies, and a consistent lack of majority support for commodity-based policies. However, people from this region are also concerned about protecting forest-dependent communities. An overview of surveys on environmental values conducted in the Western States indicated that most people in the West care about environmental protection and commodity production, in addition to developed recreational use on public lands, and believe that these uses can co-exist; they support multiple use (Nie 1999).

These studies indicate that there is a wide range of opinion on NFS land management, although the multiple-use concept is generally supported. Some individuals believe that commodity production is inappropriate on Federal lands in general, or in roadless areas specifically; others believe that management of NFS lands has over-emphasized non-commodity values. This chapter provides the relevant ecological, social, and economic information necessary for evaluating an analyzing the potential effects of protecting roadless areas of NFS lands.

Active and Passive Forest Management

Another question that is central to the debate over roadless area management is that of whether roadless areas should be managed at all. Road construction provides access to NFS lands so that management activities to promote protection of forest health, fire prevention, habitat improvement, and ecosystem restoration can be carried out. Stewardship timber harvest might be an integral component of these strategies.

Some members of the public believe that the Forest Service should take a passive approach to land management; in other words, it should let nature manage itself, and not intervene. They believe that nature knows best. Some believe that even if “natural” and more sustainable conditions can be achieved through the **active management** of a disturbed forest in the short term, the forest will get to its natural condition on its own over the long term. People of this opinion believe that society should take the long view in this regard, and think beyond the human life span as their period of reference. People who support the **passive management** approach are likely to support a prohibition on road construction and timber harvest in roadless areas.

The passive management view is rooted in a belief that undisturbed nature is good. Historically, many ecologists believed that undisturbed nature would achieve balance, constancy, and stability and, that human beings interfere with and destroy this balance of nature (Botkin 1990). Today, most ecologists accept the view that nature is dynamic and changing. However, those who favor passive management assume that even if undisturbed nature changes, it will change for the best, achieving its natural and best state on its own. If nature is disturbed, it will return to a condition that represents its natural and ecologically desirable state once the disturbance is removed. Nature functions perfectly well without human intervention. This view requires that people have no preconceived notions about what they want nature to look like, and that they be willing to accept the outcome of passive management, no matter what happens (Botkin 1990).

Other members of the public believe that the Forest Service should actively manage NFS lands to maximize environmental health, and to promote the most desirable conditions of these lands. For example, some people argue that NFS lands are not in a natural state due to a century of aggressive **fire suppression**. The result is forests that are unnaturally dense, have a disproportionate number of small trees, and are insect and disease prone. Many of these people believe that roads are needed for conducting management activities and that sufficient scientific knowledge exists to achieve the intended management outcomes. They are concerned that a prohibition on road construction or timber harvest in roadless areas would make it impossible to undertake beneficial management activities,

and are opposed to national level prohibitions on road construction and timber harvest for this reason.

The active management view is rooted in the belief that management might be necessary to achieve the outcomes we want (Botkin 1990). Tinkering with nature might enable us to improve upon it, or to return it to its natural state if it has been disturbed. Many people who support active management believe that there is no place on earth that is truly "wild" or "natural", independent of human influence, as people have been interacting with and changing the natural environment for millennia (Cronon 1996a; Botkin 1990). Therefore, active management is consistent with a human history of influence over environmental conditions. People should take an active role in conservation. Furthermore, resource harvest for utilitarian purposes might serve the interest of conservation, and the goals of resource utilization and conservation might be met through one active management approach. Active management requires that people develop a vision of what state they want nature to be in, a desired future condition, that serves as their management goal (Botkin 1990).

The Forest Service has stated that its goals for roadless area management are to protect and enhance the characteristics of these areas, which are listed at the beginning of Chapter 3. The Forest Service recognizes that some management activity may be needed to achieve the most desirable ecological conditions in roadless areas. However, management activities can be achieved in the absence of roads.

One common goal of land management is to achieve environmental conditions that are "natural" and/or desirable to human beings. The question of what is natural and what is desirable is complex, provokes disagreement, and determines the goals of either an active or a passive management approach. Nature is always culturally constructed in this regard (Cronon 1996b). People must choose the kind of environment they want, which might be one that has been altered through management (Botkin 1990). One poll conducted for the Forest Service found that 75% of the respondents believed that human intervention is necessary to maintain the health of public lands (Hammond 1994).

Whether nature should be actively or passively managed is not necessarily an either/or question. For some areas, active management might be most appropriate; for others, a passive approach might be most desirable. When active management is favored, there are many tools to achieve it, and many do not require road construction, though costs might increase without it. Clearly, people have different views about what kind of natural environment they want to see maintained on public lands. These views shape their opinion of what management approach to take towards roadless areas, which in turn has implications for whether or not they support a prohibition on road construction and/or timber harvest in these areas.

Effects of the Prohibition Alternatives

National Forest System Roads

The following discussion should help readers understand NFS roads, and how they relate to the physical, biological, social, and economic factors discussed in later sections.

Affected Environment

The Forest Service maintains and administers approximately 386,000 miles of roads on NFS lands. In the Eastern United States, the Weeks Act of 1911 (Public Law 61-435) allowed the Forest Service to purchase lands to protect the headwaters of navigable streams, and the Clark-McNary Act of 1924 permitted the Agency to purchase all types of forestlands. Many roads already existed on the lands purchased by the Forest Service in the East. Roads also existed on lands reserved as national forests in the 19th and early 20th Century in the West.

Before World War II, roads were constructed on NFS lands primarily for fire and conservation activities. From 1944 until the mid to late 1980s, the majority of the roads on NFS lands were constructed to support timber harvest activities. Figure 3-8 shows that in 1944, the Forest Service estimated there were 100,000 miles of roads under its jurisdiction and that there has been a steady increase in road miles since that time. Through the 1990s, the net increase in road miles is largely due to inventorying and classifying existing NFS roads.

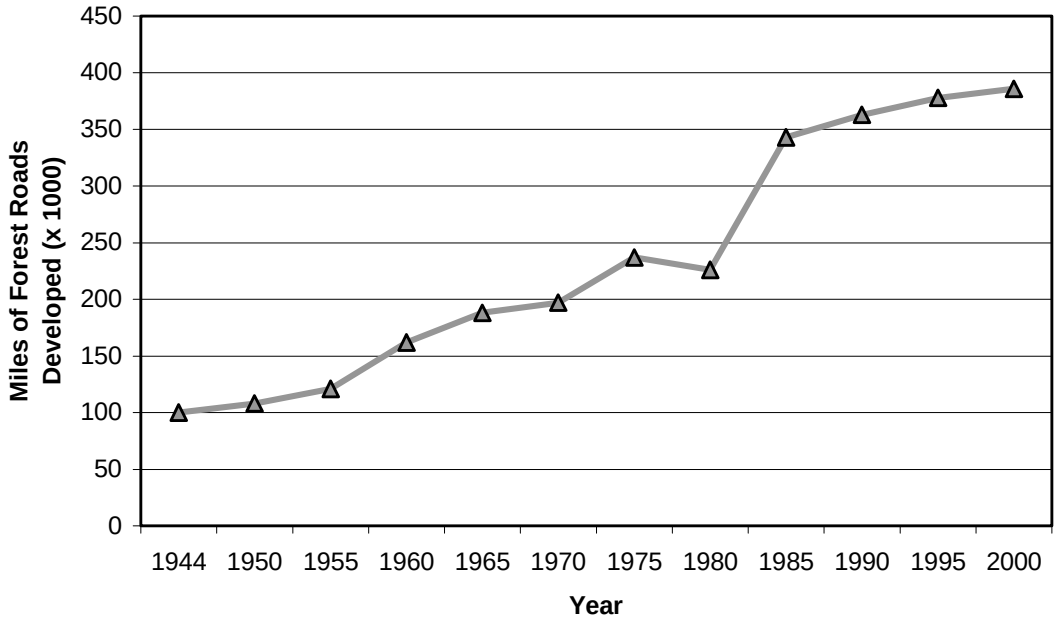


Figure 3-8. Miles of forest roads constructed from 1944 to the late 1990s.

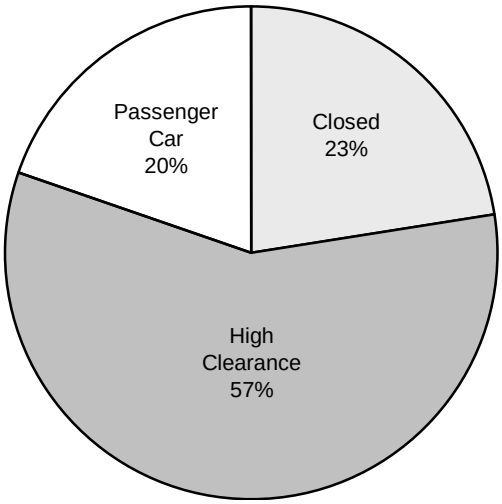
Today, NFS roads serve a wide variety of forest users and join with County, State, and national highways to connect rural communities and urban centers with NFS lands. Recreation is the single largest use or activity supported by the NFS roads, accounting for approximately 90% of the daily traffic. Administrative use (9%) and commercial use (1%) make up the balance. Eighty percent of recreation use occurs on 20% of NFS roads, primarily those roads maintained for passenger cars (Coghlan and Sowa 1998).

Road Maintenance – NFS roads are maintained to accommodate low-clearance passenger cars and high-clearance vehicles such as sport-utility vehicles, pickups, and jeeps (Figure 3-9). About 76,000 miles, or 20%, of NFS roads are maintained for low-clearance passenger cars. Another 223,000 miles, or 57%, of NFS roads are designed and maintained for high-clearance vehicles. The remaining 87,000 miles, or 23%, are single-use roads (for example, fire access) that are generally closed after their initial use and kept closed between uses (USDA Forest Service 1999h).

The construction or reconstruction of NFS roads is typically paid for by the use that most benefits from the initial access. Examples include timber harvest by timber purchasers, mining operations by mining claimants, and special use permit access by permittees. However, some roads are built using congressionally appropriated dollars such as roads for recreation, administrative access, and ecosystem restoration. The Forest Service is responsible for planning, design, and construction oversight and often retains long-term jurisdiction, including maintenance and operational responsibilities, for roads constructed on NFS lands. Each new mile of road competes for limited **road maintenance** funding. Annual maintenance on new roads costs, on average, approximately $1,500 per mile. In fiscal year 2000, the Forest Service received less than 20% of the estimated funding needed to maintain its existing road infrastructure (USDA Forest Service1999h).

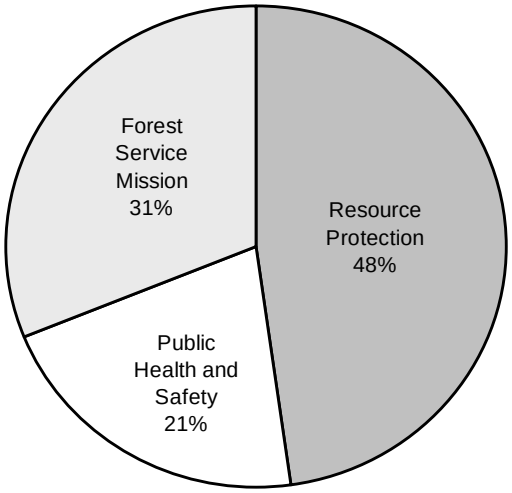
Sixty-nine percent of the Agency's road maintenance activities are focused on resource protection and public health and safety considerations. Mission related activities account for the other 31% and include general and administrative access, non-safety maintenance for user comfort, and ease of travel (Figure 3-10). A 1998 survey of road maintenance and capital **improvement** needs within the Forest Service showed an annual maintenance budget requirement of $568 million and a combined capital improvement and deferred maintenance backlog of $8.4 billion. The deferred maintenance backlog alone was $5.5 billion or 66% of the total backlog. Figure 3-10 illustrates that 48% of the annual road maintenance costs, $272 million per year, is associated with resource protection activities. The total fiscal year 2000 road maintenance budget of $111 million, (an $11 million increase over fiscal year1999) will meet less than 20% of the Agency's annual needs and less that 50% of identified critical needs. Each year's unmet maintenance increases the backlog as roads deteriorate and the cost of repairs continues to rise.

Following a period of sustained decline, NFS road-maintenance budgets have increased approximately 5% to 10% per year for the past four fiscal years (beginning in fiscal year 1998). Although this trend is expected to continue, the budget still falls short of identified annual needs.



Maintenance Level	Miles
Passenger Cars (Maintenance Level 3,4,5)	76,000
High Clearance (Maintenance Level 2)	223,000
Closed (Maintenance Level 1)	87,000
Total	**386,000**

Figure 3-9. Types of vehicle use on National Forest System roads.
(USDA Forest Service 1999h)



Annual Maintenance Requirements	Millions of Dollars
Resource Protection	$272
Public Health and Safety	$119
Forest Service Mission	$177
Total	**$568**

Figure 3-10. Annual road maintenance costs.
(USDA 1999h)

Annual maintenance needs along with capital improvement and deferred maintenance figures for roads come from the Agency's March 1999 report to Congress, titled "Supporting Documentation on Maintenance and Improvement Needs." As stated in the report, estimates of needs were based on a "random field sampling of at least 2% of each national forest's and grassland's roads." In fiscal year 1999, the Forest Service began a 5-year initiative to inventory and conduct condition surveys on its 386,000 miles of roads.

Results from the first year of the initiative indicate that the annual maintenance and deferred maintenance estimates from the March 1999 report are low and will increase as better data is collected and validated.The Forest Service also receives benefits from commercial use of its roads. A provision of the 1964 Roads and Trails Act, allows road use agreements, **timber sale** contracts, special use permits, mineral leases, and other cooperative agreements to accomplish **road reconstruction** and maintenance, or funds may be collected for maintenance. Although the amount of reconstruction and maintenance is commensurate with the commercial use, other users may benefit. For example, in 1991, timber purchasers reconstructed 2,736 miles of roads with a value of 34 million dollars, and an estimated 20 million dollars worth of road maintenance was accomplished using collections from commercial users, or was accomplished by the users themselves. This total contribution by commercial users of 54 million dollars compares to an appropriated road budget in 1991 of 264 million dollars, which is a benefit equivalent to 20.4% of the appropriated road budget. In 1998, commercial users contributed approximately $41 million to an appropriated road budget of $200 million, a benefit equal to 20.5% (USDA Forest Service 1999o).

Definitions and their use was a common topic in the public comment on the DEIS. The FEIS uses the following definitions.

Road – A motor vehicle travelway more than 50 inches wide, unless designated and managed as a trail. A road might be classified, unclassified, or temporary.

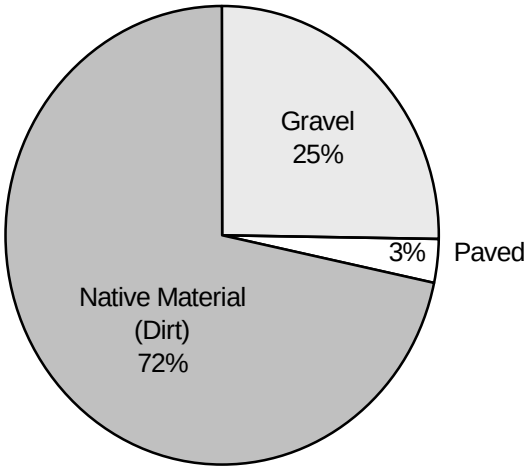
> **Classified roads** – Roads wholly or partly within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access, such as State roads, County roads, privately owned roads, National Forest System Transportation System roads, and roads authorized by the Forest Service that are intended for long-term use.
>
> **Unclassified roads** – Roads on National Forest System lands that are not managed as part of the National Forest System Transportation System, such as unplanned roads, abondoned travelways, and off-road vehicle tracks, which have not been designated and managed as a trail, and are not under permit or other authorization.
>
> **Temporary roads** – Roads authorized by contract, permit, lease, or emergency operation, not intended to be a part of the National Forest System Transportation System and are not necessary for long-term resource management.

Table 3-5 shows that there are approximately 77,073 miles of roads on NFS lands that are not under Forest Service jurisdiction. These roads are under the jurisdiction of **public road** agencies (State, Counties), or private parties (adjacent private landowners, mining claimants). The Forest Service also estimates that there are 60,445 miles of unclassified roads on NFS lands.

Table 3-5. Miles of existing National Forest System roads by Forest Service region (R).

Existing classified roads	Total	R1	R2	R3	R4	R5	R6	R8	R9	R10
Public roads on NFS lands	**54,659**	6,750	8,050	1,540	4,350	2,790	5,720	8,690	16,500	269
Private roads on NFS lands	**22,414**	5,280	5,410	210	1,670	1,650	2,470	369	5,270	85
National Forest System roads	**385,572**	53,170	31,134	54,279	37,863	44,529	93,235	36,849	30,894	3,619
Total existing classified roads	**462,645**	65,200	44,594	56,029	43,883	48,969	101,425	45,908	52,664	3,973
Total estimated unclassified roads	**60,445**	2,160	14,400	3,990	11,700	7,560	4,450	25	15,000	1,160

While the Forest Service manages approximately 9,400 miles of paved roads, the majority of NFS roads maintained for passenger cars have gravel surfaces. Of the roads maintained for high-clearance vehicles, about 190,000 miles are surfaced with native, on-site materials. Figure 3-11 displays the percentages of these road surfaces relative to the NFS roads that are open for public use. Many national forest visitors travel single lane, gravel-surfaced roads that are maintained for low-clearance passenger vehicles. Figure 3-12 shows a typical passenger car road on NFS land.



Road Surface Type	Miles
Paved	9,400
Gravel	70,000
Native Material (Dirt)	219,600
Total [a]	**299,000**

[a] Does not include roads closed to public use.

Figure 3-11. Types of road surfaces on roads that are open to public use on National Forest System lands.

(USDA Forest Service 1999h)

Figure 3-12. Typical National Forest System gravel road.
(Forest Service Engineering Files 1999)

Road Construction and ***Decommissioning*** – Over the past decade, NFS road construction has declined by 85%, from a high of 1,315 miles in 1991 to a low of 192 miles in 1999. The majority of these roads were built to support timber harvest. During the same period, about 2,660 miles of road were decommissioned each year (USDA Forest Service 1999o).

Roads are added to NFS lands when the Forest Service: 1) constructs new roads; 2) acquires new lands through purchase or land exchanges, which often contain roads; 3) identifies unclassified roads that are permanently needed and classifies them. For example, in 1999, the Forest Service constructed 192 miles of roads, decommissioned 1,842 miles, and classified 3,738 miles of previously unclassified roads. This resulted in a net increase of 2,088 miles of NFS roads (USDA Forest Service 1999v).

Beginning in the early 1990s, many planning decisions, such as those associated with the Northwest Forest Plan, identified the need to enhance watershed health. Because of planning efforts and national regulatory and policy changes such as the Clean Water Action Plan, the Forest Service increased efforts to decommission roads when they were no longer needed and as funding allowed. In fiscal year 2001, the Forest Service has a goal of decommissioning 3,000 miles of NFS roads.

Road decommissioning involves using various levels of treatments to restore unneeded roads to a more natural state, to mitigate environmental damage and restore hydrologic function. Treatment options might include blocking the entrance, water barring, removing culverts, reestablishing drainage ways, removing unstable fills, pulling back road shoulders, restoring natural contours and slopes, or other methods designed to meet specific conditions and objectives associated with the unneeded road. It includes conversion of a road to a designated trail. The cost of decommissioning varies with the treatment and local conditions, from a few hundred dollars per mile up to $50,000 or more per mile. The average range is typically $5,000 to $10,000 per mile.

The rate of NFS road construction will likely have a continued downward trend of about 5% to 10% per year in the coming decade. Nationwide, road decommissioning will probably increase as funding allows (USDA Forest Service 1999o). The combined cumulative effects section later in this chapter addresses future trends in more detail. Figure 3-13 shows the trends for NFS road construction, reconstruction, and decommissioning over the last decade.

The Forest Service constructs, reconstructs, and maintains roads on NFS lands to provide needed access for implementing land management plan goals and objectives. As these objectives and goals change, road management objectives also change. It is through road management objectives (FSM 7700) that design standards, maintenance levels, and traffic management requirements, such as seasonal closures are established. As land management goals and objectives change, so do the need for new access and the objectives for managing existing access.

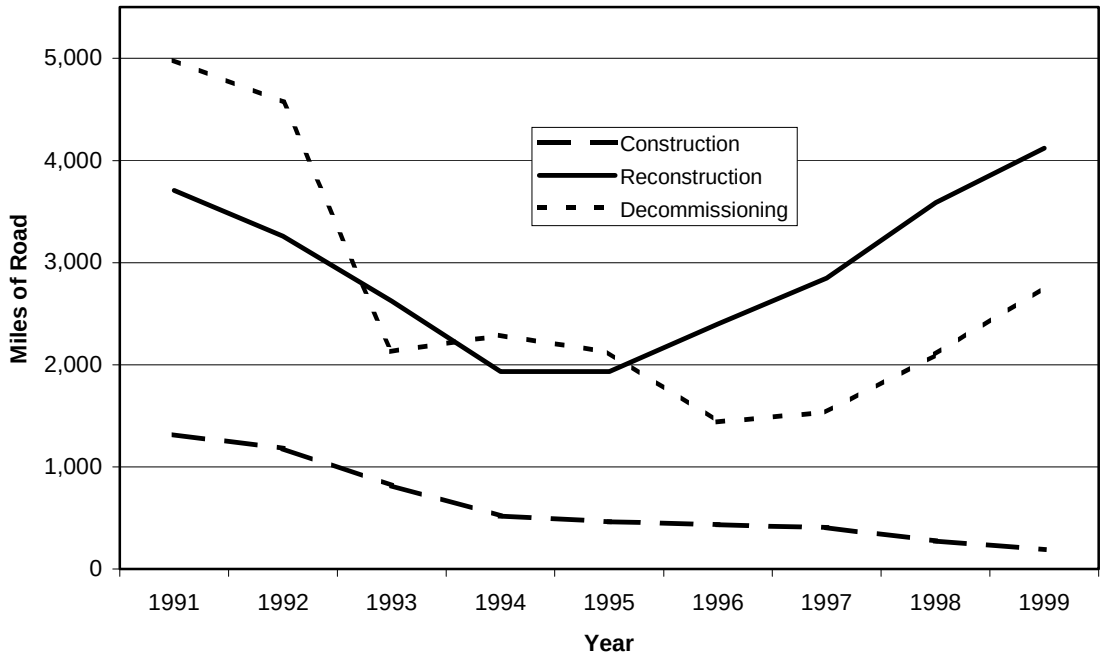


Figure 3-13. Trends in road construction, reconstruction, and decommissioning for National Forest System roads.
(USDA Forest Service 1999h)

On January 28, 1998, in an Advance Notice of Proposed Rulemaking (ANPR) (63 FR 4350), the Forest Service announced its intent to revise regulations concerning management of NFS roads. Simultaneously, the Forest Service published an Interim Roads Rule (36 CFR Part 212) to temporarily suspend permanent and temporary road construction and reconstruction in certain **unroaded areas** of NFS lands. The purpose of the Interim Roads Rule was to take a "time out" for 18 months while the Forest Service developed a new long-term road management policy and new analytical tools to provide a more ecological approach to analyzing existing and future road needs. In August 1999, the "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" was made available to Forest Service managers to use when making road management decisions.

The proposed Roads Policy requires that the findings and recommendations of a science-based roads analysis be considered when doing land management and project planning. Road management objectives are developed during land management and project level planning and these decision-making processes can be informed by a science-based roads analysis.

Management of existing NFS roads will be governed by the Roads Policy, when adopted as final (36 CFR 212 and FSM 7700) and within the framework established in the Planning Regulations at 36CFR219 and FSM 1920. A discussion of the combined cumulative effects of these and other Forest Service planning and policy initiatives is contained later in this chapter. The combined effects of the alternatives along with other Forest Service policy initiatives was often mentioned as an issue in the public comment on the DEIS.

Classified roads in general are those NFS roads that are needed to meet the goals and objectives established in land management plans that require permanent, long-term access. Classified roads also include those public roads that provide primary access into and through NFS lands and those privately owned roads that access private lands within and adjacent to NFS lands. Classified roads, with the exception of private roads, are those roads to which State traffic regulations generally apply and are designed and maintained for "highway legal" motor vehicles though use by other classes of recreational vehicles might be allowed. Classified roads may not be inventoried and mapped by the Forest Service, and they might not be maintained at the level specified by road management objectives. The proposed Roads Policy requires inventorying and mapping of all roads on NFS lands.

Temporary roads are authorized under contracts and permits, such as timber sale contracts, special use permits, oil and gas exploration permits, facility construction contracts, or they may be constructed by the Forest Service for administrative access. These roads are needed for a short time to meet a one-time access need, usually for 1 and not more than 10 years. The Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended) generally requires temporary roads be closed and revegetated within 10 years. In general, the Forest Service decommissions temporary roads within one year after the need for access has terminated.

Unclassified roads are those roads that exist on NFS lands without the Agency's authorization. They include remnants of historic uses, such as old logging and mining roads, user-created roads due to repeated travel by recreational vehicles off designated roads and trails, and old temporary roads that were not decommissioned. The Roads Policy proposes a review of unclassified roads to determine if they are needed as a road, a trail or need to be decommissioned. It is likely that some unclassified roads will continue to be created in the future though less frequently than in the past due to the Roads Policy and other policy changes.

The proposed Roads Policy would also establish definitions for road construction, road reconstruction, road decommissioning, and road maintenance. These definitions can be found in the glossary. Road decommissioning is discussed above and the definitions for construction, reconstruction, and maintenance are discussed in the alternative effects sections below.

Roads can have both beneficial and negative effects. On the benefit side, roads provide access for multiple uses such as timber harvest, grazing, mining, fire suppression, forest management, ecosystem restoration, research, monitoring, recreation, subsistence uses, emergency rescue, and to meet other access needs. Roads provide access to private lands within and adjacent to NFS lands, and roads can have historic and cultural value. Non-access related benefits include providing edge habitat and firebreaks. Properly constructed or reconstructed roads can mitigate negative effects of past roading on water quality and riparian habitats.

Roads may have undesired and negative effects on hydrology, geomorphic features such as debris slides, **sedimentation**, a source of human-caused fired, habitat **fragmentation**, predation, road kill, invasion by exotic species, dispersal of pathogens, some recreational experiences, water quality and chemical contamination, soil productivity and biodiversity (USDA Forest Service 2000h).

All management activities associated with NFS roads are required to comply with relevant State and Federal statutes such as the Clean Water Act, NEPA, and Endangered Species Act (ESA). In addition, it is the Agency's policy to use the best available scientific information and **best management practices**[5] for planning, designing, constructing, and maintaining roads regardless of where the road is located. Implementation of these policies can minimize, but not eliminate, some of these adverse environmental effects. Within the context of the alternatives, specific effects of road construction and reconstruction on individual resources are discussed later in this chapter. A key underlying assumption to all effect analyses are that road impacts are proportional to the miles of construction and reconstruction. Therefore, it is important that differences in road construction and reconstruction between alternatives are discussed.

[5]Compliance rates for implementing best management practices are between 85% and 98%, with rates increasing over time as awareness and training programs take effect (Stuart 1996, State of Oregon 1999, State of Montana 1998). Results vary between States and ownerships, with Federal lands and large forest industries showing the highest compliance, while small non-industrial landowners with little access to professional forestry assistance fall behind. A recent report from Oregon found overall compliance rates of 98% to 99% across all ownership classes (State of Oregon 1999), while a study in Maine reported only 34% of best management practices with compliance rates grater than 80% (University of Maine 1996).

The criteria used during RARE I and II allowed the presence of some roads in areas that were inventoried for Wilderness consideration (USDA Forest Service 1992). Subsequent roadless area inventories used the same criteria. Today, approximately 9,660 miles of roads currently exist on 5% of the land area in inventoried roadless areas. Some of these roads pre-date the inventories, while others have been constructed where land management plans have allowed development in inventoried roadless areas.

Alternative 1 – No Action

An estimated 1,160 miles of classified and temporary roads (including public roads not under Forest Service jurisdiction and private roads) are planned to be constructed or reconstructed in inventoried roadless areas over the years 2000 to 2004. Table 3-6 shows the miles of classified and temporary road construction and reconstruction in inventoried roadless areas, required to support the **timber offer** volume projected over the same years. The estimated percentage of the classified roads that would be closed after planned use is also displayed. Forty-two percent of the planned timber-related roads are single-purpose roads closed to traffic between uses or are short-term roads that would be decommissioned. In addition, all of the planned temporary roads would be decommissioned within 10 years after use. The Forest and Rangeland Renewable Resources Planning Act of 1974, generally requires temporary roads to be closed and revegetated after use. By closing or decommissioning roads after use, the long-term effects on the environment are reduced. On the other hand, while temporary road construction must comply with law, regulation, and policy, in general, temporary roads are not designed or constructed to the same standards as classified roads and are not intended to be part of the National Forest System Transportation System. The results can be a higher risk of environmental impacts over the short run. The effects of the road construction and reconstruction are described for the prohibition alternatives for each resource later in this chapter.

Table 3-6. Miles of planned timber-related road construction activities, 2000-2004.

Region	Classified road const	Classified road reconst	Temporary road const	Total all categories	Estimated closures of classified roads	Estimated closures of classified roads (%)
Northern (1)	12	33	7	52	26	58
Rocky Mountain (2)	16	25	18	59	31	76
Southwestern (3)	0	0	3	3	0	0
Intermountain (4)	73	15	28	116	49	56
Pacific Southwest (5)	4	3	4	11	4	57
Pacific Northwest (6)	16	1	2	19	17	100
Southern (8)	5	16	4	25	18	86
Eastern (9)	6	6	35	47	11	92
Alaska (10)	214	0	77	291	32	15
Total	**346**	**99**	**178**	**623**	**188**	**42**

Alternatives 2 through 4

The direct effect of implementing the national prohibitions outlined in all three alternatives is an immediate end to 867 miles of projected road construction and reconstruction, including temporary roads planned in inventoried roadless areas from 2000 through 2004. Long term, this is expected to result in a reduction in the Forest Service road program of approximately 173 miles per year (based on the 5-year average of the data collected).

Prohibiting new roads would prevent any construction activities that would result in adding classified or temporary road miles in inventoried roadless areas. The prohibition on reconstruction would prevent any construction activities that would result in improving or relocating an existing road in inventoried roadless areas. In general, improvements include expanding a road's design capacity allowing it to accommodate more traffic; changing its design function, for example, from that of a low standard single use road to a primary access route for low clearance passenger cars. Relocation means physically moving all or part of an existing road to a new location and includes decommissioning the old section of road. See the Glossary for specific definitions.

Design criteria used under Alternatives 2 through 4 include **exceptions** to the prohibitions on road construction and reconstruction when:

- A road is needed to protect public health and safety in cases of imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed pursuant to reserved or outstanding rights or as provided for by statute or treaty; or
- **Road realignment** is needed to prevent irretrievable resource damage by an existing classified road that is deemed essential for public or private access, management, or public health and safety, and such damage cannot be corrected by maintenance;
- A road is needed to conduct a proposed action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, section 311 of the Clean Water Act, or Oil Pollution Act.

Any roads constructed or reconstructed because of the exceptions (as noted in Chapter 2) are subject to other laws, regulations, and policies governing these activities. In particular, the requirements being established in the Roads Policy, including interim requirements for inventoried roadless areas and use of the **Road Analysis** Process would apply, if included in the final Roads Policy.

In general, road construction or reconstruction done under one of the above exceptions would be the minimum needed to meet the required short-term access need, if possible, and would be designed to minimize and mitigate impacts on an inventoried roadless area's **roadless characteristics**.

Approximately 293 miles of roads planned in inventoried roadless areas (combined construction and reconstruction 2000 through 2004) would qualify under the exceptions.

This represents an average annual road program of about 59 miles per year in inventoried roadless areas under the prohibition alternatives.

Table 3-7 summarizes, by Forest Service region, the planned road construction and reconstruction not related to timber harvest. Table 3-8 shows miles of road construction and reconstruction for various resource management purposes that would be prohibited under Alternatives 2 through 4.

Table 3-7. Planned miles of non-timber-related road construction activities including estimates for roads under Forest Service jurisdiction, other public roads, and private roads in inventoried roadless areas, 2000-2004 (Alternatives 2 through 4).

	Excepted[a]				Not Excepted[a]				
	Classified road const	Classified road reconst	Temp road const	Sub total	Classified road const	Classified road reconst	Temp road const	Sub total	Total
Northern (1)	64	0	8	72	14	1	0	15	87
Rocky Mountain (2)	25	0	0	25	41	2	0	43	68
Southwestern (3)	13	0	0	13	7	0	0	7	20
Intermountain (4)	41	19	0	60	41	52	0	93	153
Pacific Southwest (5)	27	0	0	27	31	0	0	31	58
Pacific Northwest (6)	24	0	0	24	9	2	1	12	36
Southern (8)	19	0	0	19	7	4	0	11	30
Eastern (9)	1	0	0	1	12	0	0	12	13
Alaska (10)	52	0	0	52	20	0	0	20	72
Total	**266**	**19**	**8**	**293**	**182**	**61**	**1**	**244**	**537**

[a] Exceptions to the prohibitions as noted in this FEIS.
(USDA Forest Service 1999h; Roadless Database 2000)

The prohibitions on road construction and reconstruction in Alternatives 2 through 4 do not restrict or limit road maintenance. All activities that are needed to meet a road's current road management objective would be allowed. For example, if the gravel surfacing on the road shown in Figure 3-12 wears out, then it could be replaced. If a bridge or culvert on that same road needs to be replaced because it is no longer safe or it no longer meets environmental standards, then the replacement would be allowed. However, if it were desirable to make that road two lanes, and pave it to accommodate an increased need for access, those improvements would not be allowed because this is reconstruction, which is prohibited under Alternatives 2 through 4. If a road is proposed for reconstruction to protect an endangered run of salmon in a nearby stream and reduce sedimentation, then that would be allowed. In general, those activities needed to maintain a road's current design standard, maintenance level or traffic service level would be

Table 3-8. Planned miles of classified and temporary roads by resource area that would be prohibited under Alternatives 2 through 4 (2000-2004).

	Timber	Mineral	Recreation	Access	Wildlife	Total
Classified road construction	346	59	24	85	14	528
Classified road reconstruction	99	0	8	48	5	160
Temporary road construction	178	0	1	0	0	179
Total	**623**	**59**	**33**	**133**	**19**	**867**

(Roadless Database 2000)

allowed. Maintenance activities needed to meet new environmental or safety requirements resulting from law, regulation or policy would also be allowed.

Timber harvest contracts and other commercial activities provide a means of accomplishing needed road reconstruction and maintenance. As a requirement of a timber sale contract, special use permits, or other contracts, safety and environmental problems on existing NFS roads would be corrected to the extent necessary for executing the permit or contract. Road maintenance is performed based on the level of use by the commercial user, or funds are collected for later maintenance by the Forest Service. This reconstruction and maintenance provides an indirect benefit to other road users and contributes to the accomplishment of Forest Service management objectives including elimination of backlog maintenance and capital improvement needs. As timber harvest is reduced in Alternative 3 and eliminated in Alternative 4 these direct and indirect benefits would be forgone.

Any appropriated funds for road construction or reconstruction not spent in inventoried roadless areas because of the national prohibitions would be shifted to other high-priority roads to meet health, safety, and environmental protection and mission needs.

The issue of increased law enforcement costs, both to the Forest Service and to cooperating State and local law enforcement organizations, was identified during the scoping process and during public comment on the DEIS. No closure orders would be issued because of the prohibitions outlined in Alternatives 2 through 4. There would be no additional time requirements or economic burdens placed on law enforcement beyond what already exists as a result of current regulation at CFR 36, Part 261 – Prohibitions.

Effects of Social and Economic Mitigation on National Forest System Roads

With the additional mitigation proposed in Chapter 2, the Secretary's authority to grant rights-of-way for State highway projects (23 U.S.C. 317) is maintained. Over the 5 years from 2000 to 2004, only one 5.5-mile State-highway relocation project is proposed in an inventoried roadless area, on the Chugach National Forest. In most cases, other classified roads not under Forest Service jurisdiction, public roads (County, city), and private roads would be able to be constructed or reconstructed within existing rights-of-way or within

rights-of-way granted under one of the exceptions. In cases where additional rights-of-way are needed and the exceptions do not apply, then those requests would not likely be granted.

If road construction and reconstruction for leasable minerals is permitted, then an additional 59 miles of road construction would be allowed during the 5 years from 2000 through 2004. This, along with the State Highway Project on the Chugach National Forest, would increase total miles excepted from 293 to 358, which is an average of about 65 miles per year, or approximately 13 additional miles per year than under Alternatives 2 through 4.

Other Indirect and Cumulative Effects on National Forest System Roads

It is reasonable to expect that the historic trends for developing inventoried roadless areas established over the past 20 years will continue in this century. Currently, it is estimated that in inventoried roadless areas where development is allowed, 8% has been roaded. Over the next 20 years under Alternative 1, probably an additional 5% to 10% of the area in inventoried roadless areas would be roaded. If the road program identified in data reported for 2000 through 2004 is a predictor of future activity, then probably an additional 3,200 miles of classified roads would be constructed by 2020. By 2040, between 18% and 28% of the total classified inventoried roadless area acres would be roaded with an estimated additional 6,400 miles of classified roads.

Under Alternatives 2 through 4, the rate of road construction in inventoried roadless areas would be lower than under Alternative 1. Under Alternatives 2 through 4, by 2020 the classified road miles in inventoried roadless will have grown by an estimated 1,160 miles, and by 2040, by an additional 1,160 miles. With the addition of an exception for mineral leasing, the total classified road miles in inventoried roadless areas are estimated to increase by 1,360 miles by 2020, and another 1,360 by 2040,

In 1997, there were approximately 4 million miles of public roads in the United States (USDT Bureau of Transportation Statistics 1999). Of these, about 3 million miles were rural public roads (generally, County, secondary State, and Federal land management agency roads). There are an estimated 368,000-miles of NFS roads, which represents approximately 12% of rural public roads. There is no discernable difference between Alternatives 2 through 4 and Alternative 1 in their effects on national rural public road access. Alternatives 2 through 4 would have a minimal effect on rural public road access when assessed nationally.

Included in the analysis are discussions of the implications and consistency with the Forest Service Strategic Plan, the Unified Federal Policy, and other related initiatives.

The initiatives being proposed by the Forest Service, when taken in combination, would result in more informed decisions about conservation management and use of NFS lands. The revision of the Planning Regulations sets the planning framework for considering the road network necessary for sustainable multiple-use management. A roads analysis

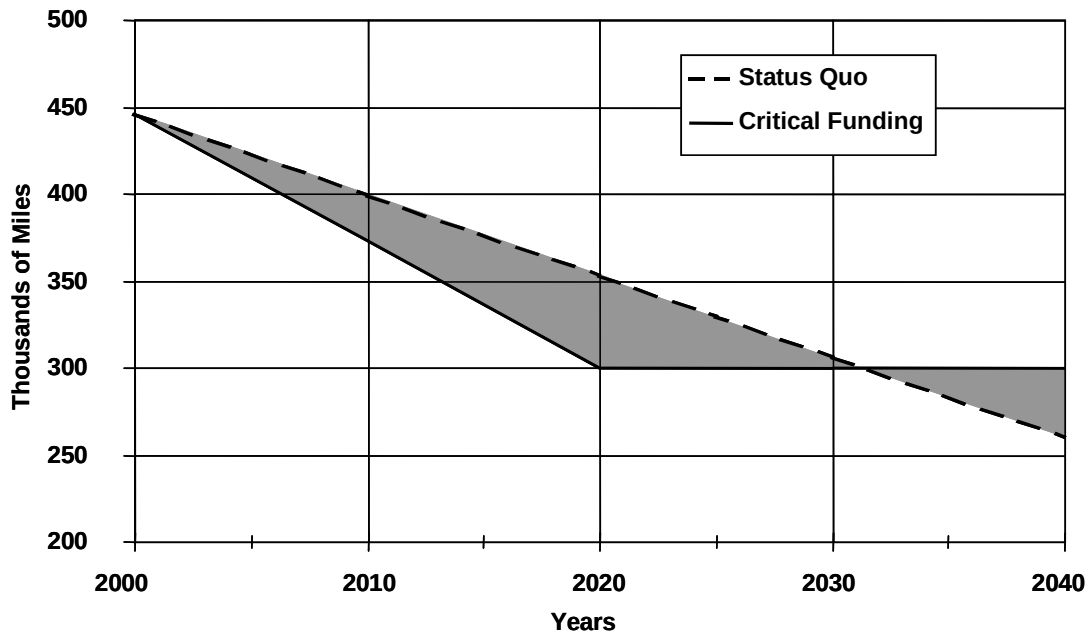
process at the land management plan level is required by the proposed Roads Policy and will change the current policy emphasis from road development to road maintenance. This analysis, required by the proposed Roads Policy, would examine NFS roads using public involvement and the best available science while considering effects on social, economic, and environmental sustainability.

The forest-wide roads analysis process required by the proposed Roads Policy would also be important for its influence on future road-management decisions. Decisions on individual road construction and reconstruction projects in unroaded areas would be informed by roads analysis as influenced by the analysis of unroaded areas required at the time of land management plan revision. The Roads Policy outlines a consistent process that each forest and grassland would follow to determine what roads are needed, including unclassified roads, for the long-term management of NFS lands. Road management decisions, made at the local level, must comply with existing laws such as the Clean Water Act, the ESA, Highway Safety Act, and be consistent with land management plans.

It is not possible to predict the outcome to NFS roads on individual national forests and grasslands from decisions that will be made at the land management plan and project level from the combined implementation of the Planning Regulations, the Roads Policy, and the alternatives considered in this FEIS. Other initiatives, such as the Unified Federal Policy, the draft Strategic Plan, and the **Cohesive Strategy** should have minimal effects on NFS roads. Under the Cohesive Strategy, there would likely be a bias toward maintaining and increasing access for **fuel treatment** in priority areas. The Unified Federal Policy establishes watershed assessments that are expected to be combined with the Roads Policy analysis guidelines to help identify needed and unneeded roads. Additionally, Regional initiatives, specifically the Interior Columbia Basin and Sierra Nevada Framework projects, could also have compounding effects of reducing the miles of classified and unclassified roads, which is consistent with the downward trends projected in Figure 3-14. Although the alternatives in the Sierra Nevada Framework Project DEIS do not show any decline in NFS road miles as a direct result of the decisions to be made, the DEIS for the Interior Columbia Basin does project declines.

It is possible to estimate reasonably foreseeable trends describing the future amount and condition of roads under Forest Service jurisdiction. It is anticipated that the majority of the existing roads will continue to be needed for management since the road network has continued to grow (Figure 3-8). The Forest Service estimates that between 260,000 miles and 300,000 miles of NFS roads will exist after implementation of these policies. Decisions about whether a road is needed will be driven by the Forest Service's ability to meet land management plan objectives within the funding received, along with safety and environmental protection standards. The actual amount of NFS roads closed, decommissioned, open to public travel, the standard maintained, and the time to reach a minimum amount of roads needed to best serve current and anticipated management objectives and public uses is dependent on many factors including budgets, environmental risks, capabilities of the land, and use. Management of NFS roads will comply with applicable law, regulation, and policy.

The two **scenarios** discussed below estimate different foreseeable future scenarios based on projections for access needs, budget, and an assumed rate at which unneeded roads would be identified and removed from the National Forest System Transportation System. The space between these two scenarios represents a range of possible outcomes (Figure 3-14).



386,000 miles of classified roads plus 60,000 miles of unclassified roads equals 446,000 miles of roads

Status Quo: 260,000 miles of roads after 40 years

Critical Funding: 300,000 miles of roads after 20 years

Figure 3-14. Range of possible National Forest System road miles based on funding.

Scenario 1: Current Budget Levels – Under this scenario the current appropriated road construction and maintenance budget of 200 million dollars a year would continue and would keep pace with inflation, which reflects the current trend of a 5% to 10% increase each year. Land management plan revisions guided by new Planning Regulations may identify unroaded areas where road construction could be prohibited. The roads analysis process would be completed on NFS lands and, through land management planning, decisions would be made about which roads are needed. As budgets allow, roads would be maintained at standards that would seek to balance the need for access with environmental protection. Because current funding levels would not achieve all road management objectives, it is likely that NFS roads would continue to deteriorate. Roads would become impassable, decisions to close roads would likely increase, and the level to which the roads are maintained would be lower than is necessary to meet all land management plan goals and objectives. In general, Agency resources would be focused on the 60,000 to 80,000 miles of road that carry the majority of NFS visitors, and on

correcting negative environmental effects on the remaining NFS roads. Under this scenario, NFS roads would reach a stable size in approximately 40 years.

Scenario 2: Critical Funding Needs Are Met – The Forest Service's Natural Resource Agenda sets clear priorities in accordance with the Forest Service Strategic Plan and within the guidelines of the Government Performance and Results Act of 1993. One of the four elements of the Forest Service Natural Resource Agenda is roads, and one of the objectives of the Roads Policy is to seek funding at a level that will allow the Agency to maintain the roads for NFS lands access to acceptable environmental and public safety standards. To do this, the Agency works with Congress and other Federal agencies to establish sustained funding for NFS roads at a $900 million annual level.

At this funding level, which will meet critical needs, the Forest Service would be able to move methodically to reduce its estimated 8.4 billion dollar capital improvement and deferred maintenance backlog over the next 20 years. Roads analysis process would be completed and NFS roads would be assessed over the next 10 years to determine which roads are needed and which are unneeded for management. These determinations would be made at the appropriate level through environmental analysis. In general, roads would be maintained at standards that would accommodate the appropriate balance between projected demand for access to NFS lands and environmental protection. Decommissioning of unneeded roads would progress at an accelerated pace compared to current trends.

Generally, no roads would be impassable due to lack of maintenance once the crucial deferred maintenance needs are eliminated. Under this scenario, NFS roads would reach equilibrium approximately 20 years from when the Agency starts to receive funding for its critical needs.

Road management decisions and the Forest Service's ability to implement them will be influenced by Agency budget levels, and the availability of Forest Service and **community** resources.

Alternatives 2 through 4 would contribute to the downward trends described above because there would be fewer roads constructed under these alternatives than under Alternative 1. However, the difference in effects between Alternative 1 and Alternatives 2 through 4 is minimal when looking at the likely trends in access on NFS lands over the next 20 to 40 years. Other policy changes and available funding for NFS roads are more likely to affect downward trends discussed above.

Creation of Unroaded Areas – The combined effect of implementing the Roads Policy, proposed Roadless Rule, and individual land management plans all within the planning framework established in the Planning Regulations would likely be reductions in road densities and possibly the creation of unroaded areas. The prohibitions on road construction and reconstruction proposed under Alternatives 2 through 4 would not apply to these newly created unroaded areas.

It is impossible to predict how many local land management plan and project level decisions would result in road density reductions and in turn how much and where

unroaded areas would be created or enlarged. Land management plan goals, such as reducing road densities for big game or recreation management, eliminating failing roads in riparian areas, or reducing fragmentation of a particular wildlife habitat, may result in road decommissioning projects. Consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service during project-level planning may result in road decommissioning to meet conservation strategy or recovery goals or to implement measures in biological opinions. The following two examples illustrate how road decommissioning could affect the amount of unroaded area acres.

In the first example, the land management-plan objective may be to reduce road density (measured as miles of road per square mile). Through planning, consultation, and local collaboration, it could be determined that the road density is too high and should be reduced to meet resource management goals. In this case, elimination of roads, even a large number of individual roads or miles of roads, may not create or enlarge unroaded areas as road density is reduced and roaded access is maintained. This particular management scenario is quite common throughout Agency-managed lands in the West. Eliminating roads to reduce road density and not creating unroaded areas is likely to be the most common decommissioning scenario accounting for perhaps 90% or more of road decommissioning decisions.

The second example is the purposeful creation of unroaded acres as a by-product of implementing land management plan objectives. For example, a watershed could have originally been roaded to provide access for timber management activities. Under new land management-plan direction, the same area could now be managed for other values or under a different **land allocation**. To reduce erosion, rehabilitate drainage patterns, increase water quality, stabilize vegetation, enhance the scenic quality, reduce landslide potential, enhance fish and wildlife habitat, and create a more secure domestic water supply, all roads could be decommissioned and the watershed restored to a more natural condition. Examples of this can be found in the portions of the Pacific Northwest that are covered by the Northwest Forest Plan where the Aquatic Conservation Strategy has placed an emphasis on road decommissioning and watershed restoration.

Restoration of large portions of watersheds where management objectives no longer require roaded access, while expected to remain uncommon, are likely to be more frequent as the Forest Service manages for sustainability of forest ecosystems. The Agency estimates that unroaded area acres are likely to increase 5% to 10% by the time NFS roads stabilize at 260,000 miles to 300,000 miles nationally.

In both of these examples it is less likely that unroaded areas would be expanded in the East due to the way these national forests were reserved, their tendency to contain more roads not under Forest Service jurisdiction, the differences in habitat and habitat needs for protected species and the differences in geology, hydrology, and topography.

The Planning Regulations would require the **responsible official**, at the time of plan revision, to identify and evaluate the important social and ecological characteristics of unroaded areas and inventoried roadless areas, and make a determination if they should

receive any additional protection. This would take place in the context of the collaboration, sustainability, and science requirements of the Planning Regulations.

The proposed Roads Policy would require that each forest and grassland undertake a roads analysis process at the national forest level. The findings of this analysis may inform a revision or an amendment of land management plans. The roads analysis process would ensure local public and private collaboration in informing road management decisions. Classified, unclassified, and temporary roads would be inventoried, mapped and a determination made by responsible officials as to whether a road is needed and, if so, where it would be located. The draft environmental assessment for the Roads Policy estimated that, at a minimum, approximately 2,900 roads would be decommissioned annually. In some cases, roads may be converted to and managed as designated trails. It is during this assessment and decision-making process that the effects of road decommissioning, including unroaded area creation, would be disclosed.

There would not be any additional unroaded areas created because of selecting and implementing the alternatives analyzed in this FEIS.

Access

Because the Roadless Rule proposes to prohibit future road construction in the inventoried roadless areas of NFS lands, it raised public concern over the question of access to these lands. There was extensive public comment on the Notice of Intent and the Draft Environmental Impact Statement pertaining to many different facets of the access issue (Chapter 1, Public Review and Comment on the DEIS and Issues Considered). People have diverse and often conflicting interests in how NFS lands are managed. Forest and grassland roads and trails represent more than just mere travel ways to many people. To many people, roads symbolize their personal rights and freedoms. People may be socially or economically dependent on the access they provide. The ways people use them are often expressions of their individual lifestyles, choices, and values. Some people view a prohibition on road construction in inventoried roadless areas as a foreclosure of future rights, opportunities, and freedoms.

The preceding section on NFS roads discussed road-related issues from a technical perspective. This section focuses on roads and the access they provide to NFS lands from a social standpoint. The following discussion summarizes existing public perceptions, concerns, and values relating to access. It is based on public comments received during this rulemaking process.

Affected Environment

Many comments received on the Notice of Intent and the Draft Environmental Impact Statement expressed concern about the effects that prohibiting road construction and reconstruction in inventoried roadless areas would have on the delivery of future goods, services, and activities. Many people perceive that the proposed rule would close roads and trails and cut off access to large areas of NFS lands. Often people oppose the proposed rule for this reason, believing it would force them to discontinue activities in

places they currently use, with negative social, cultural, or economic consequences. These activities include motorized recreation, equestrian use, hunting and fishing, grazing, logging, mining, and harvesting non-timber forest products. Other people support the rule because they believe it would close roads and trails, and as a result, have many ecological benefits, as well as benefits to people who prefer non-motorized recreation opportunities, and who have other non-commodity values relating to NFS lands. These perceptions that the proposed rule would close existing access are not correct.

There is also a perception that prohibiting road construction and other activities in inventoried roadless areas would lead to future restrictions and prohibitions on other parts of NFS lands. In addition, several comments were received that stated that a prohibition on road construction would deny future generations the opportunity to enjoy certain areas of public lands. Commentators also believe that by limiting access for forest management activities, such a restriction would lead to increased forest health and fire control problems, and would prevent ecosystem restoration activities in roadless areas. They believe that a prohibition on road construction could also hinder search and rescue efforts, and limit timber harvesting options due to increased cost.

Access is also an existing or perceived legal right to many people, some of whom believe the Roadless Rule violates this right. Mining interests refer to the 1872 United States Mining Law as providing them legal access to areas not withdrawn from mineral exploration. American Indian Tribes have treaties that may have reserved certain rights of access for various activities. Some States have laws that provide access to private lands by residents along surveyed section lines. Other regulations govern access to private lands within NFS boundaries. Some people mentioned Revised Statute 2477 (Public Law 94-579) roads as having legal standing. Other people believe past government actions or legislation, such as special designated areas, guaranteed them access to certain areas. Commentators mentioned Wilderness Acts that had release language on lands not designated as Wilderness. Still others stated that the trails or routes they use within certain roadless areas have historic significance and established use, and thus have legal standing as roads. Finally, some people felt that special use permits and administrative permits provide them with access to specific areas so that their operations can be efficiently managed. The definition of access is a legal question, and can vary on a case-by-case basis.

Another concern expressed by respondents pertaining to the issue of access is that the Roadless Rule discriminates against certain sub-groups of the population who, in their view, can only experience NFS lands by road. These sub-groups include the elderly, children, people with disabilities, persons in poor health, people who do not enjoy walking, and people who lack the time or money to visit NFS lands on foot. These respondents (who are not necessarily members of these sub-groups themselves) believe the prohibition alternatives would unfairly (and perhaps illegally) limit the ability of such people to gain access to and enjoy NFS lands. Other respondents, including members of those groups, dismiss such arguments as being purely political.

There is also concern among some members of the public that the Roadless Rule would exacerbate what they view as being a situation of unfair private roaded access to NFS lands by certain groups. There is a perception that private landowners, permittees, and lessees have exclusive roaded access rights to some areas of NFS lands because they have rights to use some roads that the public cannot. These roads are generally private roads that cross NFS lands and provide access to private **inholdings**; or, that border NFS lands and provide access to adjacent private lands. Some people view these exclusive access rights as being unfair, and believe the Forest Service should take over or open access to these roads, or build new roads, that would provide roaded access to the same areas by the general public. They are concerned that a prohibition on road construction would prevent new roads from being built in inventoried roadless areas to remedy this perceived injustice.

While many people feel their rights of access and associated forest uses are threatened by the Roadless Rule in the ways described above, many others support the rule precisely because they believe it would limit roaded and motorized access to NFS lands. They believe that limiting access, including off-highway vehicle (OHV) use, is appropriate, citing the detrimental environmental effects of roads and OHVs, and their negative effects on the peace and quiet of the forest. They feel that existing roads and motorized trails provide sufficient access to large blocks of relatively unroaded areas. These commentators also believe that there is already enough roaded access to NFS lands outside of roadless areas, which is sufficient to accommodate road-related and motorized uses.

The effects of the alternatives on access to NFS lands by specific sub-groups of the population, and by people who engage in specific uses of these lands, are discussed in the Social and Economic Factors section of this chapter.

Alternative 1 - No Action

Under this alternative existing access to roadless areas would be maintained. Access related decisions would continue to be made at the local level through forest and project land and resource management planning. Current trends for road construction, reconstruction, and decommissioning (refer to the National Forest System Roads section) would likely continue over the next decade. Access for the purposes of developed and **road based recreation** opportunities would continue to increase; conversely, the supply of land available for **dispersed recreation** (**Primitive**, **Semi-Primitive Non-motorized**, and **Semi-Primitive Motorized** ROS classes, see discussion in Chapter Three, Recreation) would continue to decrease. Future opportunities for increased roaded access to inventoried roadless areas for resource extraction and other uses would be conserved.

Alternatives 2 through 4

The action alternatives would have essentially the same effects on access. No existing roads or trails would be closed by the prohibitions. No new roads would be built in inventoried roadless areas, and existing roads could not be reconstructed. Therefore, at a minimum, the current level of roaded access to inventoried roadless areas would be

maintained, as would all forest uses associated with existing access. If funding allows, the deferred road maintenance backlog could be reduced, which would improve access on existing roads through better road maintenance (see the National Forest System Roads section).

Existing and future access to inventoried roadless areas by trail, whether motorized or non-motorized, would not be affected by the national prohibitions. Existing road and trail access for persons with disabilities would also not be affected by the prohibitions.

Future opportunities to expand activities in inventoried roadless areas would be foreclosed if they required new road construction to expand. Alternatives 2, 3, and 4 would limit or discontinue access to inventoried roadless areas, respectively, for purposes of timber harvest. New roads could be constructed, or existing roads reconstructed, to provide access to inventoried roadless areas to allow for the exceptions listed in Chapter 2, alternatives section. These include roads needed to protect public health and safety; roads needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; roads needed to conduct response actions or natural resource restoration actions under existing environmental laws; and as needed to prevent irretrievable resource damage.

Any future limitations on existing access to inventoried roadless areas required to protect roadless characteristics would be decided upon at the local level through forest and project resource management and planning efforts, with public participation.

Ecological Factors

Developing and implementing ecologically sustainable policies and programs presents many challenges for managers, scientists, and the public alike. Finding a balance between what people want from the land and what the land is ecologically capable of providing will likely continue to dominate the debate over NFS land management. The following sustainability issues are discussed in this section.

- Dynamic nature of ecological systems,
- Significance of natural processes,
- Variability of ecological systems,
- Human wants and needs, and effects of human use,
- Cumulative effects of human activities, and
- Level of our knowledge of complex ecosystems.

Ecosystem health describes the condition of an ecosystem. To measure ecosystem health, physical and biological factors, such as water, soil, air, biodiversity, terrestrial and aquatic habitat and species and **disturbance** processes, such as fire, landslides and flooding are considered. These factors are described in the Ecological Factors section. Together, all these factors describe the past, present, and potential future ecological condition of inventoried roadless areas by alternative.

The National Forest System Draft Strategic Plan (USDA Forest Service 1999f) establishes ecosystem health as a priority goal. The Strategic Plan addresses the need to improve and protect watershed conditions; increase the amount of habitat capable of sustaining all native species; and reduce risks from fire, insects, disease, and nonnative invasive species. Managers often describe the health of an ecosystem by comparing present conditions to historical ones. The estimated **historic range of variability** is a concept often used as a baseline when evaluating ecosystem health (USDA Forest Service and USDI Bureau of Land Management 2000). Scientists and land managers often compare the historic conditions of an ecosystem with today's conditions, and rate an ecosystem's health as a measure of departure from the historic conditions (historic range of variability). For example, after many years of fire suppression, more than 24 million acres of Western national forests are outside their historical **fire regimes**. At particular risk are the ponderosa pine forests in the Intermountain West, which historically experienced frequent light understory burns. Now, after decades of fire suppression, the buildup of live and dead vegetation has made these forests "unhealthy" tinderboxes that are vulnerable to large **stand** replacing fires.

In some parts of the country, it is not possible to use the historic range of variability as a benchmark either due to lack of information about the pre-settlement ecological conditions or to substantial and irretrievable ecosystem changes. For example, in the Eastern United States, much of the landscape has changed due to establishment of nonnative invasive species. Once, large chestnut trees covered 25 to 30% of many Eastern forests. Today, virtually all of these large trees have been eliminated by chestnut blight and seven moth species that feed exclusively on chestnut trees (Opler 1976). In West Virginia, more than 30% of the current plant species are nonnative and much of the forest has been harvested several times since European settlement. In this analysis, the historic range of variability is used qualitatively to describe the differences between alternatives considering the range of factors.

The ecological factors that were evaluated include:

- **Ecoregion** representation, habitat distribution,
- Size and distribution of roadless habitat,
- Size and distribution of roadless habitat relative to Grizzly Bear Recovery Areas,
- Nonnative invasive species introduction,
- Habitat fragmentation and loss **connectivity** for threatened and endangered (T&E) species other terrestrial and aquatic species,
- **Sediment** loading,
- Quantity and quality of water and air,
- Landslide,
- Fire disturbance processes,
- Insects and disease, and
- Levels of human disturbance.

Individually these factors represent various parts of an ecosystem; together, they may provide a more holistic picture. These factors are discussed under three broad subheadings: physical resources, forest health, and biological diversity.

Generally, the ecological benefits of protecting more inventoried roadless areas from development and roading include:

Physical Resources
- Conserving water, soil, and air resources
- Protecting aquatic ecosystems
- Ensuring that community drinking water sources are protected
- Protecting overall watershed health

Forest Health
- May reduce the occurrence of human-caused fires
- May reduce the spread of some damaging insects and diseases

Biological Diversity
- Increasing habitat protection
- Protecting areas from additional landscape fragmentation and further loss of connectivity
- Maintaining and/or enhancing native plant and animal communities and reducing opportunities for the spread of nonnative invasive species
- Increasing the protection of a diversity of habitats from low to high elevations
- Conserving habitat for threatened, endangered, proposed, and sensitive species (TEPS)
- Providing important habitat for populations of wide ranging animals that need large areas
- with low human activity levels

Physical Resources

Water, soil, and air resources have measurable characteristics that operate within naturally variable ranges of values. Water yield, timing, and quality, soil erosion, air quality, and other characteristics can vary widely, even in undisturbed situations. Land management practices, such as roading, timber harvest, **prescribed burning**, and other similar activities, can affect these values, and their variability. Sometimes the effects are within natural ranges; sometimes they are not. The most common effects of road construction and timber harvest activities on water, soil, and air resources are loss of ground cover vegetation, soil erosion and compaction, loss of soil productivity, increased potential for landslides, reduced transpiration (use of water by plants), increased water runoff, reduced water quality, and reduced air quality. In this analysis, the specific characteristics discussed are water quantity and timing, water quality, drinking water source areas, channel morphology, soil loss and sedimentation, site productivity, landslides, and air resources. Effects of fire on watersheds are discussed in the Forest Health and Fire Ecology section.

Roads have long been recognized as the primary human-caused source of soil and water disturbances in forested environments (Patric 1976; Egan and others 1996). Most impacts occur during initial road construction and then gradually decrease as roadside vegetation is reestablished and disturbed soil surfaces stabilize. Effects such as landslides persist when a road permanently undercuts unstable soils or landforms, or when roads are continually disturbed by road maintenance. Periodic maintenance activities can cause some of the impacts to briefly, but repeatedly, recur. Areas of particular concern are the

road surface and associated drainage structures such as ditches and water crossings (bridges, culverts, and fords). Poorly maintained roads can result in greater impacts as surface water is diverted, culverts plug, and other road design characteristics are compromised. Lack of maintenance commonly has detrimental effects on water, soil, and air resources. Insufficient maintenance funding is a key reason for the lack of adequate road maintenance (USDA Forest Service 2000h).

Temporary road construction has most of the same effects as permanent road construction, but generally for a shorter term and for a more limited physical extent. Long-term effects can occur if temporary roads receive extended use, and they are not decommissioned. Generation of sediment within timber harvest units is most strongly related to roading and associated facilities (**skid roads and trails**, log landings, etc.) that are needed to remove logs, as opposed to tree cutting (Anderson and others 1976). Skid roads and trails, log landings, and similar disturbances within the sale area are the main cause of soil erosion and can contribute up to 90% of the sediment generated by timber sale activity (Patric 1976; Swift 1988).

Until recently, poorly managed timber harvest activities have been a major source of sediment from a timber sale area (Stone and others 1979; Martin and Hornbeck 1994). Generally, monitoring has shown compliance rates for implementing best management practices to be between 85% and 98%, with compliance rates increasing over time as awareness and training programs take effect (Stuart 1996, State of Oregon 1999, State of Montana 1998, Phillips and others 2000). Results vary between States and ownerships, with Federal lands and large forest industry entities showing highest compliance, but small non-industrial landowners with little access to professional forestry assistance falling behind. A recent report from Oregon found overall compliance rates of 98% to 99% across all ownership classes (State of Oregon 1999), while a study in Maine reported only 34% of best management practices with compliance rates grater than 80% (State of Montana 1998, University of Maine 1996).

Although, best management practices do not completely eliminate water quality impacts, they do reduce impacts to acceptable levels. “Best management practices may not be completely effective, but they do provide a level of protection that the states and the Environmental Protection Agency judged sufficient to meet the goals of the Clean Water Act” (Ice and others 1997). “Audit results showed that 96 percent of the individual practices audited were effective in protecting soil and water resources” (State of Montana 1998). “When used, the forestry BMPs work well” (University of Maine 1996). Concern remains in some aspects of BMP compliance, however. For example, reports from Montana and Oregon both cited below average compliance rates with road maintenance, road drainage, and temporary crossings (State of Montana 1998, University of Maine 1996, State of Oregon 1999). These aspects of best management practices compliance may require additional education and compliance reviews. Although some excellent work is under way on assessing the effectiveness of best management practices, additional work is need is this area (Seyedbagheri 1996).

Currently, all Forest Service permanent and temporary roads needed for timber sales are designed and constructed using water, soil, and air best management practices that meet or exceed those required by individual States under Environmental Protection Agency

(EPA) direction. Current road design and management criteria incorporate the latest knowledge and experience, resulting in fewer effects such as surface erosion, landslides, sedimentation, and dust emissions, on water, soil, and air resources. Proper design and construction of new roads and maintenance of existing and new roads can limit but not eliminate these effects (USDA Forest Service 2000h).

Water Quantity and Timing

Affected Environment

Water flowing from NFS lands comprises about 14% of the total annual average water yield in the United States. This contribution is roughly 3% in the East and 33% in the West (Sedell and others 2000).

Roads affect the quantity and timing of stream flow by intercepting, concentrating, and diverting runoff (Furniss and others 1991; USDA Forest Service 2000h). They can indirectly affect annual flow volume, since they replace trees that use water. Water otherwise used by trees would become available for runoff or entry into the soil.

Water Quantity – Most experts concur that the relative effects of individual timber harvesting and roading activities on flooding decreases as watershed size increases. The extra flow generated in smaller watersheds becomes less evident as it joins flows from other watersheds and continues downstream (Anderson and others 1976; Stone and others 1979; Hewlett and Doss 1984; Thomas and Megahan 1998; Ziemer 1998; Elliot in press). Similarly, numerous harvest units and roads in multiple sub-watersheds of a larger watershed generally do not yield proportional increases in floods. Additional water from smaller units enters the main stream at different times. This action desynchronizes the flows, moderating net flow increases.

Effects of land uses, such as timber harvest and roading, are more evident during small and moderate storm events but are less important in large storm events (Hewlett 1982; Bosch and Hewlett 1982). Large runoff events are generally the result of large volume or extended periods of precipitation or snowmelt runoff that exceed the capacity of the soil to hold additional water (Lull and Reinhart 1972; Swanston 1991). This is true regardless of land use practices.

Timber harvests can cause an increase in total annual water yield, whereas roads are unlikely to have a similar effect, mainly because harvests tend to cover more area than roads (USDA Forest Service 2000h). Changes in total annual water yield would most likely be detected where there is abundant moisture to begin with, and where the soil has less ability to absorb additional water such as in the coastal forests of California, Oregon, Washington, and Alaska (Regions 5, 6, and 10) (Harr 1983; Kattelmann and others 1983; Ziemer 1987). Studies in Eastern forests indicate that at least 20% to 25% of the **basal area** in a given watershed must be removed to produce detectable increases in annual flow (Douglass 1967; Hornbeck and others 1993).

Changes in total annual water yield are generally less detectable in the drier climates of the Interior West and Southwest where additional water is quickly used by the remaining plants or is lost through evaporation (Schmidt and Solomon 1983). Harvest levels on NFS lands in the Southern and Eastern regions (Regions 8 and 9) are generally too small to generate measurable change (Hornbeck and others 1993; Lull and Reinhardt 1972). Water-yield returning to normal levels is in direct proportion to how quickly the site revegetates. Regrowth in the East and in humid parts of the West is rapid, and flows return to normal levels in 6 to 10 years after harvest. Slower growth in drier parts of the country may extend the recovery period to at least twice as long (Stone and others 1979).

Runoff Timing – Timing of water runoff (how quickly a watershed generates runoff and the time it takes for that water to work its way downstream) can change as roads and related drainage structures intercept, collect, and divert water. This accelerates water delivery to the stream, more water becomes storm runoff, which increases the potential for runoff peaks to occur earlier, be of greater magnitude, and recede more quickly than in unroaded watersheds (Wemple and others 1996).

Vegetation cover removal through timber harvest can also change flow timing. In conifer forests where the majority of precipitation is in the form of snowfall, such as in the Intermountain West, openings in the forest canopy can capture more snow and deliver it earlier during spring runoff (Leaf 1975; Troendle and King 1985; Troendle and King 1987). In rain-dominated Western conifer forests, flows from harvested areas are greater toward the end of the summer dry period than are flows from uncut forests, but the flow difference is minimal once soils are resaturated by fall rains (Ziemer 1998). Harvesting hardwood forests and areas that receive the majority of precipitation from rainfall delivers more water in the late summer or early fall. This pattern can supplement low flows during these times and can be beneficial to fish and other aquatic organisms during water-stress periods (Anderson and others 1976; Stone and others 1979; Swank and others 1988; Kochenderfer and Hornbeck 1999).

Changes in water timing are most likely to occur in areas with large amounts of timber harvest and roading since these activities have the highest potential to alter natural hydrologic processes. Areas with greater variability in seasonal precipitation and runoff, such as the arid and semi-arid portions of the West, would be more sensitive to changes in flow timing than areas with more even rates of precipitation and runoff such as the humid portions of California, Oregon, and Washington, and the Eastern United States. Changes in the magnitude of flood peaks and seasonal low flows are more evident in drier climates (Neary and Hornbeck 1994). The Northern, Intermountain, and Pacific Northwest Regions, respectively (Regions 1, 4, and drier portions of 6) are most likely to experience early runoff during any given storm, since they have relatively high planned harvest levels and are located in drier climates. Even though the Alaskan region (Region 10) has the largest volume of **scheduled timber harvest** in inventoried roadless areas, its yearlong precipitation would make any potential changes in runoff peaks or timing difficult to detect.

The USDA publication, “Forest Service Roads: A Synthesis of Scientific Information,” (2000h) summarizes most of the effects of roading and timber harvests on hydrologic regimes.

Collectively, these studies suggest that the effect of roads on basin stream flow is generally smaller than the effect of forest cutting, primarily because the area occupied by roads is much smaller than that occupied by harvest operations. Generally, hydrologic recovery after road building takes much longer than after forest harvest because roads modify physical hydrologic pathways but harvesting principally affects evapotranspiration processes.

Alternative 1 – No Action

NFS lands data shows 1,160 miles of planned roads through 2004 for both timber harvest (623 miles) and other activities (537 miles). Forests also plan to offer 1.1 BBF (billion board feet) of timber during this same period. Region 10 accounts for the largest portion of the timber offer (49%), followed by Region 4 (18%), and Regions 6 and 1 (8% each). Region 10 also plans to build the most roads (31%), followed by Region 4 (23%), Region 1 (12%), and Region 2 (11%).

Roads and timber harvest activities would be designed and implemented to meet all applicable best management practices and timber sale contract requirements, since adherence to these principles is important to maintaining optimal water yield and timing from the disturbed area. However, since best management practices and sale requirements are designed for specific maximum storm/runoff events, storms or runoff that exceed these parameters have some risk of causing on-site or downstream effects.

Average annual water yields would most likely increase where annual precipitation is abundant (although difficult to detect), such as the coastal portions of Regions 5 and 6 and on the Tongass National Forest. Annual water-yield volumes would not be likely to change in the drier portions of the Interior West, even where harvests will be heaviest, or in the East, where harvest volumes and roading are modest.

Regions 1 and 4 would be the most likely to experience increases in flood flows, especially where harvest units or roads are located in small headwater areas and also during small and moderate storm events in late summer.

Alternative 2

This alternative would eliminate roughly 75% of planned road construction (867 miles) and about 73% of the planned timber offer (840 MMBF [million board feet]) in inventoried roadless areas through the year 2004. The remaining 25% of road miles are exempt from the prohibitions for a variety of reasons. The reduction in road miles would reduce disturbance the most in humid areas with high stream densities that require the most drainage structures and crossings such as the wetter parts of Regions 5 and 6 and Regions 8, 9, and 10.

Reductions in timber offer would be dramatic in Region 10 with a 95% drop (512 MMBF), followed by Regions 4 (134 MMBF) and Region 9 (39 MMBF). Compared to Alternative 1, flood flow changes in Regions 4 and 1 would be much less likely due to

lowered timber harvests. Detecting changes in flood flows, especially larger flow events, would be less likely in other parts of the country. Average annual water yields, even in humid parts of the country, would be closer to those found in undisturbed forests due to the reduced timber harvest.

Alternative 3

The effects of this alternative on water quantity and timing would be similar to those under Alternative 2. Reductions in roading are the same, but elimination of all offered timber, except for stewardship purposes, drops the offer levels approximately 85%, and virtually eliminates harvests in Region 10, which has little opportunity for stewardship harvests. Flood flows and average annual water yields would be closer to undisturbed levels than those under Alternative 2, and would likely be at undisturbed levels in Region 10.

Alternative 4

Under this alternative, there would be the same drop in road construction as that under Alternatives 2 and 3, but with elimination of timber offered for commodity and stewardship purposes. Water quantity and timing, flood flows and average annual water yields would be the closest to undisturbed levels under this alternative. A slightly increased probability of large fires could increase flood flows and change runoff timing from burned areas.

Water Quality and Drinking Water Source Areas

Affected Environment

Road construction and timber harvest can result in measurable reductions of water quality by introducing sediment and nutrients, causing abnormal temperature fluctuations, and through the indirect effects from human use. Site preparation activities (mechanical, hand treatment, fire, etc.) following timber sales to prepare the area for either natural or artificial regeneration can also have effects on water quality although the extent and severity of these activities on NFS lands has decreased with the reduction in harvest levels and intensity of harvests. Some pollutants are from road construction and maintenance equipment, or are brought into the watershed through public road use.

Temperature – Road construction and timber harvest may cause water temperature to change where groundwater is intercepted and brought to the surface, where the stream channel shape is wider or shallower, or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Temperatures may rise sharply in exposed areas and some of those elevated temperatures may then return to normal levels as water re-enters shaded areas downstream or receives cool inflow from other streams or groundwater (Pierce and others 1993). Smaller or shallower streams are generally more susceptible to temperature fluctuations than larger or deeper streams (Chamberlin and others 1991).

Nutrients – Roading and timber harvest may indirectly affect water quality by increasing the release of certain nutrients from the decomposition of timber harvest byproducts (leaves, branches, and other organic matter). Nutrients, such as nitrogen, phosphorous, potassium, and calcium may increase in stream water following timber management activities. Nitrogen generally shows the most abrupt changes. Tree cutting has less effect than subsequent site preparation activities that are used to expedite regeneration (Hornbeck and Leak 1992). Elevated nutrient levels in streamflow usually return to normal in 1 to 4 years (Chamberlin and others 1991).

The EPA delegates the responsibility to implement the Clean Water Act to the States and Tribes. The Forest Service works closely with States and Tribes to assure Agency management practices comply with their requirements. Per agreements with many States, the Forest Service is the designated water-quality management agency for NFS lands. These agreements include specific procedures to apply if water quality problems are discovered.

Section 303(d) of the Clean Water Act requires States to evaluate water quality in light of State water-quality standards, report those stream segments that are impaired, and require development of a **total maximum daily load** of pollutants. Many States have identified impaired stream segments on NFS lands, and they are working with the Forest Service to determine how to reduce pollutant impacts and meet total maximum daily load requirements. On NFS lands, many of the recognized impairments are from sediment, temperature, nutrients, and similar pollutants (U.S. Environmental Protection Agency 1997).

Figure 3-15 identifies **major watersheds** with impaired waters that also contain inventoried roadless areas on NFS lands. The percentage of impaired stream miles within the watersheds is noted, but this does not imply that the impairments were the result of activities on NFS lands within the watersheds. The impaired stream miles listed below may come from any ownership within the watershed. Of the 533 watersheds with impaired waters, 356 (67%) have between 1% and 10% impairment, 146 (27%) have between 11% and 25% impairment, and 31 (6%) have larger than a 25% impairment. The map shows watersheds with water quality concerns and provides a basis for evaluating the likelihood of impact by implementing additional land management activities.

Drinking Water Source Areas – There are more than 2,000 major watersheds in the United States and Puerto Rico. Of these watersheds, 914 contain some NFS lands, and 661 of those contain inventoried roadless areas. Stepping this number down farther, 354 (55%) are source areas that provide water to facilities that treat and distribute drinking water to the public (U.S. Environmental Protection Agency 1997; Sedell and others 2000.) No data exist for Alaska, Hawaii, or Puerto Rico). About 150 of the source watersheds in Figure 3-16 have some use restrictions, such as the watersheds that service Santa Fe, New Mexico; Portland, Oregon; and Seattle, Washington. Most others provide a wide range of multiple uses. All watersheds that provide public drinking water will be delineated, assessed for risks, and reported to the EPA by May 2003. This action is required by the 1996 amendments to the Safe Drinking Water Act (U.S. Environmental Protection Agency 1997).

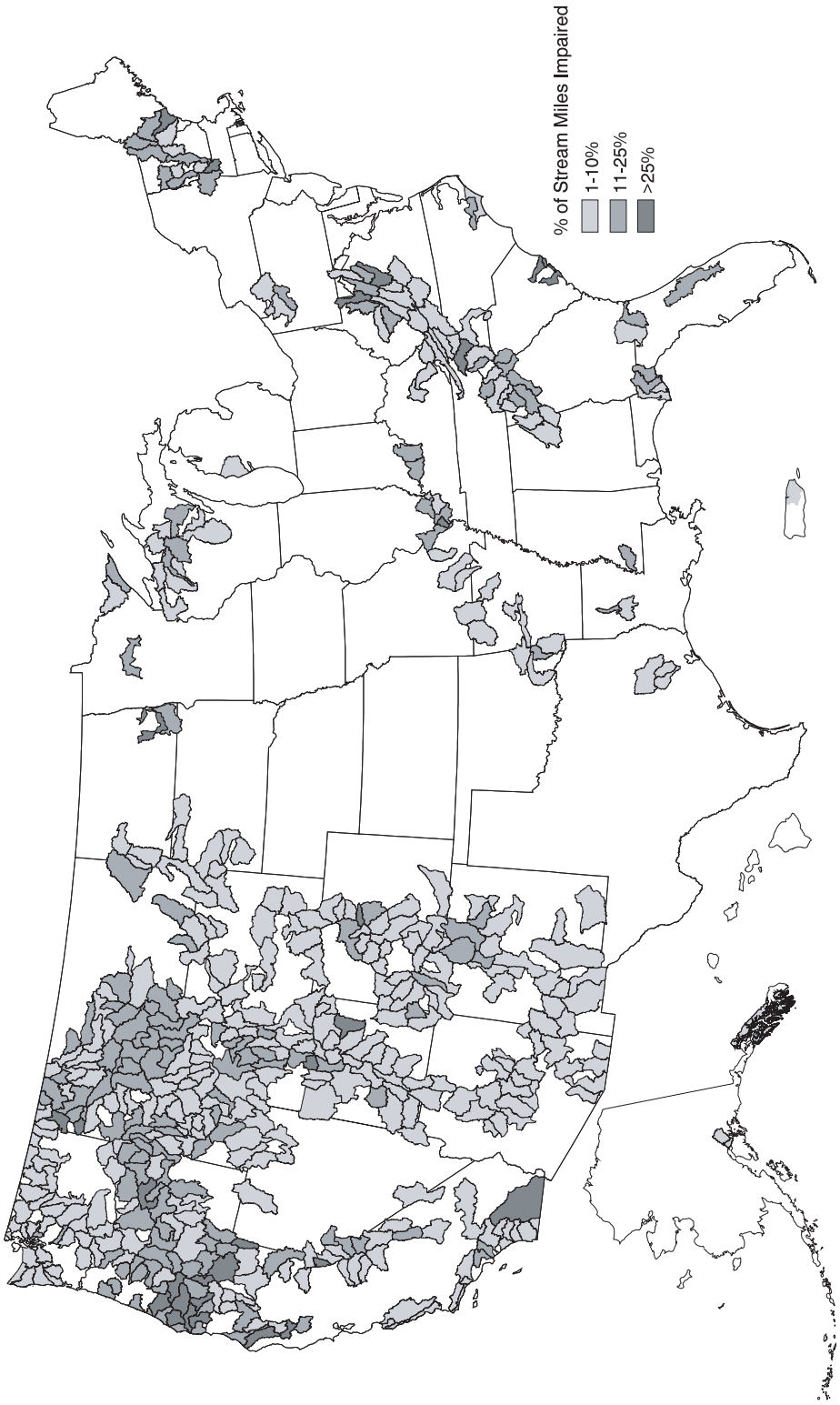


Figure 3-15. Impaired watersheds that contain inventoried roadless areas.
(Roadless Database 2000; U.S. Environmental Protection Agency 1997)

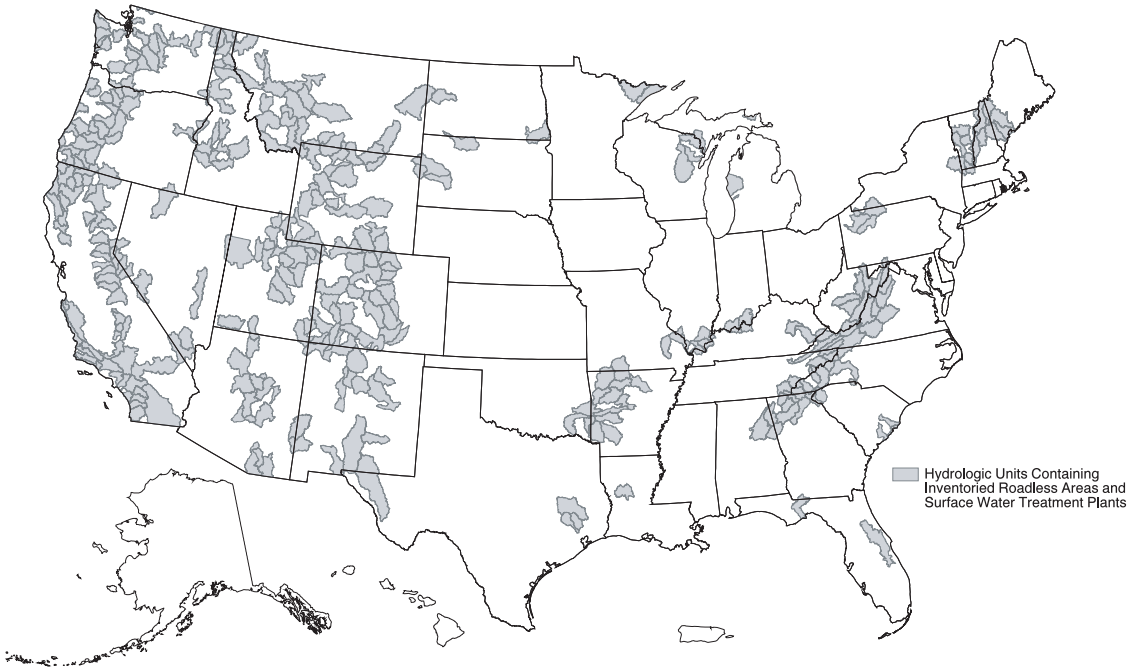


Figure 3-16. Watersheds containing drinking water source areas within inventoried roadless areas on National Forest System lands.

(Roadless Database 2000; U.S. Environmental Protection Agency 1997)

Alternative 1 – No Action

This alternative has the highest levels of timber offer and roading and therefore, has the highest probability of changes to water quality compared to the other alternatives. Although these ground-disturbing activities are closely monitored and use best management practices, the highest likelihood of water quality impacts is in the less frequent but higher volume precipitation and runoff events. In Regions 5, 6, and 10, and the wetter parts of Regions 1 and 4, high runoff can be caused by rain-on-snow events and large storms that sweep in off the Pacific Ocean. The harvest and roading levels in Regions 10, 4, and 1, and in several coastal forests in Regions 5 and 6, are most subject to these events and thus, have a high probability of impacting water quality.

In the drier parts of the Intermountain West and Southwest, rapid spring snowmelt runoff and intense spring and summer thunderstorms produce the most runoff and elevated flood peaks. High-risk seasons in the East are infrequent rain-on-snow events in the late winter and early spring, violent thunderstorms in the late spring to early fall, and precipitation from tropical storms and hurricanes along the Gulf Coast and the Atlantic Seaboard. The highest likelihood of changes to water quality occurs in these key regions during periods of high risk of erosion and runoff. Adding miles to the already under-maintained miles of NFS roads would increase the probability of additional water quality impacts.

Road construction, reconstruction, maintenance, and timber harvest activities affect watersheds. There is particular concern for watersheds that serve as drinking water source

areas. Roads tend to contribute sediment, while timber harvest contributes sediment and nutrients. Due to the high level of roading and timber harvest, the greatest likelihood of impacts to watersheds that are drinking water sources is in New Hampshire (White Mountains), Virginia, West Virginia, Georgia, Tennessee, North Carolina (Appalachian Mountains), Oregon and Washington (Cascades), Idaho, western Montana, western Wyoming; the Sierras, and California (northern coast).

The most common concern with impaired waters in forested lands is that sediment loads, nutrients, or temperature changes might further degrade water quality. Timber harvest operations and roading can affect these water quality parameters, especially during high runoff events. Based on the planned roading and timber offer levels, the highest likelihood of water quality impacts is in the forests of Vermont and New Hampshire, Virginia and West Virginia, north Georgia, Idaho and western Montana, eastern and southwest Oregon, and coastal northern California.

Alternative 2

The elimination of about 75% of the planned roading, and the associated 73% reduction in timber offer would have an effect on water quality, particularly in regions and areas highlighted in Alternative 1. Lower roading and timber offer levels would reduce concerns for increased sediment and nutrients in drinking water source watersheds. Concerns for sediment, nutrients, and temperature in watersheds with identified impaired water quality requiring total maximum daily loads would also be reduced. Under this alternative, there would be fewer new road miles needing periodic maintenance.

Alternative 3

This alternative would have the same reductions in roading as under Alternative 2, but it would further reduce the likelihood of logging impacts by allowing only stewardship harvests. Even though Region 10 has little opportunity for stewardship harvest, the region reports that 52 miles of road construction and reconstruction are tied to non-timber activities and would likely remain open, causing some concern for water quality. Similarly, Region 1 would offer only 20% of its planned volume but would still construct or reconstruct 72 miles (52%) of planned roads.

Alternative 4

This alternative would eliminate timber offered for commodity and stewardship purposes. Reductions in roading are the same as those under Alternatives 2 and 3. The incremental reduction in harvest would have fewer effects compared to those under Alternative 3. A slightly increased probability of large fires could affect the quality of water from burned areas.

Channel Morphology

Affected Environment

Roading and vegetation management have the potential to change stream channel morphology (structure and form). Unaltered streams normally exist in a state of **dynamic equilibrium** where stream shape (slope, width, depth, sinuosity) adjusts to incremental changes in sediment and water inputs but retains the same general shape over time (Lane 1955; Heede 1980). Sizable changes in sediment and water inputs can throw the channel out of equilibrium, causing it to adjust to a different form with different functions and values (DeBano and Schmidt 1989a,b; LaFayette and DeBano 1990; Furniss and others 1991; Rosgen 1996).

Stream systems or segments can exhibit vertical instability (down cutting or filling of the channel) or lateral instability (increases or decreases in stream width). Large additions of sediment or decreased flow of water can reduce a stream's ability to transport sediment, causing the channel to aggrade (fill). Sediment inputs from landslides or reductions in water flow can cause these changes. Reducing normal sediment loads or increasing the flow in a stream can increase sediment transport and cause the channel to degrade (cut into its bed or banks). Increasing flow into a channel from road ditch placement or when timber harvests decrease evapotranspiration can cause these changes.

Placing roads in floodplains near streams can confine streams, change the shape of the stream, increase the channel slope, and cause the stream to erode into its bed and banks. Recovery may take decades. Many streams are still adjusting to changes caused long ago. For example, changes in the elevation of a streambed may cause gully formation that continues to erode productive landscapes. Changes in riparian vegetation from strong, deep-rooted species (such as willow or alder) to weak, shallow-rooted species (such as Kentucky bluegrass), or loss of large woody materials can destabilize streambeds and banks. Recovery from stream channel alteration is possible. For example, a 12-year moratorium on sediment-producing activities on the South Fork Salmon River in Idaho resulted in a sizable improvement in channel condition (Chamberlin and others 1991).

Alternative 1 – No Action

Increased water runoff generated from timber harvest areas and road surfaces, and increased sedimentation from road construction, reconstruction, and maintenance are highest in this alternative. Channel degradation from increased erosion or aggradation from increased sediment deposition is a function of each local situation. Channel degradation is most likely in upper watersheds having steeper slopes and more runoff energy, but it can also occur where slopes are more moderate. Sediment from these upper watersheds may be deposited in downstream channels with flatter slopes, commonly in downstream water supply reservoirs or on lands managed by other entities. Due to the planned levels of roading and timber offer, Regions 10, 4, and 1 have the highest potential for stream channel adjustments. However, the roading planned for Region 2, and some local harvests in mountainous country in the East, hold similar concerns.

Alternative 2

The reduction in roading and timber offer provides a generally proportionate reduction in the likelihood of changes in stream channel morphology as outlined under Alternative 1. Opportunities to alter flow or sedimentation are reduced the most in Regions 10, 4, 1, and 2, and in the other specific areas as mentioned above.

Alternative 3

While the reduction in roading is the same as under Alternative 2, the further reduction in timber offer, except for stewardship activities, under this alternative provides additional benefits in terms of conserving stream channel integrity closer to undisturbed conditions. Since Region 10 has little opportunity for stewardship harvest, both roading and harvest levels would be at their minimum levels under this alternative.

Alternative 4

Elimination of timber offered for commodity and stewardship purposes, coupled with the roading reductions, provides the most benefits in terms of minimal likelihood of changes to stream channel morphology. Channels would remain closest to undisturbed conditions under this alternative. A slightly increased probability of large fires could cause changes to channel morphology on-site and downstream.

Soil Loss, Sedimentation, and Site Productivity

Affected Environment

Road construction, reconstruction, and maintenance may cause or accelerate surface erosion and initiate landslide events. General surface erosion caused by water washing over the soil produces mostly fine sediment (sand, silt, clay, gravels), while landslides produce sediment of all sizes including boulders and large organic materials such as trees and root wads. Permanent and temporary road construction and reconstruction can cause increased risk of surface erosion and landslides, but this varies widely and depends on local site characteristics. The planned mileage of permanent and temporary road construction and reconstruction provides the best estimate of effects from erosion and sedimentation.

The greatest concern for soil loss and sedimentation lies in areas where land management activities, such as roading and timber harvest, occur in conjunction with high precipitation, steep slopes, soils prone to surface erosion, and terrain susceptible to landslides. NFS lands with these characteristics include:

- New England highlands of Vermont and New Hampshire,
- Central and Southern Appalachians,
- Central Rockies in Colorado,
- Coastal forests in California and Oregon,
- Sierra Nevada Mountains of California,
- Forests in the Cascade Range of Oregon and Washington,

- Central and northern Idaho and western Montana,
- High elevation portions of Nevada, Utah, and Wyoming, and
- Coastal areas on the Tongass National Forest in Alaska.

These areas are illustrated in Figure 3-17.

Land occupied by roads is essentially lost to long-term production of vegetation unless the road is allowed to revegetate. This is also true for skid roads, skid trails, and landings associated with a timber harvest unit. The amount of land occupied by these roads, trails, and landings varies due to terrain and logging systems used. Western skyline and helicopter logging uses about 2% of the sale area, while careful tractor skidding in the East uses from 4% to 5% (USDA Forest Service 2000h).

Regions 10, 4, 6, and 1 would offer the most timber for harvest in inventoried roadless areas. Region 10 plans to leave most new roads open (85%), while all other regions plan to close half or more of the new roads. Loss of productivity from accelerated erosion and compaction during timber harvest would affect these same regions, especially Regions 10 and 4.

Alternative 1 – No Action

Under this alternative, the planned offer of 1.1 BBF of timber and construction and reconstruction of 1,160 miles of road poses the greatest potential for soil loss, sedimentation, and lost soil productivity compared to the other alternatives. Regions 10, 4, 1, and 2 plan the most road construction and reconstruction. Region 10 plans to offer the most timber volume (49% of the national total) and roading (31% of the national total) in inventoried roadless areas. As in the discussion on water quality, the greatest risks occur during the largest precipitation and runoff events. These events may exceed the design standards of the road, timber harvest, and related best management practices. Application of best management practices and timber-sale-contract requirements are generally effective in handling normal precipitation and runoff.

Alternative 2

The approximately 75% reduction in roading and associated 73% decrease in timber offer from inventoried roadless areas would proportionately decrease the risk of soil loss, sedimentation, and soil productivity compared to that under Alternative 1. The greatest benefits would occur in the Regions 10, 4, 1, and 2, respectively, based largely on reduced road construction mileage.

Alternative 3

While the reduction in roading is the same as under Alternative 2, this alternative further reduces impacts from timber harvesting except for stewardship harvests. This would provide added benefits by reducing the likelihood of soil loss, sedimentation, and lowered site productivity.

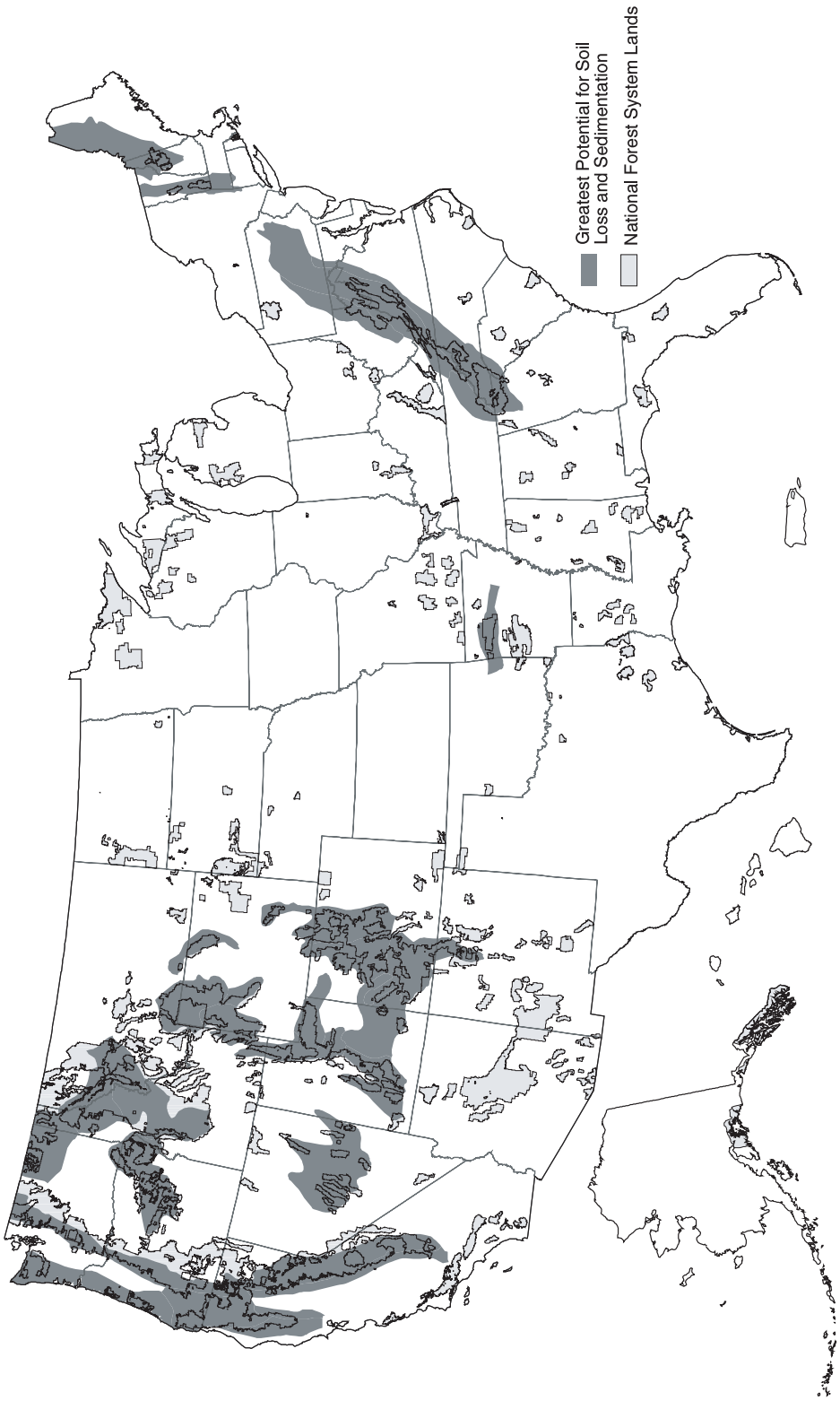


Figure 3-17. Areas with greatest soil loss and sedimentation potential. No data exist for Alaska, Hawaii, or Puerto Rico.

(Roadless Database 2000; Bailey 1995)

Alternative 4

This alternative offers the least risk and the most benefit in terms of preventing soil loss, sedimentation, and soil productivity from timber harvest and road construction activities. The benefits are slightly increased over Alternative 3 based on the elimination of timber offered for commodity and stewardship purposes. However, additional potential exists for negative effects due to slightly increased risk of large fires that can cause substantial erosion, sedimentation, and landslides, both on-site and downstream.

Landslides

Affected Environment

Landslides (the rapid downslope movement of soil, rock, water, and vegetation including mudflows, slumps, and debris flows) not only affect physical and biological watershed characteristics but can also threaten human life and safety. Landslides are recognized, particularly in many parts of Western forests, as a key source of sediment. Chamberlin and others (1991) stated that, “It is usually impossible to harvest unstable hillsides without increasing mass movements, however, except perhaps when careful selective logging with helicopter yarding can be done.”

Even a high level of care cannot guarantee avoidance of landslides because loss of root strength will increase risk until roots from new vegetation can provide stability (Ziemer 1981; Robison and others 1999). Figure 3-18 highlights specific areas of concern where land-disturbing activities, such as road construction or timber harvest, have the potential to reactivate historic landslides or initiate new ones. While all regions have some areas of high landslide potential, certain locations deserve special attention. Land-disturbing activities are more likely to occur in the West than in the East, increasing the potential for landslide events. Table 3-9 lists the inventoried roadless acreage with high landslide susceptibility in some key States.

In the West, areas of special concern include:
Steep slopes in Southeast Alaska,
Southwest corner and northeast and central mountains of Oregon,
Portions of eastern Washington,
Central and southeastern mountains of Idaho,
Portions of the mountains of western Montana,
Western edge and northwest corner of Wyoming,
Central and northeast Utah,
Large portions of central and western Colorado,
Northern New Mexico, and
North coastal, north central, and south coastal California.

While landslides are a natural process in these areas, extensive research and other investigations in the West have closely associated land management activities, particularly roading and timber harvest, with accelerated incidence of landslides by several orders of magnitude (Swanston 1974; Anderson and others 1976; Swanston and

Swanson 1976; Sidle and others 1985; Swanston 1991). Landslides were the principal source of erosion related to timber harvesting in some parts of the West, even though these slides occupy a small percentage of the land (Rice and Lewis 1991).

The winters of 1995 and 1996 offered unique opportunities to study landslides in the West. Severe storms in November of 1995 and February of 1996 triggered thousands of landslides throughout California, Oregon, Washington, Idaho, and Montana. A number of studies examined the relationship of land management activities to landslides. A joint study by the Forest Service and Bureau of Land Management in Oregon and Washington found that of 1290 slides reviewed in 41 sub-watersheds, 52% were related to roads, 31% to timber harvest, and 17% in undisturbed forest (USDA Forest Service and USDI Bureau of Land Management 1996). An evaluation of landslides initiated by the Siuslaw National Forest found that roads were the source of 41% of the slides, harvest units less than 20 years old were the source of 36%, while natural forest accounted for the remaining 23% (USDA Forest Service 1997e).

The Pacific Rivers Council funded an aerial reconnaissance to evaluate landslides in Oregon and southern Washington in 1966. Of the 651 landslides in their inventory, 36% of the slides were related to roads, 71% to harvest units less than 15 years old, and 6% to natural forest conditions[6] (Weaver and Hagans 1996). The Oregon Department of Forestry did an intense ground survey of 506 landslides and found that most slides were located in existing forest stands and relatively few were caused by active or old roads, although slides from roads were larger than those in other settings (Robison and others 1999). Other studies on the Clearwater National Forest in Idaho (McClelland and others 1997) and the Mt. Hood National Forest in Oregon (DeRoo and others 1998) found that roads and timber harvest were major causes of landslides.

As an example of the variability in regional landslide susceptibility, two studies of landslide activity in basalt formations on the west side of the Payette National Forest following 1997 storms showed marked contrast to the much-studied landslide-prone granitic formations in the Idaho batholith on the east side of the same forest. An evaluation of 483 landslides by Dixon and Wasniewski (1998) revealed that 86% of the slides (mostly small) originated in areas not affected by management activities, such as roading or timber management, although one third of the large slides were management related. They further found that only 15% were in forested areas, with the rest in grasslands and shrublands. Lesch and Shinn (1997) studied 31 landslides and found that none were directly related to management activities, such as roads, timber harvest, mining, or grazing, but originated in unmanaged settings.

Large or dramatic landslide events in the Eastern forests are rare but do occur (Patric 1976). In the Southern region, the Southern Appalachian Mountains have some areas of high susceptibility, particularly in eastern Tennessee, north Georgia, western North Carolina, and southwest Virginia. In the Eastern region, the mountains of eastern West Virginia and the mountains in central New Hampshire also have high landslide potential.

[6] Percentages sum to more than 100% since some landslides are related to both roads and harvest units.

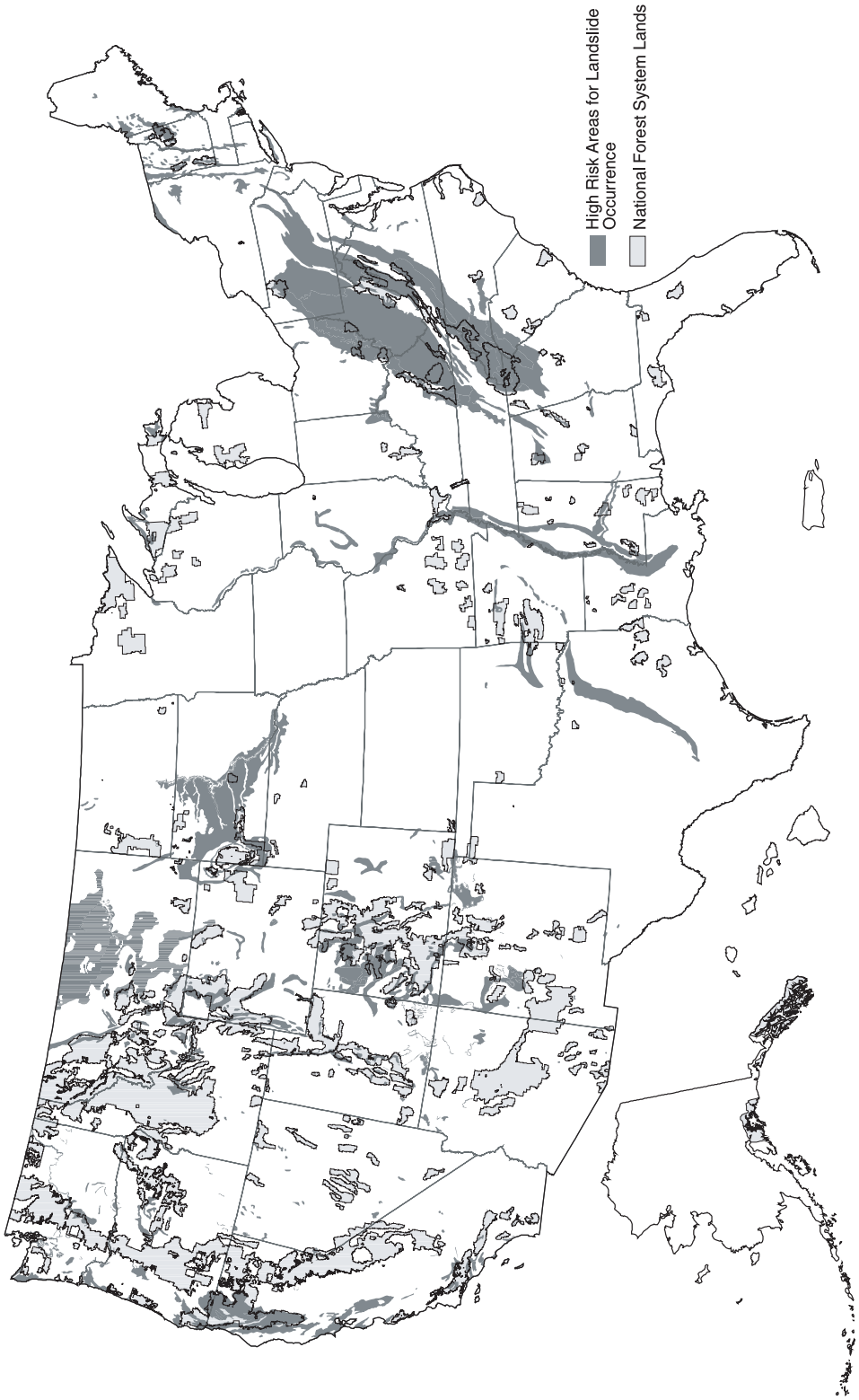


Figure 3-18. Generalized landslide susceptibility map for inventoried roadless areas. No data exist for Hawaii or Puerto Rico.

(Roadless Database 2000; Radbruch-Hall and others 1982)

Table 3-9. States with more than 100,000 acres of inventoried roadless areas, with high landslide susceptibility.

State	Total inventoried roadless area acres (thousands)	Inventoried roadless area acres with high susceptibility (thousands)	Inventoried roadless areas with high susceptibility (%)
Alaska	14,779	1,595	11
Colorado	4,433	1,295	29
Montana	6,397	975	15
California	4,416	789	18
Wyoming	3,257	693	21
Utah	4,013	534	13
Virginia	394	316	80
Idaho	9,322	294	3
North Carolina	172	148	86
Oregon	1,965	143	7
New Hampshire	235	139	59
West Virginia	202	102	50

(Roadless Database 2000; Radbruch-Hall and others 1982)

The likelihood of accelerating landslide incidence due to land management activities appears substantially different in the Eastern and Western parts of the country.

Evaluations of Eastern landslides indicate that the cause is generally extreme precipitation events, such as hurricanes or intense summer convectional storms, where precipitation far exceeds the soil's capacity to absorb and transmit moisture. In these cases, land use has less effect on landslide initiation compared to the West (Anderson and others 1976, Eschner and Patric 1982; Neary and others 1986; USDA Forest Service 2000h; Kochenderfer 2000). Small and localized slumps and other mass movements occur in the East and South, commonly because of improper road drainage (blocked or undersized culverts), which forces water onto unstable road-fill slopes (Burns 2000b; Carlson 2000; Edgerton 2000).

Alternative 1 – No Action

Of the four alternatives considered, Alternative 1 has the greatest probability of landslides, with particular concern in Regions 10, 4, 1, and 2 and with local concerns in the coastal forests of Oregon, Washington, and northern California. While modern road construction and maintenance practices are much better than those used 10 to 30 years ago, special caution is warranted in areas with high landslide potential.

Alternative 2

The reduction in timber harvest and roading under this alternative provides benefits through reduced probability of landslide events. Regions 10, 4, 1, and 2, respectively, stand to benefit most from these reductions in probability with particular emphasis on Region 10 since that region has extensive landslide susceptibility, yet plans the most timber harvesting and roading under Alternative 1.

Alternative 3

This alternative shares the same reductions in roading as Alternative 2 but has small additional benefits from a further reduction in timber harvesting and associated landslide susceptibility.

Alternative 4

The elimination of timber harvesting under this alternative would provide some incremental reduction of landslide potential compared to that under Alternative 3. Risk from roading is unchanged from Alternatives 2 and 3. However, the increased likelihood of severe **wildland fires** increases the probability of landslides in highly susceptible areas.

Air Resources

Affected Environment

Air Quality – Good air quality is necessary to attain and sustain healthy and vital ecosystems. Clean, fresh air is an attribute that visitors to NFS lands highly value. People especially enjoy viewing the scenery, being able to clearly see distant vistas, and knowing that these values are protected, even if they personally never experience them.

The authorities for air resource management on NFS lands include the National Forest Management Act, the Clean Air Act, and the Wilderness Act. A key focus of the Clean Air Act is on **Class I areas**.[7] There are 163 designated Class I areas for air quality protection in the nation. The Forest Service manages 88 of these areas, the National Park Service manages 49, the U.S. Fish and Wildlife Service manages 21, and American Indian Tribes manage five. All management activities on NFS lands must consider air quality related values for all Class I areas managed by any agency, not just those on NFS lands. Table 3-10 displays regions and forests with the highest likelihood of effects in Class I areas due to their proximity to inventoried roadless areas. Figure 3-19 displays Class I areas managed by the USDA Forest Service, other agencies, and Tribes.

Congress required that the air pollution sensitive resources in these areas, especially visibility, be protected from degradation due to air pollution (Malm 2000). Congress established a national goal to prevent visibility impairment and improve visibility in all Class I areas. Regulations issued by the EPA in 1999 specified that States must work closely with Federal land managers to establish strategies by 2004 to reduce to a natural level the regional haze that now affects virtually all Class I areas.

Atmospheric emissions from road construction and use include particulate matter consisting of suspended fine (<2.5 microns in diameter) and larger coarse soils, nitrogen,

[7]National Forest Wilderness Areas, National Parks, or National Wildlife Refuges greater than 5,000 acres in size, designated before establishment to the Clean Air Act Amendments of 1977. Class I areas can also include lands designated by Tribes or States. These areas serve as benchmarks for monitoring changes in air quality over adjacent lands.

Table 3-10. Inventoried roadless areas near Class I air quality areas.

Region	Forest or Grassland
Northern (1)	Flathead, Lewis & Clark, Lolo, Nez Perce, Clearwater, Little Missouri NG
Rocky Mountain (2)	All forests in Colorado, plus Bridger-Teton, Shoshone, Buffalo Gap NG
Southwestern (3)	Prescott, Tonto, Gila, Santa Fe
Intermountain (4)	Humbolt-Toiyabe, Dixie, Fishlake, Sawtooth
Pacific Southwest (5)	Six Rivers, Shasta-Trinity, Lassen, Mendocino, all forests in the Sierra-Nevada range, Los Padres, Angeles, Cleveland, San Bernardino
Pacific Northwest (6)	Mt. Baker-Snoqualmie, Gifford Pinchot, Siskiyou, Umpqua, Winema, Willamette, Deschutes
Southern (8)	Cherokee, Pisgah-Nantahala, George Washington-Jefferson
Eastern (9)	Monongahela, White Mountain
Alaska (10)	There are no Class I areas in proximity to inventoried roadless areas on the Chugach or Tongass National Forests.

(Roadless Database 2000)

and volatile organic compounds from gasoline engines, and soot from diesel engines. These pollutants contribute to visibility reduction. Nitrogen oxides form nitrates and ammonium deposits that contribute to soil and water acidification and leaching. Nitrogen oxides and certain volatile organics can react in the atmosphere to form ozone and other oxidants. At certain levels, ozone is phytotoxic and presents a human health risk. Oxidants are essential factors in the chemistry that creates acidification. Ozone, fine particles, and nitrogen dioxide are criteria pollutants and therefore, States must keep them at or below the critical levels established by the National Ambient Air Quality Standards.

In addition to protection of Class I areas, the Forest Service is required under Section 176 of the Clean Air Act to assure that its actions will not cause or contribute to violations of the air quality standards or increase the frequency or severity of existing violations. Any inventoried roadless areas near **non-attainment areas** may need to consider impacts on those areas.

Mechanical or other fuel treatment before prescribed burning in areas with large fuel accumulations is an important aspect of meeting air quality standards. The direct removal of fuel reduces potential site emissions and indirectly reduces fuel consumption and hence, pollutants. Emissions generated during prescribed burning in untreated forests could exceed standards, a particularly critical concern in inventoried roadless areas adjacent to Class I areas or non-attainment areas.

Global Climate Change/Carbon Sequestration – Sommers (1996) defines global climate change "… as being both physical (e.g., global warming) and chemical (e.g., acid deposition and atmospheric CO2 concentration). According to Gates (1993), "The world

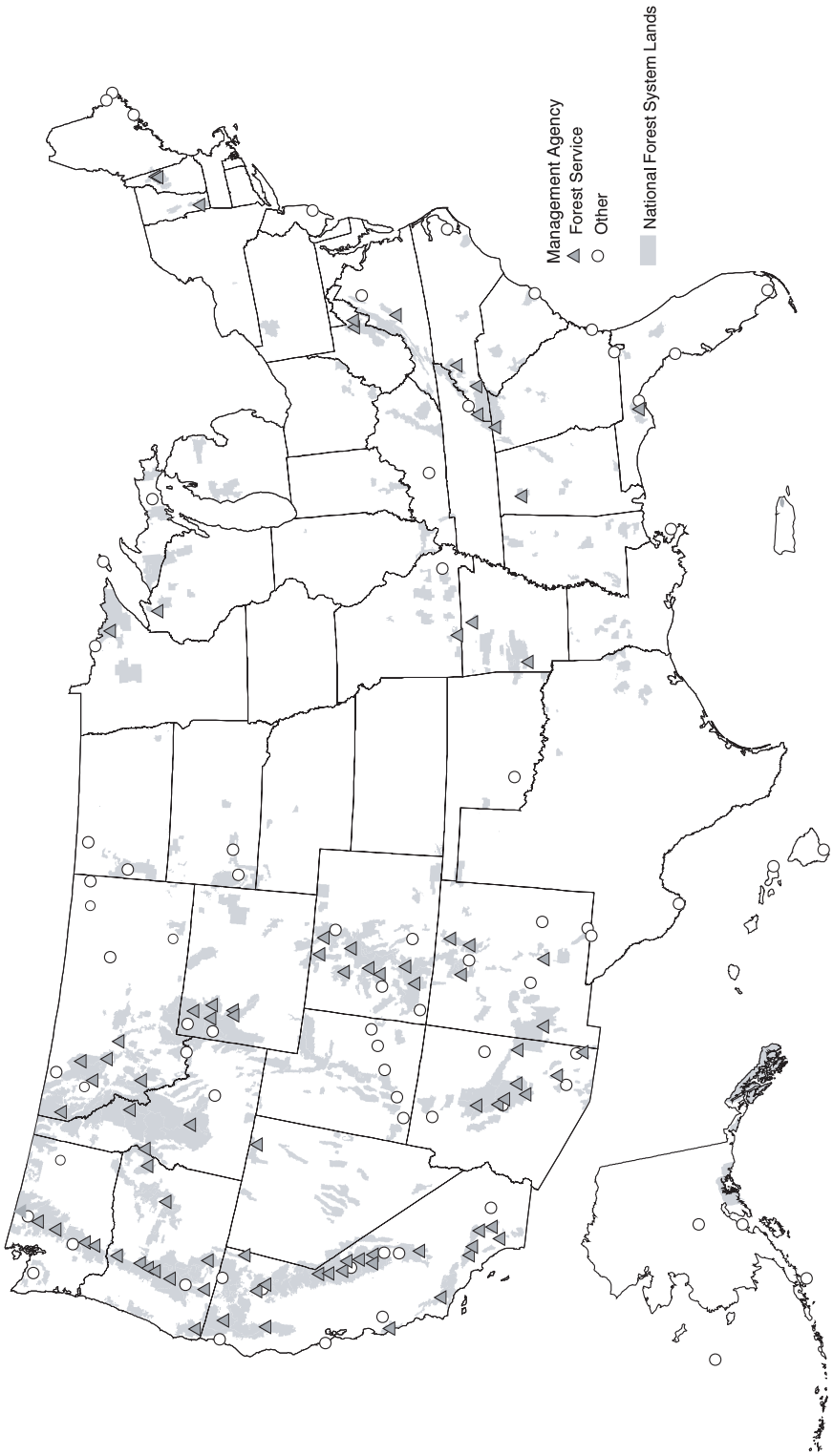


Figure 3-19. Class I air quality protection areas. No data exist for Alaska, Hawaii, or Puerto Rico.
(Roadless Database 2000; USDI, National Park Service 1994)

has been warming for over 100 years and may warm in the future at a rate unprecedented in human existence, as a direct result of industry, forest destruction, and agriculture. These activities result in the accumulation of greenhouse gasses, including carbon dioxide, nitrous oxide, methane, ozone, chlorofluorocarbons, and others. These compounds, along with water vapor, are transparent to sunlight but absorb infrared heat. Their presence in the atmosphere reduces the loss of heat from the earth's surface to outer space – the greenhouse effect - thereby making the world warmer." While estimates vary among researchers, recent data show increases in average temperatures of 0.6 °C over the past 130 years, with seven of the 10 warmest years on record occurring in the 1980s and 1990s (Gates 1993).

Carbon sequestration is the combination of carbon into materials that prevent it from being released back into the atmosphere, either in the short (a few years) or the long term (tens or hundreds of years). Carbon can be sequestered in plant materials (trees), in wood products (paper and lumber), in landfills (waste materials), and commonly in the soil and the organic litter on the soil surface. The rate of buildup varies considerably by temperature, moisture, and productivity of the site with some areas able to sequester large volumes of carbon for many years, while others sequester very little and quickly lose what little is present (Birdsey 1996). Rising use of fossil **fuels** and plants for food, shelter, and energy have released huge quantities of carbon into the atmosphere, accelerating global warming.

Carbon sequestration counters global warming through capture and long-term sequestration of carbon. Carbon sequestration serves as an offset to the carbon added to the atmosphere through burning of fossil fuels, forest clearing for agriculture, and similar actions. Currently, the rate of carbon release to the atmosphere far outstrips carbon sequestration. The size of the gap between gain and release grows wider each year largely due to the burning of fossil fuels.

Forests and forest management can play a role in addressing climate change. In accounting for the location of carbon in forest ecosystems, studies indicate that 61% resides in the soil, 8% in the forest floor (litter and humus), 1% in the understory, and 29% in the trees themselves. Of the carbon in trees, 50% is in the trunks (boles), 17% in roots, 3% in foliage, and the remaining 30% in other parts like branches, twigs, bark, etc. (Birdsey 1996; Birdsey and Heath 1997).

Forests can be managed to maximize carbon accumulation (sink enhancement) and minimize carbon loss (emission reduction). Some of the following strategies are of particular interest in managing NFS lands and several have relevance to management of inventoried roadless areas:

- Increase the area of forest lands, particularly by stocking currently unstocked lands;
- Increase the stocking levels of currently understocked lands;
- Thin or perform other activities to increase growth rates of overstocked and stagnant stands (mechanical, fire, etc.); and
- Reduce releases from wildland fire, particularly severe, stand-replacing fires (Sampson and Clark 1996).

The literature contains considerable discussion concerning timber harvest levels and the amount of time a stand of trees is allowed to grow before final harvest (rotation length). Several general themes emerge from this discussion:

- To maintain current carbon storage rates, letting existing stands grow while providing protection from loses is a reasonable strategy (Row 1996);
- Twenty to thirty-five percent of the forest biomass ends up in long-term storage after harvest (wood products, landfills, etc.), while the remainder is released to the atmosphere (loss in soils, decomposition of litter, twigs, leaves, etc). Reducing harvest level can cause a short-term increase in the amount of carbon stored in forests because volume is retained on site and releases of carbon into the atmosphere during removal of biomass and wood processing are avoided (Heath and Birdsey 1993; Heath and others 1996; Birdsey and others 2000); and
- To increase carbon storage over the long term, a continuous cycle of harvest, efficient use of biomass, and regrowth of young, vigorous trees on highly productive lands can sequester more carbon than letting existing stands grow without harvesting (Row 1996). Conversely, removal of mature or old-growth stands to begin such cycles can produce the opposite effect: net carbon emissions will ensue for many decades following the initial stand harvest. Harvest of mature forest followed by reforestation does not appear to offer net carbon sequestration benefits (Shulze and others 2000)

In discussing the effects of harvest levels, climate change and carbon sequestration, Birdsey and others (2000) conclude that, “Forestry activities that directly or indirectly result in emissions reductions may play an important role in the ability of the United States to meet its international commitments to reduce greenhouse gasses.” While this may be true at the national scale, across all ownerships, the delivery of forest products from NFS lands today is a relatively small part of the national totals. For example, NFS lands provided approximately 5% of the harvest across all ownerships in the nation in 1996. Projections show national forests are planning to offer from 3 to 4 BBF of timber each year from 2000 through 2004. Of that total, planned timber offer from inventoried roadless areas is about 220 MMBF, between 5% and 7% of the projected total NFS offer, or about 0.3% of the planned annual national harvest from all ownerships. Road construction and reconstruction related to timber operations will have little effect compared to the removal of timber. Thus, the planned annual timber offer and road construction and reconstruction from inventoried roadless areas is a very small fraction when compared with the projected annual harvest in the United States.

Forests in the United States currently serve as a carbon sink; they absorb more carbon than they release (USDA Forest Service 2000e). Growth of forests in the United States, in general, has exceeded removal (through timber harvest) since about 1952. This is enough to offset 25% of United States emissions for the same period (Birdsey and Heath 1997).

Sizable reductions in timber harvest over the past 10 to 15 years from Federal lands, particularly lands managed by the Forest Service, will likely result in more sequestered carbon on those lands for several future decades. This is especially notable in the Pacific Northwest but also holds true for other regions. This increase in stored carbon will likely be offset, however, by compensating increases in harvest on other lands, most notably private (industrial and non-industrial) lands, primarily in the South, and increased harvest

and imports, largely from Canada (U.S. Environmental Protection Agency 1995). Thus, on a global scale, the planned offer and road construction and reconstruction from inventoried roadless areas is insignificant. None of the alternatives will have a measurable impact on global climate change, carbon sequestration, or related concerns.

Alternative 1 – No Action

Effects on air quality resources in Alternative 1 are mixed. Emissions from road construction, reconstruction, and use would present a small but chronic air pollution impact, particularly where inventoried roadless areas are adjacent to Class I areas. Smoke particles are small and can travel great distances once they are in the atmosphere. Increasing access into inventoried roadless areas would likely facilitate additional prescribed burning to treat hazardous **fuels** and for other resource management purposes. Although smoke generated from these burns may affect Class I areas, the smoke events from prescribed burns are more predictable and manageable (compared to wildland fires) due to adherence to strict burning guidelines. The increased access may result in additional human-caused fires, particularly at the wildland-urban interface. In non-attainment areas, increased access and use may require mitigation measures.

Alternative 2

This alternative would prohibit roughly 75% of future roading and the associated 73% decrease in timber offer in inventoried roadless areas, thus concentrating the expected increased public use on existing roads. This could increase vehicle emissions and dust along existing roads rather than dispersing them along the larger network of roads as under Alternative 1. Concentrating emissions on existing roads could increase impacts where these roads are in or near non-attainment areas. This alternative would eliminate most emissions from the new roads adjacent to Class I areas.

Alternative 3

Timber harvest and hazardous fuel treatments that could be accomplished without road access would still proceed under this alternative. Smoke from prescribed and wildland fire would likely be similar to that under Alternative 2. Impacts from road-generated emissions would be the same as under Alternative 2.

Alternative 4

There would be a slight increased risk of large wildland fires, particularly in the dry pine and fir types in the Intermountain West, and the large quantities of smoke they generate under this alternative. The effects from road emissions are the same as under Alternative 2.

Effects of Social and Economic Mitigation on Water, Soil, and Air Resources

These exceptions would increase the number of miles allowed to go forward from 293 to 358 (662 miles with the Tongass National Forest **exemption**) for Alternatives 2, 3, and 4. The effects of road construction associated with these exceptions would be similar to those previously described under Alternative 1. The beneficial effects related to the prohibition on road construction under Alternatives 2, 3, and 4 would therefore, be somewhat less than previously described.

It is impossible to predict the amount or location of road reconstruction that would be excepted for reasons of public health and safety. Realignment or upgrade of roads would likely result in additional ground disturbance, but it is unlikely that the environmental effects of such reconstruction would substantially expand the area affected beyond that of the original construction, especially given the current emphasis on environmentally sensitive design and use of best management practices. Such reconstruction could, however, result in changes in the kinds and amount of human uses in an area. Provided that conservation of other roadless characteristics is given strong emphasis in the project design and mitigation, this reconstruction would not be likely to result in additional substantial long-term ecological changes.

Estimates indicate that few miles of road construction would be excepted for Federal Aid Highway projects over the next 5 years in inventoried roadless areas. There is no reason to anticipate a substantial increase in the future. Only one 6-mile project is currently planned on the Chugach National Forest. While this project may have local effects on the characteristics and values associated with the affected inventoried roadless area, this limited level of activity would not result in a substantial change in the overall environmental effects of the alternatives.

Six national forests and grasslands in five regions have identified 59 miles of road tied to 21 projects during the 2000 through 2004 time frame related to the exploration or production of leasable mineral materials such as oil and gas, coal, phosphate, and geothermal energy. Regions most affected by this additional mileage are: Region 2 (38 miles) and Region 9 (12 miles). Environmental effects of these road miles, should they be built, are the same as effects for other roads in similar terrain. There is no certainty whether exploration activities conducted through access provided by these roads will eventually lead to development and production of **mineral resources**. If development does take place, effects on water, soil, and air resources can be substantial at the development site and around related facilities. Considerable literature exists addressing these effects (Nelson and others 1991; FISRWG 1998). However, these development activities are subject to stringent environmental analysis, mitigation, monitoring, and evaluation measures at the local level before, during, and after project implementation.

Potential near future geothermal development activity associated with inventoried roadless areas appears limited. Only one forest anticipated lease applications in the next 5 years, with three miles of associated temporary road construction. Although the magnitude of effects from geothermal exploration and development would be dependent

on a variety of factors, impacts from such activities do not currently appear to pose substantial or widespread risks to water, soil, or air resources.

Oil and gas exploration and development activity within inventoried roadless areas is anticipated on four national forests in the next 5 years, with an estimated 34 miles of road construction for leasing and possible development. The demand for these resources is increasing nationally and may indicate additional interest in this kind of activity within inventoried roadless areas on these four forests and other NFS lands. The associated road systems would likely account for a substantial portion of potential environmental effects. Other effects of these activities would be determined by the location and size of areas disturbed, the duration of the activity, mitigation measures used for environmental protection including containment of toxic materials used in the drilling process, the type and effectiveness of site reclamation, and the overall level of exploration and development activity within an area.

One national forest identified 17 miles of roads associated with five coal exploration and leasing projects with possible eventual development of underground mining operations. Another national forest identified 5 miles of road with five phosphate leasing and permitting activities with potential for surface mining activities. The coal developments are anticipated to be subsurface and therefore, the environmental impact would involve few disruptions to surface resources and inventoried roadless values except as associated with roads. However, subsurface mining can disrupt surface water quality through release of acid waters from openings and runoff from tailing piles. The proposed expansion of phosphate mining is an open pit operation and therefore, poses higher risks to water quantity and drinking water source areas, channel morphology, soil loss, sedimentation, and soil productivity.

Environmentally, application of the social and economic mitigation measures to the prohibition alternatives would diminish the potential beneficial effects of a prohibition on road construction and reconstruction, given the greater amount of area disturbed and the kinds of activities enabled. Depending on a variety of factors, leasable mining activities supported by road access would potentially have detrimental effects to water, soil, and air resources. However, at current levels of activity and given the application of best management practices, the potential extent of these activities and their impacts do not appear to be widespread, and it is unlikely that most effects would extend much beyond local levels. Decisions on whether to permit such activities, and if so, what environmental mitigation measures would be required, would be made using current planning and decision-making processes. Overall, even with application of these measures, Alternatives 2, 3, and 4 would still provide important benefits relative to water, soil, and air resources.

Other Indirect and Cumulative Effects on Water, Soil, and Air Resources

The following analysis evaluates the incremental cumulative effects of reasonably foreseeable actions on water, soil, and air resource parameters as described earlier in this section. This analysis looks at three spatial scales: 1) inventoried roadless areas, 2) NFS lands, and 3) nationally. Some effects are detected most easily within the bounds of the

inventoried roadless area. Other effects will continue off the inventoried roadless area into the general NFS lands area. Still other effects will be detectable off the forest on other ownerships. Effects are for short-term (2000 to 2004) and long-term (2020, 2040) periods.

Many inventoried roadless areas either are in the headwaters of stream systems or are immediately downslope of relatively undisturbed areas such as Wilderness Areas. This is particularly true in the West. In these geographic positions, inventoried roadless areas have special value because they produce high quality water on that site or deliver that water for downstream users. Even though other uses within the watershed and other ownerships downstream may degrade the quality of water once it leaves the roadless area, it may have particular value on-site, such as habitat for fish, a source of clean water for irrigation, or a key recreational resource. Where inventoried roadless areas are surrounded by roaded areas, a more typical situation in many parts of the East, the healthy landscapes provided by inventoried roadless areas may provide an oasis within otherwise heavily used watersheds.

Unlike water and soil resources, air resources are not confined to watershed boundaries. Activities that affect air resources can travel to the area of concern from long distances, from either within the forest or grassland, or from many miles outside the area. Pollutants, such as dust or smoke, generated within an inventoried roadless area may travel scores or hundreds of miles outside the local area depending on wind speed, direction, and other parameters. Equally important is the impact of pollutants (smoke, dust, chemicals, etc.) generated outside of inventoried roadless areas that reduce air, water, and soil quality on Forest Service lands. Air quality on Forest Service lands may be compromised to the point that needed land treatments, like prescribed fire, cannot be undertaken.

At watershed scales that include lands managed by the National Forest System and many other land ownerships, a wide variety of land uses over many decades have dramatically altered natural processes in most watersheds in terms of water, soil, and air resources. Growing populations and the related desire for goods and services has fueled the following activities:

- Construction, maintenance, and use of transportation facilities have occurred across the nation. These include private, local, County, State, and Federal highways, and airports, railroads, and other transportation infrastructure;
- Traditional agricultural activity, such as grazing of domestic livestock and row cropping, and rapidly expanding enterprises, such as large-scale poultry and hog management;
- Timber management, fueled largely by increased demand for housing and paper products;
- Construction and operation of hydrologic modifications, such as dams and levees (nationwide), and water withdrawals for irrigation and other uses (largely in the West);
- Industrial expansion, primarily in the East, but also accelerating in some Western locations such as Denver, Salt Lake City, Phoenix, Boise, and Albuquerque;
- Elimination or reduction of natural fire cycles (most dramatic in the West); and
- Urbanization and sub-urbanization across the nation.

These activities and the effects they have on water, soil, and air parameters very often make it difficult to detect incremental changes or effects from NFS actions since activities by others have already altered these resources.

Water and Soil Resources – Under Alternative 1, incremental changes in flow timing and flood flows will most likely be detectable in and possibly downstream from inventoried roadless areas in the arid and semi-arid portions of Regions 1 and 4. Changes in average annual water yield will be most likely within inventoried roadless areas and downstream on other national forest lands in high precipitation zones in Regions 5, 6, and 10. No incremental measurable changes are expected beyond the forest boundary due to the compounding effects of flow from other land uses.

Incremental changes in water quality for Alternative 1 would most likely be detected within inventoried roadless areas and possibly downstream into other lands within the forest but should not be detectible off NFS lands because of the interaction of pollutants coming from other ownerships and land uses. Regions 10, 4, and 1 are most likely to experience water quality effects, largely from timber harvest levels and associated road construction and reconstruction. The probability of affecting drinking water source areas is directly dependent on the proximity of the individual land-disturbing activity to the withdrawal point for the water supply.

Incremental changes in channel morphology for Alternative 1 are most likely where activities occur in inventoried roadless areas and possibly on downstream national forest lands. Increased road crossings and sediment additions from road construction and re-routing of drainage along roads is the highest concern, particularly in Regions 10, 4, 2, and 1 since they project the most road activity. Incremental changes in channel morphology off national forests are unlikely.

Losses of soil and site productivity are most likely at the individual inventoried roadless area level but not beyond. Some sediment increases generated from activities in inventoried roadless areas may remain detectible at the national forest level but will rarely be detectible beyond the forest boundary because of sediment additions from other land ownerships and land uses. Regions 10, 4, 2, and 1 are the most likely to experience localized sediment increases, due largely to planned road activity.

Within inventoried roadless areas, landslide activity is most likely to increase in high-risk geologic formations in Regions 10, 4, 2, and 1. Some landslide debris may be detectible downstream on the national forest but is unlikely to be detectible beyond NSF lands.

No increased incidence of fire activity in general or large fires in particular is expected. No increases in on-site or downstream effects are expected. No increases in BAER activity are expected.

Water and Soil Resources, Alternatives 2 and 3 – Decreased levels of road construction and reconstruction and related timber harvest reduce the number of opportunities to affect many of the parameters analyzed in this section. Where these activities do occur, they will affect these parameters in the same manner and extent as described for Alternative 1,

relative to the timber offer and the number of road construction and reconstruction miles planned for the alternative.

Water and Soil Resources, Alternative 4 – The elimination of timber offered for commodity or stewardship purposes further reduces the likelihood of effects on water and soil resources described for Alternatives 1, 2, and 3. However, some slight chance exists for increases in large fire activity in inventoried roadless areas. Should additional large fires occur, some additional effects might be detectible within the burned area for all of the water and soil parameters. Some incremental effects may be detectible downstream from the burned area onto other lands on the national forests and grasslands, primarily from accelerated soil loss, landslide activity (where applicable) and resultant changes to sediment yields, channel morphology, and water quality. Loss of vegetative cover may also elevate water yields and flood flows downstream off national forests and grasslands onto other ownerships. Increased BAER activity would be needed to minimize the effects on on-site and downstream resources, health, safety, and property.

Air Resources, Alternative 1 – Impacts on air quality from road construction, use, and timber sale activity would be detectable in inventoried roadless areas and adjacent national forests and grasslands. Poor air quality entering some Class I areas from non-national forests lands may make identification of effects difficult. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 2 – Substantial reductions in road construction and reconstruction and related timber harvest will result in reduced opportunities for an incremental change to air quality beyond the NFS lands level. Emissions from outside sources will make it difficult to detect impacts from the activities in inventoried roadless areas. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 3 – Further reduction in timber harvest levels decrease the likelihood of activities in inventoried roadless areas producing detectible impacts to air quality in inventoried roadless areas, on the surrounding national forest, or off the forest or grassland. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 4 – The slightly increased likelihood of large fires elevates the probability of smoke from wildland fires affecting air resources on-site in inventoried roadless areas as well as in the surrounding forest and off NFS lands. Incremental additions to global climate change and carbon sequestration would not be detectable.

Forest Health and Fire Ecology

Approximately one-third (747 million acres) of the total land area of the United States is covered by forest vegetation (USDA Forest Service 1999j). National forests account for 147 million acres of those forested lands. Forest health is the perceived condition of these forests based on age, **structure**, **composition**, function, vigor, level of insects or disease,

presence or absence of exotic organisms, and resilience to disturbance including wildland fire. Perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that comprise the forest, and the appearance of the forest at a point in time (Helms 1998).

Diseases, insects, and abiotic agents, such as fire, wind, and drought, are the major natural disturbance agents that change forest ecosystems; anthropogenic air pollution also strongly influences forests (Edmonds and others 2000). Fire, wind, insects, and diseases strongly interact. For example, disease or insect killed trees are subject to fire, diseased trees may be windthrown or attacked by insects, and blown down or wind damaged trees may be susceptible to insects, diseases, and fire. These agents have always influenced natural forests, but in the past century, their patterns and influences have been changed by forest management practices including forest cutting and fire suppression.

Fire is an important ecological process in most ecosystems across North America. Before European settlement, fire occurred with characteristic patterns of frequency and severity that were controlled by climate, ecosystem conditions, and Native American burning. Human land use patterns since the late 19th Century, changes in climate, and organized fire suppression have resulted in alterations in fire regimes and in vegetative structure.

The concept of the "historic range of variability" helps us to understand how fire has determined the composition, structure, and function of vegetation over time, how wildland fire patterns have been altered by humans during the 19th and 20th Centuries, and when current fire patterns are characteristic or uncharacteristic of the system (Veblen and others 2000).

In the Sierra Nevada, the commonly expected consequences of decades of fire suppression—that large, infrequent fires are becoming larger and small, frequent fires smaller—is generally not confirmed by records for the 20th Century for Sierra forests (Sierra Nevada Ecosystem Project 1996). Some researchers have concluded that 20th Century attempts to exclude fire as a process have probably had little effect in forest types where natural fire intervals were long and where fire was historically stand-replacing (Brown 2000). However, in the Interior Columbia River Basin, assessment teams concluded that over all forest types, fires have become less frequent and more intense and **fire severity** has shifted from non-lethal to lethal (Hann and others 1997).

Factors Regulating Fire – Although there is conflicting evidence, wildland fires are generally considered to be increasing in size and severity since the first half of the 20th Century (Hann and others 1997; Sierra Nevada Ecosystem Project 1996; Swetnam 2000). Factors influencing fire regime, fire behavior, and fire ecology include the source and timing of ignition, fuel volumes and conditions, local weather, and climate. An understanding of the ecological consequences of fire, the risk of fire, and the implications to inventoried roadless areas involves sorting out the relative importance of these factors.

Human Ignitions – A potential factor in the increase in fire size and severity may be related to increased incidence of human-caused ignition. Human access is likely to be

increased by roads, a factor that will greatly increase the chances of both accidental and intentional human ignitions. These human ignitions may be an important source of ignition in many forests (Aber and others 2000). In an analysis of 20th Century fire patterns, the location of multiple-burn sites indicated that they were associated with busy roads (McKelvey and Busse 1996). The scientific assessments of the Interior Columbia River Basin also point out an increased probability of human-caused fire in roaded areas (Hann and others 1997). Further, while these assessments revealed that disturbance regimes were altered throughout the landscape, unroaded areas are among the least altered by management (Quigley and others 1996).

Changes in Fuels – Fire exclusion, forest management practices, and generally warmer and moister climatic conditions (Swetnam 2000) all contribute to altered stand structures and uncharacteristically high fuel accumulations in some ecosystems. In the Sierra Nevada, fire suppression and selective harvesting practices have produced forests that are denser, with generally smaller trees and more brush, and with higher proportions of certain species than were present historically. These increases in fuel have been associated with an increase in general fire severity (McKelvey and others 1996; Skinner and Chang 1996). In the Interior Columbia River Basin, model projections indicate that fire regimes have shifted, resulting in a 17% increase in lethal fires, a 3% decrease in mixed regimes, and a 22% decrease in non-lethal regimes. The increase in lethal fires is associated with altered stand and landscape conditions and fuel accumulations (Hann and others 1997).

Ecological Consequences – Fire exclusion has substantially altered the patterns of stand development, **succession** and disturbance regimes in systems formerly driven by frequent, low intensity fire. However, systems historically characterized by infrequent stand-replacing fire that operated at time scales of centuries are minimally affected. In these long-interval systems, current structures and patterns may be an expected result of the natural course of ecosystem change. Landscape and ecosystem patterns that are consistent with historical patterns are generally considered more resilient to natural and human-caused disturbances (Holling and Meffe 1996).

Fire Effects on Watersheds – Fire can have a wide array of effects on watersheds, ranging from very subtle to extreme and dramatic. The degree of effect depends on a variety of factors including physical site (slope, aspect, elevation, soil type, soil moisture content, humus and litter type and depth), vegetation (type, density, canopy levels), fuel (live vs. dead volume, arrangement, moisture content), and weather (wind speed and direction, relative humidity, temperature). These factors also determine the intensity of the fire (the amount and rate of surface fuel consumption, commonly reflected in flame length) and severity of the fire (a measure of the effects of the fire on ecosystem components, such as water, soil, vegetation, habitat). Intensity is a good measure of fire behavior, but it is a poor measure of fire effects on watershed resources. For example, a very intense fire moving quickly over a site may burn the aboveground fuel. However, this type of fire may remove little of the soil litter and humus component in a scattered **mosaic** pattern. A less intense fire may burn for an extended period over a large area, removing virtually all above-ground fuel and litter and humus layers, thereby, exposing bare mineral soil and

altering soil structural properties. Severity is the preferred measure to address the effects of fire on watershed resources.

While managers describe fires in two general categories (prescribed and wildland fire), the effects of fire on ecosystem resources is actually a continuum from very subtle effects to extreme effects. Some wildland fires can burn at low intensity and severity over large areas with few effects, while others burn at high intensity and severity with devastating effects. Some prescribed fires burn with few watershed effects, while others can cause serious disturbance over a portion of the burned area. In general, prescribed fires burn within carefully described conditions (fuel loads, fuel moisture, wind speed, fuel breaks or barriers), while wildland fires have no such constraints. Therefore, prescribed fires generally have fewer watershed effects, while wildland fires have greater impact.

Fire effects can be generally described in two categories: 1) on-site, and 2) downstream. Several authors have compiled excellent reviews of these effects (Tiedemann and others 1979; Wells and others 1979; Baker 1988; DeBano and others 1998). The following paragraphs highlight some of the known effects. The degree of these effects depends largely on the severity and extent of the fire at a watershed or multiple-watershed scale. Small fires with low severity will have few of these effects. Large fires over extensive areas may have many of these effects.

On-site effects:

- Precipitation interception – Fire consumes vegetation that normally intercepts rainfall, before it affects the ground and detaches soil particles, which results in surface erosion and eventual sedimentation.
- Transpiration – Fire can consume vegetation, reducing transpiration of water and make more water available for entry into soils or for runoff.
- Infiltration and overland flow – Fire burns the litter and humus layers of the soil, ash seals soil pores, chemical reactions make soils resistant to water entry (hydrophobic), which can result in water flowing across the soil rather than into it.
- Soil water storage – Water fails to enter the soil, reducing its capacity to store water for later use and increasing flow over the soil surface.
- Snowmelt and accumulation – Openings created by fire can increase snow accumulation on the surface and may increase the rate of spring melt.
- Surface erosion – Water running across exposed soil surface causes sheet, rill, and gully erosion.
- Landslides – In parts of the nation with high landslide risk, loss of ground cover and root strength can increase the number and size of landslides.

Downstream effects:

- Flow effects – Increased overland flow can increase flood flows in the elevation of the flood peak and in total volume of flow. Annual flow volumes may also increase if a large portion of a watershed is burned.
- Sediment – Sediment can be generated from surface erosion, and landslides can move great distances downstream, filling channels, floodplains, lakes, and wetlands, and damaging structures such as bridges, roads, and homes.

- Channel effects – Channels may fill with sediment, causing water to quickly overflow banks. Excess water may erode streambeds and banks or change channel shape.
- Chemical water quality – Fire can increase nutrients, such as nitrogen, in stream water, as well as phosphorous, potassium, calcium, magnesium, and other elements and chemicals.

The cumulative effects of fire on watershed are included in the discussion of the cumulative effects of the physical resources.

Fuel Management

The practice of fuel management incorporates the evaluation, planning, and implementation of treatments to restore and maintain forest and rangeland disturbance regimes and landscape patterns that contribute to sustainable ecosystems.

Primary objectives of fuel management are:

- Restore and improve ecosystem health through vegetation management, and
- Reduce the risk from uncharacteristic wildfire effects.

Healthy ecosystems have diverse and sustainable components and processes at the appropriate landscape scale. These include plant, wildlife, and aquatic species populations and habitat; watershed conditions (air, soil, water); human land uses; vegetation composition and structure; and disturbance (fire, insect/disease, grazing) regimes. Restoring fire as an ecological process in **fire-adapted ecosystems** can positively affect ecosystem health. Managing vegetation and fuel in areas where fire has been excluded will reduce the risk from uncharacteristic wildfire effects.

The assessment of fuel and vegetation treatments, including mechanical and hand **thinning**, prescribed fire and **wildland fire use**, to accomplish these results is an important consideration inside inventoried roadless areas.

Literally millions of acres of national forests are currently outside their historical fire regimes. Because of the cumulative effects of past wildland fire suppression, they have not experienced the natural occurrence of fire for years, sometimes decades, and past logging and grazing have added to this departure from the natural regime. This condition occurs most notably in the fire-adapted dry forests and associated rangelands of the Western United States where ecosystems historically experienced frequent, but low intensity, fires. Researchers confirm that forests and rangelands at most risk today developed under a historic cycle of high frequency, low-intensity wildland fire (Clark and Sampson 1995; Agee 1994; Mutch 1994; Hann 1997).

In the absence of natural fires, many of these lands have become overgrown with shrubs and smaller diameter trees creating a fuel profile that acts as a “fire ladder” to the crowns of the dominant overstory trees. The accumulation of **fine fuel**--dead needles, grass, and sticks on the forest floor--also contributes to increased fire spread. Many rangeland areas that were maintained in grass and shrub mosaics are now dominated by woody species that have shaded out the herbaceous cover that historically protected the soil from

erosion. These conditions diminish ecosystem vigor and resiliency, and increase the potential for unnatural, large fire outside the historical range of variability. Indeed, many wildland fires now occurring in Western ponderosa pine forests and associated rangelands are "larger, hotter, more lethal to vegetation, more damaging to top soils, and exceptionally dangerous to human settlement and property" (Clark and Sampson 1995).

Highlighting the need for fuel management, a recent U.S. General Accounting Office report (*Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats [GAO/RCED-99-65]*) concluded that:

> *"The most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation. This accumulation has caused an increasing number of large, intense, uncontrollable, and catastrophically destructive wildland fires. These fires not only compromise the forests' ability to provide timber, outdoor recreation, clean water, and other resources, but they also pose increasingly grave risks to human health, safety, property, and infrastructure."*

Awareness of this fuel management issue is longstanding. This over-accumulation of fuel has also been a primary concern in recent regional environmental analyses.

> *"Wildland fire suppression activities, aided by improved technology for fire detection, prevention, and suppression, were generally successful in reducing the extent of wildland fires from the 1910s through 1960s. Fuel loadings have steadily increased as a result of suppression efforts and fire frequencies have declined (Agee 1993). As a result, fire size, intensity, and severity have increased…"*
>
> *Interior Columbia Basin Ecosystem Management Project Supplemental Draft Environmental Impact Statement*
> *March 2000*

> *"Current management strategies and those of the immediate past have contributed to forest conditions that encourage high-severity fires. The policy of excluding all fires has been successful in generally eliminating fires of low to moderate severity as a significant ecological process. However, current technology is not capable of eliminating the high-severity fires. Thus, the fires that affect significant portions of the landscape, which once varied considerably in severity, are now almost exclusively high-severity, large, stand-replacing fires."*
>
> *Sierra Nevada Forest Plan Amendment Draft Environmental Impact Statement*
> *April 2000*

> *"[The fires of 2000] reflect a longer-term disruption in the natural fire cycle that has increased the risk of catastrophic fires in our forests and rangelands… . Wildfires are on a pace to break decades-old records. …The intensity of this year's fires is the result of two primary factors: a severe drought accompanied by a series of storms that produced millions*

of lightning strikes and windy conditions, and the long-term effects of more than a century of aggressively suppressing all wildfires, which has led to an unnatural buildup of brush and small tress in our forest and rangelands."

Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000
September 8, 2000

Affected Environment

This over riding concept frames all of the fuel management effects analysis: in inventoried roadless areas, very little **fire hazard** reduction work has occurred in the past and little work is planned for the future. Regardless of whether there is a prohibition on road construction and reconstruction or a prohibition on timber harvest in inventoried roadless areas, the highest priorities for fuel management work will continue to be on NFS lands outside of roadless areas where natural resource values or potential threats to human communities are the highest. This point has been validated in two recent government reports. The first document, a Report to the President titled *Managing the Impact of Wildfires on Communities and the Environment* (White House 2000), notes that a top priority for reducing wildland fire risk is to reduce fuels in forests and rangelands adjacent to, and within communities. The second report, *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy* (Laverty and Williams 2000), addresses the need to restore roaded and managed landscapes in close proximity to communities. Specific Cohesive Strategy priorities are:

- Wildland-urban interface,
- Readily accessible municipal watersheds,
- Threatened and endangered species habitat, and
- Maintenance of existing low-risk Condition Class 1 areas.

Even though the majority of fuel management work is expected to occur outside inventoried roadless areas, if there was a threat to human life or property, threatened or endangered species, or community or domestic watersheds from a hazardous fuel situation in inventoried roadless areas, then agency personnel, working at the local level, could choose to work in these areas.

In the fuel management effects analysis that follows, it is assumed that fire hazard reduction work would not begin in inventoried roadless areas for at least 20 years, the estimated time it would take to address the extremely hazardous fuel situations outside roadless areas. (Some agency personnel think the 20-year timeframe is overly optimistic, and that it would take a much longer period to correct the hazardous fuel situations in roaded landscapes.) The fuel management effects described in the following analysis pertain only to situations where fuel reduction work is potentially expected to be completed in inventoried roadless areas.

The fuel management trend analysis in the FEIS was based upon NFS fire occurrence data (see Fire Suppression section) and the following sources of information, strategic direction, and geographic information system mapping products:

- Coarse-scale fire regime and condition class assessment
- National fuel management restoration strategy
- Wildland-urban interface demographics
- Historical fuel management treatment costs

Coarse-Scale Fire Regime and Condition Class Assessment – A national fire regime-mapping process and coarse-scale assessment has identified acres at potential risk from uncharacteristic wildland fire effects (*Coarse-Scale Assessments for Wildland Fuel and Management*, Hardy, Bunnell, Menakis, Schmidt, and Long 1999). The coarse-scale data used in this analysis were developed for national-level planning. Summaries of the data were restricted to State or Forest Service regional scales. The data were not intended to be used at finer spatial scales.

The assessment developed three condition classes and five fire regime groups to categorize and describe vegetation composition and structure conditions that currently exist. They serve as generalized rankings – based on coarse-scale data – to be used only as approximations for strategic planning purposes at national, State, or regional scales. These fire regime groups and condition classes are shown in Tables 3-11 and 3-12, respectively.

Table 3-11. Fire regime grouping based on coarse-scale data.

Fire regime group	Frequency	Severity
I	0-35 years	Low severity
II	0-35 years	Stand replacement severity
III	35-100+ years	Mixed severity
IV	35-100+ years	Stand replacement severity
V	> 200 years	Stand replacement severity

(Hardy and others 2000)

A fire regime is a description of how fire functions as a process within an ecosystem. Fire regimes are characterized by **fire frequency**, predictability, seasonality, intensity, duration, and scale. Five combinations of fire frequency, which are based on **fire return interval** and fire severity, served as the basis for the five Fire Regimes in the *Coarse-Scale Assessment*.

Of the five Fire Regimes, Fire Regimes I and II demonstrate the most significant departure from historical fire occurrence. Fire Regime I includes western dry, pine forests and other long-needle pine species, as well as dry-site Douglas fir. Fire Regime II includes the drier grassland types, tall grass prairie, some chaparral ecosystems, and mountain brush communities. Generally these fire regimes occur in lower to mid-

elevation forest and rangelands types where people tend to dwell, and when not maintained in their natural condition, comprise the greatest risk to human health and safety, as well as potential loss of property, highly valued resources, and commodity interests.

Fire exclusion has substantially altered the patterns of stand development, succession and disturbance regimes in Fire Regimes I and II. Systems operating at longer time scales, characterized by mixed severity and less frequent stand-replacing fire (Fire Regimes III-V), have been less affected. Large, stand-replacing fires will still occur in these fire regimes.

The analysis for the FEIS also focuses on the three condition classes identified in the *Coarse Scale Assessment*. Condition class categorizes the current condition within each of the five fire regimes. Current condition defines the departure from the historic disturbance regime and the resulting vegetative structure and composition.

A qualitative risk ranking is assigned to each condition class – low, moderate, high. The chance of losing key ecosystem components in a wildland fire increases from **Condition Class 1** (lowest risk) to **Condition Class 3** (highest risk) as described in Table 3-12. The description of condition class "risk" (used to classify and rank the three condition classes) is not the probability of a fire occurring. Instead, it refers to the potential harmful effects to key ecosystem components and human communities that are occurring because of altered vegetation composition and structure and to the uncharacteristic wildfire effects that can occur once a wildland fire ignites and burns.

Figure 3-20 shows changes in fuel profile and vegetation composition and structure that have typically occurred in the dry, pine forests of the West. Grasslands, brushlands, and other vegetation types found throughout NFS lands have experienced similar changes in condition class resulting from changes in management emphasis or exclusion of fire. The sequence of photographs in Figure 3-20, taken in 1909, 1929, and 1980, shows how condition class changes from a low to a high rating. The 1909 photograph, representing Condition Class I, shows a ponderosa pine forest at the Fort Valley Experiment Station near Flagstaff, AZ. Regularly occurring forest fires would have kept this forest at a low risk from uncharacteristic wildland fire effects, but after years of fire exclusion, this forest became densely populated with small diameter trees. As time passed, the fire hazard and condition class both rose. The dense tree stocking seen in the 1929 and 1980 photographs, representing Condition Classes 2 and 3, would require some mechanical pretreatment before prescribed fire could be applied.

On the 170 million acres of NFS lands outside of Alaska, for Fire Regimes I-V, 66 million acres can be described as low risk, 57 million acres as moderate risk, and 38 million acres as high risk (Table 3-13).

The condition class and fire regime databases were developed using biophysical data, environmental modeling, and the knowledge of regional fire ecology experts. The

Table 3-12. Condition classes based on vegetation composition and structure conditions.

Condition class	Interpretation
1 Low risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes are within historical range of variability for fire frequency and intensity. Vegetation composition and structure is largely intact and functioning. Forests and rangelands within this class can be maintained by regular application of prescribed fire, or wildland fire use, and do not need pretreatment. As used in this analysis, if a wildland fire occurs in Fire Regimes I and II, it is generally non-lethal to vegetation and non-threatening to people and communities. However, some Condition Class 1 lands in Fire Regimes III, IV, and V, could produce intense, stand-replacing fires.
2 Moderate risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes and associated vegetation composition and structure are moderately altered. One or more fire cycles may have been missed, allowing denser stocking of sapling trees, woodlands or shrubs. Wildland fires on these lands produce a mixed severity burn pattern. Fifty percent of these forests and rangelands may need pretreatment (thinning, chipping, hand piling, dozer piling, yarding, helicopter logging, mastication, mowing, and crushing of fuels) before prescribed burning. Some inventoried roadless areas may need pretreatment before being managed with prescribed fire or wildland fire use.
3 High risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes and associated vegetation composition and structure are substantially altered. Multiple fire cycles have been excluded, representing a dramatic departure from historical conditions. Forests and rangelands that were once open and park-like are now densely stocked with trees, closed woodlands, or shrubs. Nearly 100% of this condition class may need pretreatment, especially along the perimeters, before prescribed fire can be successfully used. Wildland fires would be of high severity, killing most of the vegetation, damaging key ecosystem components, and possibly posing direct threats to people and communities.

(Laverty and Williams 2000)

condition class and fire regime databases were also reviewed and validated by local experts. As such, these national databases are the most accurate spatial data of their kind ever prepared for the **contiguous** United States. When viewed for entire States or regions, the databases accurately portray patterns of condition class and fire regime as they exist on the ground.

There is uncertainty associated with whether an individual pixel in the geospatial map is fire Condition Class 1, 2, or 3. This attribute uncertainty is mostly due to the scientific judgment used to integrate the biological and ecological data sets used to prepare the fire condition map. The scale of data sets (1 kilometer) contributes less to the uncertainty than does the scientific judgment. The Agency has been unable to quantify the extent to which this uncertainty exists. The Agency has also been unable to identify if errors associated with the data may be correlated with whether an area is roaded or unroaded, and therefore, the Agency has not eliminated the possibility that the data may be biased in this way.

1909 Photo – Condition Class 1

Regularly occurring, low-intensity fires could maintain vegetative conditions similar to those shown here. Analysis of fire-scarred trees indicates that fire burned these forests at 2 to 20 year intervals. The fires were "hot" enough to restrict most encroaching vegetation, but "cool" enough to avoid killing most of the older-aged trees.

1929 Photo – Condition Class 2

By 1929, because fire had been excluded for 2 to 3 cycles, the forest began to reveal changes in species composition and structure. The site had a higher percentage of small trees.

1980 Photo – Condition Class 3

By 1980, the vegetative composition and structure has changed from what existed in 1909. Over this 71-year period, grasses and herbs on the forest floor were replaced by dense thickets of small trees in the understory. During drought periods, the overabundance of vegetation stresses the site, pre-disposing it to insect infestations, disease outbreaks, and severe wildland fire.

Figure 3-20. Photos taken at the same location over 71 years illustrate changes in condition class and vegetative structure due to wildfire exclusion.

(USDA Forest Service and Ecological Restoration Institue 2000; 1909 and 1929 photographs courtesy: G.A. Pearson; 1980 photograph courtesy: Frank Ronco)

Because of this uncertainty, the Agency acknowledges that this fire-condition class data should not be used at a scale finer than an entire State. The data cannot be relied on to portray an accurate picture of geographic areas smaller than a State. Map overlay using a geographic information system was the process used to compare inventoried roadless

Table 3-13. Acres (in millions) at risk from uncharacteristic wildfire effects for Condition Classes 1 through 3 in Fire Regimes I through V, excluding Alaska.

	Fire Regimes I-V				
	Condition Class 1 low risk	**Condition Class 2 moderate risk**	**Condition Class 3 high risk**	**Other land cover**	**Total**
All National Forest System lands	66	57	38	9	**170**
Inventoried roadless areas	19	14	8	2	**43**

(Roadless Database 2000)

areas and other NFS lands outside of inventoried roadless areas with respect to condition class and fire regime. The inventoried roadless areas are mapped at a finer scale as compared to the broad scale condition class and fire regime data. The national scale and resolution of the condition class and fire regime databases limit the minimum size of areas that can be compared. Taken together, however, the inventoried roadless areas are large enough to allow comparisons to be made using State and regional summaries. The geographic information system methods used for this analysis are consistent with other assessments that used multi-scale geospatial data (USDA Forest Service and USDI Bureau of Land Management 2000). A detailed discussion of coarse-scale data sets and analysis procedures is in the Fire Management Specialist Report, which is available for review at **roadless.fs.fed.us/**.

Figure 3-21 displays the same information for inventoried roadless areas as Table 3-13 (Condition Classes 1-3, Fire Regimes I-V) for each Forest Service region. As the bar chart illustrates, the highest risk from uncharacteristic wildland fire effects in inventoried roadless areas occurs in the Western United States. The following Western regions contain the most high-risk acreage: Region 6 (Oregon and Washington), Region 1 (Montana and northern Idaho), Region 4 (southern Idaho, Utah, Nevada, and a small portion of western Wyoming), and Region 5 (California).

National Fuel Management Restoration Strategy – The Forest Service has prepared a national strategy, “Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy” (Laverty and Williams 2000), for protecting communities and restoring and maintaining ecosystem health by reducing the over-accumulation of fuel. The Cohesive Strategy tiers from the national Coarse-Scale Assessment and is a broad-scale analysis that will be refined as finer-scale national forest data become available.

Table 3-14 displays, by individual State, potential treatment acres within inventoried roadless area boundaries. Many States have no lands needing treatment. Further prioritization of treatments will occur at the forest level, commensurate with forest and rangeland sustainability, watershed protection, conservation of species diversity, protection of property, reduction of wildland fire costs, and public and firefighter safety. Unless an imminent threat to public safety, private property, water quality, or T&E

species exists, inventoried roadless areas would be a low priority for fuel treatment over the next 20 years, primarily because higher priority areas are more common outside of roadless areas.

Table 3-14 presents National Forest System fire condition class data in inventoried roadless areas by State. This data use is at a finer scale than what the *Coarse-Scale Fire Regime and Condition Class Assessment* suggests is appropriate. The Agency acknowledges that as the size of the analysis areas are reduced, the attribute uncertainty associated with the data increases. The uncertainty associated with the actual condition class that is associated with these small areas may be significant. The Agency has not quantified the extent of this uncertainty nor identified whether the results of this analysis may be biased due to a correlation between attribute error and if an area is roaded or unroaded.

Condition Classes 1, 2, and 3 and Fire Regimes I and II were identified in the Cohesive Strategy as areas for fuel and vegetation treatment. For the purposes of this FEIS, these same condition classes and fire regimes were assumed to be potential fuel treatment priorities within inventoried roadless areas. As pointed out earlier, Fire Regimes III-V were not considered potential treatment areas for purposes of this analysis.

Table 3-15 is a subset of the coarse-scale information presented in Table 3-13. This table categorizes acres of NFS lands and inventoried roadless areas by Condition Classes 1 through 3, but only Fire Regimes I and II, both derived from the *Coarse Scale Assessment.* Because of the extremely low fire hazard in the temperate rain forest of Alaska (Region 10), condition class information is not included in either Table 3-15 or Figure 3-21.

Figure 3-21 displays the risk information by condition class, under all fire regimes, for inventoried roadless areas in each Forest Service region. As the bar chart illustrates, the greatest number of acres at risk from wildland fires within inventoried roadless areas occurs in the Western United States (Regions 1-6).

Condition Class 1, Low Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 19 million acres of inventoried roadless areas are at low risk of experiencing uncharacteristic wildfire effects. 16 million of those acres are located at mid to high elevations in Fire Regimes III-V.

The remaining 3 million acres, in Fire Regimes I and II, are classified as potentially needing fuel treatment. Even though forest and shrublands within Condition Class 1 are rated at low risk to ecosystem health from wildland fire, they still require regular application of prescribed fire to remain at low risk. Of those 3 million acres, 556,000 acres are located in the East (Regions 8 and 9) and 2.45 million acres are located in the West (Regions 1-6.).

Condition Class 2, Moderate Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 14 million acres of total inventoried roadless areas are at moderate risk of losing key ecosystem components from uncharacteristic wildfire

Table 3-14. Potential treatment areas, in thousands of acres, by State. States without National Forest System lands are not included.

			Fire Regimes I and II			
						Condition Classes 1, 2, 3
States	National Forest System lands total acres	Inventoried roadless areas total acres	Condition Class 1 low risk Acres	Condition Class 2 med risk Acres	Condition Class 3 high risk Acres	Percent of total inventoried roadless areas
AL	665	13	1	11	1	100
AZ	11,255	1,174	67	792	108	82
AR	2,586	95	71	14	7	97
CA	20,698	4,416	484	534	879	43
CO	14,509	4,433	34	598	554	27
FL	1,153	50	47	0	0	94
GA	865	63	29	29	4	98
ID	20,458	9,322	291	690	77	11
MO	1,493	25	21	1	2	96
MT	16,893	6,397	49	224	90	6
NV	5,833	3,186	551	1,074	483	66
NM	9,327	1,597	182	779	358	83
NC	1,244	172	105	55	6	97
ND	1,106	266	192	0	0	72
OK	397	13	2	11	0	100
OR	15,658	1,965	74	299	428	41
SD	2,012	80	22	53	5	100
TN	698	85	54	18	9	95
UT	8,179	4,013	477	1,119	247	46
VA	1,660	394	200	92	44	85
WA	9,214	2,015	12	250	345	30
WV	1,033	202	8	46	44	49
WY	9,238	3,257	16	115	7	4
Aggre-gate[a]	5,285	69	16	12	17	0.65
Total	**161,459**	**43,302**	**3,000[b]**	**7,000[b]**	**4,000[b]**	**31**

[a] Aggregate is composed of the following States: IL, IN, KY, LA, MS, NE, PA, TX, and SC with 10,000 acres or less of Condition Class 1 through 3 lands.
[b] Rounded to nearest million acres.
(Roadless Database 2000)

effects. Because wildland fire has been excluded in these forests for years, they reveal changes in species composition and structure. Vegetation is now denser in these forests and rangelands with fewer large trees, more small trees, and fuels that are more continuous. When a wildland fire occurs, it kills a majority of the smaller trees and occasionally burns into the crowns of the larger trees, also killing them.

Nearly 7 million acres have been identified as potentially needing treatment. Of the 7 million acres, 294,000 acres are located in the East (Regions 8 and 9) and 6.7 million acres are located in the West (Regions 1-6).

Table 3-15. Potential treatment acres (in millions) for Condition Classes 1 through 3 in Fire Regimes I and II on all National Forest System lands and in inventoried roadless areas, excluding Alaska.

	Fire Regimes I and II			
	Condition Class 1 low risk	**Condition Class 2 moderate risk**	**Condition Class 3 high risk**	**Total**
All National Forest System lands	22	38	29	**89**
Inventoried roadless areas	3	7	4	**14**

(Hardy and others, 2000, Roadless Database 2000)

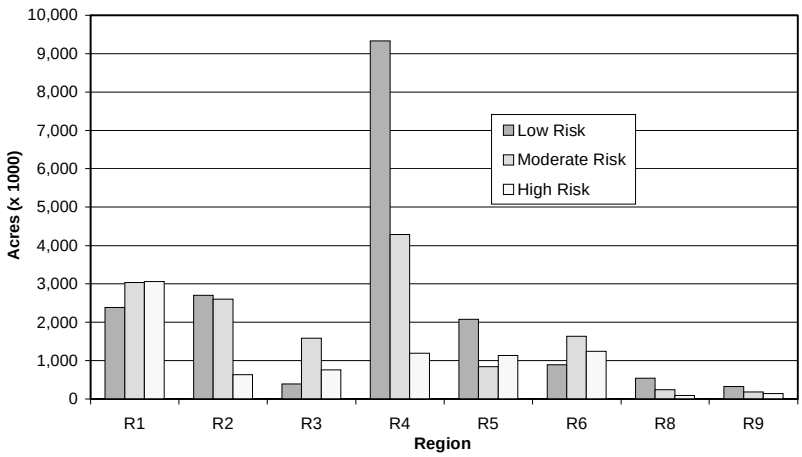


Figure 3-21. Potential risk from uncharacteristic wildland fire effects for inventoried roadless areas by Forest Service region [a] in Condition Classes 1-3 and Fire Regimes I-V.

(Hardy and others 2000, Roadless Database 2000)
[a] Because of the extremely low fire hazard in the temperate rain forest of Alaska (Region 10), condition class information is not included.

Condition Class 3, High Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 8 million acres of inventoried roadless areas are at high risk of losing key ecosystem components. These forests and rangelands are overgrown and increasing in density. Because of this overabundance of vegetation, wildland fire can quickly move from the ground to the crowns of the larger trees, contributing to severe, high-intensity fires that result in complete overstory mortality. These “hot” wildland fires damage key ecosystem components, including the soil. In these forests and rangelands, a fire would be difficult to control. Of the 8 million acres rated at high risk, nearly 4 million acres are identified as potentially needing treatment. Of these 4 million acres of high priority treatment, 428,000 acres are in the East (Regions 8 and 9) and 3.5 million acres are located in the West (Regions 1-6).

While some Eastern and Southern forests are at moderate to high risk of losing key ecosystem components, from wildfires, fuel hazard in these geographical areas is not as

widespread as in the West. On these lands, prescribed burning can usually be accomplished without **mechanical pretreatment**. The goal for fuel treatment in these regions is to maintain ecosystems in the low risk classification. Specifically, the Eastern (R-9) and Southern (R-8) regions generally have more low-risk areas than other regions. There are isolated exceptions though. For example, adjacent to the Boundary Waters Canoe Area Wilderness (R-9), 6,000 acres of a 477,000-acre blowdown occur in inventoried roadless areas posing a serious fire hazard.

Even though Alaska has minimal fire hazard and major fuel management work is not planned, it should be noted that on Alaska's Kenai Peninsula on the Chugach National Forest, a spruce bark beetle epidemic has created 112,000 acres of forest that could burn in a severe wildland fire. Approximately 92,000 acres are in inventoried roadless areas

Wildland-Urban Interface Demographics – The wildland-urban interface demographics refer to the urban areas, dwellings, or other concentrations of people adjacent to NFS boundaries. For purposes of this analysis, the wildland-urban interface was classified into five categories based on **ambient population densities** near inventoried roadless area boundaries:

- Wildland – 0 to less than 2.6 people per square mile (e.g., Loma, ND and Boulder, UT)
- Rural – 2.6 to less than 26 people per square mile (e.g., Marysvale, UT and Owyhee, NV)
- Rural/Urban - 26 to less than 260 people per square mile (e.g., Cohutta, GA and Neihart, MT).
- Suburban - 260 to less than 1,300 people per square mile (e.g., Blackduck, MN and McCall, ID)
- Urban – 1,300 or more people per square mile (e.g., Missoula, MT and Bishop, CA).

Ambient population density class distributions for each Forest Service region were created by first placing both 1- and 5-mile buffer zones around each inventoried roadless area. Figure 3-22 shows how the 1- and 5-mile buffer zones were spatially mapped near Tucson, Arizona. A similar map was produced for each inventoried roadless area.

After the buffer zones were created, an ambient population density map was placed over them, producing the density class distributions shown in Tables 3-16 and 3-17. The information in Tables 3-16 and 3-17 does not locate each density class to a specific geographic area. Instead, these tables show the proportion of the total land area for each of the five population density classes (wildland, rural, rural/urban, suburban, and urban) compared to the total land area in each buffer zone. These proportions are expressed as percentages for each Forest Service region.

As expected, in most regions the ambient population density within 1- to 5-miles of inventoried roadless areas is very low, in fact, the ambient population density is less than 1%. Exceptions occur in the Southern and Eastern regions. In the Southern region, within the one-mile buffer zone, the rural ambient population density class becomes more prevalent (40% rural vs. 52% wildland) than in other regions. A similar pattern occurs in the Eastern region, with more than 22% in the rural ambient population density class and approximately 76% in the wildland class (Table 3-16).

Table 3-16. Percentage of land by ambient population density class within 1 mile of inventoried roadless area boundaries.

Region[a]	Wildland	Rural	Rural/Urban	Suburban	Urban
Northern (1)	98.0	1.8	0.3	0.0	0.0
Rocky Mountain (2)	93.7	4.7	1.6	0.1	0.0
Southwestern (3)	94.6	4.2	1.1	0.1	0.0
Intermountain (4)	96.0	2.7	0.9	0.2	0.1
Pacific Southwest (5)	88.8	8.6	2.3	0.2	0.0
Pacific Northwest (6)	94.3	5.1	0.6	0.0	0.0
Southern (8)	52.1	39.6	8.2	0.1	0.0
Eastern (9)	75.9	22.3	1.8	0.0	0.0
National average	**86.7**	**11.1**	**2.1**	**0.09**	**0.01**

[a] Region 10 is excluded because of the low fire occurrence on National Forest System lands in Alaska.
(U.S. Department of Energy 1998; Roadless Database 2000)

Table 3-17. Percentage of land by ambient population density class within 5 miles of inventoried roadless area boundaries. [a]

Region	Wildland	Rural	Rural/Urban	Suburban	Urban
Northern (1)	95.0	3.3	1.5	0.1	0.0
Rocky Mountain (2)	91.4	5.7	2.5	0.4	0.0
Southwestern (3)	91.6	5.2	2.5	0.5	0.1
Intermountain (4)	91.6	4.7	2.5	0.7	0.4
Pacific Southwest (5)	82.8	11.1	4.3	1.2	0.6
Pacific Northwest (6)	91.4	7.1	1.4	0.1	0.0
Southern (8)	38.1	42.0	18.1	1.7	0.1
Eastern (9)	65.9	29.0	5.0	0.2	0.0
National average	**81**	**13.5**	**4.7**	**0.6**	**0.2**

[a] Percent values are rounded to the nearest 1/10 and may exceed 100%.
(U.S. Department of Energy 1998; Roadless Database 2000)

Fuel Management Treatment Costs – The national budget for fuel management on NFS lands has averaged $60 million annually. Costs for individual fuel management projects can average from $15 to $150 per acre. If fuel treatment-reduction projects are located near high value areas, total treatment costs can range as high as $500 to $1800 per acre.

In 1999, 1.4 million acres of NFS lands received fuel treatments. Most of those acres were treated using prescribed fire, and 60% of the treated acres occurred in the Southern Region (R-8). The national average cost for using prescribed fire as a fuel treatment method was $43 per acre in 1999. The 7.5 million acres of high priority acres in inventoried roadless areas may require mechanical pretreatment to prepare a site for prescribed fire. Projected average costs to apply prescribed fire are expected to range from $176 to $276 per acre if mechanical pretreatment is required (Laverty and Williams 2000).

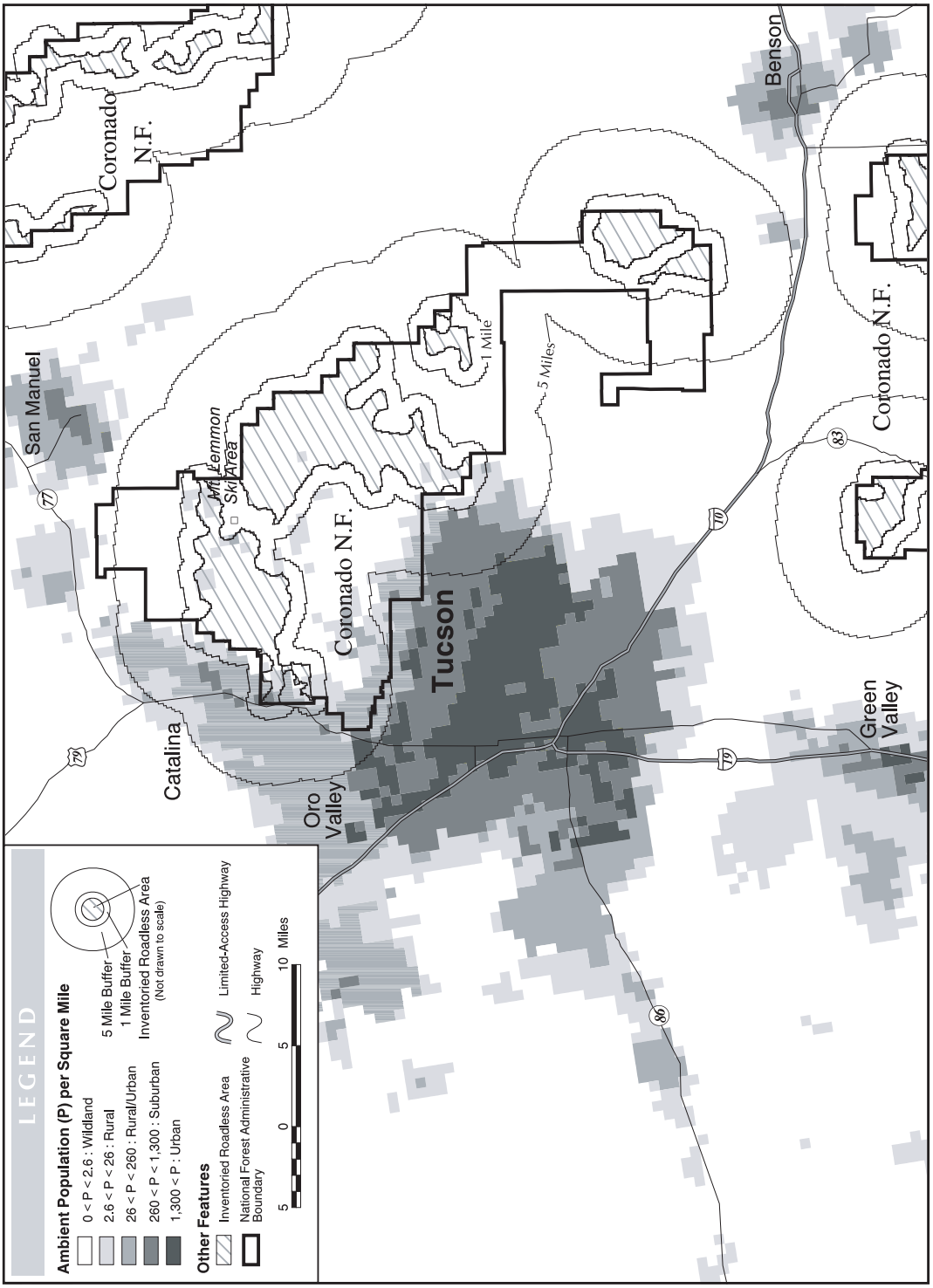


Figure 3-22. Map of inventoried roadless areas overlaid with ambient population density near Tucson, Arizona.

Historically, the Agency has not constructed roads solely for fuel management projects. Roads are constructed for other purposes and subsequently used to access fuel-treatment areas. If the costs of road construction and maintenance were added to the fuel treatment cost, the increase would likely be higher than the commodity value of the resources protected.

There are many factors limiting the amount of work completed in inventoried roadless areas, including funding, the number of personnel available to complete fuel treatment planning and implementation, and the fact that the highest priorities for fuel treatment are outside inventoried roadless areas.

Methodology – Condition class, fire regimes, wildland-urban interface demographics, and fire occurrence data (see Fire Suppression section) were used to determine the potential trends and effects of each alternative on fuel and vegetation management activities within inventoried roadless areas. In evaluating each alternative, four questions were considered:

Number of Large Wildland Fires – Will the number of large (1,000 acres or more) fires increase to such an extent that key ecological factors (water, soils, vegetation, air quality, T&E species), or human life and property are damaged?

Wildland-Urban Interface – Will fuel and vegetation management activities to ensure public safety and to protect property in the wildland-urban interface near inventoried roadless area boundaries be adversely affected?

Treatment of Potential Areas – Can an aggressive fuel and vegetation management program be implemented on the 14 million acres of inventoried roadless areas potentially needing treatment?

Fuel Management Costs – Will the costs to reduce the threat of uncharacteristic wildfire effects preclude reaching fuel and vegetation management objectives?

Design Elements Common to all Alternatives – Six key design elements along with the national coarse-scale assessment, fuel management strategy, fire occurrence data, and wildland-urban interface demographics were used to help frame the analysis.

- The primary purpose of fuel management is to maintain forest and ecosystem health and reduce the occurrence of large fire (Davis and Cooper 1963; Wood 1982; Van Wagtendonk 1996).
- Unless an imminent threat to public safety, private property, water quality, or T&E species exists, inventoried roadless areas would be a low priority for fuel treatment over the next 20 years because higher priority areas are more common outside roadless areas.
- Disposing of fine fuel reduces fire hazard and can be accomplished through mechanical treatment, prescribed burning, or combinations of both (Swetnam 2000).
- Among fuel management practitioners and researchers, uncertainty exists over how to spatially locate fuel management projects (particularly at the landscape level) to prevent large fires (Deeming 1990; Turner and Romme 1994; Pollett and Omi 2000; Miller and others 2000; Johnson 1994).

- Whether timber harvesting reduces the size and intensity of a wildland fire is disputed and uncertain. Both **commodity-purpose timber harvest** and stewardship-timber harvest can reduce **fire intensity**, the **resistance to control**, and fire spread provided the ladder fuels and unutilized coarse and **fine fuels** are removed from the site. Conversely, timber harvest can sometimes elevate fire hazard by increasing dead-ground fuel, removing larger fire resistant trees, and leaving an understory of ladder fuels (Graham and others 1999; Sacket and others 1996; Barrett 1994; Feeney and others 2000; Weatherspoon 2000).
- The costs of road construction and maintenance were not factored into this analysis as they vary widely depending on terrain, road design, and associated mitigation measures. Roads used for fuel treatment are often constructed for other purposes. This analysis focused on the direct cost of fuel treatment activities (Saveland 1987), and not on the costs of building a road just for fuel management purposes.

Alternative 1 – No Action

Numbers of Large Wildland Fires – Approximately 160,000 acres within inventoried roadless areas are projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – Minimal fuel reduction work is currently being conducted in the wildland-urban interface adjacent to inventoried roadless areas because few people live there (Tables 3-16 and 3-17). This alternative would provide the widest array of fuel treatment options to efficiently manage fuels in the wildland-urban interface.

Potential Treatment Areas – Even though some inventoried roadless areas currently allow road construction, very little fuel management work is currently being completed in these areas. Treatment areas inside inventoried roadless areas would likely continue to be classified as low priority for work due to the large amounts of fuel treatment needs that have been identified in treatment areas outside inventoried roadless areas. Because this alternative permits road development and all forms of vegetative manipulation, a full range of hazardous fuel reduction techniques could be used.

Of the 14 million acres of inventoried roadless acres identified as potentially requiring fuel treatment under this analysis, all 3 million of the low risk acres and approximately 3.5 million (or 50%) of the moderate risk acres can be treated using prescribed fire without mechanical pretreatment. Approximately 3.5 million of the moderate risk acres and all 4 million of the high risk acres, totaling 7.5 million acres, may need some type of mechanical pretreatment before prescribed fire can be used to reduce the fire hazard.

An estimated 90,000 to 95,000 acres of forest rated as Condition Class 2 and 3 could be treated in the next 5 years by commodity-purpose and stewardship-timber harvest methods. This represents just more than 1% of the 7.5 million acres in inventoried roadless areas potentially needing treatment that could require mechanical pretreatment before prescribed burning.

Fuel Management Costs – This alternative will allow a full range of mechanical fuel treatments and pretreatments in preparation for prescribed burning including: mechanical and hand thinning, chipping, hand piling, dozer piling, mastication, mowing, crushing, as well as land-based and aerial timber harvesting and associated yarding of standing live and dead trees. The fuel treatment costs will vary by the treatment method selected, but should average $176 to $276 per acre. These fuel treatment costs do not reflect the cost of road construction and maintenance.

Other Indirect Effects – In inventoried roadless areas that allow road construction and reconstruction, substantially more fuel treatment could be accomplished through timber harvest (including thinning) and other mechanical treatments than Alternatives 2, 3, or 4.

Of the mechanical treatment options available, the effects of logging can be the most problematic. Historically, some of the fuel created through logging has been left to naturally decay on thousands of acres of NFS land. A scientific report (Franklin and others 2000) *Simplified Forest Management to Achieve Watershed and Forest Health: A Critique* states:

> *"Any logging that reduces average tree size, at either the stand or landscape scale – including clearcutting, shelterwoods, seed tree cuts, selective cutting of larger trees, or thinning that lowers average stand diameter- will increase the risk of stand-replacement fires rather than decrease it. Thinning only small and intermediate trees less than 100 years old could decrease fire risk, depending on how much new risk is introduced by logging slash (or its disposal). Under-thinning done carefully can be a useful tool to reduce fire risk in dry forest types."*

In the short term (3 to 7 years), the effect of timber harvest can be a reduced fire hazard assuming fine fuel and unutilized coarse fuel created by logging is removed. Over the long term (20 to 40+ years), however, the indirect effect of timber harvesting may actually make the site more flammable than before it was logged. Once a forest is opened-up through logging, increased sunlight, more available water, and less vegetative competition may create an environment that is more conducive to tree, shrub, grass, and forb growth. This early successional vegetative growth often forms into dense thickets that create a highly flammable situation. New tree growth, whether from natural regeneration or planted nursery stock, produces needles and twigs that become the fine fuel that contributes to wildland fire spread.

A fuel management problem in these logged forests becomes how to treat the biomass created 20 to 40 or more years after the initial timber harvest to make the site less flammable and to meet land management plan objectives. If the primary silvicultural objective were to increase tree growth and yield, for example, it would be necessary to thin these dense stands to reduce competition. This can be accomplished through **pre-commercial** or commercial thinning. The problem facing the fire manager becomes what to do with the woody debris (slash) created by these thinning operations. Post-harvest fuel conditions commonly found in some managed forests prompt many scientists to conclude that harvested forests have a higher propensity for large, severe wildland fires

than forests that have not been harvested. A recent report by the National Research Council (2000) speaks to the issue of post-harvest fuel management in Pacific Northwest forests.

> *"Logging has been proposed as a possible surrogate for fire in reducing fuel accumulation with the added benefit of economic return (Agee 1993), but logging and clearcutting do not necessarily reduce flammable fuels…rapid regeneration of early-successional shrubs and trees can create highly flammable fuel conditions within a few years of cutting. Without adequate treatment of small woody residues, logging may exacerbate fire risk rather than lower it (Agee 1993)…"*

Alternative 2

Number of Large Wildland Fires – As described in the Fire Suppression section, the prohibition on roads in this alternative would have little effect on the number of acres burned by wildland fire. Approximately 160,000 acres within inventoried roadless areas are projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – A prohibition on road construction and reconstruction would limit the array of treatment options available to treat the fire hazard in or near the wildland-urban interface, slightly restricting the amount of mechanical pretreatment that could be completed by timber harvesting. However, since relatively few populated areas occur on boundaries between inventoried roadless areas and private lands, the overall direct effect is expected to be slight.

Potential Treatment Areas – Compared to Alternative 1, a full array of fuel treatment options is still available, but because of fewer roads being constructed for other purposes, fuel treatments would be more expensive and less efficient to implement, which could result in fewer acres treated. Some fuel treatment techniques available in Alternative 1 would not be economically or logistically feasible. Treatments would continue to be a priority in areas that are already roaded, near communities, or that are at risk for fire.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment under this analysis (6.5 million can be prescribed burned without pretreatment and 7.5 million which need pretreatment before burning), it is still possible to reduce the overall fire hazard without roads. Fuel treatment techniques that do not require roads include: prescribed burning, thinning, and sawing and stacking fuel into small pieces for later burning. On slopes less than 35%, heavy equipment such as bulldozers, masticators, and rubber-tire **skidders** can be used to pile or rearrange fuels provided the equipment could access treatment areas without the use of roads.

Approximately 40,000 acres of forest rated as Condition Classes 2 and 3 could be treated in the next 5 years by traditional and timber stewardship harvest methods. This is less than 1% of the 7.5 million acres of inventoried roadless areas rated as high priority, which may require mechanical pretreatment before prescribed burning.

Fuel Management Costs – Compared to Alternative 1, the prohibition on road construction and reconstruction would make the planning and implementation of fuel reduction projects more time-consuming and more expensive as new roads built for other purposes would not be available for use. The current national average cost of $176 to $276 per acre (Laverty and Williams 2000) for fuel treatment could increase by as much as 100% in areas without road access. These fuel treatment costs do not reflect the cost of road construction and maintenance.

Other Indirect Effects –Mechanical pretreatment by timber harvest in preparation for prescribed burning may become economically or logistically impractical in roadless areas, because fire managers are uncertain about their ability to mechanically pretreat fuels over large landscapes that do not have roaded access.

The Cohesive Strategy identifies areas classified as Condition Class 2 and 3 in Fire Regimes I and II as potentially requiring fuel treatment and also needing some mechanical pretreatment before prescribed fire can be used. Limiting road construction in roadless areas will result in a reduction of timber harvest as a mechanical pretreatment, thus reducing the range of fuel treatment options available. Other fuel management options would have to be attempted; such as lightly thinning the forest and using repeated applications of low-intensity prescribed fires (two to four entries) until the overall potential for wildife is reduced.

Excluding the cost of road construction and reconstruction, total direct cost to treat the 7.5 million acres of inventoried roadless area under this alternative is expected to be twice as much as treatments under Alternative 1.

It may be more cost effective to develop plans for managing lightning ignitions as a "**wildland fire used for resource benefit**" (WFURB) than to attempt fuel treatment without roads. WFURB has been widely used in Wilderness Areas (Swetnam 2000) across the United States. A method that thins small diameter trees followed by prescribed burning also has been applied in Grand Canyon and Sequoia/Kings Canyon National Parks (Barrett 1999; Keifer and others 2000; USDI National Park Service 1999). However, there is no demonstrated evidence to suggest that either technique could be applied efficiently and economically over hundreds of thousands of acres. If these techniques could not be applied, the indirect effect would be an increased occurrence of more wildfires with uncharacteristic fire effects over a portion of the 7.5 million acres of inventoried roadless areas needing mechanical pretreatment.

Even if a wildland fire burned in an area that had not been mechanically pretreated or prescribe burned, not all the fire effects are expected to be adverse. In fact, only a portion of a forest that burns, even under the most severe fire behavior conditions, is expected to experience lethal effects. The Cerro Grande wildland fire near Los Alamos, New Mexico, in July 2000, burned more than 42,000 acres. An analysis of burn severity showed 34% of the area burned at high severity, 8% burned at moderate severity, and 58% of the acres were either unburned or burned at low severity (Interagency BAER Team 2000).

Alternative 3

Number of Large Wildland Fires – As described in the Fire Suppression section, the prohibition on roads in this alternative would have little effect on the number of acres burned by wildland fire. Approximately 160,000 acres within inventoried roadless areas is projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – A prohibition on road construction and reconstruction coupled with a prohibition on commodity-purpose timber harvest would limit the array of treatment options available to treat the fire hazard in or near the wildland-urban interface, slightly restricting the amount of mechanical pretreatment that could be completed. However, since relatively few populated areas occur on boundaries between inventoried roadless areas and private lands, the overall direct effect is expected to be slight.

Potential Treatment Areas – Compared to Alternative 1, a full array of fuel treatment options is still available, but because of restricted road access, treatments would be more expensive and less efficient to implement, which would result in fewer acres treated. Some fuel treatment techniques available in Alternative 1 would not be economically or logistically feasible.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment, 6.5 million could still be treated with prescribed fire without mechanical pretreatment and 7.5 million may need some pretreatment before prescribed burning.

For the next 5 years, forests in Condition Classes 2 and 3 needing mechanical pretreatment that could be treated by stewardship timber harvest would be 22,000 acres, a decrease of 18,000 acres from Alternative 2 and a decrease of 68,000 to 73,000 acres from Alternative 1. This total acreage represents less than 1% of all inventoried roadless lands that potentially require mechanical pretreatment.

Fuel Management Costs – Compared to Alternative 1, the prohibition on road construction and reconstruction would make the planning and implementation of fuel reduction projects more time-consuming and more expensive as roads constructed for other purposes would not be available for use. The current national average cost of $176 to $276 per acre for fuel treatment could increase by as much as 100%. These fuel treatment costs do not reflect the costs of road construction and maintenance.

Other Indirect Effects – Same as those under Alternatives 1 and 2.

Alternative 4

Number of Large Wildland Fires – The prohibition on road construction and reconstruction and the prohibition on timber harvesting and thinning associated with fuel pretreatment for prescribed fire use, moderately hinder the fire manager's ability to

manage fuel for fire hazard reduction. Compared to Alternative 1, the number of large wildland fires would increase slightly.

Wildland-Urban Interface – Compared to the other alternatives, this alternative limits the fuel management tools available to the fire manager to effectively treat hazardous fuels in the wildland-urban interface. The primary non-mechanical fuel treatment tool available in inventoried roadless areas adjacent to the wildland-urban interface would be prescribed fire. Without the ability to pretreat some areas next to the wildland-urban interface before prescribed burning, managers would be hesitant to use prescribed fire there because of the risk of the fire escaping onto private property.

Potential Treatment Areas – A prohibition on road construction and reconstruction coupled with a prohibition on timber harvesting and thinning associated with fuel pretreatment for prescribed fire use limits the array of fuel treatment options available to the fire manager. Compared to Alternative 1, fuel treatments would be more expensive and less efficient to implement, which would result in fewer acres treated.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment, 6.5 million acres could still be treated with prescribed fire without mechanical pretreatment. However, on the 7.5 million acres that may need mechanical pretreatment before burning, thinning would not be an option; but other mechanical fuel treatments such as crushing, piling, or limbing would be permitted, as would construction of firelines and fuelbreaks needed to implement effective fire use.

This alternative does not restrict the use of prescribed fire or lightning-caused wildland fires allowed to burn for resource benefit (WFURB). The implementation of WFURB as a primary fuel treatment tool to reduce the occurrence of large fires within inventoried roadless areas is feasible, especially in inventoried roadless areas that are large or are located adjacent to Wilderness. This perspective has been supported in a recent position paper in *Issues in Ecology* by a team of forest ecologists (Aber and others 2000) concludes:

> *"No evidence supports the view that natural forests or reserves are more vulnerable to disturbances such as wildland fire, windthrow, and pests than intensively managed forests. Indeed, there is evidence natural systems may be more resistant in many cases."*

Fuel Management Costs – Prescribed burning and mechanical pretreatment (crushing, piling, limbing) costs are expected to double as they did in Alternatives 2 and 3. The cost of managing fuel through WFURB is estimated to be $50 per acre. Even though the fuel management treatment cost for WFURB is much lower than using other fuel management tools, fewer total acres are expected to be treated by this method. This may also lead to an increase in burned-area emergency-rehabilitation projects to treat these burned areas. These fuel treatment costs do not reflect the costs of road construction and maintenance.

Other Indirect Effects – On the 7.5 million acres possibly requiring mechanical pretreatment before prescribed burning, thinning would not be an option. Although other

mechanical fuel treatments such as crushing, piling, or limbing would be permitted, it is unlikely they could be applied on a majority of the areas needing pretreatment. The ability to treat here is limited by steep, rugged topography. Without thinning to pretreat fuels for prescribed burning, vegetation becomes more susceptible to uncharacteristic wildfire effects (Della Sala and others 1995; Barrett 1994; Graham and others 1999). The indirect effect is that more acres of inventoried roadless area would become susceptible to uncharacteristic wildfire effects.

This alternative would have several temporal and spatial indirect effects involved with using WFURB as a primary fuel management technique. Few wildland fires will be managed as a WFURB where the threat of a fire burning from an inventoried roadless area across administrative boundaries is high. In time, the fire hazard would increase. Inventoried roadless areas near Wilderness, however, could expand the total land area where lightning-ignited fires are allowed to burn. Many respondents to the DEIS indicated a preference for using the WFURB as a more passive (natural) approach to managing fire in inventoried roadless areas as the best way to retain roadless area characteristics.

Fire Suppression

Fire suppression is the practice of controlling forest and rangeland fires in a safe, economical, and expedient fashion, while meeting the natural resource objectives outlined in land management plans. All fire suppression actions are governed by the Federal Wildland Fire Management Policy, approved by the Secretaries of Interior and Agriculture (Glickman and Babbitt 1995), which states, in part:

> *"No resource or property value is worth endangering people. All of our actions and our plans must reflect this commitment. Our second priority is to protect resources and property, based on the relative values to be protected. We must be realistic about our abilities to fight severe wildland fire. As natural resource managers, we must make prudent decisions based on sound assessments of all the risks. Good management reduces the likelihood of catastrophic fire by investing in risk-reduction measures. Good management also recognizes when nature must take its course."*

A fire that is not meeting land management objectives is considered an unwanted wildland fire and is suppressed. Suppression forces, either air delivered smokejumpers and helicopter-delivered crews or ground crews with engines, are immediately dispatched to control these fires. When suppressing wildland fires, the first priority is firefighter and public safety and protecting property. Other major suppression objectives can include protection of municipal watersheds and habitat for T&E species.

Fire suppression is a complex activity. Fire personnel must be skilled to quickly make decisions, establish priorities when resources are limited, and evaluate weather and fuel conditions to predict how hot the fire will burn, and how fast it will spread.

Thousands of wildland fires – ignited by humans and lightning – occur each year on NFS lands. Suppression of these wildland fires requires large fire organizations and the expenditure of millions of dollars. Tragically, firefighters are sometimes killed working to control these wildland fires. Zimmerman and Bunnell (1998) describe the status of modern fire management:

> *"Challenges and risks associated with wildland fire management are increasing in both complexity and extent. Threats from wildland fires grow each year as long-term effects from past land use and fire management actions become visible in natural vegetation communities. The escalating values to be protected associated with current land use practices are compounding protection concerns. Federal land management agencies' ability to respond to these challenges is rapidly becoming overextended."*

Affected Environment

At issue is whether a prohibition on road construction and reconstruction in inventoried roadless areas on NFS lands would hamper the ability of firefighters to quickly suppress wildland fires, and whether more small wildland fires (less than 1,000 acres) would become large (1,000 acres or more), thus posing a danger to communities and natural resources and incurring excessive control costs.

The Forest Service controls nearly 98% of wildland fires, inside and outside inventoried roadless areas, at a relatively small size while, a few large wildland fires have the potential to burn the most acres. For example, as of September 14, 2000, only 15 fires (0.15% of the 10,192 ignitions on NFS lands) were responsible for 40%, or 856,000 acres of the 2.12 million acres burned to date (USDI 2000; USDA Northern Rockies Coordinating Group; USDI Eastern Great Basin Coordination Center).

A coarse-scale analysis of fire occurrence data for inventoried roadless areas was developed using national fire occurrence data sets for an 11-year period (1986 to 1996) overlaid with geographic information system maps of inventoried roadless areas. This data set includes four of the last half of the 20th Century's most serious fire years: 1) 1987 in northern California and the Pacific Northwest, 2) 1988 in Yellowstone National Park and Montana, 3) 1994 in the West, and 4) 1996 in the Southwest and Intermountain West.

This coarse-scale analysis identified dominant characteristics and trends for wildland fire cause (human or lightning), all causes (combination of lightning and human), fire size (more than 1,000 acres), and **median** large fire size for wildland fires burning inside and outside inventoried roadless areas. These wildland fire occurrence attributes were studied within the context of three large NFS geographic areas: 1) the West (Regions 1 through 6), 2) Alaska (Region 10), and 3) the East (Regions 8 and 9). A further refinement of the wildland fire-occurrence data included dividing all NFS lands into three subcategories: 1) Wilderness, 2) inventoried roadless areas, and 3) lands outside of Wilderness and inventoried roadless areas.

For the purposes of this analysis, NFS lands inside Wilderness and inventoried roadless areas were classified as "essentially roadless," while NFS lands outside of Wilderness and inventoried roadless areas were classified **essentially roaded**. NFS lands were classified in this manner to compare fire occurrence data for areas that do not have roads (Wilderness and inventoried roadless areas) with other areas in the National Forest System, which includes a road network of more than 380,000 miles. The total NFS land area classified as essentially roadless is 93.2 million acres (72.7 million acres excluding Alaska). For essentially roaded areas, the figure is 99.1 million acres (97.5 million acres excluding Alaska).

The fire occurrence information derived from this analysis process was tabulated and formatted into tables. Data were further refined into probabilities and then used to describe and project the fire suppression environmental effects for all three-prohibition alternatives (Alternative 2 through 4).

The fire occurrence data should only be used at a coarse-scale at national, regional, or State levels. Local variations in the data could not be projected. Fire occurrence patterns change on both national and local scales. For example, individual national forests within the same geographic area will produce different sets of fire occurrence statistics. At the coarse-scale, these localized differences could not be analyzed. While this analysis formulates conclusions at the coarse-scale, it is, nonetheless, one of the first efforts to link and correlate fire occurrence data for areas that are essentially roaded and essentially roadless.

The primary purpose in defining the analysis area as essentially roaded or **essentially roadless** was to develop a trend for the two areas to determine whether building roads in inventoried roadless areas actually reduces the chance of large fire occurrence. It should be noted that portions of inventoried roadless areas already have existing roads. In addition, large areas outside of inventoried roadless areas could actually be called unroaded. This national-scale analysis did not address these finer-scale variations.

A literature review for this analysis produced few peer reviewed scientific articles dealing with the consequences of building a road solely for fire suppression purposes. Most of the available information is anecdotal, originating from interviews with experienced firefighters (Schuster and others 1997; USDA Forest Service 2000b). In addition, access by road to a wildland fire area does not necessarily mean firefighters will not have to walk long distances in steep, inaccessible terrain to reach the fire.

The 1999 General Accounting Office report *Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats (GAO 1999),* notes that total acres burned yearly by wildland fires and number of large wildland fires are increasing (Figures 3-23 and 3-24). The 2000 fire season, as of September 14, 2000, has surpassed all years on record except for the 1910 and 1919 fire seasons, with 2.12 million acres of NFS lands burned (Figure 3-23). Figures 3-23 and 3-24 establish a national trend for large fire occurrence and total annual acreage burned on NFS lands including inventoried roadless areas.

Data used in this analysis were historical. If complete fire occurrence data from the 2000 fire season could have been included in this analysis, the individual fire occurrence calculations, especially for fire size, would have changed. However, the coarse-scale trends established for fire size and location would not have changed under each alternative.

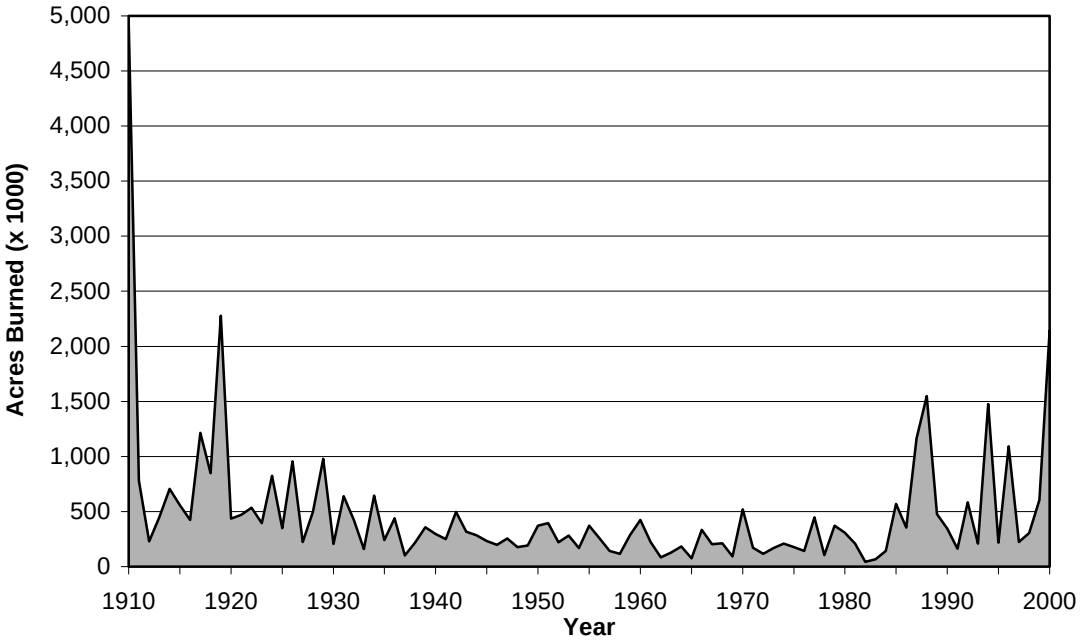


Figure 3-23. Acres burned by wildland fire on National Forest Systems lands, 1910 to September 14, 2000.

(USDA Forest Service and U.S. General Accouting Office 1999)

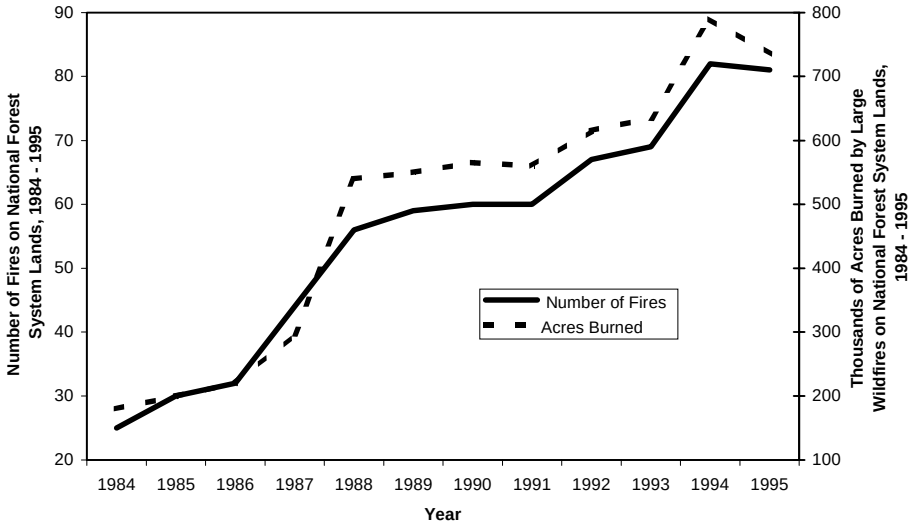


Figure 3-24. Number and acres burned by large wildland fires on National Forest System lands, 1984 to 1995.

(USDA Forest Service and U.S. General Accounting Office 1999)

Design Elements Common to all Alternatives – Four key assumptions common to all alternatives were developed to frame the discussion in the effects analysis.

- If an imminent threat of fire exists that, without intervention, would cause the loss of life or property, a road can be constructed for public health and safety.
- Congressional funding allocated to prepare for and suppress wildland fires would remain constant.
- Firefighter and public safety are always the highest priority. Regardless of the selected fire management strategy or the particular situation at the fire site, all high hazard threats affecting firefighter and public safety would be mitigated before a suppression action is taken.
- Two national trends identified in the 1999 General Accounting Office report apply to roaded and unroaded lands: 1) more wildland fires will continue to occur on NFS lands; and 2) more acreage will be burned by large wildland fires.

Four primary components, derived from extensive literature reviews and internal and external scoping processes, were developed. These components structured the fire suppression-effects analysis. The primary components became questions that were answered for each alternative.

Number of Large Wildland Fires – Will the number of wildland fires escaping **initial attack** and becoming large significantly change from current trends?

Annual Acreage Burned by Wildland Fire – Will the number of acres projected to burn annually from wildland fires significantly change from current trends?

Wildland-Urban Interface – Will the Forest Service's ability to manage wildland fires efficiently and safely in the wildland-urban interface be adversely affected?

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Will fire costs, both in preparing to fight a forest fire and in actually fighting it, significantly change from national historic averages?

Alternative 1 – No Action

Wildland fires that threaten human life and property or do not meet resource objectives are always suppressed. Suppression strategies can range from full control to allowing a portion of a fire's perimeter to burn. Human-caused fires are always suppressed. Some lightning-caused wildland fires that meet natural resource objectives are allowed to burn, mainly in designated Wilderness areas. If a fire is meeting land management plan objectives, some national forests do not suppress lightning-caused fires that occur on non-Wilderness lands. Research has shown that more than 98% of wildland fires are controlled by a local response unit while still small and that approximately 2% of wildland fires cannot be controlled by initial attack crews and become large (Strauss and others 1989).

Reviewing fire occurrence data for size of ignitions from all causes between 1986 and 1996, less than 1% (789) of 112,722 fire starts on NFS lands became large fires. For the same period, slightly more than 1% (190) of 16,611 fire starts in inventoried roadless areas burned more than 1,000 acres. While in areas classified as essentially roadless, during this period, just more than 1% (380) of 28,338 fire starts became large fires.

Before World War II (1946), most NFS roads were constructed primarily for fire suppression and conservation activities. From the mid-1940s until the mid- to late-1980s, the majority of NFS roads were constructed for timber harvest activities (Space 1979).

> *"Following the fire season of 1919, which ranks second to 1910 in area burned, the Forest Service appealed to Congress for money to build some roads . . .. The primary purpose of these roads was for fire protection and they were well worth the cost . . .. Following the war, all roads, except those in campgrounds, had been built either under contract or as part of a timber sale agreement."*
>
> *Ralph S. Space, Clearwater National Forest Supervisor 1954 to 1963*
> *"The Clearwater Story of the Clearwater National Forest" (Space 1979)*

Over the next 5 years, from 2000 through 2004, an estimated 1,160 miles of road would be constructed or reconstructed in inventoried roadless areas. Nearly 27% (363 miles) of this road construction is expected to occur in the low fire occurrence and low fire risk forests of Alaska where, because fires seldom occur on NFS lands, roads usually are not used for fire suppression purposes. In national forests outside Alaska, approximately 797 miles (or 159 miles per year) of road could potentially be constructed in the next 5 years and used for fire suppression purposes.

Number of Large Wildland Fires – Of the 1,500 total wildland fires that occur annually in inventoried roadless areas, 17 become large. These large fires account for 93% of all acres burned. This number is increasing, and this trend is expected to continue.

Annual Acreage Burned by Wildland Fire – Currently, an average of 160,000 acres of inventoried roadless areas burn annually. In the future, an increasing trend in burned acreage is expected. This increasing trend is expected to continue. More than 10,000 wildland fires occur on NFS lands each year, burning from 600,000 to 800,000 acres (General Accounting Office 1999). Approximately 96% of this burned acreage is in the West, where nearly 1,500 of these fires (14%) start in inventoried roadless areas.

Annually humans cause approximately 25% of these 1,500 fires in inventoried roadless areas. Lightning is the primary cause of forest fires in the West (Regions 1 through 6). Humans are responsible for a higher percentage of wildland fires in the South (Region 8), the Northeast (Region 9), and Alaska (Region 10).

Alaska's Chugach and Tongass National Forests experience a very low fire occurrence. From 1986 through 1996, 442 fires burned approximately 1,700 acres for an annual average of only 153 acres burned on NFS lands. Lightning accounted for only 1 of these

442 wildland fire ignitions. Because of this extremely low fire occurrence, Alaska was not included in this analysis.

Wildland-Urban Interface – As shown in Tables 3-16 and 3-17, few concentrated populations of either individuals or communities occur near inventoried roadless areas. Due to these population densities, a fire spreading from an inventoried roadless area would have little opportunity to endanger human life or property.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – The average cost of suppressing a wildland fire in inventoried roadless areas would continue to fluctuate around the averages identified in Figure 3-25. The annual average expenditure for emergency fire suppression is $304 million. In preparing and maintaining fire organizations, the fixed costs add, on average, an additional $326 million each year.

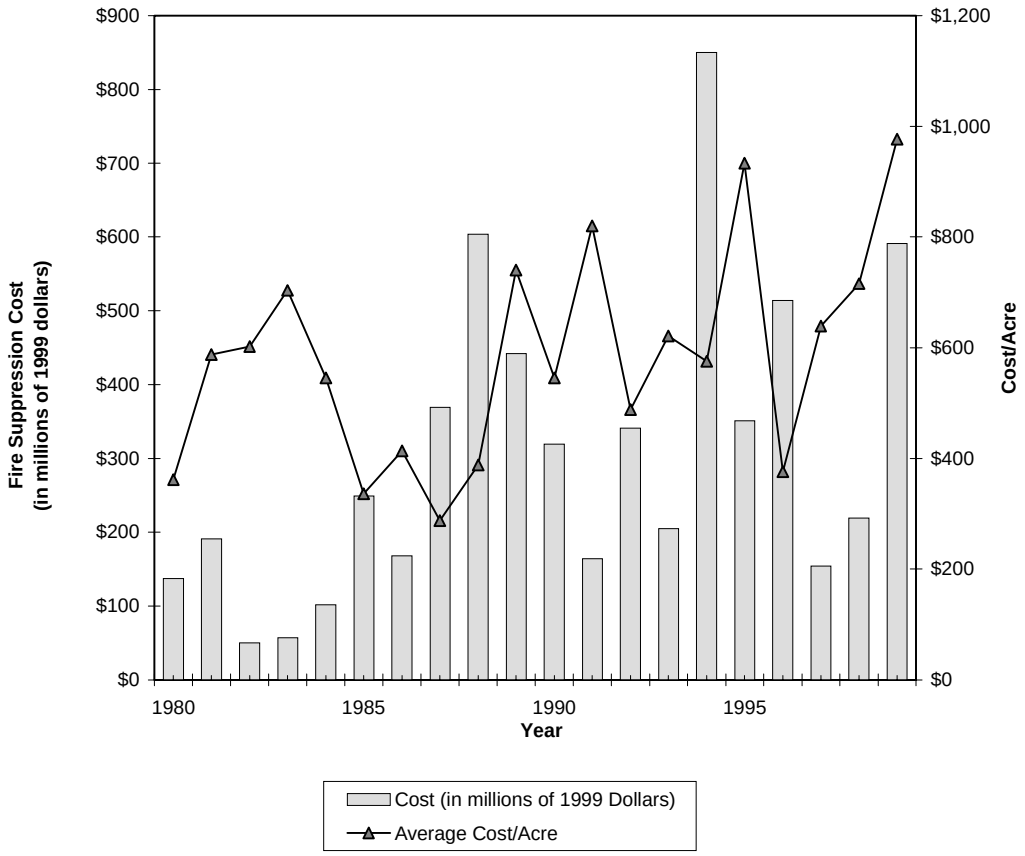


Figure 3-25. Historical fire suppression costs.
(USDA Forest Service 2000b)

Table 3-18 compares wildland fire occurrence for all causes (lightning and human-caused wildland fires) in areas classified as essentially roadless and essentially roaded. The fire occurrence (measured as the number of wildland fire ignitions per 10,000 acres) in Wilderness and inventoried roadless areas is nearly the same for all Forest Service

regions. This may be due to the limited human-use of these areas, lack of access (no roads), and nonexistence of permanent human communities.

However, when comparing inventoried roadless areas with areas that are essentially roaded, there is a significant difference in the coarse-scale fire occurrence data. In Forest Service Regions 1 through 9, fire occurs in essentially roaded areas twice as many times

Table 3-18. Lightning- and human-caused fire occurrence by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas[a]			Essentially roaded areas[b]
Regions[c]	**Total fire starts in National Forest System lands**	**Total fire starts in Wilderness[d]**	**Total fire starts in inventoried roadless areas[d]**	**Total fire starts in Wilderness and inventoried roadless areas[d]**	**Total fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	12,600	1,865 (3.7)	3,252 (3.6)	5,117 (3.7)	7,483 (6.6)
Rocky Mountain (2)	5,735	338 (0.7)	1,072 (1.7)	1410 (1.3)	4,325 (3.9)
Southwestern (3)	21,872	2,108 (7.8)	1,547 (5.6)	3,655 (6.7)	18,217 (12.0)
Intermountain (4)	12,279	1,641 (3.0)	5,050 (3.2)	6,691 (3.1)	5588 (5.2)
Pacific Southwest (5)	23,165	2,808 (6.6)	3,016 (7.2)	5,824 (6.9)	17,341 (14.9)
Pacific Northwest (6)	18,189	2,506 (5.3)	2,344 (5.9)	4,850 (5.5)	13,339 (8.4)
Southern (8)	13,614	249 (3.5)	245 (2.6)	494 (3.0)	13,120 (11.5)
Eastern (9)	5,268	212 (1.6)	85 (1.3)	297 (1.5)	4,971 (4.9)
Total	**112,722**	**11,727 (4.1)**	**16,611 (3.8)**	**28,338 (3.9)**	**84,384 (8.7)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

as in inventoried roadless areas. For the Western United States (Regions 1 through 6), the chance of a fire occurring is twice as likely in essentially roaded areas as in inventoried roadless areas. For the Eastern United States (Regions 8 and 9), the likelihood that fire will occur in essentially roaded areas is almost four-times greater than

in inventoried roadless areas. The net result is that there is a substantially increased level of fire occurrence outside inventoried roadless areas.

Table 3-19 represents a tabulation of human-caused (includes campfires, smoking, debris burning, incendiary devices, railroads, equipment use) fire occurrences using the same classifications as in Table 3-18. Similar to Table 3-18, the chance of a human-caused

Table 3-19. Fire occurrence for human-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas [a]			Essentially roaded areas [b]
Regions [c]	**Total human caused fire starts in National Forest System lands**	**Total human caused fire starts in Wilderness[d]**	**Total human caused fire starts in inventoried roadless areas[d]**	**Total human caused fire starts in Wilderness and inventoried roadless areas[d]**	**Total human caused fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	2,755	189 (0.4)	477 (0.5)	666 (0.5)	2,089 (1.8)
Rocky Mountain (2)	2,219	177 (0.4)	382 (0.6)	559 (0.5)	1,660 (1.5)
Southwestern (3)	7,757	277 (1.0)	335 (1.2)	612 (1.1)	7,145 (4.7)
Intermountain (4)	2,977	327 (0.6)	1,025 (0.6)	1,352 (0.6)	1,625 (1.5)
Pacific Southwest (5)	10,655	662 (1.5)	1,210 (2.9)	1,872 (2.2)	8,783 (7.6)
Pacific Northwest (6)	5,428	549 (1.2)	541 (1.4)	1,090 (1.2)	4,338 (2.7)
Southern (8)	12,320	184 (2.6)	175 (1.8)	359 (2.2)	11,961 (10.5)
Eastern (9)	4,944	106 (0.8)	79 (1.2)	185 (0.9)	4,759 (4.7)
Total	**49,055**	**2,471** **(0.9)**	**4,224** **(0.7)**	**6,695** **(0.9)**	**42,360** **(4.4)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

wildland fire occurring in a Wilderness or inventoried roadless areas is nearly the same for all Forest Service regions.

In the West, the chance of a human-caused wildland fire occurring in an essentially roaded area is nearly three times more likely than in an essentially roadless area. In the East, the chances are nearly five times as likely.

In the West, 80% of human-caused fires start in essentially roaded areas. In the East, the figure is nearly 97%. Nationally (in all Forest Service regions), it is four times more likely that a human-caused wildland fire will occur in an area that is essentially roaded rather than an inventoried roadless area.

Table 3-20 shows lightning-caused fire occurrence only. Nationally (in all Forest Service regions), a lightning fire is twice as likely to occur in an area that is "essentially roaded" as in an inventoried roadless area. In the West, the chances of this occurring is 1.6 times as likely, and in the East it is 1.7 times as likely. Variation in these regional statistics is most likely due to: lightning occurrence patterns unique to specific locales, historical thunderstorm paths, the amount of precipitation with thunderstorms, and the ignitability of the forest or range where the lightning strikes.

Table 3-21 shows the large fire occurrence for both human and lightning occurrence. Nationally, (in all Forest Service regions) there is a two-times greater chance of a large forest fire burning in an area that is essentially roaded as in an inventoried roadless area. However, a comparison of the land areas classified as essentially roadless (Wilderness plus inventoried roadless areas), with areas that are essentially roaded shows that these numbers are almost equal. Approximately 50% of all large fires that ignite on NFS lands occur in essentially roadless areas.

The high number of large fires occurring in essentially roadless lands cannot be attributed to lack of access. If this were the case, then fewer large fires would occur in essentially roaded areas. Because many of the large fires originate where natural barriers would eventually slow their spread, they are a low priority for fire suppression resources.

Analysis of the fire occurrence data for all causes (Table 3-21) indicates that more large fires occur in inventoried roadless areas in Region 1 (Montana and Northern Idaho), Region 6 (Oregon and Washington), and Region 4 (Arizona and New Mexico). Again, priority setting is probably the main reason wildland fires are larger in these regions. During periods of high fire occurrence, drought, and high fire danger when thunderstorms ignite hundreds of fires within a geographic area, many wildland fires burning within the boundaries of inventoried roadless areas are a low priority for fire suppression resources. For example, in a wildland fire situation where crews and materials are limited, a fire burning in a remote section of an inventoried roadless area would be prioritized lower than a fire that was threatening private homes in the wildland-urban interface.

An example of how priority setting affected the final cost and size of wildland fires occurred during the 1999 fire season in northern California. The two largest and most costly fires, the Kirk Fire and Big Bar Fire, burned 227,000 acres and cost more than $176 million dollars to suppress. They both started in unroaded, remote, and extremely rugged Wilderness Areas. Outside the Wilderness Areas, other fires threatened private

Table 3-20. Fire occurrence for lightning-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas [a]			Essentially roaded areas [b]
Regions[c]	**Total lightning caused fire starts in National Forest System lands**	**Total lightning caused fire starts in Wilderness[d]**	**Total lightning caused fire starts in inventoried roadless areas[d]**	**Total lightning caused fire starts in Wilderness and inventoried roadless areas[d]**	**Total lightning caused fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	9,845	1,676 (3.4)	2,775 (3.1)	4,451 (3.2)	5,394 (4.7)
Rocky Mountain (2)	3,516	161 (0.3)	690 (1.1)	851 (0.8)	2,665 (2.4)
Southwestern (3)	14,115	1,831 (6.8)	1,212 (4.4)	3,043 (5.6)	11,072 (7.3)
Intermountain (4)	9,302	1,314 (2.4)	4,025 (2.5)	5,339 (2.5)	3,963 (3.7)
Pacific Southwest (5)	12,510	2,146 (5.0)	1,806 (4.3)	3,952 (4.7)	8.558 (7.4)
Pacific Northwest (6)	12,761	1,957 (4.1)	1,803 (4.5)	3,760 (4.3)	9,001 (5.7)
Southern (8)	1,294	65 (0.9)	70 (0.7)	135 (0.8)	1,159 (1.0)
Eastern (9)	324	106 (0.8)	6 (0.1)	112 (0.6)	212 (0.2)
Total	**63,667**	**9,256** **(3.2)**	**12,387** **(2.1)**	**21,643** **(3.0)**	**42,024** **(4.3)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

property in less remote areas. An internal review of the fires (USDA Forest Service 2000b) stated that the Big Bar Fire "in terms of priority for resources was ranked last out of 8 fires in northern California." When firefighting resources were available to attack these fires, the fires were extremely large and were burning in such steep inaccessible terrain, that firefighters had difficulty in safely controlling them.

The 2000 fire season has provided additional examples of priority setting affecting fire size. The Flossie Fire, lightning ignited on July 31 in a Wilderness Area on the Payette National Forest, grew to 36,800 acres by August 18, with four people committed to staffing. Burning at the same time on the Lolo National Forest in Montana, the Thompson

Table 3-21. Fire occurrence, in starts per 100,000 acres, for large fires (more than 1,000 acres) by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas [a]			Essentially roaded areas [b]
Regions[c]	**Total large fire starts in National Forest System lands**	**Total large fire starts in Wilderness[d]**	**Total large fire starts in inventoried roadless areas[d]**	**Total large fire starts in Wilderness and inventoried roadless areas[d]**	**Total large fire starts in National Forest System lands outside Wilderness and inventoried roadless areas [d]**
Northern (1)	118	53 (1.1)	23 (0.3)	76 (0.5)	42 (0.4)
Rocky Mountain (2)	32	1 (0.0)	5 (0.1)	6 (0.1)	26 (0.2)
Southwestern (3)	142	40 (1.5)	28 (1.0)	68 (1.2)	74 (0.5)
Intermountain (4)	173	41 (0.8)	60 (0.4)	101 (0.5)	72 (0.7)
Pacific Southwest (5)	164	23 (0.5)	38 (0.9)	61 (0.7)	103 (0.9)
Pacific Northwest (6)	99	19 (0.4)	33 (0.8)	52 (0.6)	47 (0.3)
Southern (8)	44	7 (1.0)	3 (0.3)	10 (0.6)	34 (0.3)
Eastern (9)	17	6 (0.5)	0 (0.0)	6 (0.3)	11 (0.1)
Total	**789**	**190** **(0.7)**	**190** **(0.4)**	**380** **(0.5)**	**409** **(0.4)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 100,000 acres.
(Roadless Database 2000)

Flat Complex Fires, a group of fires threatening two communities, was at 9,300 acres on August 18, with 452 people committed to suppression (USDI 2000).

Table 3-22 indicates that the median size of large wildland fires for all causes is greater outside inventoried roadless areas in Regions 1, 2, 4, 5, 8, and 9. In Regions 3 and 6, this trend is reversed, the median size of large fires in inventoried roadless areas is greater than those outside roadless areas.

Table 3-22. Median size in acres of large fires by Forest Service region on National Forest System lands, 1986-1996. Fires are displayed by cause and location.

	Lightning caused			Human caused			All Causes		
Regions [a]	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**
Northern (1)	2,470	3,250	3,680	5,710	5,864	2,230	3,245	3,507	3,336
Rocky Mountain (2)	3,190	13,100	4,034	1,572	0	2,152	1,906	13,100	2,983
Southwestern (3)	2,910	4,200	2,315	13,000	1,237	2,950	3,080	4,050	2,450
Intermountain (4)	3,087	3,530	4,068	2,147	4,160	5,169	2,865	3,549	4,585
Pacific Southwest (5)	4,840	2,598	6,830	2,298	2,559	2,516	2,550	2,990	3,460
Pacific Northwest (6)	4,115	4,725	3,690	9,200	2,201	2,119	4,730	3,648	2,800
Southern (8)	1,115	2,015	1,225	3,400	1,964	1,649	1,180	2,015	1,564
Eastern (9)	0	3,048	1,210	0	12,600	1,234	0	3,589	1,226
National median	3,094	3,600	3,660	2,550	3,125	2,230	3,069	3,509	2,800

[a] Region 10 (Alaska) is not included. Data unavailable for Alaska.
(Roadless Database 2000)

Fire Occurrence Summary Information – On a national basis:

- Ninety-eight point nine percent of all wildland fires in inventoried roadless areas are controlled at less than 1,000 acres.
- The median size of a large fire for all fire occurrence causes is greater inside than outside inventoried roadless areas (Table 3-22).
- The median size of a large wildland fire started by humans is greater on lands inside inventoried roadless areas (Table 3-22).
- A wildland fire ignition (regardless of the cause) is nearly two times more likely to occur in an essentially roaded area than in an essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-18).
- Human-ignited wildland fire is nearly five times as likely to occur in an essentially roaded area than in an essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-19).
- A lightning-caused fire is nearly one and one half times as likely to occur in an essentially roaded area than in essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-20).
- A large fire is one and one-quarter times more likely to occur in essentially roadless areas (calculation is based on number of fire starts per 100,000 acres) (Table 3-21).

Alternatives 2 and 3

Primary wildland fire trends as outlined under Alternative 1 would be projected to continue under these two alternatives including the number of fires escaping initial attack, the annual acres burned, the effect on fire suppression actions in the wildland-urban interface, and the pre-suppression and emergency suppression costs.

Uncertainty exists among fire researchers concerning whether the number of acres burned annually by wildland fires is reduced by timber harvest (Stephens 1998) or thinning (Weatherspoon and Skinner 1996; Alexander and Yancik 1977; Fahnestock 1966). It can be said, with some certainty, that removal of large fuels substantially reduces fire intensity, and its potential to become large. However, whether timber harvesting also reduces the final size of large wildland fires is debatable. Timber harvesting “opens” a forest (Countryman 1955), which allows more sunlight to penetrate to the forest floor causing the fine fuels, needles, and small sticks to dry faster and to stay dry longer. In addition, wind is able to penetrate into an open forest, which can sometimes cause fires to spread faster and become larger.

Number of Large Wildland Fires – Same effects as those under Alternative 1.

Annual Acreage Burned by Wildland Fire – Same effects as those under Alternative 1.

Wildland-Urban Interface: Same effects as those under Alternative 1. After 20 years, however, the potential threat from wildland fire at the wildland-urban interface is expected to increase as the population at increases in this area.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Same effects as those under Alternative 1.

Alternative 4

Number of Large Wildland Fires – Over the next 20 years the number of large wildland fires in inventoried roadless areas is not expected to differ appreciably from those under Alternative 1.

Annual Acreage Burned by Wildland Fire – Over the next 20 years, the average acreage burned by large wildland fires is not expected to differ from those under Alternative 1.

Wildland-Urban Interface – Over the next 20 years, the potential threat of a wildland fire burning inside an inventoried roadless area toward a wildland-urban interface is expected to be the same as that under Alternative 1. After 20 years, however, the potential threat from wildland fire at the wildland-urban interface is expected to increase as the population at the wildland-urban interface increases.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Same effects as those under Alternative 1.

Other Indirect and Cumulative Effects on Fuel Management

Table 3-23 is a comparative summary of each alternative compared to each primary component. Information from the Fire Suppression section was combined with information from the Fuel Management analysis to summarize the effects in this table.

Since the total land area covered by the proposed Roadless Rule encompasses approximately 31% of the NFS, affecting nearly every section of the United States, the cumulative effects analysis, like the effects portrayed for each alternative, will be described on a national basis as coarse-scale trends.

A significant increase in the amount of Federal land treated for high fire hazard is expected in the near future. In a recent report to President Clinton – *Managing the Impact of Wildland fires on Communities and the Environment* (White House 2000) – it was noted that it would take “significant investments to treat landscapes through thinning and prescribed fire” to address the fuel accumulation of past wildland fire suppression. The report went on to note that “since 1994, the Forest Service and the Bureau of Land Management have increased the number of acres treated to reduce fuel build-up from fewer than 500,000 acres in 1994 to more than 2.4 million acres” in 2000.

States and private landowners also actively treat the fire hazard on their lands. The annual acreage treated by States is unknown, but it would be substantially less than what is done on Federal lands.

The Forest Service Cohesive Strategy estimates that nearly 59 million acres of the 192 million acres of NFS land will require fuel treatment to reduce the risk of uncharacteristic wildland fire effects, either by prescribed fire alone or by mechanical pretreatment followed by prescribed fire. Approximately 32 million acres could be treated by

prescribed fire alone, and 27 million acres would need mechanical pretreatment before applying prescribed fire. Even though 16% percent of the NFS lands identified as potentially needing fuel treatment are within inventoried roadless areas; very few high priority areas (wildland-urban interface, municipal watersheds, and threatened and endangered species habitat) are found in inventoried roadless areas.

Fuel treatment acreage for fire hazard reduction is expected to increase on all Federal and some State lands in the in next 5 to 20 years. Most of this fuel treatment will occur in the high priority watersheds outside inventoried roadless areas where the overall values at risk are highest. The total acreage of high priority fuel treatment lands within inventoried roadless areas is small when compared to the total acreage that requires treatment on all Federal and State lands.

Approximately 14 million acres of short interval fire-adapted NFS lands are identified as potentially needing fuel treatment within inventoried roadless areas (Table 3-14). Approximately one million acres are in the East, (Regions 8 and 9) and nearly 13 million acres are in the West (Regions 1-6).

Treatment of these 14 million acres will be deferred for at least 20 years, however, because areas with higher values at risk from uncharacteristic wildfire effects (wildland-urban interface or high valued natural resources or community watersheds) that occur outside inventoried roadless areas are the highest priority for treatment. Full fire suppression is expected to continue on most of these 14 million acres until at least 2020, when a gradual implementation of the Cohesive Strategy is expected to begin inside inventoried roadless areas.

The cumulative effect of fully suppressing wildland fires within inventoried roadless areas for the next 20 years would be the continued exclusion of an additional two to three natural fire cycles. This would result in a greater accumulation of fine, dead ground fuel (twigs, sticks, branches) and further encroachment of thickets of small trees and other vegetation beneath the dominant canopy. When a forest or rangeland fire does occur, especially during periods of high fire danger (drought, low fuel moisture, high winds), there will be a greater chance of severe fire behavior that creates negative effects within the ecosystem and, based on projected population increases, threatens increasing numbers of people and communities.

When the 14 million acres within inventoried roadless areas are compared to all Federal, State, and private lands potentially needing fuel reduction to prevent the occurrence of uncharacteristic wildfire effects, the overall cumulative effect is very small. This fact is underscored since nearly all high priority treatment areas (wildland-urban interface, municipal watershed, and threatened and endangered species habitat) occur outside inventoried roadless areas.

Wildland-urban interface – Of the 10 fastest growing States in the United States, eight are in the West (Riebsame and others 1997) where more forest and rangelands are at risk from uncharacteristic wildfire effects. The national average yearly population growth is about 1%, while the growth rate for the West ranges from 2.5% to 13%. For example, the

population of Nevada is expected to grow from roughly 1.9 million in 2000 to nearly 2.8 million in 2025. The population of Montana is currently more than 900,000 and is expected to grow to 1.2 million by 2025. The current population of Idaho is more than 1 million and is expected to grow to nearly 2 million by 2025.

Because few people currently live on the boundary between inventoried roadless areas and the wildland-urban interface, the problem of a wildland fire burning from inside an inventoried roadless area into this interface is relatively rare. The human population density at or near the wildland-urban interface will increase if current national population trends continue. In time, the cumulative effect will be more people living in close proximity to inventoried roadless areas. In the future, however, the expected increase in interface population density will make the risk of severe wildland fires at the wildland-urban interface more likely.

Interior Columbia River Basin - The cumulative impact of implementing both the Cohesive Strategy and the Interior Columbia Basin Ecosystem Management Project (ICBEMP) was analyzed. Maps displaying areas with the highest priority for fuel treatment were overlain with two maps from the ICBEMP that identify ecosystem restoration-priority areas. Cumulatively, few major conflicts would occur from implementing these two national assessments within inventoried roadless areas.

Transportation Policy Rule - As noted in the Forest Service Road System section of the FEIS, “the combined effect of implementing the road policy, proposed roadless conservation policy, and individual land management plans – all within the planning framework in the planning regulations – would create additional acres of unroaded areas.” In the future, acres of unroaded NFS lands are likely to increase by 5% to 10%.

Roads outside inventoried roadless areas would not be decommissioned if a compelling fire management need exists to keep them open. Currently, however, no scientific process has been developed to determine the consequences to the fire suppression and fuel management programs of either closing or obliterating existing roads. The cumulative effect associated with this uncertainty is that some roads might be closed that, in the future, are necessary for reducing fire hazard. Conversely, some roads that should have been closed might inadvertently remain open.

Other Indirect and Cumulative Effects on Fire Suppression

On Federal lands managed by the Bureau of Land Management, Forest Service, Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, and on lands managed by States, hereafter called “Federal and State land”, a comparison was made of annual wildland fire occurrence for human and lightning ignitions and total acres burned (Table 3-24).

As can be seen in Table 3-24, nearly 99% of all human-caused ignitions and nearly 92% of all lightning-ignited wildland fires occur on land outside of inventoried roadless areas.

Table 3-23. Comparative summary of direct and cumulative effects on fuel management under all alternatives by primary components.

Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Number of large wildland fires	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, a few more large fires than under Alternatives 1 through 3
Wildland-urban interface (WUI)	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase
Potential ability to treat areas by:				
Prescribed fire without mechanical pretreatment	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future
Timber harvest [a]	90,000 to 95,000 acres could be treated in next 5 years; potential increase in 40 years	40,000 acres could be treated in next 5 years; potential increase in 40 years	22,000 acres could be treated in next 5 years; potential increase over 40 years	No acres treated by this method
Mechanical pretreatment with prescribed fire	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future
WFURB [b]	None now; potential increase in future	None now; potential increase in future	None now; potential increase in future	None now; potential increase in future
Cost	$176 to $276/acre future	$352 to $552/acre future	$352 to $552/acre future	Less than $50/acre future if WFURB used

[a] The acres of fuel treatment that could be accomplished through timber harvest if one choose to work in an inventoried roadless area. In the future, most high-priority fire-hazard reduction work will continue to be outside inventoried roadless areas.
[b] Wildland Fire Used for Resource Benefit

Because a majority of the fire suppression activities will continue to take place outside of inventoried roadless areas, the cumulative effect of applying the Roadless Rule to them is negligible.

Table 3-24. Comparison between Federal land, State land, and inventoried roadless areas of annual average fire occurrence and annual acres burned.

Protection area	Number human-caused fires	Acres human-caused fires	Number lightning-caused fires	Acres lightning-caused fires
Federal and State land	102,000	1,900,000	13,000	2,000,000
National Forest System lands	4,400 (4)[a]	250,000 (13)[a]	5,800 (45)[a]	481,000 (24)[a]
Inventoried roadless areas	384 (<1)[a]	3,800 (<1)[a]	1100 (>8)[a]	130,000 (>7)[a]

[a] Percentage of all fires occurring and all acres burned on Federal and State lands.
(National Interagency Fire Center 2000; Roadless Database 2000)

In comparing Alternatives 2 and 3 with Alternative 1, the fire occurrence data indicate, at a national coarse-scale, that prohibiting road construction and reconstruction in inventoried roadless areas would not cause an increase in the number of acres burned by wildland fires or cause an increase in the number of large fires. The data further reveal that building roads into inventoried roadless areas would likely increase the chance for human-caused fires. Conversely, in areas that are already roaded, fire occurrence data for all causes, human and lightning, indicates that the number of large fires are dramatically higher than in inventoried roadless areas.

Using such suppression resources as smokejumpers and fire crews delivered by helicopters, the current fire suppression organization has been effective in suppressing at a small size approximately 98% of wildland fire starts in inventoried roadless areas. The Agency has a long history of successfully suppressing fires in inventoried roadless areas. This high level of suppression performance is expected to continue.

Over time, Alternative 4, when coupled with the effects described in the Fuel Management section of this analysis, would produce a fire environment in which larger fires occurred and the total acreage burned annually would rise. Under this alternative, any form of timber cutting, including thinning, would be prohibited. Therefore, forests would become thicker and denser with vegetation, resulting in an increase in fuel loading and associated potential increase in large forest fires.

After evaluating all fire occurrence data, the conclusion of this analysis is that overall fire potential is greater on NFS lands outside inventoried roadless areas than on lands inside inventoried roadless areas. Other national assessments have reached the same conclusion. “Wildland areas with complex terrain or a moderate or high road density have a moderate or higher risk of wildland fires” (USDA 1996b).

Once a fire becomes large, road access allows firefighting materials and personnel to quickly enter an area, resulting in lower suppression costs. It is doubtful, however, that a fire manager would know where to place a road before a large fire occurs, or how to pre-design a road for an effective access route to a future, potentially large fire.

During the 2000 fire season in the West, when conditions of high fire danger and drought were coupled with high fire occurrence, wildland fires became uncontrollable in roaded and inventoried roadless areas. To limit the size and number of forest and rangeland fires, fire managers must address the high fuel loads common to most of these ecosystems.

In public response to the DEIS, hundreds of respondents suggested that a direct link exists between the presence of roads and the occurrence of large fires. Without roads, one respondent explained, "you raise the probability of catastrophic fires." Another person wrote that without road access "fire control will be out of the question."

If building a road into an area where a uncharacteristic wildfire could potentially occur would limit the size, number, and intensity of future wildland fires, the following issues exist:

- To strategically locate a NFS road for fire control before the fire occurred would be a complex task of predicting the future. A fire manager would have to accurately predict all possible combinations of weather, fuel loadings, fire occurrence patterns, drought cycles, and seasonal weather events before road construction.
- The location of the current NFS road was based more on the extraction of commodities for commercial use than on creating a route for the speedy delivery of firefighters to forests that are at risk from uncharacteristic wildfire effects. In the past, road construction was paid for by the use that benefited most from the initial access (mainly timber harvesting). Therefore, if roads were built to prevent large fires, a new method of financing the construction would be necessary.
- Building a road into a forest at high risk from uncharacteristic wildfire effects could increase the incidence of human-caused fires. A human-caused wildland fire is nearly five times more likely to occur on essentially roaded lands than on **essentially unroaded** lands.
- Even in essentially roaded areas, firefighters must often walk long distances, negotiating steep mountainsides and thick brush to reach a fire area. The presence of a road, does not guarantee firefighters will have direct access to where a wildland fire is burning.
- Because of the rugged terrain, in most inventoried roadless areas it is not feasible to build roads into all areas at high risk from uncharacteristic wildfire effect. The inaccessibility of inventoried roadless areas helps to explain why roads do not currently exist in these areas.
- In many cases, even if one knew where a future large fire would occur, the environmental and economic cost of building a road into this high fire risk area would be higher than the value of the resource protected. Many inventoried roadless area forests are low in economic timber harvest value, which often is why these areas have not been logged.
- Even if roads were constructed into all inventoried roadless areas that are rated as moderate to high risk from large forest fires, a wildland fire burning there could still be given a low priority for fire suppression resources. (This occurred many times during the 2000 fire season.)
- In most cases, the highest priority for suppression resources would be where NFS land road networks currently exist, and where overall resource values are high (private property, for example, or timber stands that have been logged and replanted), not in inventoried roadless areas.
- Forest managers would concentrate their fire hazard reduction efforts on currently roaded areas where the fire hazard and threat to high value resources exists. Many fire ecologists

(USDA Forest Service 1996b; Agee, per. comm., Wildland Resources Center 1996) believe that many areas with roads have a higher fire hazard and the potential for more severe wildland fires than exists in inventoried roadless areas.

Burned Area Emergency Rehabilitation

Affected Environment

Severe impacts may occur on portions of watersheds that experience large wildland fires, activating a special program designed to handle these emergencies. The Burned Area Emergency Rehabilitation (BAER) program was developed in 1974 to assess severely burned areas and to implement treatments to prevent watershed emergencies (severe erosion, flooding, landslides, etc.) on the burned area and downstream. Teams of specially trained professionals evaluate fire effects, design and install treatments, and monitor the effectiveness of those treatments. Typical treatments include, but are not limited to, building sediment retention structures in stream channels, improving drainage on roads and trails, seeding to improve vegetative cover, mulching bare soils, placing burned trees or other materials on the slope contour to slow runoff and capture eroded soil, and similar measures (Robichaud and others 2000).

Burned areas are evaluated for treatment needs regardless of their location (Wilderness, inventoried roadless area, roaded areas, etc.). Decisions to treat areas are based upon predicted potential damages to life, property, and resources. The range of treatments may vary, however, depending on terrain or management restrictions (such as in Wilderness), or treatment costs may vary depending on accessibility or other factors.

The vast majority of BAER activities take place in Regions 1 through 6 although Regions 8 and 9 have used the BAER program on occasion. The level of BAER activities varies widely from year to year, depending on the severity of the fire season and the number of large and damaging fires that occur. BAER activity shifts between regions of the country. For example, the 1996 season saw considerable activity in the Southwest, intermountain West, and California. The 2000 fire season is very active in most regions except the Pacific Northwest. California always seems to have a busy fire year with significant BAER projects.

The number of BAER projects and funding varies widely between years. A very active fire season occurred in 1996, with 58 projects at a cost of more than $10 million. In 1997, which was considered a modest year, there were 10 BAER projects that cost about $1.1 million. A relatively quiet year was in 1998, with only four projects at a cost totaling about $1.0 million. A significant increase occurred in 1999, with 18 projects totaling more than $6.7 million.

The 2000 fire year will be a record fire year and a record BAER year both in terms of projects initiated and total funds spent. As of September 16, 2000, the Forest Service has approved 57 projects with more than 12 remaining to be submitted for approval. Total approved funding to date is more than $25 million. Projects have treated more than 200,000 severely burned acres. Treatments so far include seeding on 78,000 acres (this includes 14,000 acres of treatment to prevent the spread of non-native invasive species),

4000 acres of mulch, 11,000 acres of contour erosion barriers, 390 miles of road maintenance and culvert improvement, and 71 miles of trail maintenance (Copenhagen 2000).

Alternatives 1-3

Since the number of large wildland fires is expected to increase during the next 20 years, additional BAER activities would be required to assess conditions, design and install treatments, and monitor effectiveness. This expected rate of increase should slowly diminish as **fuels treatments** in priority areas become effective over larger landscapes. These alternatives would have no short- or long-term effect on the amount of BAER activity required by the Agency.

Alternative 4

Effects would be similar to Alternatives 1 through 3 except the number of large fires is likely to continue to increase slightly after 20 years due to expected lower rates of fuel treatments. Increased BAER activity is expected as follow-up to these fires to protect water, soil, and air resources and life and property on-site and downstream.

The indirect and cumulative effects of the alternatives on Burned Area Emergency Rehabilitation are discussed with the indirect and cumulative effects on physical resources.

Insects and Disease

Affected Environment

Many forestlands across the country are at risk of serious insect attack and disease infection. In the inland Western United States, trees across wide areas of the landscape are dying faster than they are growing or being replaced (Mutch and others 1993). Because of this, tree mortality conditions exist that almost guarantee large and severe wildland fires. Other forest resources, aquatic, wildlife, watershed and other values, are also affected. Managers of public and private forests are being challenged to take rapid preventative action to restore these forests to conditions more similar to their historic range of variability or at least to a socially desired condition (Edmonds and others 2000).

In 1996, the Forest Service initiated a mapping effort to evaluate forest health risk on all forested lands in the United States. A geographic information system database was created that displays NFS lands most at risk of mortality from insects and diseases. This database is still under development, in its current form, it is recommended for use only at the national scale. It will be used in combination with other layers (fire, T&E species, and wildland-urban interface), still under development, to help set priorities for addressing forest health problems (Lewis 2000).

Information from the insect and disease geographic information system layer has been used at a broad national scale to identify acres at risk from substantial tree mortality and

growth loss from insects and disease. The **endemic** insect and disease rate is approximately 5% mortality. Areas are at risk if 25% or more tree mortality or growth loss (beyond the endemic level) can be expected over the next 15 years. Gypsy moth, root diseases in the West, mountain pine beetle, and southern pine beetle accounted for more than two-thirds of the acres at risk of tree mortality. Dwarf mistletoes and heart rot accounted for nearly three-fourths of the acres at risk of growth loss (Lewis 2000).

Nationally, approximately 58 million acres of all ownerships are at risk of tree mortality, and 24 million of those acres are NFS lands. About 3 million of these acres on national forests occur inside inventoried roadless areas where road construction is not currently allowed by land management plans. In inventoried roadless areas, another 4 million acres at risk are in areas where road construction and reconstruction are currently permitted by the land management plans. The percent of area at risk in inventoried roadless areas is about the same as the percent of area at risk for all NFS lands.

The majority of the areas at risk from root disease are in large, highly concentrated areas in Western Montana and northern Idaho. Mountain pine beetle high-risk areas are found throughout the West but are concentrated in Washington, Oregon, and Montana. Growth-loss risk projections identified approximately 48 million acres across the country. Dwarf mistletoe infestations across the West accounted for slightly more than a third of those acres, and heart rot in Alaska made up slightly more than a third (Lewis 2000).

Geographic information system data for insect and disease risk of mortality was combined with fire risk data to identify, at a coarse national scale only, joint areas of concern. Table 3-25 below identifies the combined risk by Forest Service region.

Table 3-25. Acres (in thousands) of inventoried roadless areas at combined risk of insect, disease, and fire.

Region [a]	Inventoried roadless areas	Inventoried roadless areas at combined risk of insect, disease, and fire
Northern (1)	9,005	246
Rocky Mountain (2)	6,183	43
Southwestern (3)	2,771	35
Intermountain (4)	15,960	221
Pacific Southwest (5)	4,200	93
Pacific Northwest (6)	4,002	102
Southern (8)	954	106
Eastern (9)	664	24
Total	**43,739**	**870**

[a] Region 10 (Alaska) is not included. Data unavailable.
(Roadless Database 2000)

While these combined at-risk acres have a critical need for forest health treatments, such as thinning and fuels reduction, it should be noted that the percentage of these acres in inventoried roadless areas is slightly lower than that of the combined at-risk acres for all NFS lands.

Given the scope of the forest health problem, the controversy associated with roadless areas, and the cost of building new roads, it is likely that higher priority for treatment to reduce the impacts of insects and disease would be assigned to roaded areas than to inventoried roadless areas.

Alternative 1- No Action

Road construction and timber harvest would continue to be used, consistent with land management plan direction, to treat a portion of high-priority stands within inventoried roadless areas at risk of insect or disease mortality where stand location and other factors make timber harvest economically feasible.

Under this alternative, timber harvest could be used to improve forest health conditions (e.g., suppressing insect infestation, thinning to improve stand vigor, or fuels reduction) on an estimated 18,000 to 19,000 acres per year in inventoried roadless areas during the first 5 years following rule implementation.

New road construction or reconstruction would reduce the cost of mechanical treatment needed to achieve the resource objectives or desired conditions. New road construction or reconstruction would provide closer access for equipment and vehicles to carry out timber harvest, fuels reduction, or other stand treatment activities. Depending on the distance from the nearest road and the size and quantity of material removed, per-acre costs for stand treatments are likely to be higher in unroaded areas than in roaded areas. This is due to lower production rates in unroaded areas for moving logs, whole trees, or bundles of trees from the stump to the landing. Roads are further from where the trees are removed or where the work is actually done. Skidders must travel longer distances, other equipment must travel further from the road to the job site, and work crews must walk farther. Total management costs of multiple treatments over time, when road construction is prohibited, may be higher than comparable situations where road construction is permitted. This includes consideration of road construction and maintenance costs.

It is unlikely that national forest managers would have any substantive impact on insect and disease condition over the next 5 years. Over the next 20 to 40 years, though, this alternative is likely to be substantially more effective in reducing insect and disease problems than any of the other alternatives. In this longer term, we would expect an average of 13,000 to 15,500 acres of timber harvest per year within inventoried roadless areas that would help improve forest health. However, the Agency may still be unable to treat all of these acres because of limited budgets, resource concerns, the high cost of road construction, and increasing levels of public controversy over roadless area management.

Alternative 1 would allow a higher level of timber harvest in inventoried roadless areas than the other alternatives. This would produce higher revenues, resulting in more funds for Brush Disposal (BD) and Knutson-Vandenberg (K-V) collections. These funds are collected from timber sale receipts and could be used for fuel reduction and thinning that otherwise would require appropriated funds.

Alternative 2

Under this alternative, timber harvest not requiring new road construction or reconstruction would be used to accomplish forest health improvement objectives (e.g., suppressing insect infestation, thinning to improve stand vigor, fuels reduction) on an estimated 8,000 acres per year in inventoried roadless areas during the first 5 years following rule implementation. Fewer acres of forest health treatment would be accomplished under this alternative (compared to Alternative 1) because road construction is prohibited.

Timber harvest could be used in the following areas:

- Adjacent to roads.
- Where logging equipment (**forwarders**, skidders, etc.) could move products long distances to roads.
- Where logging equipment could move products to off-road landings or where skyline **yarders** or helicopters could swing the logs or trees to the nearest roads.
- Where standard helicopter or skyline yarding is feasible.

Depending on the value of the product being removed, helicopter yarding is economically feasible up to 1 mile from the nearest road. Since this alternative allows timber harvest for commodity purposes, the larger and higher-value trees removed would generate more revenue and offset higher logging costs. In the Pacific Northwest, timber-harvesting costs for skyline yarding are approximately twice that for ground-based equipment, and helicopter costs can range from 3 to 5 times the ground-based equipment costs (Reutebuch 2000).

In the long term, beyond the first 5 years, 3,000 to 4,000 acres per year may be accomplished by timber harvest to improve forest health, reflecting higher costs over time as forest lands nearest to existing roads are treated.

Alternative 3

Under this alternative, types of forest-health-treatment activities would be similar to those in Alternative 2. Timber harvest for stewardship purposes only would be used to accomplish forest-health improvement objectives (e.g., suppressing insect infestation, reducing the spread of disease, thinning to improve stand vigor, and fuels reduction) on an estimated average of 4,400 acres per year in inventoried roadless areas during the first 5 years following rule implementation. Fewer acres of forest health treatment would be accomplished under this alternative (compared to Alternatives 1 and 2) because treatment cost/acre would be substantially higher due to the road construction prohibition and lower harvest volumes/acre.

Less work would be done using timber sale contracts because the smaller-diameter, lower-value trees would likely result in fewer economically viable timber sales. More forest health objectives would have to be accomplished using **service contracts** or means other than timber sale contracts, which would require more appropriated funds. In the long term, beyond the first 5 years, 1,200 to 1,400 acres per year may be accomplished by

timber harvest to improve forest health, reflecting higher cost over time as forest lands nearest to existing roads are treated.

Alternative 4

With timber harvest and road construction prohibited in inventoried roadless areas, this alternative would provide little opportunity to improve forest health conditions within inventoried roadless areas. Insect infestation and disease epidemics would run their course. None of the acres treated under the other alternatives would be treated under Alternative 4. It is not an option to use mechanical timber harvest or other silvicultural treatments for fuel reduction before a prescribed burn.

Other Indirect and Cumulative Effects on Insects and Disease

Past Actions – Combined incremental effects of wildland fire suppression and reductions in timber harvest from Federal lands has led to change in vegetation structure and species composition and an increasing accumulation of forest fuels over large landscapes of most of the interior West, including inventoried roadless areas. Removals of timber from NFS lands in 1996 were approximately 20% of growth that year (USDA Forest Service 1999j). While the 1996 rate of removal is not a current annual average, it indicates an ongoing and substantial net increase in volume of wood fiber on NFS lands.

Present Actions – The primary cumulative impact of Alternatives 2, 3 and 4, when added to other past, present and reasonably foreseeable future actions, is the continuing change in vegetation structure and species composition, and the accumulation of this vegetation and forest fuels. Prohibition of road construction and reconstruction within inventoried roadless areas would result in a large proportion of inventoried roadless area acres remaining largely inaccessible (from an economic feasibility standpoint) to equipment necessary to carry out vegetation management. Some of these lands are not suitable for timber production; on other lands, road construction is not economically feasible now. Most lands within one-quarter to one-half mile of an existing road would continue to be managed using timber harvest or other methods of treatment where appropriate. However, cost per acre would increase substantially and proportionally with distance of the project from the nearest road. Total acres treated within inventoried roadless areas are likely to be less than if road construction is permitted. Trees inside these economically inaccessible (under Alternatives 2 and 3) portions of inventoried roadless areas that are killed by insects, disease, windthrow, or fire would deteriorate and add to fuel loading. Wildland fires that subsequently burn these areas may cause severe impacts to soil and water resources because higher concentrations of natural fuels would cause the fire to burn hotter. However, even if road construction and reconstruction in inventoried roadless areas were permitted, it may not be possible to treat these acres because of resource concerns, the high cost of road construction, or public controversy.

Other agency and Federal proposals will continue to affect the Forest Service timber program at both the national and local levels. Current emphasis such as that found in the

Interior Columbia Basin Ecosystem Management Project, the Sierra Nevada Framework, and the Cohesive Fire Strategy calls for a mix of longer rotation periods to increase old-growth characteristics, and thinning treatments that would continue the removal of small diameter trees. Other strategies such as the Lynx Conservation Assessment and Strategy call for preservation of early seral stage habitat that would preclude some future thinning activities.

Reasonably Foreseeable Future Actions – Natural disasters such as wildland fires, windstorms, and insect outbreaks will continue to occur, and the Agency is likely to continue salvaging a portion of the dead and dying trees. These **salvage** sales will continue to be designated as high priority for harvest due to biological and economic factors. The biological factor is the need to control secondary insect outbreaks, like Ips beetle, southern pine beetle and spruce bark beetle, whose populations would increase rapidly by attacking damaged trees and then spreading into the surrounding healthy trees. The economic factor is the rapid deterioration of the dead material due to insect damage, stains, rots, and checking. If dead or dying trees are not salvaged quickly, there will be nothing to salvage.

Timber salvage sales generate vegetation management work completed on the ground and receipts to the Federal treasury from the sale of usable trees. A portion of the money collected from the resulting timber salvage sales is used to help cover the costs of essential rehabilitation work and reforestation. If the Agency elects to reduce the use of timber salvage sales because of continuing public controversy, the use of service contracts funded by appropriations must increase to accomplish fuels reduction or other desired vegetative treatments. Net cost per acre to achieve desired conditions rises substantially over that associated with use of timber salvage. The higher cost may be a disincentive to achieving desired conditions within inventoried roadless areas.

Wildland fires and other natural disasters, especially during a wildland fire season like the one experienced in 2000 in the West, will also eliminate or devalue the timber on some timber sales currently under contract and some that were planned but not offered for sale. However, it is anticipated that the acres of vegetation management that otherwise would have been accomplished through timber harvest will be recovered or slightly increased due to restoration and salvage operations over the next 2 years.

Biodiversity

Biodiversity is the variety and abundance of species, their genetic composition, their communities, and the ecosystems and landscapes of which they are a part (Wilson 1988; Adams and others 2000). The United States has a rich heritage of biodiversity, due in large part to its great topographic and climatic diversity. Extending north to south approximately 50° latitude and east to west more than 120° in longitude, this country contains 21 of 28 globally defined ecoregions and supports at least 4,500 distinct vegetative communities. Nearly 16,000 species of the world’s vascular plants are found within the United States, and about 10% of freshwater fish species and 9% of mammal species (Adams and others 2000). Natural disturbance processes have been and continue to be instrumental in the development and maintenance of this biodiversity (Noss 1994).

Protecting areas from human development and activities is an essential part of biodiversity conservation (Wilson 1985, 1989; World Research Institute and others 1992; Noss and Cooperrider 1994). Habitat loss and degradation were identified by Wilcove and others (2000) as the most significant threat to biodiversity in the United States. Habitat loss has been implicated in the decline of approximately 85% of T&E species. Other important contributing factors they identified include competition or predation by nonnative species, pollution, and overexploitation (Wilcove and others 2000).

The current worldwide rate of species extinction is estimated to be approximately 400 times greater than that of recent geologic time, and increasing (Wilson 1985). Based on estimates made by the Nature Conservancy (Stein and Flack 1997), at least 110 species of plants and animals are extinct in the United States, and an additional 416 species are possibly extinct, with no recent documented occurrences. This represents an irretrievable loss of biodiversity.

In this analysis, the direct, indirect, and cumulative effects of alternatives on biodiversity are evaluated using both landscape and species habitat approaches. A landscape approach provides a way of evaluating large-scale biological, physical, and ecosystem processes and patterns that influence biodiversity. These include ecoregion representation, size of habitat area, adjacency to other protected habitats, elevational distribution of habitats, regional distribution and abundance of inventoried roadless areas, relationship to past and present fire regimes, fragmentation, and connectivity.

Potential effects to biodiversity at a species level were determined by considering the kinds and numbers of species potentially affected, identifying the important and sometimes unique characteristics of roadless areas that foster biodiversity, and evaluating the potential adverse and beneficial effects of road construction and timber harvest on those characteristics. These effects are discussed for terrestrial animal species and habitats, aquatic animal species and habitats, terrestrial and aquatic plants, and TEPS species. The cumulative effects of the alternatives were addressed by considering land use and land conversion trends; laws, regulations, and policies that affect biodiversity; and invasion of nonnative species.

To evaluate the adequacy of inventoried roadless areas in representing landscape diversity, a direct 12% threshold of each evaluated category was used. The World Commission on Environment and Development (1987) recommends that at least 12% of a country's land mass is designated as conservation reserves. In this analysis, 12% is used for comparative purposes and may be too low to be a representation target. For example, Noss and Cooperrider (1994) argue that 25% to 75% of a region should be protected to achieve adequate representation of habitat.

The alternatives would not designate conservation reserves or fully protect inventoried roadless areas similar to a Wilderness designation. In this analysis, the effects of the alternatives on landscapes are considered in the context of conserving and protecting certain **landscape characteristics** (i.e., ecoregions, connectivity from reduced fragmentation, and large intact landscapes at all elevational classes). The alternatives prohibit road construction and road reconstruction, and they restrict timber harvest

activities with some exceptions (as identified in Chapter 2). As a result, potential adverse effects from these activities and associated activities would be precluded or reduced, thereby conserving and protecting certain landscape characteristics important to maintaining biodiversity.

The total land area of the United States (excluding Hawaii) is 2.3 billion acres. Of this, 5% of the United States is strictly managed to maintain natural values (e.g., Wilderness, national parks), 5% is managed to maintain natural values (e.g., National Wildlife Refuges, National Recreation Areas), 21% is multiple-use management (e.g., USDI Bureau of Land Management, national forests), and 69% has no active management to maintain natural values (DellaSala and others 2000). Nationally, the combined percentage managed to maintain natural values varies from a high of 36% in Alaska, to 7% in the Western portion of the United States, and 2% in the East. When Alaska is excluded, about 5% of the United States occurs in areas managed to maintain natural values. This figure is much less than the 12% minimum suggested by the World Commission on Environment and Development (1987) and an order of magnitude less than mid-range minimum suggested by Noss and Cooperrider (1994).

To put the roadless area initiative into context, the total of 58.5 million acres included under all classes of inventoried roadless areas represents about 2.5% of the land area in the United States. When only those inventoried roadless areas where current **management prescriptions** that do not allow roads are considered, approximately 1% of the United States is included.

Nationally, the total area in inventoried roadless areas varies from 14.8 million acres (3.8% of the land area) in Alaska to 42.1 million acres (4.4%) in the Western United States and 1.6 million acres (0.2%) in the Eastern United States. When only inventoried roadless areas that currently allow roading are considered, the total area included varies from 4.6 million acres (1.2%) in Alaska, to 28.7 million acres (3%) in the Western United States and 0.9 million acres (0.1%) in the Eastern United States.

Many inventoried roadless areas alone and/or in combination with protected areas (e.g., Wilderness) function as **biological strongholds** supporting a diversity of species such as wide-ranging carnivores, localized species, and rare plants. Biological strongholds are areas that support all major life-history forms of a species that were historically found within them, with stable or increasing population numbers at levels not substantially diminished from their historical size or density. Such areas have typically not been exposed to the same levels of habitat degradation and loss that have characterized a region as a whole. They provide conditions suitable for survival of some species that may be declining elsewhere. Biological strongholds play a key role in maintaining native species and biodiversity.

Native plant and animal communities are generally more intact in inventoried roadless areas than in roaded areas of similar size, with the representation and abundance of species less likely to be altered by human disturbances. **Species richness** and native biodiversity is more likely to be conserved, particularly in areas large enough to offer a shifting mosaic of habitat patches in various stages of recovery from disturbance (Noss and Cooperrider 1994).

Inventoried roadless areas support a diversity of aquatic habitats and communities. Without the disturbances caused by roads and associated activities, stream channel characteristics, such as channel and floodplain configuration, substrate embeddedness, riparian condition, amount and distribution of woody debris, stream flows, and temperature regime, are less likely to be altered (Furniss and others 1991). Illegal introduction and harvest of fish species are also less likely to occur in these areas due to lack of ready access.

Inventoried roadless areas are home to many native species of terrestrial and aquatic plants including rare, TES species. Many have narrow geographical ranges determined by soil types, climatic conditions, or other environmental factors. These **endemic species**, due to their natural, limited distribution, are often at a relatively high risk of extinction from human activities or other causes. Areas in the United States with considerable numbers of endemic plant species include California, Texas, Alaska, the Pacific Northwest, the Southwest, the Intermountain West, and the South (Gentry 1986).

Invasion of nonnative species into North American is one of the most important issues in natural resource management today, with more than 6,000 species originating outside the United States. The ability of these species to alter native populations, communities, and ecosystem structure and function is well documented (Elton 1958; Mooney and Drake 1986; Vitousek and others 1987; Drake and others 1989). The ability of managers to eliminate invasive species, once established, is often limited. Since roads provide an entry way for nonnative species, inventoried roadless areas can act as strongholds against invasion of these species.

The following sections provide a detailed discussion of the potential effects of the prohibition alternatives on biodiversity:

- Ecoregions
- Fragmentation
- Size Considerations
- Elevational Distribution
- Terrestrial Animal Habitat and Species
- Aquatic Animal Habitat and Species
- Terrestrial and Aquatic Plant Species
- Threatened, Endangered, Proposed, and Sensitive Species.

Any other indirect and cumulative effects as well as any effects of the social and economic mitigation for all environments under Biodiversity are discussed at the end of this section.

Ecoregions

Affected Environment

The distribution of plants and animals is strongly influenced by physical environmental gradients (Whittaker 1967). These gradients are generally specified by solar radiation, thermal, moisture, nutrient, and biotic regimes (Nix 1982). These gradients are

overlapping and result in areas where ecological communities, dynamics, and inherent capabilities are distinct from neighboring areas. These areas have been defined as ecologically defined ecoregions. Ecoregions broadly describe key environmental variables across the United States, including: physiography, geology, soils, hydrology, climate, land use, vegetation, and wildlife. Figure 3-26 summarizes the ecoregion classification used in this "coarse" scale analysis (Omernik 1995; Gallant and others 1995). Ricketts and others (1999) provide detailed descriptions of the biodiversity of each ecoregion. Table 3-26 shows inventoried roadless acreage by ecoregion and protected status for ecoregions greater than 100,000 acres. Globally outstanding ecoregions (Ricketts and others 1999) are shaded and in italics.

Alternative 1 – No Action

Forty-five of the 83 ecoregions in the 'lower 48' and Alaska have more than 100,000 acres of NFS land that contain inventoried roadless areas. Of these, 35 ecoregions have more than 12% of their area managed to protect natural values, such as Wilderness or inventoried roadless areas. These 35 ecoregions make up about 70% of the NFS land base.

Sixteen ecoregions that contain more than 100,000 acres of NFS lands in the continental United States have been assigned a status of globally outstanding (Ricketts and other 1999). Globally outstanding ecoregions are biologically distinct based on species richness, degree of species endemism,[8] and rarity.

Less than 8% of the acreage in the globally outstanding ecoregions is now protected in the East, which is well below the 25% to 75% recommendations of Noss and Cooperrider (1994) and the 12% World Commission on Environment and Development (1987) (Figure 3-26 showing boundaries of ecoregions in the East). Eighty-three percent of the ecoregions in the West already exceed the 12% protection threshold and 56% exceed the 25% threshold. All of the globally outstanding ecoregions in the West and Alaska already exceed the 12% protection levels, and most (81%) exceed the 25% protection level.

Alternative 2

This alternative would greatly improve the protection of ecoregions from road construction and associated human disturbances within the NFS; more than doubling the ecoregion area protected in inventoried roadless areas in 11 of the 45 ecoregions (Table 3-27). The largest acreage increases would occur in Alaska, the Sierra Nevada, and the Klamath-Siskiyou regions of California.

Under this alternative, most of the ecoregions on NFS lands would exceed the 12% protection threshold suggested by the World Commission on Environment and Development (1987). Sixty-four percent of the ecoregions would exceed the minimum protection threshold of 25%, and 5 ecoregions would exceed the upper limit of 75% protection suggested by Noss and Cooperrider (1994).

[8] Those species with restricted geographical ranges determined by soil types, climate, and other environmental factors.

While many of the ecoregions in the United States are not considered globally outstanding, several changes that would result from this alternative are noteworthy. Nationally, 5% or less of Okanogan Forests, Eastern Cascade Forests, Montana Valley and Foothill Grasslands, and Northwest Mixed Grasslands ecoregions are protected in special designated areas. This alternative would more than double the area protected in these ecoregions. In addition, protected acreage would more than double in 13 ecoregions (Table 3-27), which currently protect between 5% and 25% of their area.

Under this alternative, the Chihuahuan Deserts and Central Pacific Coast (Coastal Washington and Oregon) have the smallest area protected of all the globally outstanding ecoregions in the West. The largest percentage increase in the West occurs in the Northwest Mixed Grasslands, Wyoming Basin, Montana Valley and Foothill Grasslands, and Okanogan forest ecoregions. Table 3-27 shows the increased protection for ecoregions resulting from this alternative. The table only includes ecoregions greater than 100,000 acres of NFS lands. Globally outstanding ecoregions (Ricketts and others 1999) are shaded.

Since relatively few acres are protected in the East, even small increases are important. Under this alternative, four Eastern ecoregions in the national forests would exceed the 12% threshold of protection (Table 3-26). Two areas, the New England/Acadian Forests and the Northern Tall Grasslands, would exceed the 25% threshold. The largest acreage increase would occur in the Ozark Mountains and Mixed Mesophytic ecoregions (Table 3-27).

Alternatives 3 and 4

Under these alternatives, the effects on the area of ecoregions protected from road construction and reconstruction would be the same as under Alternative 2.

Fragmentation

Affected Environment

Fragmentation, in this analysis, refers to human activities dividing large areas of forest into smaller tracts separated by different landscape elements. Examples are common in urban areas and forest landscapes where **clearcutting** was used extensively. (The Tongass National Forest effects analysis includes a discussion of natural and human-caused fragmentation.) As human-caused fragmentation increases, the amount of unaltered central or core habitat decreases, which increases adverse **edge effects** (see Terrestrial Wildlife section), including increase in human activity, changes in microclimate (Chen and others 1995; Concannon 1995), increase in human-caused fires, and invasion of nonnative species (Saunders and others 1991; Skole and Tucer 1993).

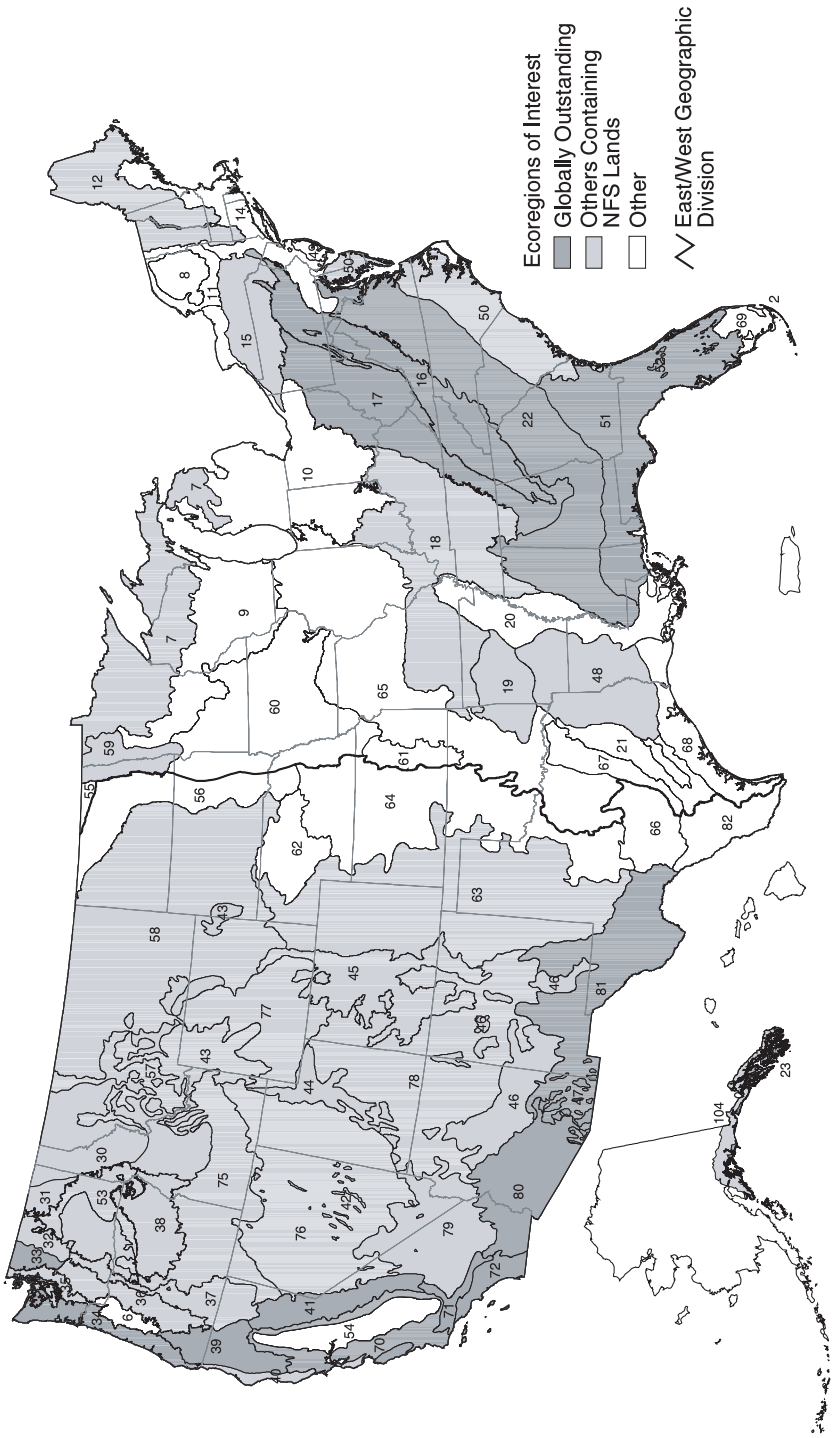


Figure 3-26. Ecoregions of the United States.

(Ricketts 1999)

Table 3-26. Ecoregion area and protected status of inventoried roadless, Wilderness, and other special designated areas. Globally outstanding ecoregions are shaded.

Ecoregion (code number)	Total National Forest System land [a]	Wilderness or other special designated areas [b]	Inventoried roadless areas; road construction prohibited [b]	Inventoried roadless areas; road construction allowed [b]	Wilderness, other special designated areas, or inventoried roadless areas [b]
Alaska					
Northern Pacific Coast (23)	10,983	33	26	17	77
Ice fields and Tundra (104)	10,674	36	34	23	94
Eastern United States					
Western Great Lakes (7)	10,983	12	0	1	13
New England/Acadia (12)	1,458	13	8	9	30
Allegheny Highlands (15)	742	7	1	0	8
Appalachian/Blue Ridge (16)	9,500	8	4	4	16
Mixed Mesophytic (17)	4,534	2	0	2	4
Central US Hardwoods (18)	4,764	2	0	1	3
Ozark Mountains (19)	3,554	6	1	2	9
Southeast Mixed Forests (22)	3,068	+ [c]	0	+ [c]	+ [c]
Piney Woods (48)	2,868	2	0	0	2
Middle Atlantic Coast (50)	719	7	0	3	10
Southeastern Conifer (51)	1,969	5	1	1	7
Florida Sand Pine Scrub (52)	246	4	0	1	5
Northern Tall Grasslands (59)	138	0	0	34	34
Western United States					
North Central Rockies (30)	17,001	23	11	16	50
Okanogan Forests (31)	810	1	1	16	18
Cascade Mtns. Leeward (32)	3,168	52	12	6	70
North Cascades (33)	1,801	54	18	4	76
Central Pacific Coastal (34)	1,727	8	5	2	15
Central/South. Cascades (36)	7,163	27	6	4	37
Eastern Cascades (37)	7,923	5	2	4	11
Blue Mountains (38)	7,183	19	5	8	33
Klamath-Siskiyou (39)	7,008	30	7	8	45
Sierra Nevada Forests (41)	10,237	26	4	7	37
Great Basin Montane (42)	960	35	6	46	87
South Central Rockies (43)	30,824	29	12	27	68
Wasatch/Uinta Montane (44)	6,980	10	6	38	54
Colorado Rockies (45)	19,037	21	5	20	46

Table 3-26 (cont.)

Ecoregion (code number)	Total National Forest System land [a]	Wilderness or other special designated areas [b]	Inventoried roadless areas; road construction prohibited [b]	Inventoried roadless areas; road construction allowed [b]	Wilderness, other special designated areas, or inventoried roadless areas [b]
Arizona Mountains (46)	15,729	16	5	6	27
Madrean Sky Islands (47)	1,517	24	24	0	48
Palouse Grasslands (53)	467	58	1	12	71
Montana Valley/Foothill (57)	1,294	4	4	27	35
Northwest Mixed Grasslands (58)	7,035	0	1	5	6
Western Short Grasslands (63)	3,136	+ [c]	+ [c]	+ [c]	+ [c]
Cen. Cal. Shrub/Savanna (70)	1,180	24	5	19	48
So. Cal. Woods/Shrub (71)	3,040	32	9	18	59
So. Cal. Coastal Scrub (72)	752	16	11	9	36
Snake/Col. Shrub Steppe (75)	1,282	7	9	24	40
Great Basin Shrub Steppe (76)	8,205	12	4	47	63
Wyoming Basin (77)	547	27	1	35	63
Colorado Plateau (78)	3,388	17	3	19	39
Mojave Desert (79)	423	82	2	3	87
Sonoran Desert (80)	179	25	7	3	35
Chihuahuan Deserts (81)	332	5	15	11	31

[a] Thousand acres
[b] Percent
[c] + represents values greater than 0% but less than 0.5%.
(Roadless Database 2000)

Fragmentation results in decreased connectivity, which is a measure of the extent to which habitat patches allow movement of wildlife species across a landscape or region. The degree of connectivity required varies depending on the species of interest. For example, a landscape for spotted owls is considered well connected if habitat patches are less than 6 miles apart and weakly connected if the patches are more than 24 miles apart (USDA and others 1993).

Habitat in inventoried roadless areas is generally less fragmented and better connected than in roaded areas of similar size. This is important to a number of species including fisher, marten, and lynx populations that have been negatively affected by habitat fragmentation and loss of connectivity due to timber harvest (Ruggiero and others 1994) and NFS roads (USDI Fish and Wildlife Service 1998b). Smaller patch size and loss of interior forest habitat resulting from fragmentation have adverse effects on numerous species dependent on such habitat, including many Neotropical birds.

Roads, the associated corridor along them, and clearcutting are major contributors to forest fragmentation because they divide large landscapes into smaller patches and convert interior forest habitat into edge habitat. As additional road construction and timber harvest activities increase habitat fragmentation across large areas, the populations

Table 3-27. Increased protection for ecoregions under Alternative 2 prohibitions. Globally outstanding ecoregions are shaded.

Ecoregion name (code number)	Increase in acreage protected under Alternative 2 when compared to No Action (%)
Alaska	
Northern Pacific Coast (23)	34
Icefields and Tundra (104)	41
Eastern United States	
Western Great Lakes (7)	12
New England/Acadia (12)	44
Allegheny Highlands (15)	8
Appalachian/Blue Ridge (16)	53
Mixed Mesophytic (17)	64
Central US Hardwoods (18)	32
Ozark Mountains (19)	64
Southeast Mixed Forests (22)	49
Piney Woods (48)	8
Middle Atlantic Coast (50)	41
Southeastern Conifer (51)	25
Florida Sand Pine Scrub (52)	33
Northern Tall Grasslands (59)	+[a]
Western United States	
North Central Rockies (30)	52
Okanogan Forests (31)	1420
Cascade Mtns. Leeward (32)	13
North Cascades (33)	7
Central Pacific Coastal (34)	18
Central/South. Cascades (36)	16
Eastern Cascades (37)	90
Blue Mountains (38)	42
Klamath-Siskiyou (39)	28
Sierra Nevada Forests (41)	26
Great Basin Montane (42)	132
South Central Rockies (43)	76
Wasatch/Uinta Montane (44)	249
Colorado Rockies (45)	83
Arizona Mountains (46)	34
Madrean Sky Islands (47)	0
Palouse Grasslands (53)	156
Montana Valley/Foothill (57)	494
NW Mixed Grasslands (58)	762
Western Short Grasslands (63)	0
Central California. Shrub/Savanna (70)	137
Southern California Woods/Shrub (71)	46

Table 3-27 (cont.)

Ecoregion name (code number)	Increase in acreage protected under Alternative 2 when compared to No Action (%)
Southern California Coastal Scrub (72)	37
Snake/Col. Shrub Steppe (75)	244
Great Basin Shrub Steppe (76)	380
Wyoming Basin (77)	901
Colorado Plateau (78)	211
Mojave Desert (79)	12
Sonoran Desert (80)	10
Chihuahuan Deserts (81)	56

[a] + represents values greater than 0 but less than 0.5%.
(Roadless Database 2000)

of some species may become isolated, increasing the risk of local extirpations or extinctions (Noss and Cooperrider 1994). Clearcut timber harvest units and associated roads affect 2.5 to 3.5 times more landscape than the surface area occupied by the actual activities themselves (Reed and others 1996). Over the past 50 years, landscapes have been appreciably impacted from fragmentation caused by clearcutting and road construction (Harris 1984; Saunders and others 1991; Noss and Csuti 1994; Forman and Alexander 1998).

Roads also fragment some invertebrate habitat. In the Klamath-Siskiyou province, Frest (personal communication) documented a reduction in habitat for common land snails from fragmentation caused by roads and other land-disturbing activities. Reasons cited included microclimate changes on the road surface; loss of habitat complexity and structure; effective width of roads greater than actual width; and avoidance of exhaust residues, petroleum products, and other chemicals that were exhibited by many species. Timber harvest, particularly where associated with extensive ground disturbance and sizeable canopy removal, also provides a substantial threat to population **viability** of some invertebrates (Frest 1993; Frest and Johannes 1995).

Alternative 1 – No Action

The relative effects of the most common ground-disturbing activities on landscape fragmentation and connectivity are summarized in Table 3-28. Alternative 1 would result in the greatest degree of fragmentation and the largest negative impact on biodiversity when compared to the other alternatives. Over the next 5 years, the projected road construction miles and timber harvest levels are the largest in this alternative.

More than half of the timber harvest volume would be from clearcutting, primarily on the Tongass National Forest (if the roading prohibitions apply to the Tongass, very little clearcutting would occur). Clearcutting is an important cause of biodiversity loss due to the loss of biological legacies, such as snags and logs, which usually remain after a natural disturbance (Franklin and others 2000). In the long term, since inventoried roadless areas would likely continue to be available for development, fragmentation and effects from loss of connectivity are expected to continue to occur over time. The actual

effect will vary depending on the location, final harvest and roading prescriptions, mitigation measures, and the condition of the surrounding landscapes. Actual estimates of biodiversity losses would be determined at the local project level.

While the Intermountain Region would have the highest harvest levels and road construction in the 'lower 48', less than 10% of the acres harvested are expected to be from clearcutting. The remaining acres harvested are likely to be through tree thinning, which can be less fragmenting if post-harvest canopy cover remains relatively high. For example, thinnings that substantially lower canopy covers can have adverse affects on the movements of northern goshawk (Reynolds and others 1991) and American marten (Ruggiero and others 1994) prey species, at least in the short term. Harris (1984) suggests that impacts from fragmentation generally are relatively low from thinning compared to clearcutting.

Table 3-28. Relative impact of management activities on fragmentation and connectivity.

Management activity	Most impact	Moderate impact	Least impact
Clearcutting and associated roads	X		
Thinning from below to reduce fire risk or to enhance old growth [a]			X
Classified road construction		X	
Temporary road construction [b]			X

[a] Thinning of small diameter trees in the understory.
[b] Designed with minimal clearing widths and decommissioned after use.
(Roadless Database 2000)

There may be local impacts on some national forests, such as the Payette, Dixie, Manti-Lasal, Clearwater, and the Idaho Panhandle, since a higher percentage of timber harvest is expected on these forests than others in the West. Seven national forests in the East are planning to harvest more than 5MMBF over the next 5 years. Of these, the Monogahela, Superior, and Ozark/St. Francis are projecting the highest levels of harvest volume and road construction, and may experience some increase in fragmentation depending on harvest prescriptions.

This alternative would provide the opportunity for thinning, brush piling, under burning, and other vegetation treatments to conserve or enhance ecosystem structure, function, and composition. Such stewardship activities can have important local beneficial effects on biodiversity. For example, reducing wildland fire intensity by reducing accumulated fuels in ponderosa pine forests in the West may conserve local biodiversity by increasing the survivability of large, old-growth pines following wildland fires; reducing mortality from moisture stress; reducing insect and disease outbreaks in stressed stands; restoring fire dependent herbs and shrubs; and restoring the historical fire regime.

These benefits should be weighed at the local project level against the risks of implementing these treatments. For example, depending on the terrain, tree removal prescription, equipment type, skill, and concern of the equipment operators, and

administrative oversight, benefits from stewardship timber harvest may be outweighed by adverse impacts to terrestrial and aquatic resources. Since this alternative would allow the full range of timber harvest to occur, some local negative impacts to these resources and to biodiversity from reduction in snags, coarse down wood, canopy cover, and large old-growth trees would likely occur.

Alternative 2

This alternative would greatly reduce the potential for further fragmentation and loss of connectivity from road construction or timber harvest. The level of fragmentation depends on the land management objectives and type of timber harvest. On the Tongass National Forest, the roads prohibition would greatly reduce clearcutting and the effects from human-caused fragmentation.

This alternative would be beneficial to animals with large home ranges such as the grizzly bear. In the West, important connectivity would be conserved between Yellowstone, Bitterroot, North Continental Divide, and Cabinet/Yaak ecosystems because of increased inventoried roadless area protection.

Alternative 3

The impacts on biodiversity from increased fragmentation and reduced connectivity would be less than under Alternative 2. Clearcutting is not expected to occur under this alternative. Only timber harvest that maintains or restores biodiversity is expected under this alternative.

This alternative would provide the opportunity for thinning, brushing, under burning, and other vegetation treatments to conserve or enhance ecosystem structure, function, and composition. Such stewardship activities can have important local benefits on biodiversity and overall ecosystem health. For example, reducing fire intensity by reducing accumulated fuels in ponderosa pine forests in the West may conserve local biodiversity by: increasing the survivability of large, old-growth pines following wildland fires; reducing mortality from moisture stress; reducing insect and disease outbreaks in stressed stands; restoring fire dependent herbs and shrubs; and restoring the historical fire regime.

Depending on the terrain, equipment type, skill, and concern of the equipment operators, and administrative oversight, benefits from vegetation treatments may be outweighed by adverse impacts to terrestrial and aquatic resources. If all of these factors are carefully managed, the results can be positive. While there are many examples of successful fuel reduction efforts in individual forest stands, it has not been shown that large-scale treatment of fuels can effectively restore natural fire regimes and ecological conditions.

Alternative 4

No effects on biodiversity from fragmentation and loss of connectivity are expected since no timber would be harvested.

This alternative would have some local negative effects on biodiversity since stewardship-type timber harvest treatments would not be allowed with the exception of those timber harvest activities needed for protection or recovery of a T&E species, or species that have been proposed for listing under the ESA. As a result, ecosystems that currently are or could be contributing to local biodiversity may be negatively altered by uncharacteristic wildland fire or insect and disease outbreaks. It is likely that some of these areas, over time, would experience stand replacement fires, and landscape vegetation patterns would shift more towards larger, **even-aged** stands initiated by large fire.

Size Considerations

Affected Environment

There is a positive relationship between size of an area protected from human disturbance and maintenance of biodiversity (MacArthur and Wilson 1967). Large, relatively undisturbed areas are important for species with large home ranges and species that are sensitive to human activity. Ecosystem processes are generally intact in larger areas; particularly fire disturbance processes. Smaller areas are important for biodiversity conservation as well, especially for species with small home ranges, species with special habitat needs, or for providing linkages between larger areas.

As described in the Landscape Analysis of Inventoried Roadless Areas and Biodiversity specialist report, most of the more than 2,800 inventoried roadless areas in the NFS are larger than 5,000 acres, but some are as small as 2 acres (Figure 3-3).

Alternative 1 – No Action

About 41% of the inventoried roadless areas are currently allocated to prescriptions that do not allow road construction and reconstruction and/or that forest plans recommend as Wilderness (Appendix A). Even though most of these areas are between 1,000 and 5,000 acres in size, most of the acreage occurs in the size class between 5,000 and 25,000 acres. One area is larger than 250,000 acres. In the East, there are about 90% fewer areas protected from road construction and reconstruction in the 5,000 to 25,000 acre size class than in the West. There are no areas larger than 50,000 acres in the East, and three between 25,000 and 50,000 acres in size (Figure 3-27). The East has a higher portion of smaller areas than the West.

In Alaska, more than 10 million acres of inventoried roadless areas are currently protected. On the Tongass National Forest, 76% of the acreage currently protected from road construction and reconstruction occurs in inventoried roadless areas greater than 50,000 acres. Alaska has the largest inventoried roadless areas. In fact, most of the acreage in Alaska occurs in 10 separate areas that are each more than 250,000 acres.

Table 3-29 illustrates that a high percentage of inventoried roadless areas are adjacent to existing Wilderness. This provides a major cumulative benefit for large animals, such as the grizzly bear, by increasing the size of security areas and improving travel ways to

other habitat. In Alternative 1, nearly 9 million acres of inventoried roadless areas adjoin existing Wilderness. These areas are currently protected by land management plans. In the East, this is the case for almost 19% of the 655,000 acres of currently protected inventoried roadless areas.

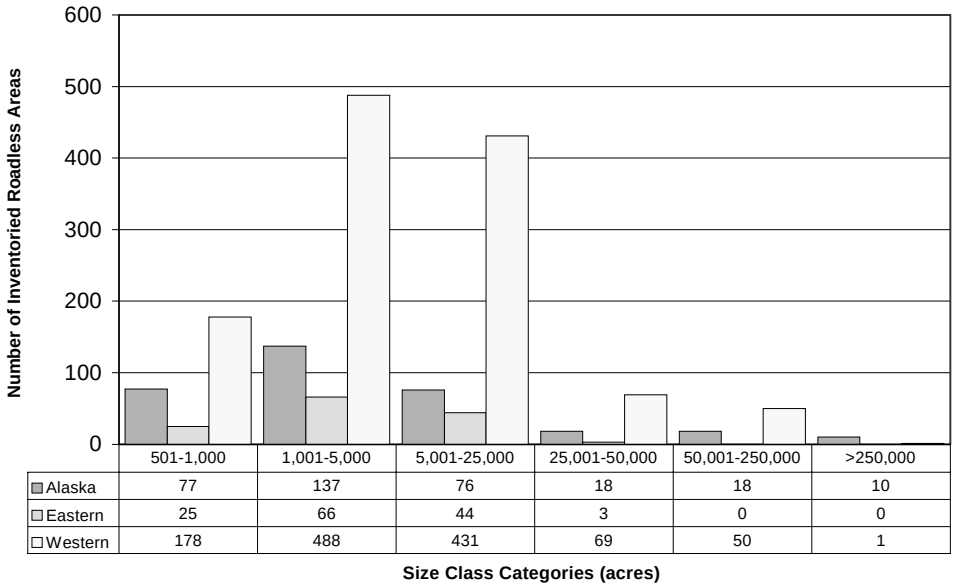


Figure 3-27. Size class distribution of protected inventoried roadless areas under Alternative 1. Inventoried roadless area numbers are for each individual map unit and not groups of units with the same name.

(Roadless Database 2000)

Table 3-29. Inventoried roadless areas, in thousands of acres, adjacent to existing Wilderness.

Geographic division	Wilderness within National Forest System lands	Inventoried roadless areas recommended for Wilderness or where road construction and reconstruction is already prohibited			All inventoried roadless areas		
		Lands adjacent to Wilderness	Total land in this category	Percent adjacent to Wilderness	Lands adjacent to Wilderness	Total land in this category	Percent adjacent to Wilderness
Alaska	5,747	4,140	10,117	41%	5,649	14,779	38%
Eastern U.S.	2,025	122	655	19%	460	1,618	28%
Western U.S.	26,917	4,625	13,409	34%	13,972	42,121	33%
Total	**34,690**	**8,886**	**24,182**	**37%**	**20,080**	**58,518**	**34%**

(Roadless Database 2000)

In Alaska, 41% of the currently protected inventoried roadless areas are adjacent to Wilderness. In the West, 34% of the inventoried roadless areas that currently prohibit road construction are adjacent to Wilderness. These areas together encompass large areas where road construction and reconstruction are prohibited (Figure 3-28).

The six Grizzly Bear Recovery Areas identified in the Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service 1993) include more than 23 million acres, of which 7.5 million is Wilderness (Table 3-29). These areas are located in Montana, Idaho,

Washington, and Wyoming. Figure 3-29 illustrates how effectively inventoried roadless areas contribute to overall integrity of these management units. More than 44% of the Grizzly Bear Recovery Areas are currently protected from road construction by inventoried roadless areas that currently prohibit roading and adjacent Wilderness

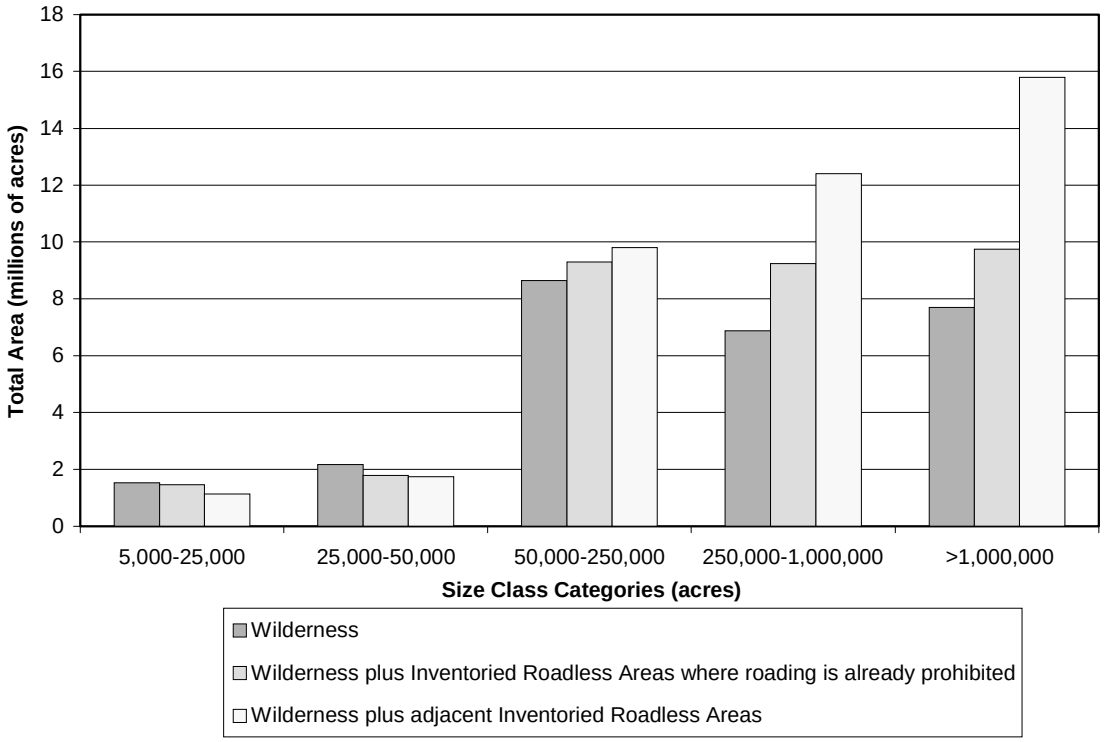


Figure 3-28. Acreage of large protected areas in the Western United States from combining inventoried roadless areas and adjacent Wilderness.
(Roadless Database 2000)

Alternative 2

Alternative 2 would greatly increase the protection of large (>5,000 acres) contiguous inventoried roadless areas from road construction and reconstruction (Table 3-30). This would have a large positive effect on conserving biodiversity in the contiguous United States. Since so much of Alaska is already protected from road construction, the proportional benefits to biodiversity could be less than in some other States.

In the West, 12 inventoried roadless **map units** more than 250,000 acres, 97 areas between 50,000 and 250,000 acres, and 827 areas between 5,000 and 25,000 acres would be added to the already protected units under Alternative 1 (Figures 3-27 and 3-30). The number of areas protected below 5,000 acres would increase by 185. In the East, the largest change would occur in the 5,000 to 25,000 acre size class where 77 inventoried roadless map units are added to what is already protected under Alternative 1. Two map units between 25,000 and 50,000 acres would be added in the East because of this alternative.

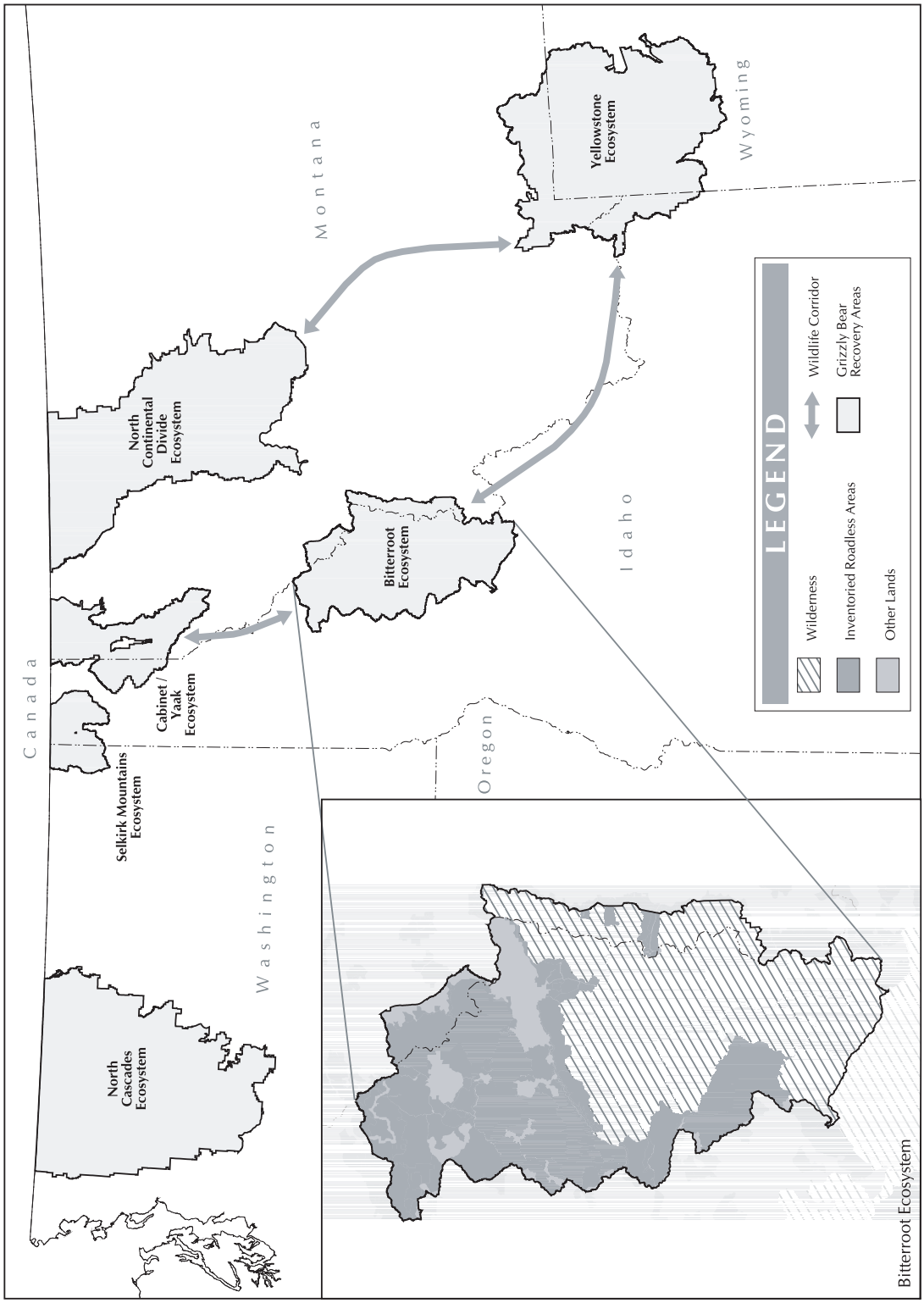


Figure 3-29. Example of inventoried roadless area contributions to the integrity of Grizzly Bear Recovery Areas.

(Roadless Database 2000; USDI Fish and Wildlife Service 1993; Weaver and others 1986)

Table 3-30. Acres, in thousands, of inventoried roadless areas within Grizzly Bear Recovery Areas.

Recovery areas	Total recovery area	Wilderness	Inventoried roadless areas road construction prohibited	Inventoried roadless areas road construction allowed	Wilderness or inventoried roadless area
Bitterroot	3,468	1,713	752	682	3,147
Cabinet/Yaak	1,488	94	332	224	649
North Cascades	6,245	1,928	954	312	3,194
Northern Continental Divide	5,717	1,640	428	688	2,757
Selkirk Mountains	690	42	86	137	265
Yellowstone	5,899	2,126	342	328	2,797

(Roadless Database 2000)

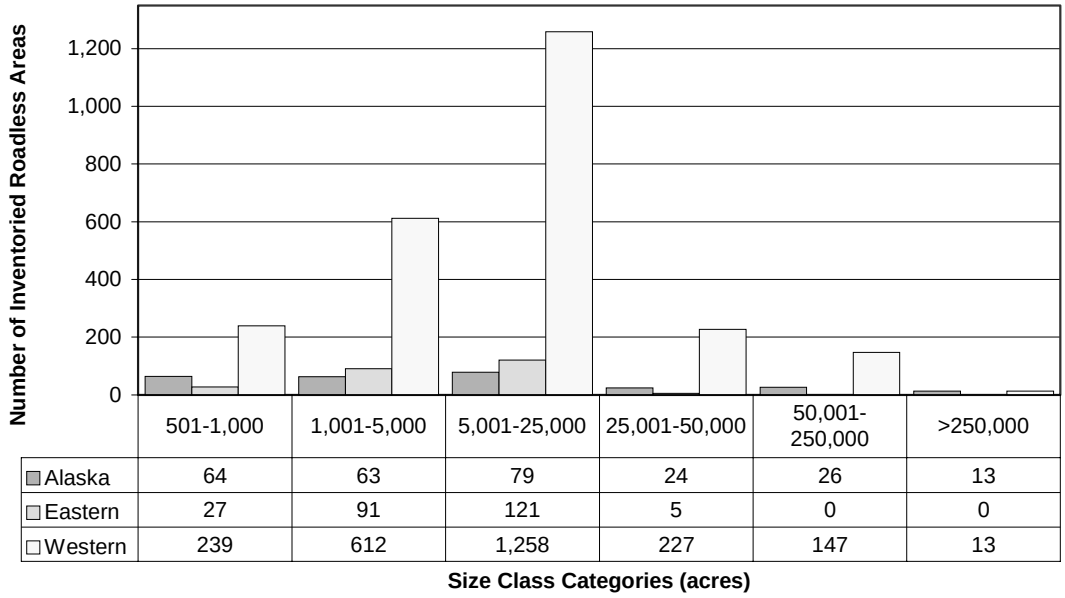


Figure 3-30. Size class distribution of protected inventoried roadless areas under Alternative 2.
(Roadless Database 2000)

In Alaska, the number of inventoried roadless areas more than 5,000 acres would increase slightly from 122 under Alternative 1 to 142 (Figure 3-27 and 3-30). However, the acreage in the upper size classes would nearly double. In the less than 5,000-acre size classes, the number of inventoried roadless map units would shrink by about half.

Most designated Wilderness areas on the national forests are less than 50,000 acres in size (277 areas totaling 5 million acres), and 30 areas exceed 250,000 acres (totaling 20 million acres). This alternative would increase the amount of inventoried roadless area adjacent to Wilderness from about 9 million to more than 20 million acres. When

adjacent inventoried roadless areas are viewed together with Wilderness areas, the acreage of combined areas smaller than 50,000 acres decreases, while areas larger than 250,000 acres would increase.

The largest inventoried roadless area acreage-adjoining Wilderness occurs in the West where nearly 14 million acres (33%) adjoins Wilderness areas (Table 3-29). The largest increases in the West would occur in the upper size classes. In the 250,000 to 1 million-acre size class, the acres of inventoried roadless areas would increase from 9 to more than 12 million and in the 1 million acre or greater size class; the number of acres would increase from about 10 to nearly 16 million acres (Figure 3-28).

This alternative should support the recovery of grizzly bears in the Western United States by increasing inventoried roadless areas protected from roading by more than 2 million acres within Grizzly Bear Recovery Areas. Likewise, it greatly increases the number and size of wildlife corridors between protected areas. In the East, the area adjoining Wilderness areas would increase from about 122,000 acres to more than 460,000 (Table 3-29). The size class distribution of the contiguous Wilderness and inventoried roadless areas is about the same as under Alternative 1.

Alternatives 3 and 4

The effects on biodiversity related to the size of inventoried roadless areas would be the same as Alternative 2. Overall, this alternative would have the most beneficial effects to biodiversity of all the alternatives.

Elevation Distribution

Affected Environment

Ecologically, the distribution of habitats across a range of elevations can indirectly describe the habitat diversity. Plants that thrive in cold environments with short growing seasons generally dominate habitats at high elevations. Often these habitats have shallow, poor soils, and tree growth is greatly reduced. On the other hand, habitats at low elevations are generally the most productive. Forests at low elevations grow some of the largest trees in North America, such as redwood and Douglas fir, which grow along the coast of northern California. Furthermore, species richness is generally greater at low and mid-elevations (see summary by Noss and Cooperrider 1994). Human settlement in North America has had the greatest impact on lower elevation habitats. These areas were the most accessible and the most productive, consequently the amount of low elevation habitat types is much less than high elevation types.

Alternative 1 – No Action

In the West, only about 1 million acres of land is below 1,000 feet in elevation. Most land is above 4,000 feet. Likewise, most of the land that is currently unroaded due to Wilderness designation or decisions in land management plans is at higher elevations. Less than 10% of the land below 1,000 feet in the West is protected (Table 3-31).

In the East, about 2.8 million acres are currently protected in Wilderness, areas recommended for Wilderness, and inventoried roadless areas where land management plans currently prohibit road construction. More than 70% of this land lies between 1,000 and 3,000 feet in elevation. Very little acreage is protected above 4,000 feet or below 2,000 feet. This situation is most pronounced on forests in the Southeastern United States, since there are very few designated Wilderness Areas, or other areas that limit road construction.

In Alaska, more than 55% of all elevation classes are currently protected from road construction. Above 5,000 feet, more than 75% of the land is in categories that prevent road construction. On the Tongass National Forest, more than 55% of elevation classes between 3,000 and 7,000 feet are protected, and more than 30% of the classes between 0 and 3,000 feet are protected from roading.

Alternatives 2 through 4

Habitat protected from roading would increase across all elevation classes in the NFS under this alternative. More than 74% of all elevation classes in Alaska would be protected from roading with the largest increases occurring in the lower elevation classes. In the West, more than 20% of elevation classes at about 1,000 feet would be protected from roading. Elevations below 1000 feet would be the least protected in both the East and West.

Terrestrial Animal Habitat and Species

Affected Environment

Inventoried roadless areas encompass a range of habitat types including grass and shrublands, young forested stands, and **old-growth forests**. The character, distribution, and extent of habitats are affected by the size of an area, the kinds, intensity and timing of management-induced and natural disturbances that have occurred, and the landscape context in which they are found. Inventoried roadless areas provide large, relatively undisturbed blocks of important habitat for terrestrial animal species and communities. In addition to supplying or influencing habitat for more than 300 TEPS terrestrial animal species, these areas support numerous other game and non-game vertebrate and invertebrate species.

Many of these inventoried roadless areas function as biological strongholds and places of refuge for many species, covering the spectrum from wide-ranging carnivores to narrowly distributed endemic snails (that is, restricted to a specific location). Some of these areas may play an increasing role in supporting species viability and overall native biodiversity than in the past, due to the cumulative degradation and loss of other habitat in adjacent landscapes.

In general, the composition of, and relationships between native plant and animal communities in inventoried roadless areas may be less disrupted than in roaded areas of similar size. Species richness and native biodiversity are more likely to be effectively

Table 3-31. Distribution of inventoried roadless areas and Wilderness Areas by elevation class and geographic division.

Elevation classes (feet)	Total area within National Forest System[a] (thousand acres)	Inventoried roadless areas where road construction is allowed within each elevation class (%)	Inventoried roadless areas where road construction is prohibited within each elevation class (%)	Wilderness Areas within each elevation class (%)	Wilderness areas or inventoried roadless area within each elevation class (%)
	Alaska				
0000-1000	8,109	17	36	20	73
1001-2000	5,278	22	39	25	87
2001-3000	3,376	24	45	26	95
3001-4000	2,499	24	48	25	97
4001-5000	1,518	20	54	24	97
5001-6000	587	15	56	27	98
6001-7000	170	11	69	18	98
7001-8000	63	10	78	11	99
8001-9000	35	4	95	1	99
>9000	30	3	95	0	98
	Eastern U.S.				
0000-1000	19,431	1	+[b]	2	3
1001-2000	18,219	2	1	8	10
2001-3000	5,251	6	5	5	16
3001-4000	2,466	8	6	8	22
4001-5000	441	11	4	11	26
5001-6000	53	16	4	23	42
>6000	3	26	10	7	44
	Western U.S.				
0000-1000	1,214	2	5	4	11
1001-2000	3,440	7	7	8	22
2001-3000	11,497	9	5	8	22
3001-4000	15,503	9	7	10	25
4001-5000	24,804	9	6	10	25
5001-6000	24,577	12	8	15	34
6001-7000	25,484	20	10	17	46
7001-8000	24,197	28	10	16	53
8001-9000	18,079	30	9	18	57
>9000	21,923	23	9	36	68

[a] Private inholdings not subtracted from acreage.
[b] Represents values greater than 0% but less than 0.5%.
(Roadless Database 2000)

conserved in inventoried roadless areas, particularly in areas large enough to offer a shifting mosaic of habitat patches in various stages of recovery from disturbance (Noss and Cooperrider 1994). For example, in comparing the distribution of inventoried

roadless areas with centers of biodiversity identified in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Quigley and Arbelbide 1997a), these areas cover approximately 21% (1,650,000 acres) of the identified acreage in centers of biodiversity for animals. In addition, almost 10% (2,780,000 acres) of the acreage identified in the ICBEMP as centers of endemism for animals is contained in inventoried roadless areas.

Habitat in these areas is likely to be less fragmented from human activities and more likely to be better connected than in roaded areas of similar size. This is important to a number of species, as the following examples illustrate:

- Fisher, marten, and lynx populations have been negatively affected by habitat fragmentation and loss of connectivity due to timber harvest (Ruggiero and others 1994) and **roads** in forested areas (USDI Fish and Wildlife Service 1998b).
- Hargis and others (1999) documented an adverse response by American martens even to low levels of habitat fragmentation in the Uinta Mountains and determined that martens also respond negatively to increased size and proximity of open areas such as clearcuts.
- Analyses done in the northern Rocky Mountains illustrate the value of inventoried roadless areas in supporting connectivity between large core areas of quality habitat for grizzly bear, mountain lion, and elk, and in providing important contributions of core habitat (American Wildlands, 2000). Figure 3-29 illustrates the contribution made by inventoried roadless areas in providing important grizzly bear habitat.
- Smaller habitat patch size and loss of interior forest habitat has adverse effects on numerous species dependent on such habitat including some neotropical migratory bird species such as the cerulean warbler, hooded warbler, and wood thrush (Southern Appalachian Man and the Biosphere 1996a).

Inventoried roadless areas may provide important habitat to species that are sensitive to human disturbance. Such disturbance can disrupt species migration, reproduction, and rearing of young, and can increase physiological stress. The importance of this type of habitat has been identified in a number of studies:

- Isolated forest habitat has been shown to be essential for wolverine presence (Ruggiero and others 1994).
- In some areas, large mammals, such as elk, bighorn sheep, grizzly bear and wolf, exhibit strong road avoidance (Trombulak and Frissell 2000).
- The recovery plan for the grizzly bear acknowledges that increases in bear-human conflicts or adverse changes in the quality and security of habitat can affect population viability (USDI Fish and Wildlife Service 1993).
- Remoteness from human activity is a key characteristic of black bear habitat (Southern Appalachian Man and the Biosphere 1996c).
- In selection of nest sites, some bird species, including bald eagles, golden eagles, and sandhill cranes, may avoid areas close to roads (Anthony and Isaacs 1989; Fernandez 1993; Norling and others 1992).

It has become increasingly apparent that in certain parts of the country some types of past timber harvest, combined with the effectiveness of wildland fire suppression over the past century, have caused significant ecological shifts in vegetation composition and structure.

Fire regimes have become altered in some vegetation types because of increasing fuel loads and flammability. These changes in vegetation have resulted in habitat losses for species using open old growth and early seral stages such as the flammulated owl and northern goshawk (Smith 2000). Conversely, multi-storied, late-successional forested habitats preferred by species such as the northern spotted owl, pileated woodpecker, and American marten, have been enhanced in some areas.

Response activities for fire suppression in inventoried roadless areas have likely been more limited in the past, due in part to a lower priority being placed on rapid suppression of fires in these areas, relative to fires in roaded and more developed areas. Many of these areas have also had lower levels of commodity timber harvest, which can remove larger and more fire resistant trees, leaving smaller diameter, less fire resistant stems. Stand conditions within these areas may lie within or closer to the historic range of variability, and they may have more normal levels of fuel loading and stand composition and structure. The precise condition of these areas relative to risk of uncharacteristic wildland fire effects has not been determined, but estimates made indicated that approximately 8 million acres, or 14%, of inventoried roadless areas in all fire regimes may be at high risk of uncharacteristic wildfire effects. This compares to an estimate of 38 million acres or 20% of all NFS lands estimated to be at high risk. Further discussion relative to regional levels of risk can be found in the Fuel Management section in this chapter.

Many inventoried roadless areas include plant associations (for example Rocky Mountain lodgepole pine, spruce/fir/whitebark pine and true fir/hemlock) where long fire intervals (70 to 400 years) and stand-replacement fires are consistent with the historic range of variability. In many cases, these are associated with upper elevation fire regimes that encompass a significant amount of inventoried roadless areas. For example, in the western United States 32% and 39% of inventoried roadless areas are > 9,000 feet and 8000-9000 feet in elevation respectively. As exemplified by the 1988 Yellowstone fires, both uniform stand-replacing fire events and mosaic mixed severity fire events are possible in these areas.

For many terrestrial ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildland fires that create habitat mosaics can improve foraging habitat for lynx (USDA Forest Service and others 2000a), wild turkey, black bear, elk, and northern goshawk (Smith 2000).

Alternative 1 - No Action

Approximately 40% of the 58.5 million acres of inventoried roadless areas are covered by land management-plan prescriptions that currently prohibit road construction and reconstruction, while the other 60% does not. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1. If this rate of entry continues, over the next century, this could equal 50% of inventoried roadless areas being

affected by roaded entry. The actual amount, however, would probably be much lower due to rugged terrain in many of these areas, and public controversy over entry into inventoried roadless areas.

An estimated 1,160 miles of permanent and temporary road construction or reconstruction is planned through 2004. Table 3-32 displays total planned offer volumes and miles of road construction and reconstruction through 2004, by alternative, both with and without the Tongass exemption. Timber harvest under this alternative would occur on an estimated 18,000 acres of inventoried roadless areas per year initially, dropping to about 14,000 acres annually in the long term.

The type and extent of impacts to terrestrial species and habitats from this road construction would depend on road location and design, mitigation measures applied, the activities that are enabled, the amount and kinds of other activities occurring in adjacent areas, current condition of species populations, and the kinds and intensities of natural and human-induced disturbances in the area. With application of current design standards and best management practices, the effects of these kinds of activities have been mitigated or avoided in many situations. Some effects, however, cannot be mitigated, such as increased levels of habitat fragmentation.

Table 3-32. Total planned timber offer and miles of road construction and reconstruction for all activities through 2004, by alternative.

	Total planned offer (MMBF [a])		Total miles road construction/reconstruction	
Alternative	With Tongass National Forest exemption	Without Tongass National Forest exemption	With Tongass National Forest exemption	Without Tongass National Forest exemption
1	1,100	1,100	1,160	1,160
2	840	300	597	293
3	700	160	597	293
4	0	0	597	293

[a] Million board feet

Some of the potential direct and indirect adverse effects of road construction and timber harvest include:

- Increased fragmentation and loss of connectivity,
- Adverse edge effects for some species,
- Habitat loss, and losses of habitat suitability and effectiveness for some species,
- Increased risk of introduction and establishment of nonnative invasive species, and
- Increased potential for negative interactions with humans and illegal collection or over harvest of some species.

Some of the potential beneficial effects of road construction and timber harvest include:

- Enhanced access for some plant and wildlife management activities (for example, census survey and collection, and structure maintenance),

- Easier access for habitat restoration and enhancement for some species through stand manipulation,
- Creation of edge habitat and early successional habitat used by some species, and
- Easier access for hunting and wildlife viewing activities.

Almost all roads present some level of benefits and risks. These effects can vary greatly in degree (USDA Forest Service 2000h), and can shift over time. Some effects are immediately apparent, but others may require external events, such as a large storm, to become visible. Still other effects may be subtle, such as increased susceptibility to invasion by nonnative species or pathogens noticed only when they become widespread in the landscape, or with increased road use as recreation styles and motor vehicles change (USDA Forest Service 2000h). A road-related beneficial effect for one species, may, in fact, represent an adverse effect for another. For example, although forest edges, such as those created by road construction and timber harvest, may benefit some species, such as deer and bobwhite quail, they also provide access to interior forest patches for opportunistic or predator species (Norse and others 1986).

Beneficial effects to terrestrial species from timber harvest activities are often due to creating or maintaining some specific habitat condition. Timber harvest creates forest age-class diversity and mosaic habitats used by some species (Wisdom and others 2000; USDA and others 2000; Southern Appalachian Man and the Biosphere 1996c; USDA Forest Service 1995a; USDI Fish and Wildlife Service 1990; USDI Fish and Wildlife Service 1976). Some species require early seral or open-forest habitats that can be created and maintained by properly planned, restorative timber harvest. Timber harvest activities may also reduce the risk of uncharacteristic large stand-replacing insect and disease outbreaks and severe wildland fires. These disturbance events, can present both benefits and risks to some species (Wisdom and others 2000; USDI Fish and Wildlife Service 1995a; USDA and others 1993), at least at a local level. Some examples of timber harvest potential beneficial effects include the following:

- Timber harvest can be used to benefit species like the red-cockaded woodpecker (USDA Forest Service 1995a), Florida scrub jay (USDI Fish and Wildlife Service 1990), and Kirtland's warbler (USDI Fish and Wildlife Service 1976) by creating and maintaining open forest or early seral conditions.
- The Mexican spotted owl may benefit from timber harvest activities that maintain and develop large old-growth pine habitats, and alleviate risk from wildland fire, insects, and disease (USDI Fish and Wildlife Service 1995a).
- The snowshoe hare, a primary lynx prey species, can benefit from properly planned regeneration harvests (USDA Forest Service and others 2000).
- Reynolds and others (1991) suggest that active management activities like tree thinning may be beneficial in producing and maintaining the desired conditions for sustaining goshawks and their prey species.

Fragmentation and Connectivity – Landscape fragmentation and loss of connectivity from road and timber harvest causes habitat loss, increases in edge effects, and increases in habitat isolation (British Columbia Ministry of Forest Research Program 1997). As described under the previous section on fragmentation, roads can increase forest fragmentation by breaking up large patches and converting interior forest into edge habitat (Reed and others 1996).

Forest fragmentation affects terrestrial species to different extents and at different scales. In studying fragmentation in Douglas fir forests in northwestern California, Rosenberg and Raphael (1986) found that species showing the most sensitivity to fragmentation included fisher, gray fox, spotted owl, and pileated woodpecker. As road construction, reconstruction, and timber harvest activities increase habitat fragmentation across large areas, populations of some species may become isolated into smaller groups, which increase the risk of local extirpations or extinctions (Noss and Cooperrider 1994). In examining the effects of road construction on wetland biodiversity, Findlay and Bourdages (2000) found increases in local extinction rates and decreases in re-colonization rates, with effects sometimes taking decades to be apparent.
Roads can fragment habitat for some invertebrates, particularly for less mobile, ground dwelling species. In the Klamath-Siskiyou province, researchers have identified habitat fragmentation for common land snails caused by roads and other land-disturbing activities (Frest personal communication). Reasons cited included microclimate changes on the road surface, loss of habitat complexity and structure, effective width of roads greater than actual width, and avoidance of exhaust residues, petroleum products, and other chemicals. Baur and Baur (1990) documented similar road avoidance findings for the land snail *Arianta arbustorum*, which avoids crossing even small, unpaved roads. Timber harvest, particularly where associated with extensive ground disturbance and canopy removal, may have adverse effects on some invertebrate populations (Frest 1993; Frest and Johannes 1995).

Edge Effects – Roads create environmental edges whose effects may extend well beyond the actual road. Loss of canopy along road corridors may result in greater temperature extremes, more exposure to winds, more direct sunlight within adjacent zones, and changes in relative humidity (Chen and others 1996; Chen and others 1993). The distance that this effect may extend is highly variable. The zone of disturbance related to road noise is estimated to be as great as one-half mile in forested areas (Forman and Deblinger 2000). Haskell (2000) found a large drop in abundance and diversity of macro invertebrate soil fauna close to NFS roads, with effects extending up to 100 meters into the forest.

Forest edges, such as those created by timber harvest and road construction, may benefit some species, such as deer and bobwhite quail. The close proximity of cover and forage areas at forest edges provides ideal habitat for many game species (see Game Species). However, edges also provide access to interior forest patches for opportunistic species, such as the brown-headed cowbird, with effects extending into forest interiors as far as 600 meters from an edge (Norse and others 1986). Cowbirds are implicated in the decline of certain songbirds in the Sierra Nevada, including the willow flycatcher, least Bell's vireo, yellow warbler, chipping sparrow, and song sparrow (Sierra Nevada Ecosystem Project 1996).

Habitat Suitability and Effectiveness – For some mammals, open road density has been shown to be indicative of habitat suitability, with increases in road density related to declines in habitat effectiveness and population viability (Noss and Cooperrider 1994). Some research has shown that the presence of a few large areas with low road density, even when found within an area with an overall high road density, is a key indicator of

suitable habitat for large vertebrates (Rudis 1995). Unroaded areas may provide important security habitat for some species year round. Black bear population size was shown to be negatively associated with road density in the Adirondack Mountains (USDA Forest Service 2000h). Road density is a major determining factor for suitability of habitat for grizzly bear, a species with a home range size of 50 to 300 square miles for females and 200 to 500 square miles for males (USDI Fish and Wildlife Service 1993).

With an expected increase in roaded access into these areas, a corresponding increase in human disturbance is expected. Potential for harassment, disruption, and poaching of some species would increase. Species, such as forest carnivores, that require sites free from human disturbance are likely to be adversely affected. Habitat effectiveness for deer and elk has been shown to decrease with increases in open road density in some areas (Thomas and others 1979). Rowland and others, (in press) found that female elk in the Starkey Experimental Forest consistently used areas away from open roads in spring and summer, and that spatial distribution and distance to roads were more accurate predictors of habitat effectiveness than overall road density.

In their proposal to list the Canada lynx under the ESA, the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998b) found that this species is threatened by human alteration of forests and by increased levels of human access into lynx habitats. Factors identified as threats to this species included timber management, forest and **backcountry** roads and trails, fragmentation and degradation of lynx **refugia**, and habitat degradation by nonnative invasive plant species. The lynx was listed as threatened on March 24, 2000.

In evaluating species-road relationships for 91 vertebrate species in the Interior Columbia River Basin, Wisdom and others (2000) found that more than 70% of those species could be negatively affected by one or more factors associated with roads. They concluded, from their review of scientific literature, that there are numerous potential adverse effects related to road construction and use. Some of their findings include:

- Road construction converts large areas of habitat to nonhabitat (Hann and others 1997; Reed and others 1996).
- Loss of large trees, snags, and logs in areas adjacent to roads through commercial harvest or firewood cutting has adverse effects on cavity dependent birds and mammals (Hann and others 1997).
- Roads facilitate poaching (Cole and others 1997) of many large mammals such as caribou, pronghorn, mountain goat, bighorn sheep, wolf, and grizzly bear (Dood and others 1985; Knight and others 1988; McLellan and Shackleton 1988; Mech 1970; Stelfox 1971; Yoakum 1978).
- Roads provide access for chronic, negative interactions of humans with wolves and grizzly bears (Mace and others 1996; Mattson and others 1992; Thiel 1985), which increases mortality of both species and often causes high-quality habitats near roads to serve as population sinks (Mattson and others 1996; Mech 1973).
- Reptiles seek roads for thermal cooling and heating and experience substantial mortality from motorized vehicles (Vestjens 1973). Roads facilitate human access into habitats for collection and killing of reptiles.

- Many species are sensitive to harassment or human presence during particular seasons, with potential reductions in productivity, increases in energy expenditures, or displacements in population distribution or habitat use (Bennett 1991; Mader 1984).
- Roads often restrict the movements of small mammals (Mader 1984; Merriam and others 1988; Swihart and Slade 1984) and function as barriers to population dispersal (Oxley and Fenton 1974).

Trombulak and Frissell (2000) drew similar conclusions in their review of scientific literature on the ecological effects of roads. They identified seven general, potential effects of roads: mortality related to construction, mortality from being hit by vehicles, behavioral modifications, changes in the physical environment, changes in the chemical environment, introduction and establishment of nonnative species, and increased human use of roaded areas. They concluded that, although not all species and ecosystems are affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems. These effects included detrimental changes in species distribution, composition, and population size.

Although only used for relatively short periods, temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in an area to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the area than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used for periods ranging up to ten years, and are then decommissioned, their short- and long-term effects can be extensive to terrestrial species and habitats.

In addition to posing many of the same risks as road construction, road reconstruction could result in substantial changes in the kinds and amount of human uses in an area. Improvements such as realignment or improving road surfacing or gradient to provide easy access for low clearance vehicles may promote increases in the amount of human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Early Successional Habitat – Although early successional habitat is well represented in many parts of the country, questions have been raised in some areas relative to the potential effects of the road and timber harvest prohibitions on the availability of this type of habitat, particularly in the Eastern and Southern Forest Service regions. Early successional communities are characterized and shaped by differences in structure, composition, and successional pathways. Such communities can include grasslands, shrublands, semi-forested habitat, and open land communities within larger forest patches.

Types of disturbance affecting the development, availability, and distribution of some early successional habitat include natural processes and events such as fire, wind, insect and disease, and management-induced disturbance associated with land use practices,

such as timber harvest, road construction, and prescribed fire (USDA Forest Service 1999e; Southern Appalachian Man and the Biosphere 1996c). When human-induced disturbances reset the successional clock to an earlier stage, they frequently affect larger areas and result in increased mean patch size, with adverse effects on habitat suitability for many species (Verner 1986). Natural disturbances, such as wildland fires, can also affect large areas of land and modify habitat suitability. In many cases, wildland fires blend into larger landscapes, and the adverse impacts are less severe or negligible.

In the United States, the abundance and distribution of many early-successional species before European settlement is unknown. It is estimated that by 1820 in New England, less than 25% of the original forest was left on land that was suitable for agriculture. By the middle of the 19th Century, New England was experiencing wood shortages. This sizeable increase in early successional habitat was likely followed by corresponding increases of populations and distributions of species using such habitat. As forested habitats have become reestablished in this century in some areas, there has been a corresponding decline in some species directly or indirectly dependent on early successional habitat. For example, as forest cover increased in New Hampshire by 40% between 1880 and 1980, New England cottontail populations decreased from a continuous distribution throughout 60% of the State, to a fragmented distribution covering less than 20%; bobcat populations were affected by this decrease in available prey (Trani-Griep 1999; Martin 1999).

Information in the Southern Appalachian Assessment (Southern Appalachian Man and the Biosphere 1996c) indicates that as of 1995, NFS **timberlands** within the approximately 37 million acre assessment area provided about 11% of the habitat in the grass/seedling/shrub successional stage. Non-industrial private lands at that time provided approximately 69% of this stage. Examples of species within the Southern Appalachian Assessment area using early successional habitat include bobwhite quail, ruffed grouse, Bachman's sparrow, and prairie warbler. The Southern Appalachian Assessment identified no T&E species that were principally associated with early successional habitat in the assessment area. A comparison of the habitat information from the Southern Appalachian Assessment with the distribution of inventoried roadless areas shows that less than .09% (approximately 1,380 acres out of 1,570,000 acres) of early successional grass shrub habitat are currently provided by inventoried roadless areas in the assessment area.

Game species – These species are wild animals that people hunt or fish for food or recreation according to prescribed seasons and limits (USDA Forest Service 1999u; USDA Forest Service and USDI Bureau of Land Mangement 2000). They are generally described in terms of either big game (including white-tailed deer, mule deer, elk, bear, wild boar, and turkey) or small game (including ruffed grouse, blue grouse, hare, cottontail rabbits, gray squirrel and quail).

Game species are generally associated with mixed habitat mosaics or patterns that include a variety of habitat types and age classes. In forested areas, early seral patches, natural openings, and open woodlands are important habitat components. Many game species are habitat generalists (for example deer, elk and ruffed grouse,) using a variety of habitats

and therefore, cannot be easily associated with a single habitat type (Southern Appalachian Man and the Biosphere 1996c).

In many areas of the United States, NFS lands, including inventoried roadless areas, are a significant source of high quality game species habitat, given the influences of private land conversions, including urbanization, agriculture, and development. In some cases, NFS lands are strongholds for some game species. For example, black bear populations are increasing in some areas of the Eastern United States in part because of security within NFS lands (Vaughan and Pelton 1995). Lands outside of inventoried roadless areas have important influences on game species populations. As an example, deer and elk winter ranges on many non-NFS lands are critical in maintaining stable populations.

The public interest in providing and maintaining game species habitat on NFS lands is evidenced by the various program initiatives that focus on these species. The Forest Service has partnered with a number of organizations (for example Wild Turkey Federation, Rocky Mountain Elk Foundation, Quail Unlimited) to implement wildlife program initiatives such as: “Answer the Call,” “Elk Country”, “Dancers in the Forest”, “A Million Bucks”, and “Making Tracks.” These initiatives have resulted in substantial amounts of game species-habitat improvement, including the creation and maintenance of early seral habitats in some areas.

A number of factors can influence game populations. For example, State harvest strategies and regulations are an important management tool for achieving desired population levels, especially in big game management (Flather and others 1999). In addition, other factors like predation and disease can influence some game species populations. In recent years, game species population trends have varied, with some species exhibiting declines, while others have increased or remained stable (Flather and others 1999). It is reasonable to assume that many of these game species-population trends are substantially influenced by changes in their habitat.

Flather and others (1999) in *Wildlife Resource Trends in the United States* concluded that a nation-wide (but most evident in the 20 northern States) decrease in species that are associated with early seral stages (and grasslands) could be expected in the next 20 years. However, this conclusion is not necessarily indicative of what would happen to game species populations. In fact, Flather and others (1999) predict that many game species populations are expected to remain relatively stable to the year 2045 (the 50 year outer benchmark for their long-term population projections), including black bear, wild turkey, pronghorn, and deer. Elk are expected to decrease slightly after recent population increases and range expansion (Flather and others 1999). Many small game species like ruffed grouse and bobwhite quail appear to be declining in some parts of the country (USDA Forest Service 1999u; Southern Appalachian Man and the Biosphere 1996c). These declines in part may be due to reductions in the amount of early seral and shrub dominated sites.

Roads can serve a number of purposes relative to game management. They can provide access for timber harvest activities that can improve or enhance game species habitats. Some roads provide access for other kinds of game species-habitat improvements,

including, construction and maintenance of water developments (for example guzzlers, ponds and spring boxes). In addition, roads are often used to facilitate the maintenance of natural and created openings.

Timber harvest activities can fundamentally change the composition and configuration of game species habitats. These changes can alter and modify animal behavior, causing changes in population numbers and distribution. Whether the impacts are adverse or beneficial depends on species needs, and the extent, duration, timing and intensity of timber harvest activities and associated roads.

Timber harvest activities that create, restore, and maintain a mixture of habitats and a variety of age classes are generally beneficial to most game species. Thus, timber harvest activities can be designed to meet specific game species habitat needs, and have positive impacts (Brown 1985; Hoover and Wills 1984; Thomas 1979). For example, timber harvest designs that create and maintain edge, early seral patches, natural openings, and open woodland habitats, are beneficial for most game species (Southern Appalachian Man and the Biosphere 1996c; USDA 1999u; Flather and others 1999; USDA Forest Service and USDI Bureau of Land Management 2000). In some managed forest areas, deer and elk populations have benefited from improved forage conditions created by some timber harvest activities (USDA Forest Service and USDI Bureau of Land Management 2000). Turkey (Dickson 1992), forest grouse, and quail have benefited from openings and saplings created by some timber management activities. Generally, timber harvest activities in combination with access management strategies that reduce road densities are more effective at providing high quality game species habitats.

Conversely, when timber activities are poorly placed on the landscape, and road densities are not managed, game populations can decline due to poaching, concentrated legal hunting (USDA Forest Service 1999p), reduced habitat quality or habitat loss (Brown 1985; Hoover and Wills 1984; Thomas 1979). There is evidence that inventoried roadless areas are important security areas and linkages for some game species.

Late Successional Habitat – Inventoried roadless areas encompass a variety of cover types and age classes, including late successional habitats. Late successional or old-growth forest has been defined as forest stands that are greater than 100 years old (Southern Appalachian Man and the Biosphere 1996c; USDA 1999u). They are also defined as the later stages of stand development with large trees, large-size dead trees standing and on the ground, multiple canopy layers, canopy gaps and decadence in the form of broken or deformed tree tops, boles and root decays (USDA Forest Service and USDI Bureau of Land Management 2000). Forest Ecosystem Management Assessment Team 1993 defined late successional habitats as “forests older than 80 years.” Some late successional habitats have developed with frequent disturbances (such as fires) resulting in large tree single story structure.

Various efforts at defining and delineating late successional habitats have occurred for NFS lands. For example, the Forest Ecosystem Management Assessment Team (USDA and others 1993) estimated that approximately 4.5 million acres of medium/large multistoried conifer late successional habitat occurred within the 57 million acre range of the northern spotted owl. The Southern Appalachian Assessment (Southern Appalachian

Man and the Biosphere 1996c) estimated that approximately 1.1 million acres of late successional habitat occurred in the assessment area in 1995. Some late successional habitats are considered critically endangered, such as Eastern deciduous and Western ponderosa pine forests (Noss and others 1994).

Much of the late successional habitat remaining on NFS lands is highly fragmented and poorly connected because of past management activities and natural disturbances. Late successional habitats associated with inventoried roadless areas are often better connected than those found in roaded areas, and are often linked to larger intact forests in Wilderness and other protected areas. This connectivity provides benefits for a number of late successional associated species such as the northern spotted owl, marbled murrelet, fisher, white-headed woodpecker, and American marten.

Timber harvest to improve late successional habitat could be implemented under Alternatives 2 and 3. Alternative 4 prohibits timber harvest activities, but provides an exception for timber harvest activities needed for the protection or recovery of T&E species. In addition, prescribed fire continues to be an acceptable management tool for maintaining some single-storied late successional habitats.

Summary of Effects – Relative to Alternatives 2, 3, and 4, the No Action Alternative would result in a greater likelihood of measurable losses of habitat quality and quantity in inventoried roadless areas. Assuming that roaded entry and timber harvest would continue in these areas at rates approximating that occurring in the past 20 years and given the risks associated with timber harvest and other road-dependent activities, the No Action Alternative would have the greatest potential for adverse effects to some species and to overall biodiversity,

Mitigation measures offsetting some adverse effects would undoubtedly be identified as part of site-specific NEPA decisions and ESA consultations. However, some adverse effect, such as increased habitat fragmentation and loss of connectivity, cannot be effectively mitigated.

Alternative 2

With a prohibition on road construction and reconstruction in inventoried roadless areas, the potential for increased levels of human-caused disturbance and degradation of terrestrial habitat quality, quantity and distribution would be substantially reduced relative to Alternative 1, particularly in those inventoried roadless areas currently open to road construction. A description of the potential adverse effects of road construction is provided under Alternative 1. This alternative does not prohibit any type of timber harvest, but the overall level of timber harvest would be reduced by a prohibition on road construction and reconstruction.

Alternative 2 would offer a greater degree of assurance than Alternative 1 that current biodiversity would be maintained. Based on estimates provided by each national forest, there would be approximately a 75% reduction in the total miles of road that would be constructed or reconstructed in inventoried roadless areas through 2004 under

Alternatives 2, 3, and 4. Under the exceptions common to all action alternatives (as described in Chapter 2), approximately 300 miles of road would be constructed or reconstructed. See Table 3-32 for a comparison of planned timber offer volume and miles of road construction and reconstruction by alternative both with and without the Tongass National Forest exemption.

Even though there could continue to be stewardship and commodity-purpose timber-harvest activities in inventoried roadless areas, information collected from the forests indicates that much of the timber harvest currently planned in these areas would require road construction and reconstruction and hence, would not occur under this alternative, as shown in Table 3-32. The remaining timber harvest in inventoried roadless areas would potentially occur on an estimated 8,000 acres per year, dropping to half that level in the long term. Approximately 2.8 million acres of inventoried roadless areas have had classified roads constructed since the time of inventory, under land management plan prescriptions that allowed road construction. In addition, in some areas, one or more roads were present at the time of inventory. Prohibiting further road construction in these areas would provide some level of benefits to the overall area, by avoiding the additional risks inherent with new road construction or reconstruction, such as additional landscape fragmentation and loss of connectivity, increased levels of human activities, and nonnative species introductions.

Wildlife management activities that are not dependent on new or reconstructed road access would be feasible under this alternative. Information submitted by each national forest on terrestrial wildlife projects that would potentially be precluded if road construction and reconstruction were prohibited in inventoried roadless areas indicates that, within the next 5 years, seven projects are planned nationwide that, as currently designed, could not be implemented. Almost 15 miles of road construction or reconstruction would be associated with these projects. Types of projects identified include thinning and fuels management in late successional reserves, aspen regeneration, other stewardship timber harvest for habitat improvement, and prescribed fire. It is likely that at least some of these projects could be redesigned so that they could proceed without road construction or reconstruction in inventoried roadless areas.

Nationally, the average number of wildlife projects precluded per year by this alternative is less than 2, which is estimated to be substantially less than 1% of the overall national program, based on the 1999 Wildlife, Fish and Rare Plants reporting system database (USDA Forest Service 2000d). It appears that few roads are built into inventoried roadless areas to support wildlife management activities. As a result, this alternative would not limit the current overall ability of the Agency to manage wildlife habitat in inventoried roadless areas, including the ability to maintain or enhance early or late successional habitat or create and maintain mixed habitat mosaics where such need is demonstrated or to implement other stewardship-timber harvest activities.

The prohibition on road construction and reconstruction under Alternative 2 would have a negligible effect on management of game species and their habitats. While this alternative would prohibit new roads, it would not affect existing transportation systems. Existing access for wildlife management activities would not be affected. The current

capabilities and tools to design and implement habitat-improvement methods and techniques would be retained under Alternative 2, although alternative means of access may be needed for implementation. In addition, other timber harvest projects planned and implemented in inventoried roadless areas, but not necessarily driven by game species objectives (for example threatened, endangered, and proposed (TEP) species objectives, forest health or fuels management objectives) may also benefit some game species.

Summary of Effects – The prohibition on road construction and reconstruction would avoid many of the potential adverse affects of roads to terrestrial animal species and habitats, as described under Alternative 1. This includes habitat loss and fragmentation, negative edge effects, increased fire risk, access for poaching, increased potential for excessive hunting pressure, harassment and disturbance, movement barriers, displacement or avoidance behavior, increased potential for establishment of nonnative invasive species, and greater risk of chronic negative interactions with people (Wisdom and others 2000; USDA Forest Service 2000h). No adverse effects to terrestrial animal species and habitats would be expected, as this alternative does not directly authorize any ground disturbing activities, nor does it preclude any activities essential for management of these species or their habitats by this Agency or other government agencies with jurisdictional responsibilities. Overall, beneficial effects to conservation of biological diversity would be expected.

Alternative 3

By prohibiting road construction and reconstruction and non-stewardship timber harvest, Alternative 3 would provide a greater likelihood that terrestrial habitats, species, and their associated plant and animal communities, would be maintained at current levels, relative to Alternative 1. A description of the potential adverse effects of road construction and timber harvest is provided under Alternative 1. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. An estimated 4,400 acres per year would be harvested under this alternative, dropping to about 1,300 acres per year in the long term.

Relative to Alternative 2, the additional prohibition of non-stewardship timber harvest would further reduce the potential for adverse effects to species and habitats. Over time, this additional prohibition could provide important cumulative beneficial effects relative to conservation of terrestrial species and habitats, beyond those described under Alternative 2.

By retaining the ability to harvest timber for stewardship purposes, the Agency's capability to enhance habitat directly and indirectly would be maintained, making this alternative potentially somewhat more ecologically beneficial compared to Alternative 4. Timber harvest for stewardship purposes is described in the Timber Sale Program Information Reporting System as " . . . sales being made primarily to help achieve desired ecological conditions and/or to attain some non-timber resource objective that requires manipulating the existing vegetation – for example, improving forest health or reducing forest fuels" (USDA Forest Service 1998b). Projects where the primary objective would be restoring wildlife habitat would be included in this category. This could potentially

have beneficial effects for some species on a site-specific basis. An example of stewardship timber harvest beneficial to a species would be mid-story vegetation removal for enhancement of foraging habitat for red-cockaded woodpecker (USDA Forest Service 1995a).

Summary of Effects – This alternative would not affect the current overall ability of the Agency to manage wildlife habitat including the ability to maintain or enhance early or late successional habitat, create, or maintain mixed habitat patches, where such need is demonstrated. No adverse environmental effects to terrestrial species would be expected from this alternative, as it would not directly authorize any ground-disturbing activities, nor would it preclude activities essential for management of these species, and their habitats, by this or other government agencies with jurisdictional responsibility. The overall ability of the Agency to implement management actions for conservation of terrestrial animal communities would not be affected.

Alternative 4

This alternative would prohibit road construction, reconstruction, and all timber harvest except for that needed for protection or recovery of TEP species. Alternative 4 would provide a greater likelihood that terrestrial habitats, species and their associated communities, would be maintained at current levels, relative to Alternative 1. A description of the potential adverse effects of road construction and timber harvest that could be avoided is provided under Alternative 1. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Overall, the current need for timber harvest specifically to manage terrestrial wildlife habitat within inventoried roadless area appears to be minimal. In fiscal year 1997, approximately 15% of the total **volume harvested** for stewardship purposes on all NFS lands was for wildlife or TEP species habitat management objectives (USDA Forest Service 1998b). The current national capability of the Agency to manage such habitat would not be measurably affected by a prohibition on timber harvest. Alternative 4 does not preclude use of other restorative tools like prescribed fire, which under some conditions can be used without prior timber removal, to benefit early seral and open forest species.

Timber Harvest to Reduce Fuels – Timber harvest to reduce fuel loading may be desirable in some areas where there is an abnormally high risk of high intensity, large-scale fires. Uncertainties about the magnitude and extent of beneficial effects of such activities have to be carefully weighed against the well-documented risks of adverse effects associated with timber harvest and associated road construction. Even though some timber harvest activities are intended to mimic the effects of natural disturbance processes such as fire, there is little known about the long term ecological legacies of such treatments. It is not clear how those legacies would compare to areas where natural disturbance processes have played a more dominant role in controlling successional pathways, landscape mosaics, and ecosystem composition. Analysis conducted by the fire specialist on the FEIS team showed minimal landscape level differences between

Alternatives 2 through 4 and Alternative 1, relative to the likelihood of timber harvest providing significant reductions in the risk of uncharacteristic wildfire effects in inventoried roadless areas.

Regardless of the alternative selected, wildland fires will continue to play a dominant role in shaping terrestrial species habitats in many areas, including many fires that are of a much higher intensity and greater size than those historically occurring within an area. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand-replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. While wildland fires may negatively affect individuals of some species, the overall effects on species populations are less likely to be adverse in nature.

Game Species – The prohibition of timber harvest would probably have limited local impacts on the ability of the Agency to actively manage for the mixed pattern habitats used by game species, although other tools, such as prescribed fire, would continue to be feasible in many areas. Natural disturbances are likely to continue creating and maintaining mixed pattern habitats in inventoried roadless areas for a number of game species.

The prohibitions on timber harvest are not likely to detrimentally impact mule deer, white-tailed deer, and elk populations. Elk populations have been increasing across the west and are expected to continue to increase for the next four decades. In the east, white-tailed deer density information for the Southern Appalachian Assessment (Southern Appalachian Man and the Biosphere 1996c) indicates that the highest densities of deer in the Southern Appalachian Assessment area are found in association with private croplands and agricultural lands. Because of poaching (USDA Forest Service in press), increased hunting pressure (Flather and others 1999), and continuing land use development in many areas, deer and elk populations may benefit from the security and isolation provided by inventoried roadless area protection.

Black bears are habitat generalists utilizing early seral patches, edge, and open forested habitats (Hoover and Wills 1984; Wisdom and others 2000; USDA Forest Service 1999u) in juxtaposition with mid to late seral-forested habitats. Black bears tend be absent for portions of the Southern Appalachians where large amounts of nonforested habitat and limited forested habitat occur. Dense forest cover and security areas, and remoteness provide protection from poaching and hunting and are a key habitat parameter (Southern Appalachian Man and the Biosphere 1996c).

Timber harvest prohibitions would likely benefit bear populations. In the east where poaching, intense hunting pressure and land development are threatening bear populations, one of the primary limiting factors for bears is availability of relatively undisturbed tracts of land habitats. The remaining large tracts of roadless area in the east are important strongholds for bear populations, and may help stabilize bear populations over the long term. In the West, bear populations are expected to remain stable in the Rocky Mountains and increase along the Pacific coast. Eliminating timber harvest and associated new road construction in inventoried roadless areas would avoid habitat

modifications and changes in animal behavior that can detrimentally impact large mammals like bears (USDA Forest Service 2000c; Fredrick 1991). While early seral habitats are important components of bear habitat, the security and isolation provided by inventoried roadless areas are likely more significant at maintaining stable bear populations than are the potential forage opportunities created by timber harvest activities.

Turkeys prefer habitat where openings are interspersed with mature forests (Dickson 1992; USDA Forest Service 1999u). The inventoried roadless areas likely have only a minor influence on changes in turkey populations in the Southern and Northeast regions. Only 6% (1.6 million out of almost 25 million acres) of NFS lands in Regions 8 and 9 are in inventoried roadless areas, therefore the management of areas outside of inventoried roadless areas would likely have the most significant impact on turkey populations. In addition, the prohibitions would likely maintain important security areas, and minimize potential increases in illegal hunting.

It is unlikely that a timber harvest prohibition on the 6% of NFS lands in inventoried roadless areas in Regions 8 and 9 would have an adverse impact on small game populations. The management of NFS and other lands outside of inventoried roadless area would likely have the most significant impact on these populations. Grouse populations have declined since the 1970s possibly due to regional decreases in the amount of sapling/pole seral stages, which grouse favor (Flather and others 1999; Southern Appalachian Man and the Biosphere 1996c; Hoover and Wills 1982; Wisdom and others 2000) or to a decline in winter range higher elevation coniferous forests. Some grouse populations would benefit from protection of upper elevation winter-range habitats. For ruffed grouse in the east, NFS lands provide a significant amount of habitat (Southern Appalachian Man and the Biosphere 1996c), but only about 6% of Region 8 and 9 NFS lands are in inventoried roadless areas.

Squirrel numbers show steady but slight gains in the North, declines in the Rocky Mountains, and declines since 1985 in the South. Gray squirrel populations in the Southern Appalachian Assessment area (1996c) have remained stable and have benefited from increased acorn production from maturation of oak forests. In the West, gray squirrels have declined as interior ponderosa pine and Oregon white oak habitats are converted to human uses (Wisdom and others 2000). Other small game species (e.g., sharp-tailed grouse, bobwhite quail and cottontail rabbits) are found in heavily fragmented forested habitats, but are more closely associated with rangelands, highly interspersed forests, and agricultural and/or croplands (Wisdom and others 2000; Klimstra and Roseberry 1975; Flather and others 1999); these species therefore are not likely to be impacted by the prohibitions.

Summary of Effects – By eliminating the ability to harvest timber for stewardship purposes except when needed for protection or recovery of TEP species, the current capability of the Agency to enhance habitat directly and indirectly would potentially be impaired at the stand level, but it is unlikely to have much impact at larger scales. This would hinder the Agency's ability to use timber harvest to manage for early successional or other structural stages in some areas, where such a need is identified, although prescribed fire is an effective tool under certain conditions. In fiscal year 1997,

approximately 15% of the total volume harvested for stewardship purposes on NFS lands was for wildlife or TEP species habitat-management objectives (USDA Forest Service 1998b). Although adverse effects associated with timber harvest would not occur, this limitation of the Agency's ability to manipulate stand structure and successional stage for habitat improvement would make this alternative potentially less ecologically beneficial compared to Alternative 3.

Aquatic Animal Habitat and Species

Affected Environment

Inventoried roadless areas support a diversity of aquatic habitats and communities, providing or affecting habitat for more than 280 TEPS species, and numerous other aquatic species. Without the disturbances caused by roads and the activities that they enable, stream channel characteristics are less likely to be adversely altered compared with stream channel conditions in roaded areas. Important characteristics that influence habitat quality for aquatic species include channel and floodplain configuration, amount of fine sediment in stream substrate, riparian condition, amount and distribution of woody debris, streamflow, water quality, and temperature regime (Furniss and others 1991). Smaller streams, such as many of those found in inventoried roadless areas, provide important habitat for resident and migratory aquatic species and also influence the quality of habitat in larger, downstream reaches (Chamberlin and others 1991).

Illegal introduction and harvest of aquatic species is less likely to occur in these areas due to lack of ready access. Poaching of large, migratory bull trout, a native char found in the Northwest, has been described as an important cause of mortality (Lee and others 1997). Illegal introduction of nonnative fish species has had measurable effects on native aquatic communities in many parts of the country. For example, the Sierra Nevada Ecosystem Project (SNEP) report (Moyle and others 1996) identified illegal introductions of predatory fish, such as northern pike and white bass, and other nonnative fish, as important causes of disruptions in native fish communities in Sierran waters.

The nonnative fish most commonly established through bait bucket introductions in Sierra Nevada waters was the golden shiner, a species able to survive in many high elevation lakes. Thirty species of nonnative fish have been introduced (both legally and illegally) or have invaded most waters in the Sierra Nevada Range. The SNEP determined that less than half of the 40 fish species native to those waters seem to have stable or expanding populations. Adverse effects to native species included hybridization, increased predation, and competition (Moyle and others 1996.)

Waters in inventoried roadless areas have been shown to function as biological strongholds and refuges for many fish species. The size of an area, kinds and intensity of management-induced and natural disturbances that have occurred, and the landscape context in which it is found, all affect the quality, distribution, and extent of these habitats. Some of these waters may now play a relatively much greater role in supporting aquatic species viability and biodiversity than in the past due to cumulative degradation and loss of other, potentially more biologically rich habitat within associated drainages.

The Nature Conservancy and the Association for Biodiversity Information identified the United States as a global center of freshwater biodiversity (Chaplin and others 2000). In examining the distribution of 307 fish species and 158 mussel species that are imperiled or vulnerable, they identified 87 watersheds as aquatic biodiversity hotspots, supporting 10 or more vulnerable or imperiled species. The majority of these watersheds are in the Southeastern United States, with one occurring west of the 100th meridian (Figure 1-1). Inventoried roadless areas are found within 29 of these watersheds, and likely play a role in supporting the continued survival of these species either directly through providing habitat or indirectly by contributing to water quality within the drainage.

Analysis done for the ICBEMP (Lee and others 1997) indicates that strong fish populations are often associated with areas of low road density. That analysis showed that increasing road densities (miles of road per square mile) and their attendant effects were associated with declines in the status of bull trout, westslope cutthroat trout, yellowstone cutthroat trout, and redband trout. Approximately 60% of unroaded or very low road density subwatersheds within the assessment area supported strong salmonid populations. In contrast, less than 25% of subwatersheds with moderate and 18% with high road densities supported strong populations (Quigley and others 1996).

As shown in Table 3-33, approximately 2 million acres of inventoried roadless areas contain high priority watersheds identified in the ICBEMP for conservation of threatened Snake River Chinook, with about half of those acres falling in inventoried roadless areas where road construction is not prohibited by current management direction. An additional 5 million acres of inventoried roadless areas contain identified priority watersheds[9] for conservation of bull trout and other species. Cumulatively, the data indicate that more than 30% of the acreage in designated priority and high priority watersheds for aquatic species are in inventoried roadless areas.

A substantial amount of inventoried roadless areas provide important habitat for Pacific anadromous fish species. Table 3-34 shows the acreage of inventoried roadless areas that lie within the habitat range of Pacific salmonids including those for chinook, chum, coho, and sockeye salmon, as well as steelhead and coastal cutthroat trout. This table also shows acreages of inventoried roadless areas specific to federally listed Pacific salmonids.

In considering the contributions of large unroaded areas for conservation of aquatic habitats and species, comparisons can be drawn from research in other areas lacking roads and with minimal levels of human disturbance. For example, in evaluating the role of Wilderness Areas in conserving aquatic biological integrity in Western Montana, Hitt and Frissell (1999) concluded that, although the presence of designated Wilderness does

[9] Priority Watersheds were identified in the ICBEMP (Quigley and Arbebide 1997a) as those important for conservation of bull trout (from the Inland Fish Strategy), or with potentially “critical habitat” for anadromous species not listed as threatened or endangered under the Endangered Species Act as of March 1996 (from PACFISH); or as watersheds containing high quality habitat but no listed species as of March 1996.

Table 3-33. Inventoried roadless areas (in thousand acres) in ICBEMP [a] priority and high-priority watersheds.

State	Inventoried roadless areas in ICBEMP priority watersheds	Inventoried roadless areas in ICBEMP high-priority watersheds
Idaho	2,952	1,937
Montana	1,527	Not Applicable
Nevada	10	Not Applicable
Oregon	429	92
Washington	174	45
Total	**5,092**	**2,074**

[a] Interior Columbia Basin Ecosystem Management Project
(Roadless Database 2000)

Table 3-34. Pacific anadromous fish habitat in inventoried roadless areas (in thousand acres).

Species	Inventoried roadless areas within the range of Pacific salmonids	Inventoried roadless areas within the range of threatened and endangered Pacific salmonids
Chinook Salmon	8,869	6,314
Chum Salmon	1,401	95
Coho Salmon	1,823	1,175
Sockeye Salmon	258	179
Steelhead	7,593	6,033
Coastal Cutthroat Trout	1,884	156

(National Marine Fisheries Service [NMFS]; Roadless Database 2000)

not guarantee aquatic biological integrity due to factors such as fish stocking practices and impacts from adjacent roads, “the importance of Wilderness in aquatic conservation is extraordinary.” Their analysis showed that more than 65% of waters that were rated as having high aquatic biological integrity were found within subwatersheds containing Wilderness. They also concluded that, given the relative rarity of unprotected areas that support a relatively greater degree of aquatic biological integrity, undisturbed areas warrant permanent protection.

For many aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many species evolved under the influence of recurrent fire, including stand-replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these kinds of disturbance events. For example, fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, an important habitat attribute essential for many salmonid and other aquatic species.

In certain parts of the country, some types of past timber harvest combined with the effectiveness of past wildland fire suppression over the past century, have caused

significant ecological shifts in vegetation composition and structure, resulting in altered fire regimes by increasing fuel loads and flammability. As discussed under the Terrestrial Habitats and Species section, response activities for fire suppression in inventoried roadless areas have likely been more limited in the past due to a lower priority placed on rapid suppression of fires in these areas, relative to fires in roaded and more developed areas. When this is considered in conjunction with the lower level of past timber harvest activities in many of these areas, it is likely that stand conditions within these areas may lie within or closer to the historic range of variability, with more normal levels of fuel loading and stand composition and structure, as compared to conditions within roaded and more heavily timbered areas.

Alternative 1 - No Action

Alternative 1 would have the greatest potential for additional aquatic habitat loss, degradation, and disturbance associated with roads, timber harvest, and other activities. Approximately 40% of the 58.5 million acres of inventoried roadless areas are covered by land-management plan prescriptions that currently prohibit road construction and reconstruction. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1, predominantly in those areas currently open to road construction. The planned timber harvest offer of 1.1 BBF through 2004 would occur on approximately 90,000 acres. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction through 2004, both with and without the Tongass exemption, for each alternative.

Potential Effects from Roads – Road construction, maintenance, use, and even the presence of roads in a watershed, can have numerous adverse effects to aquatic systems and the species they support. Recent changes in road designs and application of best management practices have been effective in some instances at moderating or avoiding many adverse effects. The discussion in this section captures the principal effects that have been associated with roads, but these are potential effects, and not every road would necessarily exhibit each or even many of these effects. The Physical Resources section provides a full discussion of potential geomorphic and hydrologic effects of roads on watershed and stream channel conditions.

These effects can potentially include (Furniss and others 1991; USDA Forest Service 2000h):

- Increasing sediment loads in streams;
- Modifying watershed hydrology and stream flows;
- Altering stream channel morphology;
- Increasing habitat fragmentation and loss of connectivity;
- Degrading water quality, including increasing chance of chemical pollution;
- Altering water temperature regimes.

These physical alterations can potentially result in a variety of adverse effects to aquatic species including:

- Loss of spawning and rearing habitat, and deep pools, from excess sediment deposition;
- Increased mortality of eggs and young from lower levels of oxygen in stream gravels;
- Increased susceptibility to disease and predation;
- Increased reproductive failure;
- Shifts in macro invertebrate communities to those tolerating increased sediment or other types of diminished water quality;
- Increased susceptibility to over harvest and poaching;
- Loss of protective cover and resting habitat through changes in channel structure including large woody debris, overhanging banks, and deep pools;
- Competition from nonnative species;
- Loss of habitat caused by habitat degradation, barriers to passage, increased gradient, high temperatures, and other factors; and
- Increased vulnerability of subpopulations to catastrophic events and loss of genetic fitness, related to loss of habitat connectivity.

Trombulak and Frissell (2000) concluded that, although all species and ecosystems are not affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems including changes in species composition and population size.

Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in a watershed to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the watershed than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used temporarily, for periods ranging up to 10 years before decommissioning, their short- and long-term effects on aquatic species and habitats can be extensive.

Potential Effects of Timber Harvest - The effects of activities associated with timber harvesting (e.g., tree felling, yarding, landings, site preparation by burning or scarification, fuels reduction, brush removal and whip felling, and forest regeneration) are often difficult to separate from the effects of roads and road construction. The road systems developed to harvest timber are often a significant factor affecting aquatic habitats, as discussed above. Some of the potential effects to aquatic habitat from timber harvest can include the following (Chamberlin and others 1991, Hicks and others 1991, Beschta and others 1987):

- Increasing sediment supply and storage in channels,
- Modifying watershed hydrology and streamflow, including the timing or magnitude of runoff events,
- Decreasing stream bank stability, and altering stream channel morphology,
- Degrading water quality,
- Altering energy relationships involving water temperature, snowmelt and freezing,
- Diminishing habitat complexity, and
- Altering riparian composition and function

If present, these physical changes in habitat would have may of the same biological effects as previously listed under the effects of roads, above. With the recent increased emphasis on use of best management practices and other protective measures in the design and implementation of timber harvest activities, the effects can often be mitigated to some extent. Cumulatively, however, timber harvest activities within a watershed can have pronounced and lasting effects to aquatic habitat (Chamberlin and others 1991).

Extent and Duration of Effects – For aquatic habitats, the indirect effects of disturbances associated with road construction and timber harvest could extend well beyond those areas directly impacted, given the influence that upslope areas and upstream reaches have on the condition of downstream habitat (Chamberlin and others 1991). The types and extent of impacts on aquatic habitats would depend on road location and design, proximity to accessible habitat, mitigation measures applied, and the activities enabled. For fish populations, habitat alterations can adversely affect all life-stages, from egg to adult, and habitat essential for migration, spawning, incubation, emergence, rearing, feeding, and security (Furniss and others 1991).

The duration of effects, or recovery time, is dependent on a variety of factors. Site productivity, rainfall, and length of growing season influence the rate and success of vegetation regrowth. The type, location, extent and duration of an activity, magnitude of adverse effects, dominant hydrologic and geomorphic processes within the watershed, overall watershed condition, and the effectiveness of mitigation and reclamation activities are some of the other factors influencing the duration of physical effects on a watershed and associated stream channels. The duration of biological effects can extend beyond the recovery time for the physical environment, and can be irreversible if a species is extirpated from the watershed.

Sedimentation – Roads can cause direct and indirect effects to important habitat factors for fish and other aquatic species. They contribute more sediment to streams than any other land management activity. The majority of sediment from timber harvest is related to road construction and use. Roads also increase the potential for erosion and slope failure in many areas. This can increase sedimentation of aquatic systems and adversely affect aquatic communities (Furniss and others 1991). Past timber harvest and road construction on unstable slopes in the South Fork Salmon River watershed in Idaho resulted in massive amounts of sediment being heavily deposited in spawning gravels during the 1960s, which substantially impacted spawning success for anadromous and resident fish populations (Platts and Megahan 1975).

Sediment entering stream channels can clog streambed gravels, reducing oxygen concentrations critical to incubating eggs, young fish, and macro invertebrates, fill deep pools, and change channel shape and form, all of which can have adverse effects on aquatic species (Bjornn and Reiser 1991; Hicks and others 1991; Furniss and others 1991). Populations of tailed frogs can be severely reduced or eliminated by increased sedimentation (Corn and Bury 1989; Welsh 1990). In the Clearwater Basin of Washington, the amount of fine sediment from roads was equal to that contributed by landslides and cumulatively resulted in degraded spawning habitat for coho salmon (Chamberlin and others 1991).

A general picture of the effects of sedimentation on aquatic populations like salmon can be constructed from investigations in the Pacific Northwest. Fine sediment can directly reduce egg-to-fry survival, food production, summer rearing area, and winter survival; it can also change the morphology and stability of stream channels, causing long-term reductions in the **carrying capacity** and the survival of salmon in the stream (Murphy 1995). Holtby and Scrivener (1989) concluded that increased sedimentation following timber harvest reduced escapement by chum salmon (*Oncorhynchus keta*) by 25% in a stream in British Columbia. Scrivener (1991) concluded that sedimentation associated with logging over a 40-year period contributed to the decline of the chum salmon population on Western Vancouver Island. Cederholm and Reid (1987; cited in Murphy 1995) found that sediment from a debris torrent and a streamside salvage operation caused a stream in Washington to aggrade to the point at which the stream dried up during the summer. The yield of coho salmon smolt in that stream declined 60% to 80%.

Increases in turbidity from suspended fine sediment can cause direct mortality to aquatic species, reduce growth and feeding activity (Nelson and others 1991), and can affect the abundance and diversity of benthic invertebrates (Lee and others, 1997).

Habitat Fragmentation and Loss of Connectivity –Large blocks of unroaded areas, such as inventoried roadless areas, while having relatively more intact aquatic habitat, may still support isolated aquatic populations because of road-related effects and other causes of habitat alteration in adjacent areas. Ground-disturbing activities, including timber harvest, can result in further loss of habitat connectivity. Improperly placed culverts can result in migration barriers. Gucinski and Furniss (USDA Forest Service 2000h) cited studies showing that:

- Thirteen percent of the historical coho habitat in a large river basin in Washington was lost because of improper culvert barriers (Beechie and others 1994);
- Total taxa richness and some species-specific richness were negatively related to the number of stream crossings (Hawkins and others in press); and
- There were significant differences between macroinvertebrate assemblages above and below road stream crossings (Newbold and others 1980).

Areas where changes in riparian vegetation have reduced shading may present thermal barriers to movement of aquatic species (Furniss and others 1991) including many salmonid species such as bull trout.

When habitat connectivity is lost, sub-populations lose the ability to interact, making these species more vulnerable to local extirpations and extinction from any cause. The lack of genetic interchange in an isolated subpopulation or in one with severely restricted size can lower its ability to adapt or respond to changing environmental conditions, resulting in an increased long-term risk to species viability (Gilpin and Soule 1986; Lee and others 1997). While the localized effect of an individual road-stream crossing may not have a substantial adverse effect, the cumulative effect of road networks and multiple crossings increases the potential for major adverse effects to aquatic habitats.

Watershed Hydrology and Stream Channel Morphology – Accelerated changes in stream channel morphology and alterations in flow can adversely affect aquatic species by causing a loss of important habitat attributes such as overhanging banks, spawning substrate, deep pools and riffles, winter refugia, and suitable water temperature and volume, affecting virtually all life stages and the overall quality of habitat.

Timber harvest activities can have significant effects on the hydrologic processes that determine streamflow. Increased peak flow can be detrimental to aquatic species, including salmon, because the resulting bedload overturn can scour stream channels, kill incubating eggs, and displace juvenile salmon from winter cover (McNeil 1964; Tschaplinski and Hartman 1983).

Timber harvest can weaken channel banks by removing the source of large woody debris, altering the frequency of channel modifying flows, and changing sediment supply. Riparian tree roots provide bank stability. Streambank instability often increases when these trees are removed, leading to loss of overhanging banks, which is an important habitat attribute for rearing Pacific salmonids (Murphy 1995) and other aquatic species. Streambank destabilization from vegetation removal adds to sediment supply and causes a loss of the channel structures that provide the habitat diversity needed to support healthy fish populations (Harris 1984; Scrivener 1988).

Habitat Complexity – Hicks and others (1991) found that a primary consequence of past timber harvest activities was the simplification of fish habitat. Example of such activity included changes in stream flow velocities and depth (Kaufmann 1987), reductions in large wood (Bisson and others 1987; Bilby and Ward 1989), changes in stream and floodplain interaction (Naiman and others 1992), and loss of habitat types and certain substrates (Sullivan and others 1987). The consequence of these changes has been a reduction in the diversity and quality of habitats. In Pacific Northwest streams, habitat simplification resulting from timber harvest and associated activities has diminished diversity of the anadromous salmonid complex (Bisson and Sedell 1984; Hicks 1990).

Water Quality – Road construction and timber harvest can result in measurable reductions of water quality by introducing sediment, nutrients, and chemical pollutants, and by causing abnormal temperature fluctuations. Some pollutants are from road construction and maintenance equipment, or are brought into the watershed through public road use.

Road construction and timber harvest may cause water temperature to change where groundwater is intercepted and brought to the surface or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Removal of riparian canopy associated with road construction and maintenance can elevate stream temperatures to levels that have adverse physiological effects on aquatic species, and can result in increased mortality rates and lowered reproductive success. Elevated temperatures can inhibit upstream migrations, increase disease susceptibility, reduce metabolic efficiency, and shift species assemblages (Beschta and others 1987; Hicks and others 1991).

Pools – In the broad scale assessment of aquatic species and habitats in the Columbia River Basin (Lee and others 1997), sizeable losses of large pools, critical habitat features

for many fish species, and deep pools were found in streams in managed areas (multiple-use, roaded areas) over the last 50 to 60 years, compared with streams in unmanaged areas. This analysis showed that streams in 20 managed watersheds in the Central Idaho Mountains ecological reporting unit (ERU) had a 40% decrease in the frequency of large pools, whereas large pools in 11 unmanaged streams in the same ERU showed no noteworthy change. A substantial decrease was also found in the frequency of deep pools in managed streams, in contrast to a considerable increase in streams in unmanaged areas. Pools showed a clear decline in size and frequency with increasing road density.

Riparian Vegetation – Timber harvest and road construction can affect riparian vegetation through removal, soil compaction, changes in drainage pattern and floodplain function, and introduction of nonnative invasive plant species. Riparian vegetation is a controlling factor of stream habitat quality, particularly in smaller streams. It contributes organic materials that supply nutrients and affects productivity, insects that serve as a food source, and logs and branches that affect channel morphology and habitat complexity. Riparian vegetation retains organic matter and provides cover for fish. Roots stabilize stream banks and maintain undercut banks. The protective canopy provided by riparian vegetation helps to regulate temperature by shading the channel in summer and insulating from heat loss in winter (Murphy and Meehan 1991).

Introduction of Nonnative Species and Diseases – Introductions of nonnative fishes and other aquatic species, whether authorized or unauthorized, have the potential to affect the distribution and abundance of native fishes, amphibians, and other aquatic organisms through competition, hybridization, predation, and introduction of parasites and diseases. Nonnative aquatic plants may also be inadvertently introduced to lakes and streams from boats and boat trailers. Unauthorized releases of aquarium fishes, bait fishes, nonnative amphibians and reptiles, and nonnative plants to streams and lakes are strongly influenced by the presence of roads (USDA Forest Service 1999p; Lee and others 1997; Allan and Flecker 1993).

Over Harvest and Illegal Introduction – he presence of a road system and associated facilities accessing streams, lakes, and wetlands can contribute substantially to declines in rare and unique native vertebrate populations (USDA Forest Service 1999p) due to over harvest and illegal collection. Increased access can increase the likelihood of disruption of aquatic native communities with illegal or inadvertent introductions of nonnative species, as discussed under the affected environment section.

Recent Studies – Analysis done for the Interior Columbia Basin Ecosystem Management Project (Lee and others 1997) indicates that strong fish populations are often associated with low road density. The Sierra Nevada Ecosystem Project documented a negative correlation between the abundance of roads in a watershed and the integrity of native stream biota (Moyle and Randall 1996).

The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998a) found that bull trout are exceptionally sensitive to the direct, indirect, and cumulative effects of roads. Dunham and Rieman (1999) demonstrated that disturbance from roads was associated with reduced bull trout occurrence. They concluded that conservation of bull

trout should involve protection of larger, less fragmented, and less disturbed (lower road density) habitats to maintain important strongholds and sources for naturally recolonizing areas where populations have been lost.

Road construction and timber harvest were identified as important factors in the regional decline and loss of populations of some inland cutthroat trout subspecies (Young 1995; Duff 1996). Adverse effects related to roads were identified for Colorado River, westslope, Bonneville, and Yellowstone cutthroat. Timber harvest was identified as a cause of habitat degradation for westslope, Rio Grande, Bonneville, and Yellowstone cutthroat trout.

The biological opinion issued by the National Marine Fisheries Service for PACFISH[10] (USDA Forest Service and USDI Bureau of Land Management 1995) identified roads as a primary cause of salmonid decline, and indicated that roads may have unavoidable effects on streams, regardless of how well they are located, designed, or maintained. In discussing the effects of management activities in inventoried roadless areas in the Pacific Northwest, the scientific analysis team headed by Jack Ward Thomas (Thomas and others 1993) concluded that such activities would increase the risk of damage to aquatic and riparian habitat and could potentially reduce the capacity and capability of key watersheds important for maintaining salmonid populations.

Beneficial Effects of Roads and Timber Harvest – Provided a road is located, designed, constructed, and maintained to the standards needed to protect aquatic habitat, roads can have positive aspects for a fisheries management program for a particular stream or lake (Furniss and others 1991). Roads provide access to lakes and streams, facilitating both fishing and law enforcement. They also provide easier access for inventory and assessment of stream habitat and populations, for habitat improvement and enhancement projects, and for State stocking and population management activities.

Stewardship timber harvest may provide some potential beneficial effects to some aquatic species. For example, careful thinning to reduce fuel loading in some areas where there is an abnormally high risk of high intensity, large-scale fires, may lower the risk of extirpation of an isolated fish population from a watershed, particularly where habitat complexity and spatial diversity have already been diminished, and where recolonization would not be possible due to a lack of habitat connectivity.

Summary of Effects – With the expectation that roaded entry and timber harvest will continue in these areas at rates approximating those in the past, and given the numerous negative direct, indirect, and cumulative effects identified in the literature associated with these activities, the No Action Alternative has the greatest potential for increased risk of adverse effects to aquatic and riparian habitat and species, relative to Alternatives 2, 3, and 4.

[10]Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California

Alternative 2

This alternative offers a greater degree of assurance than Alternative 1 that current aquatic biodiversity would be maintained, due to the prohibition on road construction and reconstruction. Based on estimates provided by each national forest, there would be approximately a 75% reduction in the total miles of road that would be constructed or reconstructed in inventoried roadless areas through 2004 under this alternative. Under the exceptions common to all action alternatives (as described in Chapter 2), about 300 miles of road could be constructed or reconstructed. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Even though timber harvest activities could continue in inventoried roadless areas, information collected from the forests indicates that much of the timber harvest currently planned in these areas would require road construction and reconstruction and hence, would not occur under this alternative as shown on Table 3-32. Therefore, much of the potential adverse effects associated with road construction would be avoided, and a lower level of risk associated with less timber harvest would be expected, compared to Alternative 1.

Aquatic habitat management activities that are not dependent on new or reconstructed road access could be implemented under this alternative. Forests identified approximately 4 miles of road construction or reconstruction in inventoried roadless areas associated with fisheries habitat improvement projects within the next 5 years. These projects included limestone applications in two streams in Region 8 to reduce acidic conditions, road reconstruction in Region 6 to reduce sedimentation, mine reclamation in Region 8 to reduce stream sedimentation, and stream barrier construction in Region 3 to prevent movement of nonnative fish species into habitat occupied by threatened loach minnow and Apache trout, as well as other native fish species.

These projects represent substantially less than 1% of the annual national program (USDA Forest Service 2000d). One or more of them could likely be redesigned so that road construction or reconstruction would not be necessary in inventoried roadless areas by using aerial access or by walking heavy equipment into the site. For instance, the Region 3 project-feasibility study presented two alternatives that would not require road construction – using a site 8 miles upstream with current road access at a 20% cost savings, or using helicopter access to a site about 3 miles upstream at an 18% increased cost (USDI Bureau of Reclamation 1998).

All action alternatives offer an exception to prohibitions for situations where an existing road needs to be realigned to prevent resource damage, caused by the road itself. For example, this exception could be invoked to prevent substantial adverse effects to aquatic habitat caused by excessive sedimentation from an adjacent road. The Region 6 road reconstruction project listed above could potentially fall under this exception.

Overall, the need for additional road access to manage aquatic habitat within inventoried roadless area appears to be minimal. The current national capability of the Agency to manage aquatic habitat would not be measurably affected.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities, and this and other government agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall effects to aquatic species and biodiversity would be beneficial.

Alternative 3

With the added prohibition against non-stewardship timber harvest, this alternative presents a lower risk than Alternatives 1 and 2 of additional degradation or loss of aquatic habitat quality, quantity, and distribution resulting from timber harvest, particularly in those inventoried roadless areas that are currently open to road construction. A description of the potential adverse effects of road construction and timber harvest is provided under Alternative 1.

As discussed under Alternative 2, a reduction of approximately 75% in the total miles of road that could be constructed or reconstructed in inventoried roadless areas through 2004 would be expected under this alternative. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

By restricting timber harvest to activities necessary for resource stewardship, many of the adverse effects of timber harvest would be minimized, while maintaining a management tool potentially needed for ecological restoration. Mechanical vegetation manipulation to reduce fuel loading may be desirable in some areas where there is an abnormally high risk of high intensity, large-scale fires. Fuels reduction stewardship activities may be indirectly beneficial to some aquatic populations, if such activities are implemented with minimal impacts to aquatic habitats. Other types of stewardship timber harvest to meet objectives for aquatic habitat could include watershed restoration and enhancement of riparian vegetation (USDA Forest Service and USDI Bureau of Land Management 1995).

As described under Alternative 2, aquatic habitat management activities that are not dependent on new or reconstructed road access could be implemented under this alternative. Overall, the need for additional road access to manage aquatic habitat within inventoried roadless area appears to be minimal. This alternative would not measurably affect the current ability of the Agency to manage aquatic habitat.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities. This Agency and other government agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall, the effects on biodiversity would be beneficial.

Alternative 4

The potential beneficial effects of this alternative on aquatic communities would be similar to those described in Alternatives 2 and 3, but potentially somewhat greater. By prohibiting all timber harvest, except for that needed for protection or recovery of TEP species, this alternative would provide the greatest assurance that these areas would not experience increased levels of human-caused disturbance and associated degradation of aquatic habitat quality, quantity, and distribution, associated with road construction and timber harvest.

However, by prohibiting all timber harvest, the Agency would loose a management tool that may be desirable for ecological restoration in some areas. Vegetation manipulation using mechanical means to reduce fuel loading may be desirable where there is an abnormally high risk of high intensity, large-scale fires, but could not be implemented under this alternative.

Whereas the benefits of less ground disturbance from road construction and timber harvest are well documented in the literature, it is less clear whether failure to reduce fuel loading would constitute a substantially increased level of risk to aquatic communities. Even though some timber harvest activities are intended to mimic the effects of natural disturbance processes such as fire, there is little known about the long term ecological legacies of such treatments. It is not clear how those legacies would compare with areas where natural disturbance processes have played a more dominant role in controlling successional pathways, landscape mosaics, and ecosystem composition.

Although Rieman and others (1997) documented that large fires can adversely affect aquatic systems, and can result in fish mortality and even extirpation, they concluded that the resilience and persistence of salmonid populations are heavily influenced by the complexity and spatial diversity of habitats. A complex, well-dispersed network of habitats is likely to be an important element in the persistence of fish populations during and after large fires. They concluded that some aquatic species, such as bull trout and redband trout, appear to be well-adapted to “pulsed” disturbances, such as fire and its associated hydrologic effects, as opposed to more continual or “press” effects linked to roads and extended timber harvest. They recommended that where small or isolated sensitive fish populations occur in watersheds at high risk of uncharacteristic wildland fire, management actions should be implemented only after careful site-specific risk evaluation. When a need to reduce fuel loading is identified, silvicultural prescriptions emphasizing low-impact logging and yarding and prescribed fire would be preferable.

Research on the Boise National Forest after large intense fires in 1994 showed rapid recolonization of reaches by bull trout (Rieman and others 1997). Burns (2000a) found that risks to fish populations from prescribed fire or wildland fire are low where fish populations can freely migrate and ecosystems are not severely fragmented. Research on fish recolonization after large disturbances or experimental removal indicates that full population recovery can occur quickly, often within a few years (Niemi and others 1990; Detenbeck and others 1992) or even in much shorter periods (Sheldon and Meffe 1995; Peterson and Bayley 1993). These studies support a determination that, provided aquatic

populations are not functionally isolated, this alternative would not result in a greater risk of adverse effects to aquatic communities from prescribed or wildland fire.

Overall, the need for additional road access and timber harvest to manage aquatic habitat within inventoried roadless area appears to be minimal. Although there may be some local limitations, this alternative would not affect the overall current ability of this Agency or other Federal, State, or local government agencies with jurisdictional responsibility to manage aquatic species and habitat. Existing access would not be affected by this or the other prohibition alternatives.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities. This Agency and other agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall effects relative to conservation of aquatic species and biodiversity would be beneficial.

Terrestrial and Aquatic Plant Species

Affected Environment

Inventoried roadless areas provide large, relatively undisturbed blocks of important habitat for a wide variety of native terrestrial and aquatic plants including, more than 1,400 sensitive and almost 100 TEP plant species. Many of these are endemic species, with narrowly limited geographical ranges determined by soil types, climatic conditions, and other environmental conditions. Endemic species, due to their limited distribution, are often at a relatively higher risk of extinction from either natural or human-induced causes. Areas in the United States with sizeable numbers of endemic plant species include California, Texas, Alaska, the Pacific Northwest, the Southwest, the Intermountain West, and the South (Gentry 1986). Appendix C includes a list of TEP plant species found on NFS lands and identifies which species may be affected by inventoried roadless areas. A list of potentially affected sensitive species can be found in the biological evaluation for the project or at the project website **roadless.fs.fed.us**.

These inventoried roadless areas may provide important biological strongholds for native plant species and communities. In comparing the distribution of these inventoried roadless areas with centers of biodiversity identified in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Lee and others 1997), inventoried roadless areas cover approximately 10% (2,810,000 acres) of the identified acreage for centers of biodiversity for plants. In addition, almost 10% (1,370,000) of the acreage identified in ICBEMP as centers of endemism for plants is contained in inventoried roadless areas.

Because access to many inventoried roadless areas is relatively difficult, and there are typically fewer projects and activities requiring rare-plant inventories, areas that are more accessible are often better surveyed than inventoried roadless areas. Therefore, inventoried roadless areas are more likely to yield new distributional records and even previously unknown species.

Compared to roaded areas, plants in inventoried roadless areas are less likely to be exposed to disruption from a variety of human activities such as collection, trampling, and other surface disturbance. This lower level of disruption may make inventoried roadless areas important references for understanding the natural composition and dynamics of native plant communities.

Roads are also avenues for invasion by nonnative invasive plant species that frequently compete with or displace native vegetation. Competition by nonnative invasive species is one of the leading causes for plant species being listed as T&E (Pimental and others 1999; Fay personal communication). More than 3,700 nonnative plant species have become established in the United States (Williams and Meffee 1998). Table 3-35 shows the estimated numbers of established nonnative species in this country, providing an indication of the magnitude of this issue. Areas subjected to intense and wide spread natural disturbances, such as high intensity stand-replacing wildland fire, can be susceptible to nonnative plant invasions for a period. However, the risk is significantly less than in roaded areas where human activities and disturbances associated with roads can exacerbate the problem. Lacking roads and many of the disturbances associated with them, inventoried roadless areas are less likely to experience problems with nonnative invasive species and are more likely to be able to maintain intact native plant communities.

Table 3-35. Estimated number of established nonnative species in the United States.

Species group	Number
Plants	3,723
Terrestrial vertebrates	142
Insects and arachnids	>2,000
Fishes	76
Mollusks	91
Plant pathogens	239
Total	**>6,200**

(Williams and Meffe 1998)

Alternative 1 - No Action

This alternative would have the greatest potential for additional ground disturbance associated with roads, timber harvest, and other management activities. Approximately 40% of the 58.5 million acres of inventoried roadless areas are currently covered by land management-plan prescriptions that prohibit road construction and reconstruction. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1, predominantly in areas currently open to road construction. The type and extent of impacts to native plant species and communities from this road construction would depend on road location and design, mitigation measures applied, and the activities that occur. Approximately 90,000 acres (18,000 acres per year) would be directly

impacted by the planned level of timber harvest offer of 1.1 BBF through 2004. Over the long term, the average annual acreage affected is expected to drop to about 14,000. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Nonnative Invasive Plants – With the expectation that roaded entry would continue at approximately the same rate in inventoried roadless areas and given the disturbances and uses associated with roads, this alternative poses the greatest degree of risk for increased introduction and spread nonnative invasive species, with a corresponding increase in risk of all of the adverse ecological effects associated with establishment of such species. Roads serve as a means of entry for many nonnative invasive plant species, with seeds or plant parts inadvertently transported into previously unaffected areas. Ground disturbance associated with roads and with other road activities provides additional opportunity for establishment or expansion of nonnative invasive plant populations (Parendes and Jones 2000).

A recent survey conducted by the U.S. Department of the Interior found that nonnative invasive plants have invaded more than 17 million acres of public rangelands within the Western United States, more than quadrupling their range from 1985 to 1995. At this rate of expansion, Western wildlands are being lost at a rate of 4,600 acres per day to invasive plants such as leafy spurge and yellow starthistle (Westbrooks 1998). The source of many of these infestations has been traced to roads, trails, railroads, and other travel corridors. When vehicles are driven through a **noxious weed**-infested area, seeds from these plants may become lodged in tire treads, in a winch, and in other cracks and crevices on the chassis of a vehicle. Such seeds may become dislodged hundreds of miles away, infesting new areas (Westbrooks 1998). Many nonnative invasive plants are dispersed through transportation of contaminated hay or seed along roads. Spotted knapweed and yellow starthistle are just two examples of plants that are dispersed throughout roadways by the transportation of contaminated alfalfa and clover seed.

Site disturbance by road construction and the transport of contaminated soil and gravel have been identified as a major contributors to long distance seed dispersal for yellow starthistle (Thomsen and others 1996). Additionally, within California, scotch broom has been found to be dispersed by vehicles through the transportation of seed in mud and debris (USDI 1994). Routine roadside mowing aids in the elimination of some noxious weeds, but can accidentally spread the seeds of others, like knapweed in the Midwest and the dust-like seeds of parasitic weeds such as small broomrape in South Georgia (Westbrooks 1998). Gorse has been recognized as a significant nonnative invasive plant occurring within Oregon and California (Amme 1983). Subsequent use of roadways in close proximity to gorse facilitates its spread by serving as a mechanism for seed dispersal (Hill 1949). Now widely distributed throughout North America (Whitson and others 1991; Young 1991), cheatgrass has been identified as a common species along many roadsides. The highly flammable cheatgrass alters the frequency and intensity of fires on Western rangelands, and therefore alters vegetative communities important for many big game species.

Aggressive nonnative invasive plant species generally undermine native plant diversity through competition and habitat alteration. For example, the Sierra Nevada, an area

historically rich in plant diversity with more than 3,500 native species, now supports hundreds of nonnative species, many of which have had considerable detrimental ecological effects (Sierra Nevada Ecosystem Project 1996). Other parts of the country show similar situations. Areas infested with invasive species, such as spotted knapweed and leafy spurge, can have low grass productivity (Hillis 1999) affecting the quality and amount of forage available to many species. Once established, many of these nonnative species are extremely difficult or impossible to eradicate. The use of herbicides in eradication or control efforts can have unintended adverse effects to populations of other terrestrial and aquatic species (Norris and others 1991).

Fragmentation – While most studies of forest fragmentation have focused on animal species, some research has addressed plants. In studying the effects of forest fragmentation from timber harvest clearcuts on trillium (*Trillium ovatum),* a common herbaceous understory plant, Jules (1998) documented continuing adverse effects (high mortality during initial disturbance and a continuing lack of new plants) even in sites that had been clearcut more than 30 years ago. Although he found individual plants as old as 72 years, study areas showed few plants younger than the age of the clearcut. His study also demonstrated that populations in remaining forest remnant patches that were within 65 meters of the edge of a clearcut experienced similar adverse effects, most likely due to a combination of reduced seed set and reduced survival of seeds and seedlings near edges. He speculated that, given the severe effects from fragmentation demonstrated for this common species, it is likely that the distribution and abundance of other understory plants were similarly altered. Jules concluded that the likelihood of maintaining biodiversity would be greater in areas that have never been harvested and where landscape fragmentation has not increased.

Isolation or severely restricted subpopulation size due to habitat fragmentation may also have adverse effects due to the lack of genetic interchange that can lower a species ability to adapt or respond to changing environmental conditions. This would constitute an increased long-term risk to species viability (Gilpin and Soule 1986).

Effects of Temporary Roads – Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to an area than a single, well-designed, maintained, and use-regulated road. Rare plant populations can be lost during road construction, whether roads are temporary or permanent. While temporary roads may be used temporarily, for periods ranging up to 10 years, and are then decommissioned, their short and long-term effects can be extensive to rare plant populations.

Summary of Effects – Increased access into inventoried roadless areas would present an increased risk to rare plant populations and communities due to increased level of habitat disturbance, habitat fragmentation, introduction of nonnative invasive plant species, and

collection or trampling of individual rare plants. Alternative 1, therefore, would pose the greatest threat to conservation of native plant species and communities.

Additional discussions on the effects of road construction and timber harvest relevant to plant species are in the Terrestrial, and Aquatic Animal Species sections, and in the biological evaluation.

Alternative 2

This alternative would offer a greater degree of assurance than Alternative 1 that current plant diversity would be maintained, due to lower levels of disturbance, less potential for additional forest fragmentation, and less development of road access.

Based on estimates provided by each national forest, there would be an approximate 75% reduction in the total miles of road that could be constructed or reconstructed in inventoried roadless areas through 2004 under this alternative. Under the exceptions common to all action alternatives (as described in Chapter 2), approximately 300 miles of road would be constructed or reconstructed.

The amount of potential additional forest fragmentation associated with timber harvest would be reduced under this alternative. Timber harvest activities and road construction would continue in inventoried roadless areas, but at much-reduced levels. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Without the ground disturbance, ecological edges, and uses created or enabled by additional road construction and reconstruction in inventoried roadless areas, these areas would be less vulnerable to establishment of nonnative invasive species than roaded areas of similar size. Relative to Alternative 1, this alternative would provide a lower risk of adverse effects to native plant species and communities from establishment of nonnative invasive species, providing greater protection of existing biodiversity and site productivity. All action alternatives are consistent with and help further the intent of Executive Order 13112 on invasive species.

Through 2004, two projects were identified for restoration of native plant communities that as currently designed would require 2.5 miles of road construction in inventoried roadless areas. These projects in Region 8 involve boreal habitat enhancement and variable sedge restoration. Alternative means of access could potentially be developed for both projects. Overall, the need for road construction and reconstruction for native plant projects appears to be minimal.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities. Existing access to inventoried roadless areas would not be affected. The overall ability of this Agency or other Federal, State, or local government agencies with jurisdictional responsibilities to implement management actions for conservation of rare plant communities would be unaffected, including those actions

needed for control or eradication of nonnative invasive plants. Overall effects to terrestrial and aquatic native plant communities would be beneficial.

Alternative 3

With a prohibition of non-stewardship timber harvest and of road construction and reconstruction in inventoried roadless areas, this alternative would provide a greater degree of assurance than Alternatives 1 and 2 that these areas would not experience increased levels of human-caused disturbance and degradation of native plant habitat quality, quantity and distribution. The overall beneficial effects of this alternative to native plant species and communities would be similar to those described under Alternative 2, but would be somewhat greater with the additional prohibition on non-stewardship timber harvest.

Information collected from each national forest indicates that much of the timber harvest currently planned in these areas would either require road construction and reconstruction or was not classified as “stewardship.”, and hence, would not occur under this alternative. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

With a reduced level of planned timber harvest, there would be less potential for increased ground disturbance, ecological edges, fragmentation, and other associated timber effects. This alternative would provide additional assurance beyond Alternative 2 that inventoried roadless areas would retain current levels of resistance to the introduction and establishment of many nonnative invasive species. (See the discussion on nonnative invasive species under Alternative 2 above.) All action alternatives would be consistent with and would help further the intent of Executive Order 13112 on invasive species.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities, and the overall ability of this Agency or other government agencies to implement management actions for conservation of rare plant communities would be unaffected. Overall effects to native plant communities would be beneficial.

Alternative 4

The beneficial effects of this alternative on native plant communities would be similar to those described in Alternatives 2 and 3, but potentially somewhat greater. This alternative would provide additional assurance that these areas would not experience increased levels of human-caused disturbance and degradation of native plant habitat quality, quantity, and distribution. Without any of the ground disturbance and ecological edges associated with timber harvest and combined with a 75% reduction in road construction and reconstruction, this alternative would provide the greatest assurance that these areas would retain current levels of resistance to the introduction and establishment of many nonnative invasive species. This alternative is consistent with and would help further the intent of Executive Order 13112 on invasive species.

This alternative would provide an exception to the prohibition on timber harvest, if needed, to protect or recover a T&E species or a species that has been proposed for listing under the ESA.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities. Although there may be some local limitations, the overall ability to implement management actions for conservation of rare plant communities would not be affected. Overall effects to native plant communities would be beneficial.

Threatened, Endangered, Proposed, and Sensitive Species

The worldwide rate of extinction is estimated to be approximately 400 times that of recent geologic time, and is apparently increasing (Wilson 1985). Based on estimates made by the Nature Conservancy (Stein and Flack 1997), at least 110 species of plants and animals are known to be extinct in the United States, and an additional 416 species are possibly extinct, with no recent documented occurrences. They estimate that about one-third of the United States plant and animal species have an increased risk of extinction. It is conceivable that the number of species in the United States that merit listing early in the 21st Century may be 2 or 3 times that of the number currently listed (Wisdom and others 1999). These statistics indicate the importance of conserving the remaining relatively undisturbed, large blocks of habitat for species whose continued viability may be at risk.

A high percentage of federally listed T&E species, and species proposed for listing under the ESA, as well as Forest Service designated sensitive species, are affected by inventoried roadless areas. Statistics generated from Forest Service species lists indicate that:

- More than 55% of TEP species, with habitat on or affected by NFS lands, are directly or indirectly affected by inventoried roadless areas. This percentage represents approximately 25% of all animal species and 13% of all plant species listed under the ESA within the United States.
- More than 65% of all Forest Service sensitive species are directly or indirectly affected by inventoried roadless areas. This percentage is composed of birds (82%), amphibians (84%), mammals (81%), plants (72%), fish (56%), reptiles (49%), and invertebrates (36%).

These statistics suggest the important role that inventoried roadless areas fill, both individually and cumulatively, in maintaining species viability and biodiversity in all parts of the country. It is likely that some inventoried roadless areas are more important now than in the past in supporting species viability and biodiversity, due to cumulative degradation and loss of other potentially more biologically rich habitat in adjacent landscapes. With extinction risk for many species directly correlated to habitat loss and degradation (Stein and Flack 1997), the data in Table 3-36 indicate the numbers of species that may be at increased risk of endangerment or extinction if the relatively

undisturbed habitat provided by these areas is not maintained. Even though the numbers vary between species group and parts of the country, nationally these inventoried roadless areas play an important role in providing habitat for TEP and sensitive species.

Table 3-36. Estimated number and percent of threatened, endangered, proposed, and sensitive species within each Forest Service region affected by inventoried roadless areas.

	Threatened, endangered, and proposed species		Sensitive species	
Region	**Number of species**	**Percent by region**	**Number of species**	**Percent by region**
Northern (1)	15	75	245	82
Rocky Mountain (2)	27	100	135	83
Southwestern (3)	45	57	245	57
Intermountain (4)	31	89	222	99
Pacific Southwest (5)	60	63	313	77
Pacific Northwest (6)	30	83	329	75
Southern (8)	65	38	346	54
Eastern (9)	29	85	276	42
Alaska (10)	1	25	26	93

(Roadless Database 2000)

Wilcove and others (2000) examined available information for 1880 imperiled and listed species and determined that habitat destruction and degradation contributed to the endangerment of 85% of those species. Other important contributing factors included competition with or predation by nonnative species (49%), pollution (24%), and overexploitation (17%).

Nationally, on NFS lands, there are approximately 400 proposed, threatened and endangered species, and 2,930 sensitive species. Inventoried roadless areas provide or affect habitat for approximately 220 TEP and 1,930 sensitive species. Forty-four species have designated critical habitat on NFS lands, along with proposed critical habitat for an additional eight species. Inventoried roadless areas provide or affect critical habitat for approximately 75% of these species. These species are identified in Appendix C.

The Forest Service Roadless Area Conservation Biological Evaluation for Threatened, Endangered, Proposed, and Sensitive Species (biological evaluation or BE) was completed for the alternatives in the FEIS and is part of the project record. As part of ESA consultation, the biological evaluation was provided to the National Marine Fisheries Service and the U. S. Fish and Wildlife Service, along with other supporting documentation. The level of analysis in the biological evaluation was commensurate with the national scale and non-ground disturbing nature of the action alternatives. It does not take the place of specific, project-level or forest-plan level planning and analysis for future decisions regarding other activities in these areas, but it does provide an important overall context for such analyses. The list of TEP species is included in Appendix C. This

list, the sensitive species list and the BE are available on the project website at **roadless.fs.fed.us**.

The overall determination of effects in the BE was the same for all action alternatives:

- May affect, but are not likely to adversely affect T&E species or adversely modify designated critical habitat; and are not likely to jeopardize **proposed species** or adversely modify proposed critical habitat. Furthermore, these alternatives may beneficially affect TEP species and critical habitat.
- May affect individuals, but are not likely to cause a trend towards Federal listing or a loss of viability for any sensitive species. Furthermore, these alternatives may beneficially affect sensitive species and their habitat.

The Terrestrial Animals and Habitat, Aquatic Animals and Habitat, and Terrestrial and Aquatic Plant Species sections provide additional description of the affected environment and environmental consequences of the alternatives including discussions on nonnative invasive species.

Alternative 1 - No Action

Refer to the Alternative 1 sections under Terrestrial Animals and Habitat, Aquatic Animals and Habitat, and Terrestrial and Aquatic Plant Species for a comprehensive discussion of the principal effects from road construction and timber harvest, and to the biological evaluation.

Relative to the No Action Alternative, all of the action alternatives would have the potential for important beneficial impacts to TEPS species, by reducing risks of future habitat degradation and disturbance, and conserving existing biological strongholds. The degree of beneficial effects would vary by alternative, in response to the level of prohibitions applied.

Past road construction and timber harvest practices have had substantial impacts on TEPS species and habitats in many areas. Recent changes in project designs and specifications, along with application of best management practices, have been effective at moderating or avoiding many adverse effects. Some effects, however, cannot be completely mitigated or avoided. The following summary lists the principal effects that have been associated with roads and timber harvest, but these are potential effects, and not every project would necessarily give rise to one or more of these effects. These effects are discussed in detail under the Terrestrial animal Habitat and Species, the Aquatic Animal Habitat and Species, and the Terrestrial and Aquatic Plant Species sections.

Potential Effects of Roads

- Habitat loss
- Habitat fragmentation and loss of connectivity
- Adverse edge effects
- Displacement and avoidance behavior
- Access for poaching and illegal collection

- Increased potential for chronic negative interactions with humans
- Direct mortality from vehicles and recreational shooting
- Harassment and disturbance
- Dispersal and movement barriers for some species
- Lethal toxicity
- Introduction and spread of nonnative invasive species and diseases
- Increases sediment loads in streams
- Adverse changes in watershed hydrology and stream flows
- Alterations of stream channel morphology
- Degradation of water quality, including increasing chance of chemical pollution.
- Alteration of water temperature regimes

Potential Effects of Timber Harvest

- Habitat loss, fragmentation, and negative edge effects.
- Habitat loss of snags and down logs
- Degradation of rare and unique communities such as those found in talus slopes, cliffs, caves, and wetlands
- Disruption of dispersal and species migration
- Lowered success in reproduction and rearing of young
- Increased levels of physiological stress for some species
- Introduction and spread of nonnative invasive species
- Changes in streamflow and the timing or magnitude of runoff events
- Loss of stream bank stability
- Increases in sediment supply and sediment storage in channels
- Degradation of water quality
- Altered energy relationships involving water temperature, snowmelt and freezing
- Loss of habitat complexity
- Alterations in riparian composition and function

Summary of Effects – The No Action Alternative would result in a greater likelihood of measurable losses of habitat quality and quantity in inventoried roadless areas, with the increased potential for adverse effects to some TEPS species.[11] Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. This alternative poses the greatest likelihood of increased risk cumulatively to species viability, although mitigation measures offsetting some adverse effects would undoubtedly be identified as part of site-specific national NEPA decisions, and where TEP species may be affected, ESA consultations and conferencing.

Alternative 2

With a prohibition on road construction and reconstruction in inventoried roadless areas, the potential for increased levels of human-caused disturbance and degradation of habitat quality, quantity, and distribution would be greatly reduced relative to Alternative 1,

[11] Assuming that roaded entry and timber harvest would continue in these areas at rates approximating that occurring in the past and given the disturbances from other road-dependent activities.

particularly in those areas currently open to road construction. Given the numbers, diversity, and distribution of TEPS species that have habitat in inventoried roadless areas, this alternative would provide important local, regional, and national conservation for these species and their habitats.

All of the action alternatives offer an exception to the prohibition on road construction and reconstruction for situations where an existing road needs to be realigned to prevent irreparable resource damage, which is being caused by the road itself. For example, this exception could be invoked to relocate a road to prevent substantial adverse effects to habitat for a threatened or sensitive fish species caused by excessive sedimentation from the existing road location, when such effects could not be avoided through maintenance.

With a 75% reduction in planned road construction and an associated reduction in many activities, including road-dependent timber harvest, habitat degradation and fragmentation, harassment, disruption, and illegal capture or harm would be less likely, relative to Alternative 1. Overall effects to conservation of species and maintenance of biodiversity would be beneficial, with no adverse effects anticipated.

A comprehensive description of the principal effects from road construction and timber harvest is in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation for this project. Table 3-32 provides the planned timber harvest and miles of road construction projected under this alternative.

Through 2004, no planned activities from conservation strategies for sensitive species were identified that would require road construction and reconstruction in inventoried roadless areas. Of the general (that is, not specifically targeted at TEPS) wildlife, fish, and rare plants projects planned, four fisheries projects and eight terrestrial species projects were identified that would require road construction or reconstruction as currently planned. It is likely that some of these projects would directly or indirectly benefit one or more TEPS species. If redesigned, some of these projects could likely be implemented without road construction and reconstruction.

One project was identified for recovery of T&E species that would require road construction in an inventoried roadless area. This involves stream barrier construction in the Forest Service Southwest Region to prevent movement of nonnative fish species into habitat occupied by threatened loach minnow and Apache trout, as well as other native fish species. As currently designed, it would require 1 mile of temporary road construction in an inventoried roadless area. A feasibility study for this project presented two alternatives that would not require road construction: using a site 8 miles upstream with current road access at a 20% cost savings, or using helicopter access to a site about 3 miles upstream at an 18% increased cost (USDI Bureau of Reclamation 1998).

In general, it appears that the need for road construction or reconstruction for recovery or protection of TEPS species would be minimal. There is no reason to expect that this would change in the upcoming decades. It is unlikely that alternate means of access could not be found to accomplish recovery or conservation objectives, although costs may increase in some situations. With the exception provided under all prohibition action

alternatives that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated.

Summary of Effects – No adverse environmental effects to these species would be expected from this alternative, since it does not authorize any ground disturbing activities. The current capability of the Forest Service and of other agencies with jurisdictional responsibilities to manage species or habitat within these areas would not be measurably affected by such a prohibition. None of the alternatives would reduce existing access. The Agency would retain the tools necessary to manage these resources. Overall effects relative to conservation of TEPS species and biodiversity would be beneficial.

Alternative 3

This alternative would provide important national conservation for TEPS species and their habitats given the diversity and distribution of these species affected by inventoried roadless areas. Without road construction and reconstruction, non-stewardship timber harvest, and many of the activities that roads enable, there would be a lower likelihood of harassment, disruption, illegal take, and habitat degradation, relative to Alternatives 1 and 2. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. Overall effects to conservation of TEPS species would be beneficial, and would be somewhat greater than those of Alternative 2.

A comprehensive description of the potential effects from road construction and timber harvest that would be reduced or avoided under this alternative can be found in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation for this project.

As described under Alternative 2, through 2004, no planned activities from conservation strategies for sensitive species were identified that would require road construction in inventoried roadless areas, and only one project requiring road construction was identified for recovery of T&E species, for which alternate designs not requiring road construction are available. There is apparently little need for road construction or reconstruction in inventoried roadless areas for recovery or protection of TEPS species.

Summary of Effects – The current ability of this Agency and of other government agencies with jurisdictional responsibilities relative to these species would be unimpaired. Under the exception that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated. No adverse environmental effects to these species would be expected from this alternative, since it does not authorize any ground disturbing activities. The overall effects relative to conservation of TEPS species and biodiversity would be beneficial.

Alternative 4

Given the numbers, diversity, and distribution of TEP and sensitive species that have habitat in inventoried roadless areas, this alternative would provide important local, regional, and national protection for these species and their habitats. Without road construction, reconstruction, or timber harvest, and many of the activities that roads enable, there would be a lower likelihood of harassment, disruption, illegal take, and habitat degradation. The beneficial effects of this alternative would be similar to those described for Alternatives 2 and 3.

This alternative includes an additional exception for TEP species, as described in Chapter 2. The responsible official may authorize an exception to the prohibition on timber harvest if it is determined that such harvest is:

- Necessary to prevent degradation or loss of habitat for a TEP species to the extent that such loss or degradation would increase the risk of extinction; or
- An important action needed to promote recovery of a T&E species.

In all cases, agreement that a project is warranted would need to be obtained from the NMFS or U.S. Fish and Wildlife Service, as applicable. It is not anticipated that this exception would be used frequently or for large-scale projects, but rather for conservation of specific habitat components necessary for continued species viability where a clear need is identified. This exception would not apply to sensitive species.

An example of why the exception may be applied is for recovery of the red-cockaded woodpecker (RCW). In their biological opinion on the revised land management plan for NFS lands in Texas, the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1996) identified concerns about the limited ability of the Forest Service to cut trees to maintain or improve habitat for RCW within Wilderness areas, which would permit midstory encroachment and uncontrolled southern pine beetle infestations. They concluded that several RCW clusters were likely to be lost and six more would be adversely affected by loss of foraging habitat. These same needs may exist for RCW habitat in inventoried roadless areas. Another possible scenario would be a thinning project to reduce fuel loading and risk of high-intensity stand replacing wildland fire to protect a single remaining endangered plant population. This exception would permit such activities, providing the appropriate regulatory agency concurs.

A comprehensive description of the potential effects from road construction and timber harvest avoided under this alternative can be found in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation.

Potential for Adverse Effects from the Prohibition on Timber Harvest – An important objective of this analysis was to determine whether a prohibition on timber harvest in inventoried roadless areas would have any adverse effects on the ability of Agency to take actions needed to conserve or protect TEPS species and their habitats. For example, there may be situations where excessive build up of fuels could result in an increased incidence of uncharacteristically large, stand-replacing wildland fires. Pretreatment of

areas through thinning may be desirable to safely use prescribed fire. There may also be a need to restore or enhance stand structure and composition to sustain suitable habitat for some TEPS species, such as previously described for the red-cockaded woodpecker.

The indirect effects of a prohibition on timber harvest, therefore, would have potential implications to management of TEPS species in inventoried roadless areas. Given that concern, the exception for timber harvest for conservation or recovery of TEP species was added to this alternative. As described above, Alternative 4 would not preclude use of timber harvest for stand enhancement, successional stage management, or fuels reduction when needed for recovery or protection of TEP species, provided the applicable Federal agency with ESA oversight responsibilities supports the need. As there is essentially, then, no prohibition of timber harvest that would preclude activities needed for recovery or conservation of TEP species, none of the action alternatives would pose an increased risk of adverse effects, relative to the No Action Alternative. This exception, however, would not apply to sensitive species.

In evaluating the potential need for fuels reduction efforts for conservation of sensitive species, it is important to recognize that, for many terrestrial and aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildland fires that create habitat mosaics can improve foraging habitat for lynx (USDA and others 2000). Fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, which is an essential habitat feature for many salmonid and other aquatic species. While such disturbance events may have negatively affected individuals of some TEPS populations, the overall effects on species population viability are less likely to have been adverse in nature.

The effects of wildland fires on terrestrial and aquatic species can vary depending on fire occurrence, intensity, severity, uniformity, size, and season. The effects of fire may be both direct and immediate, as well as indirect and sustained over an extended period (Minshall and others 1989; Niemi and others 1990; Smith 2000). Some impacts may result in short term habitat loss, but long-term habitat enhancement. For example, fires may destroy some northern goshawk nest sites. However, these same fires may also create the habitat mosaics that enhance goshawk habitat. Species with limited ranges or low population numbers may be more vulnerable. For example, adverse effects to fish populations have been limited to areas where native fish populations have declined and become increasingly isolated because of human activities (Gresswell 1999).

The analysis in the FEIS showed that some types of past timber harvest and the effectiveness of past wildland fire suppression have caused significant ecological shifts in vegetation, fuel loading, and fire regimes in some areas, increasing the risk of high-intensity, large-scale, stand-replacing fires in many areas. However, as previously discussed in the Fuel Management section, there appear to be minimal landscape level differences between alternatives, relative to the likelihood of timber harvest providing

significant reduction in the risk of uncharacteristic wildland fire effects in inventoried roadless areas, at projected harvest levels. There is also a lack of current scientific literature addressing the feasibility, effectiveness, and ecological legacies of landscape-level fuels reduction efforts.

Regardless of the alternative selected, wildland fires of increased severity and size will continue to impact habitat for some species. While wildland fires may negatively affect individuals in some TEPS populations, the overall effects on population viability are less likely to be adverse in nature. None of the alternatives would preclude the use of other restorative tools like prescribed fire, which under some conditions can be used without prior thinning, to benefit early seral and open forest species.

Summary of Effects – Based on the information provided by each national forest, the need for road construction or reconstruction for recovery or protection of TES species appears to be minimal. Alternate means of access could likely be found to accomplish recovery or conservation objectives. With the exception provided in the proposed rule that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated.

As previously discussed, the prohibition of timber harvest could be waived to permit needed for recovery or conservation of TEP species. This alternative would prohibit timber harvest that may be desirable to enhance or restore habitat for some sensitive species at the local level. However, it is unlikely that this inability would represent a substantial change in the overall level of risk to continued species viability from that expected under the No Action Alternative. Overall, this alternative would be beneficial to conservation of TEPS species and biodiversity.

Effects of Social and Economic Mitigation on Biodiversity

These mitigation measures could result in an additional 65 miles of road construction (none expected on the Tongass) in inventoried roadless areas over the next 5 years. This would increase the miles of road construction and reconstruction under Alternatives 2, 3, and 4 from 293 to 358 (662 miles with the Tongass exemption).

It is impossible to predict the amount or location of road reconstruction that would be excepted for reasons of public health and safety. Realignment or upgrade of roads would likely result in additional ground disturbance, but it is unlikely that the environmental effects of such reconstruction would substantially expand the area affected beyond that of the original construction, especially given the current emphasis on environmentally sensitive design and use of best management practices. Such reconstruction could result in substantial changes in the kinds and amount of human uses in an area, with potential adverse effects on biodiversity as previously described.

Estimates of the miles of road construction that may be excepted for Federal Aid Highway projects over the next 5 years indicate that few additional miles would likely be constructed in inventoried roadless areas. There is no reason to anticipate a substantial increase in the future. Only one 6-mile project is currently planned on the Chugach

National Forest. While this project may have local effects on the characteristics and values associated with the affected inventoried roadless area, this limited level of activity would not result in a substantial change in the overall environmental effects of the alternatives.

As currently projected for the next 5 years, requests for new leasable mineral activities in inventoried roadless areas are expected on six national forests, requiring an estimated 59 miles of road construction. There would likely be additional activities on other forests in the future, in response to changing economic conditions and shifts in supply and demand for these resources. The types of activities that would be eligible under this exception include exploration and development of geothermal, oil and gas, coal, and phosphate resources.

There appears to be limited potential in the near future for geothermal development activity associated with inventoried roadless areas, based on data submitted by the national forests and grasslands. Only one forest anticipated lease applications in the next 5 years, with 3 miles of associated temporary road construction. Although the magnitude of effects from geothermal exploration and development would depend on a variety of factors, impacts from such activities do not appear to pose substantial or widespread risks to biodiversity. Geothermal exploration activity in many areas has been restricted in extent and has often resulted in little disturbance to areas around drilling sites. As the location of drilling sites for exploration is often somewhat flexible, environmentally sensitive areas usually can be avoided (USDA Forest Service and USDI Bureau of Land Management 1994b).

Oil and gas exploration and development activity within inventoried roadless areas is anticipated on four national forests in the next 5 years, with an estimated 34 miles of road construction. Nationally, the demand for these resources is increasing. Therefore, there may be increases in this activity within inventoried roadless areas on these four forests and other NFS lands. The associated road systems would likely account for a substantial portion of potential environmental effects, including increased risk of spread and establishment of nonnative plant species.

Other effects of these activities would be determined by the:

- location and size of areas disturbed,
- duration of the activity,
- mitigation measures used for environmental protection including containment of toxic materials used in the drilling process,
- type and effectiveness of site reclamation,
- overall level of exploration and development activity within an area, and
- persistence of any post-project activities.

Ten projects on two national forests were identified that would involve exploration or development of coal or phosphate resources, with an estimated 22 miles of road construction. In addition to the potential effects of road construction associated with these

projects, these kinds of activities can have adverse effects to aquatic and terrestrial species, some of which can be substantial and long term.

Environmentally, application of the social and economic mitigation measures to the prohibition alternatives would diminish the potential beneficial effects of a prohibition on road construction and reconstruction, given the greater amount of area disturbed and the kinds of activities enabled. Depending on a variety of factors, leasable mining activities supported by road access would potentially have detrimental effects to aquatic and terrestrial habitats and species. However, at current levels of activity and given the application of best management practices, the potential extent of these activities and their impacts do not appear to be widespread and it is unlikely that most effects would extend much beyond local levels. Decisions on whether to permit such activities, and if so, what environmental mitigation measures would be required, would be made using current land management planning and decision-making processes. Overall, even with application of these measures, Alternatives 2, 3, and 4 would still provide important benefits relative to conservation of biological diversity.

Other Indirect and Cumulative Effects on Biodiversity

The cumulative effects of the prohibitions, and past, present, and reasonably foreseeable actions on biodiversity were considered in this analysis for several time intervals and geographical scales. Short-term effects were considered to occur in the next 5 years. Long-term effects were considered generally to be two or more land management planning cycles (30 to 40+ years). Where applicable the cumulative effects were assessed at local, regional, and national scales, including local inventoried roadless areas, all NFS lands, regions of the United States, and the entire United States. Various land ownership patterns and land designations were also considered.

Several ecological and biological resource indicators discussed in the Biodiversity section of this chapter were used to assess the cumulative effects of the prohibitions, land uses and conversions, laws, regulations, policies, and nonnative species invasions on biodiversity. Biodiversity resource indicators used were the habitat and population trends for terrestrial and aquatic plant and animal species, and communities (including TEPS) and **landscape characteristics**.

Based on current literature (Flather and others1999; Noss and Cooperrider 1994; Stein and others 2000) and data from Forest Service regions, it is possible to conclude that with or without conservation of inventoried roadless areas, biodiversity is at an increased risk of adverse cumulative effects from increased population growth and associated land uses, land conversions, and nonnative species invasions. Conservation of inventoried roadless areas provided by the alternatives, however, may lessen this risk at least in the short term (20 years) by reducing the level of potential adverse impacts on inventoried roadless areas, some of the last relatively undisturbed large blocks of land outside of designated Wilderness. The action alternatives would increase conservation of inventoried roadless areas and therefore, could have beneficial effects on biodiversity conservation at the local, regional, National Forest System, and national levels. There would be similar incremental beneficial effects on biodiversity conservation when any one of the

prohibition alternatives is combined with the past, present, and reasonably foreseeable land uses and conversions, laws, regulations, policies, and nonnative species invasions. The local, regional, and national cumulative beneficial effects could include:

- Conserving and protecting large contiguous blocks of habitat that provide habitat connectivity and biological strongholds for a variety of terrestrial and aquatic plant and animal species including TEPS species.
- Providing important local and regional components of conservation strategies for protection and recovery of listed TEPS species.
- Providing increased assurances that biological diversity would be conserved at a landscape level, including increased area of ecoregions protected, improved elevational distribution of protected areas, decreased risk of additional timber harvest and road caused fragmentation, and maintenance and restoration of some natural disturbance processes.
- Providing increased assurance that biodiversity would be supported within inventoried roadless areas including the maintenance of native plant and animal communities where nonnative species are currently rare, uncommon, or absent.

The value of inventoried roadless areas in conserving biodiversity is likely to increase as habitat loss and habitat degradation increase in scope and magnitude. With these increasing trends, the importance of roadless area conservation and other laws, regulations, and policies in the management of biodiversity is also likely to increase.

The action alternatives when considered alone may not be as important on a national level as when considered in combination with other land conservation laws, policies, and strategies. For example, many inventoried roadless areas in combination with Wilderness Areas, Nature Conservancy Preserves, some National Forest System land allocations, national parks, or conservation easements provide large contiguous habitat blocks with national significance for biodiversity conservation.

The beneficial effects of the prohibitions may be most noticeable at an inventoried roadless area, regional, or NFS level, but there are also beneficial effects for the United States. For instance, in the Southeastern United States, because of the magnitude of land use and land conversion, and the relatively small size of existing protected areas, inventoried roadless areas are especially important for local species like the Louisiana black bear. Similarly, inventoried roadless areas in some areas of the Forest Service Intermountain and Northern regions of the Western United States, contribute to habitat connectivity, which is an important feature of northern Rocky Mountain ecosystems for species like the grizzly bear, wolf, and lynx. In these examples, the local protection and conservation of T&E species habitat is also important in terms of conserving biodiversity at a national level.

Whether the cumulative beneficial effects of the prohibitions and other past, present and reasonably foreseeable actions would fully offset predicted future increases in land uses, land conversions, and nonnative species invasions is difficult to assess. Yet, it is possible to conclude that without the prohibitions, there would likely be an increased risk of adverse cumulative effects to biodiversity. When compared to the No Action Alternative, the prohibition action alternatives would help conserve management options over the

next 20 or more years, so society would have time to make choices on biodiversity conservation.

At some point in the future, projected habitat loss and degradation, from the direct and indirect effects of increasing population growth could potentially surpass the contribution of inventoried roadless areas to biodiversity conservation. In this scenario, habitat loss and loss of viable plant and animal populations may be of a magnitude such that the beneficial effects of the prohibitions and other laws, regulations, and policies relative to biodiversity conservation may be lost or overwhelmed. Even under this scenario, inventoried roadless areas would still likely convey some beneficial effects relative to conservation of individual species locally, regionally, and nationally.

Research, Monitoring, and Reference Landscapes

Widespread interest exists in obtaining information about large-scale ecological patterns, processes, and management activities (Bormann and others 1999). Issues, such as viability of wide-ranging animals, watershed cumulative effects, and restoration of fire dependent ecosystems, require research and monitoring at large scales to significantly address this interest. Inventoried roadless areas enable monitoring of long-term environmental change, an improved understanding of the affect of past events and activities on the landscape, and help to establish emerging management policies, programs, and activities and evaluate the effects of past policies.

Unique opportunities to gather information about ecological systems and human related impacts exist in these areas because, unlike wilderness, national parks, and other restrictive areas, roadless areas provide large expanses where a range of management treatments may be applied and tested. Gathering this information is possible through research and monitoring activities conducted in partnerships between scientists, the public, and managers (Bormann and others 2000).

Large areas for the long-term study of trends in ecosystem health are available in inventoried roadless areas. For example, inventoried roadless areas may be used to study changes in neo-tropical migratory bird populations, climate change, global warming impacts on forest ecosystems, and impacts of nonnative invasive species on natural ecosystems. This type of research and monitoring typically involves establishment of measurement plots and installation of equipment to periodically measure change.

Inventoried roadless areas also serve as valuable reference points for comparison of the effects of past activities on adjacent lands; especially in larger areas adjacent to wilderness or parks. Comparison of long-term effects that roads have had on watersheds, recreation, forest health, and other resources is only possible if roadless areas are available as a basis for comparison.

Inventoried roadless areas provide an opportunity for research and monitoring efforts to help Agencies understand the consequences of their land management policies. Public

land management policies have a history of change. Future policies will likely be different from present and past policies. The past policy of intensive clearcutting and roading is giving way to a widely supported program focusing on small trees and fuel reduction to restore ecosystems damaged by continued fire suppression. Future choices, to a large degree, will be dependent on the results of trials and knowledge gained through research and monitoring as policies and programs change.

As an example, well-designed landscape scale management experiments are needed to evaluate methods for restoring historical fire regimes and fuel loads in the Intermountain West. Important questions to consider include:

- Can ecological effects from large, uncharacteristic wildland fires be reduced through prescribed fire, mechanical treatments, or a combination of these fire treatments? Which approach will best suit the needs of which ecosystem?
- What are the long-term landscape effects from continued wildland fire suppression in fire-dependent ecosystems? Can these effects be mitigated through management? What is the recovery time of severely burned ecosystems?
- Should land managers use an active or “natural” approach to restoring fire regimes? What are the consequences of both of these choices?
- Are roads needed to restore historical fuel conditions and fire behavior?

These questions might be answered by applying several different treatments to roadless, roaded, or a combination of these areas. Treatments might include total fire suppression, allowing only wildland fires to burn, fuel reduction with prescribed fire only, or using a combination of mechanical fuel cutting and prescribed fire. All treatments would require application time sufficient to obtain the desired information. At a minimum, such large-scale management experiments would require reevaluation when land management plans are revised. The commitment of scientists, managers, and the public is critical to sustaining long-term research and monitoring success.

Inventoried roadless areas provide different opportunities for study than are found in other designations, such as Wilderness Areas, Research Natural Areas, Experimental Forests, or general forestland. In Wilderness and Research Natural Areas, learning opportunities are limited because it may be impossible to apply certain management prescriptions; particularly the more intensive ones. Conversely, in Experimental Forests or general forestland, a broad range of treatments, such as roading, clearcutting, or other intensive management, may occur.

Long-term commitment to learning is essential to achieve sustainable ecosystem management. The next generation of scientists, citizens, and managers may benefit from the information derived from today’s land management experiments. Working collaboratively with scientists, managers, and the public in development of research and monitoring activities could help ensure that the right questions and values are considered and that long-term commitments to learning are made.

Alternatives 1 through 4

No alternative precludes the use of inventoried roadless areas for future research and monitoring. The No Action Alternative would reduce the opportunity for long-term study where comparisons of natural settings are needed since many inventoried roadless areas would be subject to commodity production and development. Alternatives 2 and 3 place progressively greater limits on human activities, which will narrow the range of possible management experiments. For example, under Alternative 3, clearcutting experiments would be unacceptable since this alternative promotes stewardship related activities. Alternative 4, which does not allow timber harvest including thinning before prescribed fire, places the most limits on the range of possible management experiments. Alternative 4 would affect ongoing research projects that require mechanical vegetation treatments. Alternative 4 would place greater limits on research than Alternatives 2 or 3.

Human Uses

Timber Harvest

Affected Environment

American forests have a wide variety of forest types and ages, including old-growth stands, naturally regenerated forests, and planted forests. Areas of old growth remain in the Pacific Northwest, parts of California, and much of the Rockies. East of the 100th meridian (Figure 1-1), most of the forests are second growth, naturally regenerated stands. In some cases, these lands were never fully converted to agricultural use, but selective logging was common. The tree species found in these stands are usually similar to those that would have existed there before European settlement. Even in most forest plantations, the species composition mimics the forest that would have naturally regenerated there (Sedjo 1991).

Of the 747 million acres of forestland in the United States, about 490 million acres are considered commercial forestland, capable of growing 20 cubic feet or more per acre per year. About 72% of all commercial forestland is found in the Eastern United States and 28% is found in the West. Private lands account for 71% of the total commercial forestland. National forests account for another 19% of the total commercial forestland, the remaining 10% are in other public or Tribal ownerships. The volume of timber on all forestlands has been increasing since 1952 when inventory data first became available. Much of the hardwood timber volume is in the East, while much of the softwood volume is in the West. In the West, 46% of the softwood timber resource is on NFS lands (USDA Forest Service 1999j).

In 1997, the volume of growing stock on all NFS lands was approximately 1,260 billion board feet. Net annual timber growth in 1996 on all NFS lands was about 20.5 billion board feet. Removal of timber volume from all NFS lands due to harvest, mortality, or land clearing for the same year totaled about 4.1 BBF. Removal for 1996 was

approximately 20% of growth (USDA Forest Service 1999j). While the 1996 removal is not a current annual average, it is indicative of an ongoing substantial net increase in volume of wood fiber on NFS lands.

Trends in Consumption, Production, and Import of Wood Products – A significant effect of the reduction in Federal timber harvest between 1987 and 1997 (from about 13 BBF to 4 BBF annually) has been to transfer harvest to private forest ecosystems in the United States and to forest ecosystems in Canada (MacCleery 2000). For example:

- Since 1990, United States softwood lumber imports from Canada rose from 12 to 18 BBF, increasing from 27% to 36% of United States softwood lumber consumption. Much of the increase in Canadian lumber imports has come from the native old-growth boreal forests. In Quebec alone, the export of lumber to the United States has tripled since 1990. The increased harvesting of the boreal forests in Quebec has become a public issue there.
- Harvesting on private lands in the southern United States also increased after the reduction of Federal timber in the West. Today, the harvest of softwood timber in the southeastern United States exceeds the rate of growth for the first time in at least 50 years. Increased harvesting of fiber by chip mills in the southeastern United States has become a public issue regionally.

Total national production of lumber, plywood, and all other timber products in the United States has been relatively stable over the past decade, averaging slightly more than 18 billion cubic feet annually from 1987 to1999. Total national consumption of timber products during the same period has averaged about 20 billion cubic feet annually. Softwood lumber production is the largest category within the totals above. National production has not been keeping pace with demand. Production averaged 35 BBF while consumption averaged 45 BBF annually.

Suitable Lands – Of the 93 million acres of commercial forestlands on NFS lands, an estimated 47 million acres (51%) are considered suitable for timber production. Lands that are suitable for timber production are those that are capable of reforestation within 5 years of harvest, able to be harvested without irretrievable damage to soils or watershed, and are not in an area reserved by Congress or otherwise determined to be unavailable for timber production. Responsible officials may establish timber production as a multiple-use land management plan objective for lands where cost of timber production are justified by the ecological, social, or economic benefits.

Through the land management planning process, each national forest and grassland determines the location and amount of suitable acres. Of these suitable acres, approximately 9 million acres (roughly 20%) are located in inventoried roadless areas where existing land management plans would allow timber harvest and road construction to occur. Most of the acres of commercial forestland in inventoried roadless areas occur in the Western United States and Alaska. Table 3-37 shows the approximate amount of suitable acres of commercial forestland in inventoried roadless areas by region.

Table 3-37. Estimated acres (in thousands) of forestland suitable for timber production in inventoried roadless areas, by Forest Service region.

Region	Acres suitable for timber production
Northern (1)	2,274
Rocky Mountain (2)	1,317
Southwestern (3)	63
Intermountain (4)	1,598
Pacific Southwest (5)	394
Pacific Northwest (6)	1,701
Southern (8)	332
Eastern (9)	85
Alaska (10)	1,274
Total	**9,038**

(USDA Forest Service 1994)

Allowable Sale Quantity (ASQ) – The quantity of timber that may be sold from an area (usually a national forest) covered by a land management plan during a period specified by the plan. It is usually expressed as an average annual volume that is suitable for timber production, which may be sold from the forest's land base. Timber may be sold from lands that are not identified as suitable for timber production in the land management plan if necessary to achieve desired vegetation conditions; however, this volume is generally not included within the ASQ.

As land management plans have been revised, a trend of substantial decreases in ASQ has been appearing. Table 3-38 summarizes this information for forests that have revised land management plans or have published draft plan revisions through 1999. In the Pacific Northwest Region, forests are operating under probable sale quantities (Table 3-37) until their next land management plan revisions calculate new ASQs. As land suitable for timber production and ASQ volumes continue to decrease, it is likely that timber harvest volume from non-suitable lands will increase because of the need to meet fuel reduction and other non-timber vegetation management objectives of land management plans.

This downward trend in ASQ volume is assumed to be continuing throughout all NFS lands, not just inventoried roadless areas. This is partly due to changing management emphasis in inventoried roadless areas. The change in emphasis can be traced to the emergence of ecosystem management in the early 1990s, development of the Northwest Forest Plan and other similar regional plans, and the Forest Service Natural Resource Agenda. ASQ volume applies only to that volume scheduled to be removed from land suitable for timber production. Additional unscheduled timber volume has been and will continue to be harvested to restore, improve, or maintain ecosystem health.

Table 3-38. Changes in allowable sale quantity (ASQ) in recent land management plan revisions.

Region	Forest	Year plan revised	Previous ASQ (MMBF [a])	New ASQ (MMBF [a])	Reductions (%)
Rocky Mountain (2)	Arapaho-Roosevelt	1997	30	7	-77
	Black Hills	1997	152	87	-43
	Rio Grande	1996	36	23	-36
	Routt	1998	38	38	0
Intermountain (4)	Targhee	1997	86	8	-91
Pacific Northwest (6)	Deschutes	1994	99	63	-36
	Gifford Pinchot	1994	334	65	-81
	Mt. Baker Snoqualmie	1994	108	7	-94
	Mt. Hood	1994	189	65	-66
	Okanogan	1994	63	45	-29
	Olympic	1994	111	10	-91
	Rogue River	1994	120	26	-78
	Siskiyou	1994	160	24	-85
	Siuslaw	1994	335	12	-96
	Umpqua	1994	334	78	-77
	Wenatchee	1994	136	20	-85
	Willamette	1994	491	116	-76
	Winema	1994	45	37	-18
Southern (8)	Francis Marion	1996	59	17	-71
	George Washington	1993	38	33	-13
	NFs in Texas	1996	112	113	1
	NFs in Florida	1999	107	86	-20
	Kisatchie	1997 (Draft)	128	51	-60
Alaska (10)	Tongass	1999	450	187	-58

[a] Million board feet
(Forest Service Ecosystem Management Coordination Staff 2000)

Estimates of expected timber offer and harvest quantities over the short- and long-term are provided in this section as effects under each alternative. The ASQ for existing land management plans will be recalculated at the time of the next plan revision.

National Forest Timber Harvest – Timber harvest is the process by which trees with commercial value are cut and removed from the forest. Timber sale refers to a contractual process of selling the timber to a purchaser and implementing a series of harvesting requirements for what type, how and when the trees are removed. For purposes of this analysis, these terms are used interchangeably.

Timber sales are often used as a least-cost method (revenue is returned to the Federal treasury to offset the costs of preparing and carrying out the timber harvest) of managing vegetation to meet resource objectives or to achieve desired ecosystem conditions. These objectives and the desired conditions include improving wildlife habitats, reducing fuels that may increase fire risk, recovering timber value from natural disasters, such as windstorm or fire, reducing impact of insect and disease, and improving tree growth.

Roads are required to support a timber sale, and frequently they must be constructed or reconstructed to meet timber harvest or other resource management objectives. Roads are needed to move equipment into the area and to haul logs or other forest products to the community where they will be processed. While timber can be harvested using helicopters or cable yarding systems from existing roads, the use of these methods depends on the value of the timber being removed, the terrain, and the distance to an existing road. Each timber sale contract specifies the yarding method and any permanent or temporary road construction and reconstruction required.

Timber purchasers may be required to complete needed road reconstruction to ensure public safety and to mitigate the damage to the environment from logging traffic. When the Forest Service determines that roads are needed for other multiple-use activities, the roads are constructed to meet appropriate road specifications and retained for future use after the timber sale. By law (16 USC 1608 (b)), temporary roads are used only for the duration of the timber sale and then closed or decommissioned or converted to a classified road. Even helicopter sales may require some classified road construction, reconstruction, or temporary roads to access landings for hauling logs.

Road spacing and distance from the nearest road have a direct effect on yarding costs of wood fiber. As the road spacing or distance from the nearest road increases, so does the average yarding distance for a given harvest unit. This affects production rates that affect skidding and yarding costs. Generally, wider road spacing or increased distance from the nearest road means longer skidding and yarding distances, which requires larger yarders and wider road widths (USDA Forest Service 1999p).

The trend in silvicultural practices is shifting away from **even-aged management** toward management of **uneven-aged** stands primarily due to public controversy and management concerns about non-timber resources. These multi-story and multi-age stands require thinning and other silvicultural treatments with greater frequency, thus needing road access more often. Thinning to remove excessive forest fuels, before using prescribed fire, or to treat diseased or insect infested stands is often economically feasible only if a road system is present (USDA Forest Service 1999p). Nationally, clearcutting has decreased from 31% to total harvested acres in 1989 to 10% in 1997 (USDA Forest Service 1998b), with the downward trend expected to continue.

National Forest Timber Trends – Figure 3-31 displays volume of **timber sold** from national forests from 1905 to 1999.

The volume of timber sold from NFS lands declined from more than 11 BBF in 1987 to 2.2 BBF in 1999. The average annual **volume sold** from 1993 to 1999 was 3.2 BBF.

Nationally, this reduction was offset by an increase in Canadian and other foreign imports and harvesting on private lands.

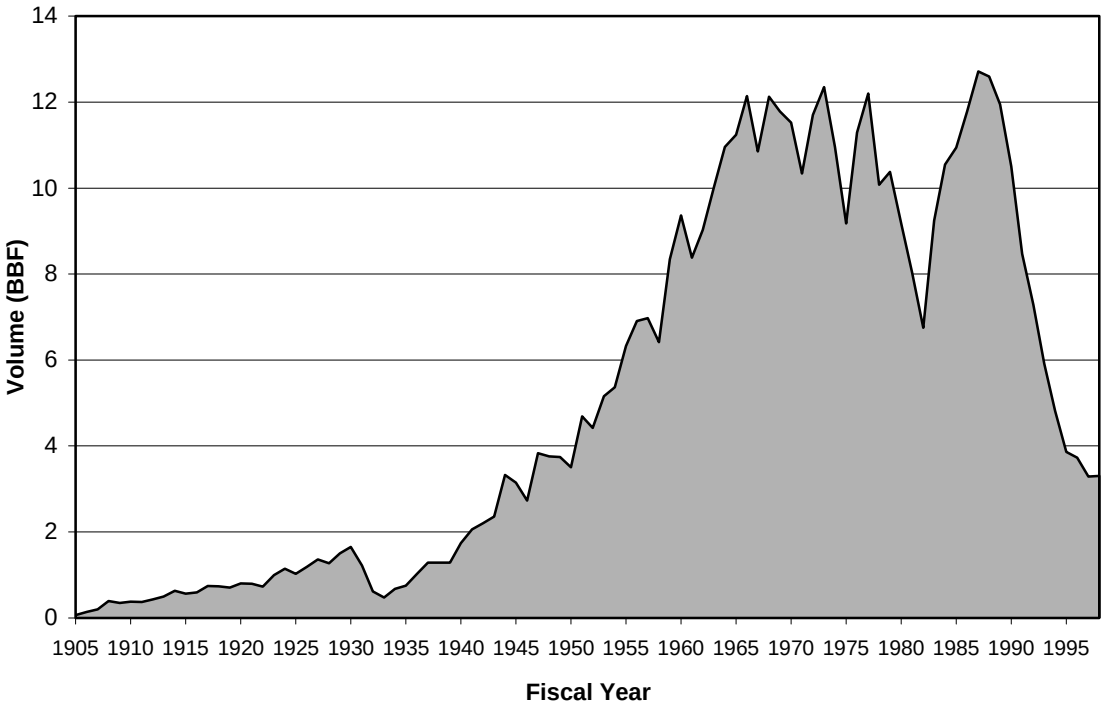


Figure 3-31. Long-term trend in volume of timber harvested from the national forests.

Table 3-39 shows the recent national trends in area harvested and volume offered as part of the NFS timber sale program. Timber offered is the volume of timber advertised for sale. Volume sold is the amount of timber actually purchased, which is usually less than offered volume because some sales are judged as economically marginal by prospective purchasers, and they receive no bids. Volume harvested is the actual volume removed from the forest in a given year, which may be higher or lower than volume sold depending on market conditions. Most harvest volume was actually sold 1 to 3 years earlier. Refer to the Timber Harvest and Forest-dependent Communities portions of the Social and Economic Factors section of this chapter for a more detailed discussion regarding market influences, employment, Payments to States, and dependent communities.

Table 3-39. National trends in National Forest System timber sale program.

Fiscal year	Timber offered (MMBF [a])	Volume sold (MMBF [a])	Volume harvested (MMBF)	Acres harvested (thousands)
FY 1997	3,999	3,688	3,285	458
FY 1998	3,388	2,955	3,284	526
FY 1999	2,300	2,200	2,939	449
FY 2000	1,800	1,700	2,522	385

[a] Million board feet

(USDA Forest Service 1998b, WO Forest Management Staff estimates)

Timber Sale Purpose – Timber sales are used to achieve a variety of vegetation management objectives. Under the Timber Sale Program Information Reporting System (TSPIRS), timber is sold for one of three purposes: 1) forest stewardship, 2) timber commodity, or 3) personal use. The main objective of **stewardship-purpose timber sales** is restoring, improving, or maintaining ecosystem health. The main objective of commodity-purpose timber sales is to provide a sustainable yield of forest products to meet the nation's demands. Personal use sales are made primarily to supply firewood, Christmas trees, and other miscellaneous forest products to individuals for their own consumption. Most timber sales (90% or more of the national volume sold) are for either stewardship or commodity purposes, or they may include volume for both purposes within the same sale.

During fiscal year 1997, 52% of national forest timber harvested was for commodity purposes, down from 71% during 1993. Timber harvested for stewardship purposes in 1997 was 40%, compared to 24% during 1993, and this increase is expected to continue. Timber harvest for personal use purposes remained stable in the 5% to 8% range over the same period (USDA Forest Service 1998b).

Roadless Areas Timber Harvest Trends – From 1993 to 1999, national forests sold 783 MMBF from approximately 80,000 acres (an average of 112 MMBF and about 11,000 acres per year) from inventoried roadless areas. This is less than 4% of the average annual volume sold from all national forests during the same period. About one-third of that volume was salvage from trees killed by fire, insects, and disease.

Timber volumes planned from inventoried roadless areas on all national forests during fiscal years 2000 through 2004 were evaluated. Table 3-40 summarizes current planned volume, acres to be harvested, and miles of road construction planned. The proposed rule would not apply to fiscal year 2000 sales already sold, and may not apply to much of the volume in fiscal years 2001 and 2002 where projects are more likely to have approved environmental decisions before final rule implementation date. However, the data represent a reasonable estimate for the first 5 years under full implementation of the final rule.

Alternative 1 – No Action

Under Alternative 1, timber harvest in inventoried roadless areas would continue under the direction of current land management plans and national and regional policy. Given the recent trend of increased stewardship-purpose timber sales, 60% or more of the acres and 50% to 60% or more of volume offered is likely to be stewardship-purpose timber sales. About 30% to 40% of volume offered would be commodity-purpose timber sales, and roughly 5% to 10% of volume offered would be personal-use purpose sales. The full range of silvicultural and harvest systems would be considered to accomplish vegetation management objectives.

Both even-aged and uneven-aged silvicultural systems may be used under this alternative. Methods will be determined at local levels based on further site-specific analysis. When even-aged management is used, **shelterwood** and seed-tree prescriptions are more likely

Table 3-40. Projected timber offer and planned road construction in inventoried roadless areas for 5 years, by Forest Service region. Construction mileages include new, reconstructed, and temporary roads.

Region	Projected timber offer (MMBF [a])	Projected acres harvested (thousand acres)	Projected timber-related road construction (miles)
Northern (1)	85	10	52
Rocky Mountain (2)	48	7	58
Southwestern (3)	3	0.6	3
Intermountain (4)	201	25	117
Pacific Southwest (5)	33	4	10
Pacific Northwest (6)	87	17	19
Southern (8)	30	6	26
Eastern (9)	78	11	47
Alaska (10)	539	14	291
Total	**1,104**	**94.6**	**623**

[a] Million board feet
(Roadless Database 2000)

to be used than clearcutting, except in Alaska where clearcutting is expected to be the most commonly used harvesting practice. **Uneven-aged management** uses single tree or **group selection**, or a combination of these systems. Pre-commercial and commercial thinning would be used in both even- and uneven-aged systems. Salvage and **sanitation** cutting under both even- and uneven-aged systems would be used where consistent with other resource needs, such as the retention of standing dead or large, down woody material. Logging systems are likely to include ground-based (tractor, forwarder), cable and helicopter.

Substantially more salvage harvest is likely to occur over time in inventoried roadless areas under this alternative, as road construction and timber harvest may be used to recover the usable volume from fire, insect, disease, and wind damage and to reduce fuel loading. This alternative is likely to result in more **pre-commercial thinning**, intermediate thinning, and other silvicultural treatments to manage forested landscapes for a variety of purposes over time than Alternatives 2 through 4.

Approximately 90,000 to 95,000 acres are likely to be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 18,000 to 19,000 acres harvested from a suitable land base of approximately 9 million acres within inventoried roadless areas. About 15% of the volume and harvest acres are within 2.8 million acres where roads already exist.

Nationwide, approximately 1.1 BBF could be offered in inventoried roadless areas over the first 5-year period. It would be necessary to construct or reconstruct about 445 miles of classified road, and about 177 miles of temporary road to harvest about 800 MMBF. The remaining could be harvested without the need for new or reconstructed roads. This alternative would result in the highest potential level of road construction and timber

harvest of all alternatives. During this first 5-year period, timber harvest and road construction could occur on approximately 0.3% of the total inventoried roadless areas nationwide on the land base where current land management plans allow road construction to occur.

From past Agency experience, the estimated volume of 1.1 BBF could be reduced by as much as 30% before harvest due to results of site-specific analyses, statistical variation in inventories and volume estimates, NEPA process delays, litigation, or difficulties in completing the sale preparation process.

Tongass National Forest – The Tongass National Forest would offer nearly half of the national timber sale program in inventoried roadless areas. This would be 539 MMBF from approximately 14,000 acres, over the next 5 years, primarily using clearcutting. This is about 0.4% of the inventoried roadless area acres on the Tongass National Forest where road construction is permitted by the current land management plan. All of this volume would be considered commodity-purpose timber harvest.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005, are made for Alternative 1 recognizing that there are high levels of uncertainty about the Agency's ability to continue harvesting timber for any purpose from these areas. Approximately 130 to 160 MMBF of timber would be sold each year from 2005 through 2040 from 13,000 to 15,500 acres in inventoried roadless areas. The Tongass National Forest would account for about half to two-thirds of the projected volume.

Alternative 2

Under Alternative 2, timber harvest consistent with land management-plan prescriptions, standards and guidelines would continue, while road construction and reconstruction would be prohibited within all inventoried roadless areas. A split between commodity, stewardship, and personal use timber-sale volumes similar to that under Alternative 1 is expected under this alternative. The full range of silvicultural and harvest systems would be considered to accomplish vegetation management objectives.

Both even-aged and uneven-aged management may be used under this alternative. Shelterwood and seed-tree prescriptions are more likely to be used than clearcutting, except in Alaska where clearcutting is expected to be the most commonly used harvesting practice. Timber harvest objectives and silvicultural prescriptions would generally be the same as those under Alternative 1. Helicopter yarding may be more prevalent under this alternative than under Alternative 1 due to the prohibition on road construction.

Nationally, about 300 MMBF would likely be offered from about 40,000 acres in inventoried roadless areas over the first 5-year period. About 0.1% of the acres in inventoried roadless areas where current land management plans allow timber harvest would be harvested. This timber offer-volume reduction of slightly more than 800 MMBF (73%) over the 5-year period from Alternative 1 would be due to the prohibition on road construction and reconstruction. The estimated offer volume of 300 MMBF could be reduced before harvest by as much as 30% due to results of site-specific

analyses, NEPA process delays, litigation, or difficulties in completing the sale preparation process.

The effects of a prohibition on road construction on the mix of stewardship and commodity purpose-timber harvest are largely unknown. Salvage volume could be removed when consistent with land management plan direction, though only areas near existing roads, high volumes per acre, or high-value species within a mile of the nearest road that could be yarded with helicopters would be economically feasible to harvest. Consequently, with no opportunity for new road construction, substantially less salvage volume from fire, insect, disease, and wind damage is expected under this alternative than under Alternative 1. This alternative is likely to result in much less pre-commercial thinning, intermediate thinning, and other silvicultural treatments to manage forested landscapes for a variety of purposes.

The largest reductions in volume offered and area harvested over the 5-year period would occur in Region 10 (512 MMBF and about 13,000 acres harvested) and Region 4 (134 MMBF and about 17,000 acres harvested). Prohibition of road construction would have the greatest volume impacts on the Tongass National Forest in Alaska, the Idaho Panhandle and Payette National Forests in Idaho, the Dixie and Manti-La Sal National Forests in Utah, and the Superior National Forest in Minnesota.

Timber harvest objectives and silvicultural prescriptions would generally be the same as those under Alternative 1. The prohibition on road construction and reconstruction would increase timber harvest costs or costs of silvicultural or fuels reduction activities normally accomplished by service contract or means other than timber sale contract. In the Pacific Northwest, logging costs for helicopter yarding are three to five times higher than for tractor yarding the same ground; cable yarding costs are twice that of tractor yarding costs under the same conditions (Reutebuch personal communication). In Montana, the cost of cable yarding is roughly twice that of tractor skidding and approximately 50% higher than using forwarders. Helicopter yarding is roughly three times the cost of tractor yarding and twice that of using forwarders (Keegan and others 1995). Helicopter timber harvest feasibility depends on many factors, including value, log size, and volume per acre of timber removed. Generally, helicopter yarding is not feasible at distances of more than one-half to three-quarters of a mile from the nearest road. Topography and location of existing roads directly affects the feasibility of timber harvest when using helicopters or cable systems.

Approximately 40,000 acres could be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 9,000 acres harvested from a land base suitable for timber production of approximately 9 million acres in inventoried roadless areas. Roughly one third of the volume and harvest acres are within 2.8 million acres of inventoried roadless areas where roads already exist.

Tongass National Forest – Under the road construction and reconstruction prohibitions of this alternative, the forest would likely offer 27 MMBF harvested from about 700 acres. This is a 95% volume reduction to the Tongass National Forest from Alternative 1.

Harvests would be accomplished primarily using clearcutting. All of this volume would be considered commodity-purpose timber harvest.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005 are made for Alternative 2 recognizing that there are high levels of public controversy and uncertainty about the Agency's ability to continue harvesting timber from these areas. Approximately 35 to 44 MMBF of timber would be sold each year from 2005 through 2040 from between 3,000 and 4,200 acres in inventoried roadless areas. Most of the volume and area harvested would be within the roaded portion of inventoried roadless areas. The Tongass National Forest would continue to harvest only a minor proportion of the total national volume from inventoried roadless areas after 2004.

Alternative 3

Under Alternative 3, road construction and reconstruction would be prohibited, while timber harvest would be used only for stewardship purposes in inventoried roadless areas. This alternative differs from Alternative 2 in that commodity-purpose timber sales would not be allowed in inventoried roadless areas. Approximately 90% to 95% of timber harvest would be for stewardship purposes; 5% to 10% would be for personal use, such as firewood cutting. Both even-aged and uneven-aged management may be used under this alternative.

Timber harvest objectives within inventoried roadless areas would focus on restoration of sustainable vegetation conditions, improving forest health, reducing excessive fuels and associated wildland fire risk and intensity, reducing insect and disease conditions that are outside the natural range of variability, and improving habitat for wildlife. The same kinds of silvicultural prescriptions as described under Alternatives 1 and 2 are likely to be used under this alternative, with a higher proportion of thinning being used to accomplish stewardship objectives. Salvage, when used to accomplish one or more of the objectives under this alternative, is likely to be used most often for excessive fuels reduction and insect and disease suppression.

An estimated 160 MMBF would be offered for sale in inventoried roadless areas nationwide during the first 5-year period. This is approximately 0.07% of the inventoried roadless areas with land management plan directions that allow road construction. This 85% reduction from 1.1 BBF harvested over the first 5-year period under Alternative 1 is due to the prohibition on road construction, reconstruction, and commodity-purpose timber harvest.

Approximately 22,000 acres could be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 4,400 acres harvested from a land base suitable for timber production of approximately 9 million acres currently available in inventoried roadless areas. About half of the volume and harvest acres are within 2.8 million acres of inventoried roadless areas where roads already exist.

Impacts on Costs and Accomplishment – Under this alternative, unit costs for contracts designed to reduce fuels through mechanical thinning and prescribed burning in

inventoried roadless areas would be higher than those under Alternatives 1 and 2. The smaller diameter trees that are removed and sold would have lower value and would cause the sale to be less economically feasible than if commodity-purpose timber harvest is available. Fewer acres of thinning will be accomplished using timber sale contracts under this alternative than are likely under Alternatives 1 and 2. While thinning may also be accomplished through service contracts, cost per acre is expected to rise in direct proportion to distance from the nearest road.

Tongass National Forest – Under this alternative, the Tongass National Forest would not offer any volume and no acres would be harvested in inventoried roadless areas since timber harvest in the Tongass is not for stewardship purposes. This is a reduction of 539 MMBF over the 5-year period.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005 are made for Alternative 3 recognizing that there are high levels of public controversy and uncertainty about the Agency's ability to continue harvesting timber from these areas. Approximately 12 to 15 MMBF of timber would be sold each year from 1200 to 1400 acres in inventoried roadless areas.

Alternative 4

Under Alternative 4, road construction, reconstruction, and all forms of timber harvest would be prohibited in inventoried roadless areas.

No timber volume would be offered in inventoried roadless areas during the first 5-year period or beyond. This potential reduction of 1.1 BBF and 90,000 to 95,000 harvest acres from Alternative 1 (100%), would be due to the prohibition of road construction, reconstruction, and all timber harvest.

Other Indirect and Cumulative Effects on Timber Harvest

Past and Present Actions-Timber Trends – The National Forest System contribution to the nation's need for wood products has been in decline during the past decade. Sawtimber harvest on national forests has dropped from a 1988 high of 27% of the nation's softwood lumber production to approximately 5% of that production in 1999. The harvest level of the 1980s was found not to be sustainable in light of public issues and conflicts with other management objectives. The Agency believes that its annual contribution will stabilize between 3 and 4 BBF. During this decline in available timber resources from the National Forests, softwood consumption nationally has increased.

Suitable Lands – Land management plan revisions in recent years have shown a decreasing trend in acres suitable for timber production due to allocations to other uses or environmental concerns. Examples of these uses and concerns include endangered species, water quality, wildlife habitat, scenic quality, recreation, and reforestation capabilities. Total acres suitable for timber production on all NFS lands, including

inventoried roadless areas, have dropped from approximately 63 million acres in 1987 to roughly 47 million acres in 1999.

It is reasonably foreseeable that this trend will continue. Acres suitable for timber production will be recalculated during each national forest's next land management plan revision. As those plan revisions are made, certain areas within inventoried roadless areas are likely to be dropped from the suitable land base under Alternatives 1, 2, and 3 due to the same concerns mentioned in the previous paragraph. Under Alternatives 2 and 3, additional areas are likely to be dropped from the suitable base because of lack of access and economic feasibility. With the prohibition on all timber harvest under Alternative 4, land management plan revisions are likely to determine that there are no suitable acres within inventoried roadless areas.

Forest Plan ASQ – In the past, it has been difficult for the Agency to harvest timber in roadless areas. Concerns have been expressed that this could leads to increased and disproportional harvest on roaded lands to meet ASQ levels. The importance of the roadless area volume to a forest's ASQ depends on when the area was scheduled to be harvested in the land management plan. If most of the volume uncut on a forest is in roadless areas, these areas may be critical to meeting current ASQs. However, regardless of this rulemaking, it is unlikely that there will be any substantial increase in road miles constructed or timber volume sold within inventoried roadless areas due to the current pattern of public controversy, appeals, and litigation. Table 3-38 displays the results, in terms of declining ASQ, of recent land management plan revisions. It is reasonably foreseeable that, as land management plans are revised, ASQ may be adjusted downward in response to changes in suitable acres as previously discussed.

Softwood Lumber Production, Import, and Consumption – National consumption of softwood lumber has steadily increased from 1990 (45.7 BBF) to 1999 (54.5 BBF). While the average family size in the United States has decreased 16% since 1970, the average single-family home being built today has increased by 48% (MacCleery, 1999). The difference between production and the higher levels of consumption are accounted for by increases in timber product imports from other countries. Softwood lumber imports have risen from 14.2 BBF in 1987 to 19.2 BBF in 1999. More than 95% of current softwood lumber imports are from Canada.

Present Actions – NFS lands contribute approximately 5% of the nation's total timber harvest from all ownerships. In the face of stable or increasing per-capita consumption in the United States, the effect of the shift to **ecological sustainability** on United States public lands has been to shift the burden and impacts of that consumption to ecosystems somewhere else – to private lands in the United States or to lands of other countries (MacCleery, 1999). Implementation of Alternatives 2, 3, or 4 will add to that shift. Volume reductions (an average of 160 MMBF per year in the first 5-year period as a result of the proposed action, half of which would come from the Tongass National Forest) from national forest roadless areas in the short term are likely to be offset by increases in timber harvest on private lands in the United States and in other countries.

Longer term, given the increasing demand (roughly 1% to 3% annually) for wood products in the United States, the situation is more uncertain. The anticipated Agency

timber program (timber volumes sold and harvested are assumed to be equal) projected out through 20 and 40 years with a prohibition on road construction in inventoried roadless areas, is estimated at roughly 130 to 160 MMBF per year. This estimate recognizes that large areas of currently suitable lands in the inventoried roadless areas, which may have larger ASQs under land management plans now, may be unavailable for future timber harvest due to continuing public controversy (over entering these areas under the No Action Alternative).

Compared to Alternative 1, the indirect and cumulative effects of Alternative 2, and to a greater degree Alternative 3, are likely to include a decrease, over time, in acres treated for fuels reduction and other stewardship purposes, and a corresponding reduction in timber volume offered, sold, and harvested. This is due to the cost increase for thinning and other forest-health improvement treatments done without road access, and the negative effect those cost increases are likely to have on future funding priority and actual acres accomplished. However, this decrease may occur because of other agency actions. The Cohesive Strategy, for example, would place priority for fuel treatment on the wildland-urban interface, readily accessible municipal watersheds, and T&E species habitat. Inventoried roadless areas, because they are generally not near areas of human habitation, would rarely receive high priority for fuels reduction given these other priorities.

Other Federal Initiatives – Other agency and Federal proposals will continue to affect the Forest Service timber program at both the national and local levels. Current emphasis like that found in the Interior Columbia Basin Ecosystem Management Project, the Sierra Nevada Framework, and the Cohesive Fire Strategy calls for a mix of longer rotation periods to increase old-growth characteristics, and thinning treatments that would continue the removal of small diameter trees. Other strategies like the Lynx Conservation Assessment and Strategy call for preservation of early seral stage habitat that would preclude some future thinning activities. The balancing and stabilizing of the timber program will happen locally through the collaboration processes envisioned in the Agency's planning rule at the land management plan- and project-level. Overall, it is anticipated that the national program will remain between 3 and 4 BBF, with periodic variations due to salvage after major natural disasters that temporarily increase timber harvest, or emerging issues that decrease certain harvest activities until an appropriate solution can be developed.

Reasonably Foreseeable Future Actions – Natural disasters, such as wildland fires, windstorms, and insect outbreaks, will continue to occur, and the Agency is likely to continue salvaging a portion of the dead and dying trees. These salvage sales usually become the highest priority for harvest. This is usually due to two factors: biological and economic. The biological factor is the need to control secondary insect outbreaks, like Ips beetle, southern pine beetle and spruce bark beetle, whose populations would increase rapidly by attacking damaged trees and then spreading into the surrounding healthy trees. The economic factor is the rapid deterioration of the dead material due to insect damage, stains, rots, and checking. If they are not salvaged quickly, there will be nothing to salvage.

Timber salvage sales generate vegetation management work accomplished and receipts from the sale of usable trees. A portion of the money collected from the resulting timber salvage sales is used to help cover the costs of essential rehabilitation and reforestation. If the Agency elects to reduce the use of timber salvage sales because of continuing public controversy, the use of service contracts funded by appropriations must increase to accomplish fuels reduction or other desired vegetative treatments. Net cost per acre to achieve desired conditions rises over that associated with use of timber harvest.

Wildland fires and other natural disasters, especially during a wildland fire season like the one experienced in 2000 in the West, will also eliminate or devalue the timber on some timber sales under contract and some that were planned but not offered for sale. However, it is anticipated that the timber volumes lost will be recovered or slightly increased due to salvage operations over the next 2 years. This will create a slight rise in the Agency's timber offer, similar to the period of 1995 to 1997. A proportionate decrease in timber offer would occur after those 2 years as the individual forest shifts from the salvage emphasis back to its regular timber planning cycle.

It is also anticipated that America's lumber consumption trend will continue to rise over the next 40 years and beyond at a rate of increase of 1% to 3% annually, as will its consumption of all wood products. With the Forest Service sustaining an average harvest level of between 3 and 4 BBF for the next 40 years, the Agency's volume contribution to the nation's lumber supply will remain stable as consumption increases. This means that harvest levels will continue to increase on private forestland to help meet the demand. The RPA Assessment projections for the next 30 to 40 years indicate that the South will continue to be the main source of increased softwood production nationally in the future to the point that softwood lumber imports may decline slightly. Transition is projected to take place between the years 2000 and 2020 (Darr personal communication).

Imports are expected to continue to increase from Canada's boreal forests, especially from Quebec, Alberta, and the Atlantic Provinces, as there is no anticipated decline in American consumer demand for wood products for construction and pulp in the future. There is no anticipated substitution of hardwood imports for softwood imports. Therefore, the prohibition alternatives would not cause an indirect or cumulative effect to tropical hardwood forests like the Amazon, and Southeast Asia. Exports are expected to remain near or below the current level. Any increase in importing to meet demand would proportionately increase the nation's trade deficit.

Recreation

Recreation provides tangible benefits for individuals, families, communities, and society as a whole (Driver and others 1991). NFS lands support a vast array of recreational activities, ranging from hiking in remote areas to snowmobiling on groomed trails to camping in developed sites. These activities, and many others summarized in Table 3-41, occur along a continuum, or Recreation Opportunity Spectrum (ROS).[12] ROS is divided

[12] The Recreation Opportunity Spectrum (ROS) was developed to provide a framework for classifying and defining segments of outdoor recreation environments, activities, and experience opportunities. The ROS Users Guide provides guidance for inventorying, planning, and managing the recreation resource.

into 6 classes: (P) Primitive, (SPNM) Semi-Primitive Non-Motorized, (SPM) Semi-Primitive Motorized, (RN) **Roaded Natural**, (R) **Rural**, and (U) **Urban** (USDA Forest Service 1982). These classes were created for management and conceptual convenience. They are mixes or combinations of activities, settings, and probable experience opportunities. The class names (e.g., Primitive, Rural) were selected and used because of their descriptiveness and use in land management planning and other management application. This classification system provides a framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum a particular national forest might be able to provide.

Inventoried roadless areas are characterized mainly by Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes. In approximately 3 million acres of the inventoried roadless areas, classified roads, recreation sites, and other facilities have been constructed, causing, in some cases, a shift to the more developed end of the ROS. These classified roads would be allowed to remain and be maintained, however, reconstruction of them would most likely be restricted.

Dispersed Recreation Activities

Affected Environment

Inventoried roadless areas are remnants of vast landscapes substantially unmodified by high-intensity management activities (e.g., timber harvesting, mineral extraction, developed recreation). In the past, unroaded areas were viewed as a bank, holding lands in reserve for future resource development. Over time, other allocations, uses, and designations have withdrawn lands from the bank, creating a situation where the remaining relatively undisturbed landscapes have retained increasingly valuable roadless characteristics.

Some of the value of these lands lies in their unique Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation opportunities. Activities that are prohibited in designated Wilderness and not readily available in areas with classified roads can occur on these lands. For example, Wilderness areas prohibit mechanized and motorized uses like OHV, mountain bikes, chainsaws, snowmobiles, and helicopters. Wheelchairs designed for pedestrian use in urban areas are allowed, but trails in Wilderness areas seldom accommodate these devices.

Primitive and Semi-Primitive Non-Motorized settings are characterized by large natural-appearing landscapes (refer to Table 3-42 and Table 3-43 for size and setting criteria), with little evidence of other people or management restrictions. They have many Wilderness-like attributes, yet allow mountain bikes and other mechanized conveyances, and they have fewer restrictions on motorized tools, search and rescue operations, and aircraft use.

Areas characterized by Semi-Primitive Motorized settings feature large natural appearing landscapes and other attributes similar to Semi-Primitive Non-Motorized, yet allow motorized activities, such as OHV use, motorboats and helicopters, chainsaws, and other

Table 3-41. Recreation opportunity spectrum activity characterization. [a]

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Land based (includes aircraft): Viewing scenery Hiking and walking Horseback riding Camping (all) Hunting (all) Nature study (all) Mountain Climbing General information	**Land based (includes aircraft):** Viewing scenery Automobile (off-road use) Motorcycles and scooters Specialized landcraft Aircraft (motorized) Hiking and walking Horseback riding Camping (all) Hunting (all) Nature study (all) Mountain climbing General information	**Land based (includes aircraft):** Viewing scenery Viewing activities Viewing works of humankind Automobile (inc. off-road use) Motorcycles and scooters Specialized landcraft Train and bus touring Aircraft (motorized) Aerial trams and lifts Hiking and walking Bicycling Horseback riding Camping (all) Organization camping (all) Picnicking Resort and commercial services Resort lodging Recreation cabin use Hunting (all) Nature studies (all) Mountain climbing Gathering forest products Interpretive services (all)		**Land based (includes aircraft):** Recreating cabin use Hunting (all) Nature studies (all) Mountain climbing Gathering forest products Interpretive Services (all) Team sports Individual sports Games and play **Land based:** Viewing scenery Viewing activities Viewing works of humankind Automobile (inc. off-road use) Motorcycles and scooters Specialized land-craft Train and bus touring Aircraft (motorized) Aerial trams and lifts Aircraft (non-motorized) Hiking and walking Bicycling Horseback riding Camping (all) Organization camping (all) Picnicking Resort and commercial services Resort lodging	
Water based: Canoeing Sailing Other non-motorized watercraft Swimming Fishing (all)	**Water based:** Boating (powered) Canoeing Sailing Other watercraft Swimming Diving (skin or scuba) Fishing (all)	**Water based:** Tour boat and ferry Boat powered Canoeing Sailing Other watercraft Swimming and water play Diving (skin and scuba) Water skiing and water-sports Fishing (all)		**Water based:** Tour boat and ferry Boat powered Canoeing Sailing Other watercraft Swimming and water play Diving (skin and scuba)	

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
				Water skiing and water sports Fishing	
Snow and ice based: Snow play Cross country skiing/snow shoeing	**Snow and ice based:** Ice and snow craft Skiing, downhill Snow play Cross-country skiing/snow shoeing	**Snow and ice based:** Ice and snow craft Ice skating Sledding and tobagganing Downhill skiing Snow play Cross-country skiing/snow shoeing		**Snow and ice based:** Ice and snow craft Ice skating Sledding and tobogganing Downhill skiing Snow play Cross-country skiing /snow shoeing	

[a] These characteristics are illustrative only and may vary within a ROS class depending on local situations.
(USDA Forest Service 1982)

Table 3-42. Recreation opportunity spectrum size criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
5,000 acres [a]	2,500 acres [b]	2,500 acres	No size criteria.	No size criteria.	No size criteria.

[a] May be smaller if contiguous to Semi-primitive Non-motorized Class.
[b] May be smaller if contiguous to Primitive Class.
(USDA Forest Service 1982)

Inventoried roadless areas also provide outstanding opportunities for other dispersed recreation activiti motorized tools. Access is greatly enhanced for persons with disabilities in Semi-Primitive Motorized settings.es, such as hiking, fishing, camping, horseback riding, hunting, picnicking, wildlife viewing, cross-country skiing, and canoeing. While these activities can also occur in areas managed for ROS classes on the developed end of the spectrum, they typically result in different types of settings and produce different experiences. Roaded Natural, Rural, and Urban classes are characterized by more interactions with people, more sights and sounds of human development and activity, more restrictions and controls, and more landscape modification from other resource management activities.

The SPNM and Primitive experiences become increasingly more remote (Table 3-44) without evidence of **motorized equipment**, requiring more isolation, self-reliance, and challenge. The remoteness criteria in this table can be modified to conform to natural barriers and screening, or other relevant features of local topographic relief and vegetative cover. This fits the criteria to the actual forest landscape. As shown in Table 3-45, the SPM experience is characterized by moderate isolation, independence, and closeness to nature, tranquility, and self-reliance. Motorized equipment is allowed in an

Table 3-43. Recreation opportunity spectrum setting characterization.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Area is characterized by essentially unmodified natural environment of fairly large size. Interaction between users is low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.	Area is characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted.	Area is characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.	Area is characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized provided for construction standards & design of. facilities	Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available.	Area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans, on-site, are predominant. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

(USDA Forest Service 1982)

Table 3-44. Recreation opportunity spectrum remoteness criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
An area designated at least 3 miles from all roads, railroads, or trails with motorized use.	An area designated at least ½-mile but not further than 3 miles from all roads, railroads or trails with motorized use; can include the existence of primitive roads and trails if usually closed to motorized use.	An area designated within ½-mile of primitive roads or trails used by motor vehicles; but not closer than ½-mile from better than primitive roads.	An area designated within ½-mile from better than primitive roads, and railroads.	No distance criteria.	No distance criteria.

(USDA Forest Service 1982)

environment of challenge and risk. The experiences described in this table are highly probable outcomes of participating in recreation activities in specific recreation settings.Scoping revealed a wide range of conflicting opinions on motorized recreation use in unroaded areas. This is an important issue because motorized and non-motorized dispersed recreation use is highly variable throughout the country and dependent on distinct social and environmental conditions.

Prohibiting all activities, including motorized recreation, was considered (see Alternatives Considered but Eliminated from Detailed Study, Chapter 2), but was eliminated from further consideration because decisions of this nature are better made through local planning and collaboration processes.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land-management plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those with prescriptions that currently prohibit roading could be affected over the long term as local conditions and situations lead to a change in management prescriptions.

Existing or future trails would not be affected by the proposed prohibitions in inventoried roadless areas. Decisions regarding trail planning, construction, reconstruction, decommissioning, or maintenance would be made at the forest level based on local environmental and social conditions. A trail is a commonly used term denoting a pathway for purposes of travel by foot (or wheelchair), stock, or trail vehicle (FMS 2353.06(6)). Trail widths may vary and are not limited to 50 inches. Examples of activities associated with foot travel are hiking, skating, cross-country skiing, snowshoeing, backpacking, and rock climbing. Examples of stock animals are horses, llamas, mules, and goats. Examples

Table 3-45. Recreation opportunity spectrum experience characterization.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Extremely high probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers a high degree of challenge and risk.	High, but not extremely high, probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk.	Moderate probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. Opportunity to use motorized equipment while in the area.	About equal probability to experience affiliation with other user groups and for isolation from sights and sound of humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive type of recreation are not very important. Practice and testing of outdoor skills might be important. Opportunities for both motorized and non-motorized forms of recreation are possible.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. These factors are generally more important than the setting of the physical environment. Opportunities for wild-land challenges, risk-taking, and testing of outdoor skills are generally unimportant except for specific activities like downhill skiing, for which challenge and risk-taking are important elements.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Experiencing natural environments, having challenges and risks afforded by the natural environment, and the use of outdoor skills are relatively unimportant. Opportunities for competitive and spectator sports and for passive uses of highly human-influenced parks and open spaces are common.

(USDA Forest Service 1982))

of trail vehicles are bicycles, motorcycles, snowmobiles, watercraft, 4x4s, and all terrain vehicles.

A key characteristic of inventoried roadless areas has been their ability to supply P, SPNM, and SPM settings for a wide range of dispersed recreation activities. Unroaded areas are the last relatively undisturbed landscapes outside Wilderness areas. As these lands are developed or put into a restrictive designation, the supply of unroaded lands available for other multiple-use activities continues to decline. At the same time, demand for motorized and non-motorized dispersed recreation opportunities is increasing (Cordell and others 1999b).

The alternatives are compared by their relative ability to maintain the existing supply of inventoried roadless areas available for dispersed recreation opportunities. Those that create safeguards to maintain the most NFS lands in an unroaded condition are rated high; conversely, those alternatives that maintain the fewest acres in an unroaded condition are rated low.

Recreation use data has not been collected specifically for inventoried roadless areas. As a result, estimates of environmental consequences based on use cannot be made with any degree of precision. Comparison of the alternatives is based on known factors, such as trends in recreation use and road construction, availability of supply to meet demands, and conditions that influence shifts in recreation patterns.

Alternative 1 – No Action

An underlying assumption in Alternative 1 is that inventoried roadless areas, outside of Wilderness and other designated areas, would be available for resource management activities that may degrade their unroaded characteristics. Road construction, timber harvesting, and other resource management activities in inventoried roadless areas (where land management plan prescriptions allow it) would reduce the supply of land available for dispersed recreation opportunities in the SPM, SPNM, and P classes. Since national prohibitions do not apply to this alternative, it has a relative low ranking for its ability to maintain a supply of unroaded areas.

Demand for SPM, SPNM, and P dispersed recreation opportunities is increasing (Cordell and others 1999b) in an environment of diminishing supply. The supply of lands suitable for these activities would continue to decline under this alternative, along with opportunities to resolve controversy about the appropriate balance between motorized and non-motorized dispersed recreation activities.

Alternatives 2 through 4

Because the national prohibitions are applied to the highest number of total acres, these alternatives would maintain the highest relative supply of lands with dispersed recreation potential. Availability of unroaded areas for forest visitors seeking primitive and semi-primitive recreation opportunities would remain high. Minor shifts in recreation use might occur because of timber harvesting allowed in Alternatives 2 and 3. For example, hunting or berry picking could be enhanced in timber harvest areas; lands that were avoided because of insect infestations could draw backcountry uses once they are treated.

These shifts, however, would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities; therefore, Alternatives 2, 3, and 4 are barely distinguishable. This cluster of alternatives is rated high because they would provide considerable and immediate stability to the level of supply; whereas, Alternative 1 is rated low because it would allow for continued reduction in the supply of inventoried roadless areas maintained in an undeveloped condition.

Demand for SPM, SPNM, and P dispersed recreation opportunities is increasing (Cordell and others 1999b) in an environment of diminishing supply. Since Alternatives 2, 3, and 4 would maintain higher levels of supply, they would provide more opportunities to resolve the issue of balance between motorized and non-motorized dispersed recreation activities. Controversies might be considerably fewer than under Alternative 1 and might have a higher probability of being resolved over time.

Some level of certainty for the dispersed recreation opportunities available on NFS lands would be added under these alternatives, although minor shifts would occur as use patterns, local priorities, and environmental conditions change. Under these alternatives, approximately 44% of NFS lands would be available for road-based and developed recreation (primarily U, R, and RN) and 56% would be available for dispersed recreation (primarily P, SPNM, and SPM). The lands available for dispersed recreation would include acres of designated Wilderness, inventoried roadless areas, and acres outside inventoried roadless areas and Wilderness that restrict road construction and reconstruction by land management plan prescription.

Creating a level of certainty regarding land uses on Federal lands would assist **gateway communities** in making sound economic, social, and land planning decisions. Recreation and tourism is a growing segment of the United States economy, which can contribute to the economic base in communities associated with NFS lands. Increasing demand for recreation on NFS lands will continue to provide economic opportunities for businesses and local communities. These recreation opportunities also contribute to the quality of life and **sense of place**.

In the past, communities could base decisions on the developed and **road-based recreation** opportunities; however, dispersed recreation opportunities were more unpredictable. Selection of Alternatives 2 through 4 would define the Agency's position regarding the value of inventoried roadless areas and would set the stage for continued maintenance of dispersed recreation opportunities.

Forecasting continued availability of dispersed recreation opportunities would assist communities in determining where to place their priorities. Examples of where this has benefited communities in the past are:

- Towns and villages along the Appalachian Trail have created a service infrastructure for millions of people that hike through their areas;
- Moab, Utah has shifted to a mecca for mountain bikers and OHV use;
- Sedona, Arizona provides extensive 4-wheel drive touring services to explore the spectacular red rock country;
- Hood River and The Dalles in Oregon cater primarily to wind surfers; and
- Ely, Minnesota, is shifting to a more diversified economic base by supporting increasing demands for canoeing opportunities.

From a national perspective, areas with roadless characteristics will become increasingly more important as the nation's population grows and the country becomes more intensely developed. Besides reversing the decline in the number of acres of roadless areas, Alternatives 2, 3, and 4 would more sharply focus the management emphasis in these

areas on roadless characteristics. Land managers would balance recreation demands with other key values such as maintenance of ecosystem and scenic integrity, clean water, wildlife viability, biodiversity, landscape character, research opportunities, traditional cultural properties, and sacred sites.

Developed and Road-based Recreation Activities

Affected Environment

Even though about 44% of NFS lands are available for developed and road-based recreation, demand for new opportunities is increasing (Cordell and others 1999b). Camping and picnicking at developed sites, driving for pleasure, visiting interpretive sites and visitor centers, riding personal watercraft, and participating in road dependent dispersed recreation are examples of activities associated with the developed end of the ROS. This involves greater social interaction with other people, higher levels of managerial control, and more evidence of human activity, which are summarized in Tables 3-46, 3-47, and 3-48. The experiences described in Table 3-46 are highly probable outcomes of participating in recreation activities in specific recreation settings. Traditionally, expansion of these opportunities would occur in unroaded areas, ultimately shifting the ROS classes from P, SPNM, and SPM to Roaded Natural or Rural.

Table 3-46. Recreation opportunity spectrum social setting criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Usually less than 6 parties per day encountered on trails and less than 3 parties visible at campsite.	Usually 6-15 parties per day encountered on trails and 6 or less visible at campsites.	Low to moderate contact frequency.[a]	Frequency of contact is Moderate to High on roads: Low to Moderate on trails and away from roads.[a]	Frequency of contact is Moderate to High in developed sites, on roads and trails, and water surfaces; Moderate away from developed sites.[a]	Large numbers of users onsite and in nearby areas.

[a] Specific numbers must be developed to meet regional or local conditions.
(USDA Forest Service 1982)

Roads associated with recreation sites and activities, although low in number of miles, would continue to be constructed or reconstructed in inventoried roadless areas. National prohibitions would have an immediate effect on road construction.

About 33 miles of roads are planned for construction or reconstruction in the next 5 years to support or access dispersed or developed recreation opportunities. They all occur within portions of inventoried roadless areas that have become developed with classified

Table 3-47. Recreation opportunity spectrum managerial setting criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive Motorized	Roaded natural	Rural	Urban
On-site regimentation low with controls [a] primarily off-site.	On-site regimentation and controls [a] present but subtle.	On-site regimentation and controls [a] present but subtle.	On-site regimentation and controls [a] are noticeable, but harmonize with the natural environment.	Regimentation and controls [a] obvious and numerous, largely in harmony with the man-made environment.	Regimentation and controls [a] obvious and numerous.

[a] Controls can be physical (such as barriers) or regulatory (such as permits).
(USDA Forest Service 1982)
[b] Sensitivity level 1 and 2 travel routes from Visual Management System USDA Handbook 461.
(USDA Forest Service 1982)

roads, recreation sites, and other constructed features. These developed portions of inventoried roadless areas have lost their roadless character, and may have shifted the ROS setting to Roaded Natural. National prohibitions would apply to these areas, and planned road construction or reconstruction would not occur in the action alternatives.

The alternatives are compared by their relative supply of inventoried roadless areas available for expansion of developed recreation, roads, and road-based recreation. Alternatives are rated low that maintain a higher supply of unroaded areas because they would result in a lower supply of settings for more development based recreation activities. Future expansion of more urban oriented recreation would then occur in areas already developed, increasing the density of use. Alternatives are rated high that would allow for future expansion into inventoried roadless areas.

Alternative 1 – No Action

Developed and road-based recreation would continue to expand into inventoried roadless areas primarily for two reasons. First, recreation use follows roads constructed for another purpose, such as timber or fire prevention; and second, popular dispersed recreation sites are developed to manage use and to eliminate resource damage.

This alternative would provide the most opportunity for developed and road-based recreation to occur. There would be no national prohibitions in place to restrict continued development of inventoried roadless areas. Opportunities to shift from Primitive and Semi-primitive settings to road-based and developed classes of recreation would be maximized. As a result, Alternative 1 receives a relative rating of high.

Alternatives 2 through 4

Because the national prohibitions are applied to all the inventoried roadless areas, these alternatives would maintain the lowest supply of lands with developed recreation potential. Access for forest visitors seeking road based or developed recreation

Table 3-48. Recreation opportunity spectrum evidence of human criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Setting is essentially an unmodified natural environment. Evidence of humans would be unnoticed by an observer wandering through the area. Evidence of trails is acceptable, but should not exceed standard to carry expected use. Structures are extremely rare.	Natural [a] setting may have subtle modifications that would be noticed but not draw the attention of an observer wandering through the area. Little or no evidence of primitive roads and the motorized use of trails and primitive roads. Structures are rare and isolated.	Natural [a] setting may have moderately dominant alternations but would not draw the attention of motorized observers on trails and primitive roads within the area. Strong evidence of primitive roads and the motorized use of trails and primitive roads. Structures are rare and isolated.	Natural [a] setting may have modifications which range from being easily noticed to strongly dominant to observers within the area. However from sensitive [b] travel routes and use areas these alternations would remain unnoticed or visually subordinate. There is strong evidence of designed roads and or highways. Structures are generally scattered, remaining visually subordinate or unnoticed to the sensitive [b] travel route observer. Structures may include power lines, micro-wave installations, etc.	Natural [a] setting is culturally modified to the point that it is dominant to the sensitive[b] travel route observer. May include pastoral, agricultural, intensively managed wildland resource landscapes, or utility corridors. Pedestrian or other slow moving observers are constantly within view of culturally changed landscape. There is strong evidence of designed roads and or highways. Structures are readily apparent and may range from scattered to small dominant clusters including power lines, microwave installations, local ski areas, minor resorts and recreation sites.	Setting is strongly structure dominated. Natural or natural-appearing elements may play an important role but be visually subordinate. Pedestrian and other slow moving observers are constantly within view of artificial enclosure of spaces. There is strong evidence of designed roads and or highways and streets. Structures and structure complexes are dominant, and may include major resorts and marinas, national and regional ski areas, towns, industrial sites, condominiums or second home developments.

[a] In many Southern and Eastern forests what appears to be natural landscapes may in actually have been strongly influenced by humans. The term natural appearing may be more appropriate in these cases.

opportunities would also be low. The road prohibition is consistent throughout; therefore, these alternatives are indistinguishable regarding their ability to expand development in inventoried roadless areas. As a group, they are rated low because they would immediately prohibit road construction and reconstruction and reduce the possibility of shifts from primitive and semi-primitive ROS settings to Roaded Natural or Rural experiences.

Most recreation use on NFS lands depends on roads for access to developed sites. Increased recreation use of all types will increase demand for more roads and more developed sites. For example, a popular dispersed recreation area near a road may become a developed site to minimize environmental damage and manage the number of people; popular backcountry destination areas may require new trailheads; or, as the NFS road system stabilizes, increased use may require reconstruction to a higher level of design. Since expansion into inventoried roadless areas would not be likely, increased demand for opportunities at the more developed end of ROS would occur in existing areas available for development or road based recreation opportunities.

Historically, dispersed recreation followed roads built for timber, fire, or other resource management activity. As use became heavy and demand for amenities increased, some areas became suitable for developed sites. This resulted in wide dispersion of small to medium sized developed sites. This option would no longer be available in inventoried roadless areas under Alternatives 2 through 4. All future increased developed recreation demand would be met and concentrated in areas already available for development.

Under Alternatives 2 through 4, many existing developed sites would require expansion, and their design levels would be raised. Concentrations or clusters of developed sites would become more common. Road-design standards would be raised to handle increased volumes of traffic. Higher concentrations of people would require more infrastructure, high intensity management, and law enforcement. Whereas, campgrounds and other developed sites have been traditionally designed for Semi-Primitive Motorized to Roaded Natural ROS classes, design standards would shift to Roaded Natural and Rural. This condition would be especially apparent in areas where demand for developed and road-based recreation is highest; usually this occurs closest to large population centers and areas with attractions that draw large numbers of people.

Effects of Social and Economic Mitigation on Recreation

Some road construction and reconstruction associated with mineral development would be allowed, which may cause shifts in the type of recreation opportunities available. Local areas would experience the effects of individual developments; however, from a national perspective the effects on dispersed recreation in inventoried roadless areas would be minimal.

Other Indirect and Cumulative Effects on Recreation

Demand for developed and dispersed recreation will continue to grow (Cordell and others 1999b). Growing recreation demand on NFS lands is and will be driven by population increases, population migration to areas close to NFS lands, the travel and tourism industry, expanded information services, new and shifting recreation activities and technology, influence of special interest groups, and actions of other land management agencies. However, specific projections regarding developed and dispersed recreation growth would be speculative, and would not add substantially to our understanding of the incremental contributions from the alternatives considered in this FEIS. Although the Forest Service has very little, if any, control over this growing demand, it does have control over how it manages the effects.

In the next 40 years, as demand increases, there would likely be more competition for recreation uses and conflicts between recreation users. Carrying capacity for developed and dispersed recreation will exceed supply in various locations throughout the country. In particular, the Eastern United States, areas close to urban population centers, and popular attractions will experience stress due to increased competition. Carrying capacity would usually be exceeded if heavy resource damage occurs, management standards cannot be met, or user satisfaction can no longer be provided. This situation is often related to developed and road based recreation opportunities. However, in dispersed areas close to high population centers and attractions, these management challenges would also become prevalent. In situations where carrying capacity is exceeded, aggressive administrative controls, such as entry stations, closures, increased compliance and law enforcement, increased use of reservation, fee, and permit systems, rest and rotation of recreation areas and facilities, and more dependency on the private sector, would be implemented to manage use. A road system with fewer miles would tend to exacerbate the situation.

Supply of inventoried roadless areas is the basis for comparing alternatives. If an action alternative (Alternatives 2 through 4) were selected, the supply of inventoried roadless areas would be stabilized at close to 58.5 million acres. Coupling acres of inventoried roadless area with the 34.7 million acres of designated Wilderness provides a more complete picture of NFS lands available for Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized dispersed recreation opportunities. The total area available for dispersed recreation opportunities would then approach 93.2 million acres, or 48% of NFS lands.

Data are unavailable to identify the number of available NFS acres outside of Wilderness and inventoried roadless areas with road construction and reconstruction restrictions. However, a conservative estimate would place the amount at approximately 15 million additional acres. Although this is a rough estimate, the total acreage of inventoried roadless areas, designated Wilderness, and other NFS lands with road construction restrictions can serve as a baseline for discussion of cumulative effects. Areas without road construction restrictions are generally available for developed and road based recreation activities and are estimated at 84.1 million acres.

Within the context of NFS lands, analysis identified factors that might have major, minor, or no effect on the baseline of recreation supply. The proposed Roads Policy could cause a major shift in the national baseline of recreation supply. The most common scenario associated with road decommissioning is to reduce road density, not to create unroaded areas. However, the possibility exists that there could be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This would decrease the supply available for developed and road based recreation opportunities.

Factors that might have minor effects on the baseline of recreation supply include lands acquired through purchase, exchange, or legislation; reduced access because of private property closures; temporary use restrictions; or fish and wildlife protection closures. These factors may cause recreation use shifts in localized areas or cause small incremental shifts over long periods. However, they typically would not cause major shifts in the national baseline of recreation supply.

Another factor that would not change the baseline recreation supply but would reduce the supply of inventoried roadless areas acres is future Wilderness designations. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventoried roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8 % (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline but could potentially displace some motorized, mechanized, and other forms of dispersed recreation use.

Actions by other land management agencies can be important factors in increasing demand for recreation opportunities on NFS lands. Public lands managed by some local, County, and State agencies, the National Park Service, and the U.S. Fish and Wildlife Service will most likely reach carrying capacity sooner than lands managed by the Forest Service. Access to private lands for outdoor recreation, particularly for Semi-Primitive and Primitive settings, will become increasingly constrained. Actions such as placing limitations on visitation or closing areas to the public (Betz and others 1999), would displace recreation use and shift more demand to available recreation opportunities on NFS lands. For example, the National Park Service is currently promulgating regulations that would reduce or eliminate certain motorized recreation equipment (snowmobiles and personal watercraft) in areas under its jurisdiction. This reduction in supply of public lands for motorized recreation use may put additional pressure on the Forest Service to allow or continue to allow the uses on NFS lands. This action may also increase the use of motorized recreation where allowed. Snowmobiling, which is a recreation activity suited for unroaded areas, is expected to be one of the fastest growing outdoor recreation activities over the next 40 years (Bowker and others 1999). As the demand increases and supply of land diminishes, the future issue for the Forest Service is likely to be striking the appropriate balance between motorized (for example, snowmobiling) and non-motorized (for example, cross-country skiing, snow shoeing) uses in unroaded areas; these are uses generally thought to be incompatible.

Use of personal watercraft (jet skis), on the other hand, is usually associated with developed recreation because roaded access and boat ramps are needed. If any of the action alternatives are implemented, no new roads could be constructed to lakes or rivers in inventoried roadless areas, which would result in limited access to new venues for personal watercraft. In this case, effects of the National Park Service action and the Roadless Rule would be additive in reducing areas (present and future) for use of personal watercraft.

Another current example is the Bureau of Land Management action to develop a national strategy regarding OHV use. The Bureau of Land Management manages the largest supply of Federal lands where opportunities for motorized recreation are abundant. Although the outcome of this action is uncertain at this time, there is a trend for land management agencies to more closely monitor and manage OHV use. Any limitations on OHV use resulting from this action on Bureau of Land Management lands would likely increase demand for OHV use on NFS lands.

Recreation Special Uses

Frequently, visitors to national forests turn to others to facilitate their recreation experience. This may come in the form of lodging, rental equipment, or guiding services. Recreation special use authorizations are employed by Forest Service managers to allow others to provide these desired services. They form a legally binding relationship between the Forest Service and other entities, primarily from the private sector. However, some recreation special use permit holders are nonprofit organizations and other government agencies.

Dispersed Recreation Activities

Affected Environment

Outfitters and guides for activities such as sightseeing, hunting, fishing, and rafting provide most recreation opportunities authorized by special use permits in unroaded areas. Some dispersed recreation opportunities are offered by special use permit holders in association with their management of ski areas, resorts, marinas, and organization camps. Outfitters and guides help visitors enjoy high quality experiences as an extension of the Agency’s mission. Even though they provide a small fraction of the total recreation visitor days that occur on national forests, they benefit the visitor, resources, and economy of communities where outfitters and guides are based (USDA Forest Service 1997b).

Visitor demand for a diversity of experiences, settings, and opportunities on national forests continues to increase (Cordell and others 1999b). Many are capable of total self-sufficiency in conducting their activity, but many people want assistance to experience the outdoors. For instance, people with disabilities and first time visitors often choose outfitters and guides to gain access to opportunities, experiences, and settings that would otherwise be unavailable to them.

Outfitting and guiding activities in inventoried roadless areas usually provide recreation opportunities for an unconfined type of outdoor recreation, free of the urban influence. These activities are matched with the appropriate ROS setting (Table 3-43) identified in the land management plan. In areas managed as P and SPNM, opportunities such as hiking, boating, caving, mountaineering, hunting, horseback riding, fishing, cross-country skiing, mountain biking, dog sledding are offered. Areas managed as SPM offer additional opportunities, such as motorized rafting and boating, snowmobiling, OHV driving (motorcycle, ATV, or 4x4), and aircraft transport to remote areas (Table 3-41).

The need for a particular type of special use authorization is determined in the land management plan or by user demand. Increased marketing is one of the key forces driving greater demand for outdoor recreation opportunities on NFS lands. For many communities adjacent to public lands, recreation opportunities provide the potential to diversify their economies. Chambers of commerce, visitor bureaus, and businesses providing a wide range of services for America's travelers use many forms of communication, including the Internet, to offer information about recreation opportunities on Federal lands near their area. These gateway communities are extremely attractive to visitors because of their quality of life and sense of place, factors that are interdependent with the public lands in the vicinity (Abbott and Sheridan 1997).

Focusing the increasing demand for outdoor recreation opportunities through effective marketing has created a growing demand for outfitting, guiding, and ecotourism services in inventoried roadless areas. Therefore, demand for special use permits to provide these services is also on the rise. Through the NEPA process, the Agency responds to these demands within a framework of creating balance between competing resource needs and of the land's capacity to accommodate increased recreation use. Supply of unroaded areas is decreasing.[13] Alternatives in this rulemaking that maintain the highest supply of total acres have the highest relative ability to accommodate increased demand for outfitting and guiding services. Alternatives with low supply accommodate fewer opportunities for commercial outfitting and guiding experiences for forest visitors and fewer special use permits issued to local businesses.

Comparison of the alternatives shows that effects on demand for outfitting and guiding services and special use permits are similar to those for recreation opportunities in general. Visitors to the nation's national forests are looking for the same settings, activities, and experiences whether assisted by outfitters and guides or discovering them on their own. Demand for P, SPNM, and SPM classes of dispersed recreation is increasing (Cordell and others 1999b) in an environment of decreasing supply. The alternatives fall into different levels based on their relative ability to maintain a supply of outfitting and guiding dispersed recreation opportunities. An alternative that maintains the most NFS lands in an unroaded condition and provides the most protection for roadless characteristics when compared to the other alternatives would result in a high level of supply. Conversely, a low level of supply would result from alternatives that

[13] See discussion in Recreation, Dispersed Activities, and Affected Environment. Supply of unroaded areas is decreasing because most land allocations allowing development or creating special designations are carved out of inventoried roadless areas.

maintain the fewest acres in an unroaded condition, and offer minimal or no protection for roadless characteristics.

Alternative 1 – No Action

An underlying assumption in Alternative 1 is that inventoried roadless areas, outside of Wilderness and other designated areas, are available for resource management activities that may degrade their unroaded characteristics. Road construction, timber harvesting, and other resource management activities in inventoried roadless areas (where land management plan prescriptions allow it) would reduce the supply of unroaded areas available for outfitter and guide assisted dispersed recreation opportunities in the SPM, SPNM, and P classes. Supply of inventoried roadless areas maintained in an undeveloped condition would decline over time. Since national prohibitions do not apply to this alternative, it has a low ranking for its ability to maintain a supply of unroaded areas.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land management-plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those currently protected could be affected over the long term as local conditions and situations change.

Alternatives 2 through 4

Because the national prohibitions are applied to the highest number of areas and total acres, these alternatives would maintain the highest level of supply of lands with potential for outfitter and guide assisted dispersed recreation. Minor shifts in assisted recreation use may occur because of timber harvesting allowed in Alternatives 2 and 3. For instance, most outfitters and guides prefer natural appearing landscapes, so cutover areas could be avoided until they grow back; or, on the other hand, timber harvested areas may attract use because of increased hunting, wildlife viewing, or berry picking opportunities.

In the final analysis, these shifts would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities; therefore, Alternatives 2, 3, and 4 are barely distinguishable. These alternatives are rated high because they would provide considerable and immediate stability to the level of supply, maintain the most access for forest visitors, and allow for the highest opportunity for services authorized by special use permits.

When inventoried roadless areas are managed for their unroaded characteristics, the associated uses are complementary. Outfitting- and guiding-assisted dispersed recreation opportunities would be balanced to complement the other key values such as, maintenance of high ecosystem and scenic integrity, clean water, wildlife viability and biodiversity, landscape character, research opportunities, traditional cultural properties, and sacred sites. Focusing management activities on these few multiple-use activities would enable managers to determine appropriate capacity for outfitting and guiding operations. In the short term, some operations might need to be shifted. Over the long term, the national prohibitions would begin to create a level of certainty regarding

dispersed recreation opportunities. This would enhance Forest Service managers' ability to make sound decisions regarding overall management of unroaded areas and special use permit holders' ability to make long-term business decisions.

Stable land uses on Federal lands would allow communities in and around national forest to make sound economic, social, and land use planning decisions. Outfitting and guiding on NFS lands is an important aspect of recreation and tourism, and can be a key component of local economies. In the past, availability of unroaded areas was unpredictable. Continued availability of unroaded areas for P, SPNM, and SPM dispersed recreation opportunities would assist communities and small businesses in setting their priorities.

Developed and Road-based Recreation Activities

Affected Environment

While outfitter and guide activities are the primary uses requiring a permit in inventoried roadless areas, there are potential effects associated with campgrounds, resorts, ski areas, and other developments that are located nearby. In several cases land management plans have identified inventoried roadless areas for future expansions of existing special uses, or special use have been issued with expansion into inventoried roadless areas as part of the approved activities. In these cases, the holder has made business decisions based on the possibility of future expansion.

Holders of special use permits providing developed recreation opportunities are in various stages of master plan development, revision, or implementation. Many proposed projects are planned for construction in inventoried roadless areas, some within their authorized permit boundary and some outside their authorized permit boundary. Included in the mix of projects proposed in inventoried roadless areas are three new ski areas. All of these projects go through many levels of scrutiny before they are approved, including feasibility study, land management planning, master development planning, and NEPA review.

Comparison of the alternatives is based on the relative ability of the special use permit holders to proceed with the process of planning and implementing their projects; or, in the case of new recreation developments, their ability to proceed with the process to acquire a special use permit. Those alternatives that allow the projects to proceed under existing policy and safeguards would be rated high. Those that preempt existing procedures, creating a situation where the project may be placed in jeopardy because of imposed restrictions would be rated lower.

It should be noted that activities and constructed features of ski area development and management are primarily consistent with Rural and Urban ROS classes. That is, the setting, experience, and activities usually associated with ski areas are more in line with the developed end of the ROS. This is inconsistent with management of inventoried roadless areas for roadless characteristics. Because of the sharp contrast between ski area characteristics and those of inventoried roadless areas, controversy has been high and will

continue. It may become increasingly more difficult for ski area expansion or new construction because of increased regulatory jurisdictions, complex procedures, and heightened public scrutiny.

Alternative 1 – No Action

Under this alternative, projects associated with campgrounds, resorts, ski areas, or other entities that hold special use authorizations would proceed with planning. The largest category of projects proposed is ski area expansion or new ski area development. Determination of actual implementation in inventoried roadless areas would be dependent on existing policy, not on a decision influenced by an overlay of national prohibitions. Because all proposals, no matter what stage of planning or implementation, would be allowed to proceed under existing Forest Service policy, this alternative has a relative rating of high.

Alternatives 2 through 4

Proposed expansion of ski areas, resorts, or other recreation developments into inventoried roadless areas would be allowed to continue under existing Forest Service procedures if special use permits are in existence and proposed activities take place within boundaries established by the special use permit. Proposed expansion or new construction, inside or outside an authorized special use permit boundary, in an inventoried roadless area that has been approved by a signed Record of Decision, Decision Notice, or Decision Memo before implementation of the proposed rule, would also not be subject to the prohibitions.

New construction or projects proposed outside the authorized special use permit boundary in inventoried roadless areas could be subject to the prohibitions; it would depend on the type of project and how it would be constructed. For example, if it were possible to design and build a project without road construction or reconstruction, the project would not be prohibited and could proceed complying with existing processes in Alternative 2. If a proposed project could be designed and built without road construction or reconstruction and timber harvesting (assuming timber harvesting for stewardship purposes is not appropriate for clearings created for developed recreation), it could proceed with normal Forest Service procedures in Alternatives 3 and 4.

It is unlikely that new ski areas would be built under any of these alternatives unless it already had a Record of Decision before implementation of the final rule. Impacts on categories (other than ski areas) of developed recreation special use permit holders would be minimal from a national perspective.

One project proposed in an inventoried roadless area is expected to have a Record of Decision in place before implementation of the final rule; it is an expansion of an existing ski area. It would not be subject to national prohibitions. Six other proposed projects will not have a decision in place before implementation of the final rule, three are new ski areas and three are expansions of existing ski areas. All of these projects would be subject to the national prohibitions. Being subject to national prohibitions probably would affect

their ability to proceed with planning and implementation of the projects if road construction and reconstruction is planned.

Future ski area expansion of any kind outside existing authorized permit boundaries would probably not occur in Alternatives 2, 3, and 4 because roads would not be allowed. Although the alternatives have a different mix of prohibitions, the overall effect on ski areas would be similar. These alternatives are rated low because national prohibitions would affect some existing planned projects and would have a considerable effect on new ski areas or expansion of existing ski areas beyond their authorized permit boundaries.

Effects of Social and Economic Mitigation on Recreation Special Uses

Some road construction and reconstruction associated with mineral development would be allowed, which may cause shifts in the type of recreation opportunities available. Local areas would experience the effects of individual developments; however, from a national perspective the effects on recreation activities associated with outfitters and guides in inventoried roadless areas would be minimal.

Other Indirect and Cumulative Effects on Recreation Special Uses

Increasing demand for dispersed developed, and road-based recreation opportunities (Cordell and others 1999b) could affect private-sector delivery of recreation products and services. Over the next 40 years, budget limitations would most likely cause the Forest Service to turn more often to the private sector to construct and manage developed recreation facilities and to provide more dispersed recreation opportunities through outfitters and guides. As demand continues to increase, the private sector will play a more important role in the delivery of recreation related products and services on NFS lands.

Future expansion of ski areas, resorts, and other developed recreation entities that require a special use permit would only be able to expand into inventoried roadless areas within their existing authorized permit boundary if the preferred alternative is selected. NFS lands would no longer be the reservoir for future ski areas because lands suitable for ski area development are usually associated with high elevation unroaded areas. One major ski area expansion has been approved on NFS lands in the last 20 years. Ski area use, nationwide, is relatively flat. Because of this, it is expected that there would be little impact in the near future. Over time, however, the number of ski areas would become finite in number and size, resulting in increased resource impacts and demand for more support facilities and infrastructure. Future opportunities, although limited by the amount of suitable lands available for ski area development, would occur on private, Tribal, or other government lands, or through legislation.

Scenic Quality

Affected Environment

High quality scenery, especially scenery with natural-appearing landscapes, enhances people's lives and benefits society. It is a primary reason that people choose to recreate on the NFS lands, and contributes directly to real estate values in neighboring communities and residential areas. Scenic quality is based on two definable elements, landscape character, and scenic integrity. Landscape character is the overall visual impression of landscape attributes that provide a landscape with an identity and sense of place. It consists of the combination of physical, biological, and cultural attributes that makes each landscape identifiable and distinct. Scenic integrity is a measure of the wholeness or completeness of the landscape, including the degree of visual deviation from the landscape character valued by constituents. A landscape, which is perceived to have minimal to no deviation from the valued landscape character, is rated as Very High or High scenic integrity. Those landscapes, which appear to be heavily altered, have Low to Very Low scenic integrity (USDA Forest Service 1996a).

The scenic quality of a forest is not static; it changes over time. To varying degrees, roads, timber harvest, insect infestations, and wildland fire events all affect the scenic integrity of a landscape. The Agency has limited control over natural events such as insect infestations and wildland fire. Managers may influence the effects of natural events to some extent by managing vegetation with silvicultural and fuels treatments. In these instances, the positive effects on scenic quality resulting from reducing the effects of these natural events are, to some extent, offset by the negative effects of road construction and vegetative treatments, depending on an individual's perspective.

All resource management activities in inventoried roadless and unroaded areas strive to achieve long-term sustainable Landscape Character Goals[14] within the Scenic Integrity Objectives identified in the land management planning process. The scenic integrity of landscapes in these areas is generally High or Very High, which indicates a low level of landscape modification due to a lack of high intensity management activities in the past; however, altered landscapes do exist in some areas due to activities such as mining, grazing, and special uses. These areas tend to have lower levels of scenic integrity.

Inventoried roadless areas generally have landscapes with High to Very High scenic integrity. Evaluation of the alternatives, therefore, is based on the relative potential for reducing the scenic integrity. Reducing scenic integrity would affect the overall high level of scenic quality. Scenic quality would be higher in those alternatives that prohibit resource management activities that create alterations in the landscape or reduce the amount of acres managed to maintain roadless characteristics. The alternatives fall into distinct groups based on the extent to which they would maintain the high level of scenic quality that exists in unroaded areas.

[14]Landscape Character Goals and Scenic Integrity Objectives are terms defined in the Scenery Management System (USDA Forest Service 1996a) used by the Forest Service in planning and implementing activities that affect the visual landscape.

Alternative 1 – No Action

Under Alternative 1, inventoried roadless areas would be available for resource management activities that could affect their unroaded status or roadless character. Impacts on the scenic quality from resource management activities that require roads or other modifications of the landscape would be the most severe in this alternative because there would be no national prohibitions as a screen during planning. Conversely, there might be some positive effects on scenic quality from silvicultural and fuels treatments that reduce the potential magnitude of natural events such as insect infestations and wildland fires. Relative to all other alternatives, however, Alternative 1 would have a low ability to maintain scenic quality.

Alternatives 2 through 4

Alternatives 2 and 3 would allow timber harvesting that would result in short-term disturbances on the scenic integrity. However, the amount and types of timber harvest allowed in inventoried roadless areas would enhance vegetative health and reduce fuel loading, thereby providing protection from pests, diseases, and large fires. Over the long term, scenic integrity could be maintained or improved.

No short-term disturbances or long-term benefits would accrue because of timber harvesting in Alternative 4, but long-term improvement of ecosystems with health problems or other conditions that would benefit from vegetation manipulation would not occur. This alternative has the highest probability of reduced scenic quality resulting from catastrophic natural events. From a national perspective, though, the differences between these alternatives would be minimal, and they would all have the ability to maintain high levels of scenic quality. They have a relative rating of high.

Inventoried roadless areas managed for their unique characteristics and values would have a beneficial effect on scenic quality from a national perspective. These valued characteristic landscapes are visual images of geographic areas that consist of a combination of their unique and identifiable physical, biological, and cultural attributes. Managing for ecological health, viable populations of fish and wildlife, clean water, low impact recreation opportunities, and research are all complementary activities. Each contributes to the overall scenic integrity or wholeness of the landscape character.

From a local perspective, maintenance or enhancement of high scenic quality attributes would contribute to the economic and cultural viability of gateway communities and to the well being of its visitors and residents. Inventoried roadless areas are the backdrop and ‘backyard’ for many gateway communities. Communities in and around NFS lands tend to foster a unique sense of place. Sense of place is the result of the cumulative experiences a person receives by visiting or living in an area; it is the setting within which the community is identified, and it is the area where people work and play. Sense of place produces a mental image and positive feelings. High scenic quality is a key component of sense of place. Scenery, architecture, land-use patterns, wildlife, and available activities all contribute to quality of life.

Effects of Social and Economic Mitigation on Scenic Quality

Some road construction and reconstruction associated with mineral development would be allowed. This could cause considerable deviation from the landscape character in a few areas throughout the nation; however, from a national perspective the effects on scenic quality would be minimal.

Other Indirect and Cumulative Effects on Scenic Quality

Inventoried roadless areas generally have landscapes with High to Very High scenic integrity. Evaluation of the alternatives is based on the relative potential for reducing, maintaining, or increasing the scenic integrity. If an action alternative were selected, scenic integrity would be maintained or improved on 58.5 million acres of NFS lands. Combining the number of inventoried roadless area acres with 34.7 million acres of designated Wilderness provides a more complete picture of NFS lands with high to very high scenic quality. The total area being managed for high scenic quality would approach 93.2 million acres.

Data are unavailable to identify the number of NFS acres outside of Wilderness and inventoried roadless areas with road construction and reconstruction or other development restrictions in land management plans. However, a conservative estimate would place this figure at approximately 15 million additional acres, or 15 million additional acres that would contribute to maintenance of High to Very High scenic integrity. Although this is a rough estimate, the total acreage of inventoried roadless areas, designated Wilderness, and other NFS lands with restrictions on development can serve as a baseline for discussion of cumulative effects. Areas without restrictions, generally those with management prescriptions that allow a wide range of development activities and may have less capability to maintain high scenic quality, total 84.1 million acres.

Within the context of NFS lands, analysis identified factors that may have major, minor, and no effect on the baseline high scenic quality. The only reasonable foreseeable factor that could cause a major shift in the baseline acres managed for High and Very High scenic integrity is the proposed Roads Policy. The most common scenario associated with road decommissioning is to reduce road density, not create unroaded areas. However, the possibility exists that there could be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This may increase the number of acres available to be managed for a heightened level of scenic quality.

Factors that might have minor effects include lands acquired through purchase, exchange, or legislation; temporary visual impacts from fire, flood, or other catastrophe; or deviations from the characteristic landscape caused by multiple-use activities. These factors may cause scenic quality shifts in localized areas or cause small incremental shifts over long periods. However, they typically would not cause a major shift in the national baseline for high scenic quality.

Another factor that would not change the baseline for high scenic quality, but would generally raise the scenic integrity levels, is future Wilderness designations. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventories roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8% (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline, but potentially shift scenic quality to higher levels.

Actions taken by other land management and regulatory agencies are important factors in maintaining high scenic quality from a national perspective. Most land management agencies administer their lands with some form of visual goals integrated into their planning processes. However, the mission of each agency determines that they will manage the natural landscape for high scenic quality. For instance, the National Park Service, U.S. Fish and Wildlife Service, and some parkland managed by local and State agencies manage their lands to maintain the very highest levels of scenic quality. Although a small percentage of these lands are highly modified to handle the large numbers of people drawn to the attraction. Other agencies, such as Bureau of Land Management or State resource development departments, have missions that focus on resource management. The Army Corps of Engineers, Bureau of Reclamation, and local parks, have missions to primarily manage for developed or road-based recreation. Lands managed by these agencies would typically have higher percentages of modified landscapes resulting in lower scenic quality of natural landscapes in some areas.

Certain regulatory agencies have effects on the scenic quality of landscapes at the regional and local scale. For instance, State Coastal Commissions have strong mandates to maintain high scenic quality along their coastlands. Various local commissions throughout the nation use zoning to preserve particular views or valued landscape features. Much of the scenic backdrop and open space around communities is private land. Large ranches, private landholdings, and agricultural lands are being developed at an accelerated pace. As more and more of this land is developed, public awareness of the loss of natural landscapes with high scenic quality has increased and resulted in national efforts focused on maintaining areas of high scenic value. These efforts resulted in the Scenic Highway movement, Wild and Scenic Rivers System Act, American Heritage Rivers program, anti-billboard campaigns, and anti-litter laws.

High scenic quality of natural landscapes is an important component of our national heritage. Over time, the last vast natural landscapes with high scenic quality will be those managed by agencies responsible for the Federal lands. Over the next 40 years, as private lands continue to be developed, and as public lands continue to be altered by management actions, the value of natural landscapes of high scenic quality will continue to increase. Consideration for maintenance of natural landscapes with high scenic quality will play an increasingly larger role in decisions that would cause visual impacts.
This may increase the number of acres available to be managed for a heightened level of scenic quality.

Heritage Resources

Affected Environment

Heritage resources include areas, sites, buildings, art, architecture, memorials, and objects that have scientific, historic, or cultural value. They link people to their cultural history, provide insight into how people lived in the past, and reveal past and ongoing relationships between people and the natural world. Many of the nation's heritage resources are located on Federal lands, with NFS lands containing a substantial share.

Under Executive Order 11593, "Protection and Enhancement of the Cultural Environment," Federal agencies are charged with the task of inventorying the historic and prehistoric sites located on the lands they manage. More than 270,000 heritage sites have been inventoried on NFS lands to date (USDA Forest Service 1999f). Approximately 25% of all NFS lands have been inventoried for heritage sites. It is estimated that NFS lands may contain up to 1 million heritage sites (Kaczor personal communication).

The National Historic Preservation Act of 1966, as amended through 1992, and the NEPA (1970) both require Federal agencies to take into account the effects of any development or management actions on historic and cultural properties, which are protected under these laws. Agencies must identify any historic or cultural properties that will potentially be affected by the preferred alternative, assess the effects of that action on those properties, and seek ways to avoid, minimize, and mitigate any adverse effects.

To comply with these laws, agencies inventory areas where projects are proposed, and they identify potential heritage sites. If a site is identified, it is evaluated to determine whether it is significant and eligible for listing in the National Register of Historic Places. If a site is significant, the preferred alternative may not proceed until steps to minimize impacts and mitigate effects are taken. Mitigation measures may also be taken if proposed projects or development activities are undertaken in areas having cultural sites that are considered significant to local American Indian Tribes and other ethnic groups.

The Archaeological Resources Protection Act of 1979 protects archaeological resources and sites on public and American Indian lands to prevent their loss and destruction. The Act provides for criminal prosecution for the unauthorized disturbance of archaeological resources, including any culturally related items of Tribal affiliation. It also establishes a permit process for the management of cultural sites on Federal lands, which provides for consultation with affected Tribal governments. The Native American Graves Protection and Repatriation Act of 1990 requires timely consultation with culturally affiliated Tribes when human remains are inadvertently discovered in the course of implementing projects on Federal lands. Executive Order 13007 states that agencies must consider sacred sites on Federal lands in determining how areas that contain them should be used and managed. The Forest Service consults with more than 400 American Indian Tribes in managing the heritage sites on NFS lands (USDA Forest Service 1999f).

Of the estimated 270,000 heritage sites that have been inventoried on NFS lands, 109,000 of these are considered significant, and most of the remainder have not yet been assessed for significance (Kaczor Personal communication). Of the heritage sites that have been recorded on NFS lands, less than 1% have been stabilized or restored, most have not been studied or evaluated, and 3,000 have been listed on the National Register of Historic Places (USDA Forest Service 1999f). Approximately 2,000 heritage sites on NFS lands are interpreted in some way for the public (USDA Forest Service 1999f).

Most inventories for heritage sites have been conducted on lands where development or management projects have been proposed because of legal requirements to disclose the impacts of such projects on heritage resources. Many heritage sites that have not been inventoried probably exist in inventoried roadless areas, where development has been relatively minimal.

Heritage tourism is one of the fastest growing sectors of the tourism industry, and it is ranked among the top two or three reasons that people take vacations (USDA Forest Service 1999f). In 1994 and 1995, an estimated 123.3 million people visited an historic or prehistoric site in the United States (Cordell and others 1999b). Unfortunately, it is estimated that up to 90% of the nation's prehistoric sites were destroyed by development by the 1960s (USDA Forest Service 1999f). NFS lands contain many of the best-preserved heritage sites that remain in the United States, in some of the least disturbed natural settings. These sites provide opportunities for Americans to learn about their cultural heritage (USDA Forest Service 1999f).

Members of the public who commented on the DEIS largely supported maintaining roadless areas in a roadless state, believing this would protect heritage sites. There was some concern, however, that a prohibition on road construction could make it difficult for the Forest Service to protect historic structures and archaeological sites located in roadless areas. There was also some concern that the proposed rule would make it harder for the Forest Service to inventory heritage resources in roadless areas.

Alternative 1 – No Action

Additional road construction, road reconstruction, and timber harvest would take place in inventoried roadless areas under Alternative 1, as estimated in the National Forest System Roads and Timber Harvest sections of this chapter. The Federal laws described under Affected Environment will help to protect heritage resources under Alternative 1. Nevertheless, building roads and implementing management actions such as timber harvest can affect heritage resources. In the past, roads were often built in locations that have the highest likelihood of containing historic or prehistoric sites, such as along rivers and creeks, or through open areas. Although best management practices now discourage road development in riparian areas and floodplains, some buried or surface remains of archaeological sites may inadvertently be damaged by the earth-moving equipment used in the road construction process, or by logging equipment (USDA Forest Service 2000h). Roads may also cause increased erosion of historic or cultural sites.

However, road construction and reconstruction and timber harvest could lead to the inventorying of as yet unrecorded heritage resources that are located in areas where projects or development are planned. As a result, additional information regarding heritage resources in inventoried roadless areas would be obtained. This might eventually lead to the protection, restoration, and potential development of some of these sites for interpretive and educational purposes. However, given that fewer than 1% of known sites on NFS lands have been stabilized or restored to date, it is likely that only a small number of sites would potentially benefit.

Roads provide access to heritage sites for purposes of research, restoration, visitation, teaching, and interpretation to the public. By making these sites accessible, it is possible to raise public awareness, which helps serve to protect them. However, because they make sites known and accessible to the public, roads provide increased opportunities for vandalism and looting. Furthermore, publicizing heritage resources and increasing visitation to them can increase conflict between people who assign different values and meanings to them, and want to see them managed differently (Lee and Tainter 1999). Roads and timber harvest can also alter the character of heritage sites.

Construction or reconstruction of two heritage-related roads is planned in inventoried roadless areas within the next 5 years to provide public access to historic sites. Each of these planned roads would be 1 mile long, would provide access to a Lewis and Clark historic site, and would be located on the Beaverhead-Deerlodge National Forest in Region 1. One of the planned roads is new construction, which would take place during the year 2000. The other road is a planned reconstruction of a classified road to take place in the year 2001. Under Alternative 1, both of these roads could be built as planned.

The short-term effects of Alternative 1 on heritage resources would likely be small because of the relatively small percentage of inventoried roadless areas to be roaded and logged over the next 5 years, the legal protections already in place, and the low percentage of sites that get restored and developed for interpretive and tourism purposes. However, the long-term effects of no action could be substantial. Road construction and timber harvest would require heritage inventory work in areas targeted for development, which would enhance knowledge and documentation of the heritage resources roadless areas contain over time. A small percentage of these sites might be restored or developed for education and tourism in the future. No action could also lead to accelerated degradation of some heritage resources located in inventoried roadless areas over time.

Alternatives 2 through 4

Potential positive effects common to all of the action alternatives include:

- No new roaded access to heritage sites, meaning less potential for future disturbance, vandalism, and looting;
- Better maintenance of the current character of heritage resources and sites;
- Less conflict between interest groups over the use and management of heritage resources such as sacred sites; and

- Less risk of destruction of heritage resources through development and project-related activities.

Potential negative effects common to all of the action alternatives include:

- Less future opportunity to discover and document the heritage resources that exist in inventoried roadless areas;
- Less opportunity to protect and restore any of the sites that occur in roadless areas; and
- Less opportunity to provide tourism, educational, and interpretive opportunities to the public regarding heritage.

Timber harvest activity can alter the character of heritage resources and sites, and inadvertently damage them. Therefore, Alternative 4, which prohibits all timber harvest in inventoried roadless areas, would provide the most protection from accidental damage to heritage resources. Alternative 2, which does not prohibit any timber harvest activity in inventoried roadless areas, would provide the least amount of protection. However, Alternative 4 would provide less opportunity than Alternative 2 to discover and document heritage resources in inventoried roadless areas. The effects of Alternative 3, which allows timber harvest for stewardship purposes only, would be intermediate between Alternatives 2 and 4.

Fires can also have an impact on heritage resources. They can damage artwork, artifacts, cave shelters, pueblos, historic buildings, and other surface and near surface remains. They alter the character of historic and cultural landscapes, at least temporarily. They also remove vegetation, exposing sites and objects, and making them more vulnerable to vandalism and the elements. The Fire Suppression section of this report concludes that, nationally, the same number of inventoried roadless acres is predicted to burn from wildland fires with or without a prohibition on road construction.

However, Alternative 3, which allows timber harvest for stewardship purposes, including fuels management, could be more beneficial to heritage resources than Alternative 4. Wildland fires that burn out of control in areas where there is a buildup of fuels tend to burn intensively, and induce more damage to sites than fires that burn less intensively. Stewardship timber harvest would make it possible to use thinning as a fuels management technique. This would help to reduce the incidence of intense fires in inventoried roadless areas. Thus, Alternative 3 would be more beneficial to heritage resources than Alternative 4, from the perspective of fire damage. Under Alternative 4, fuels management methods that could take place in roadless areas would be prescribed fire, wildland fire for resource benefit, and some mechanical treatments that do not include cutting of trees.

There is not likely to be a substantial difference between the effects of Alternatives 2 and 3 with regard to fire impacts on heritage resources. Under Alternative 2, thinning for stewardship purposes would be allowed, as would **commercial timber harvest**, which is assumed to reduce the likelihood of intense, uncontrolled fires. However, because the amount of timber harvested for commercial purposes is likely to be small in inventoried roadless areas in the absence of roads, Alternatives 2 and 3 would have similar effects. None of the fire-related effects of the different alternatives discussed above, with regard to timber harvest, would start to be significantly different until at least 2020. Between

2000 and 2020, the effects of the action alternatives are likely to be the same, because under the Forest Service Cohesive Strategy, inventoried roadless areas would not begin to be treated for fuels management until 2020.

A prohibition on road construction and reconstruction would mean that no new roads would be built or reconstructed for the specific purpose of providing access to heritage sites located in inventoried roadless areas. As described under Alternative 1, during the next 5 years, a 1-mile length of new road is planned for the specific purpose of providing access to a heritage site on the Beaverhead-Deerlodge National Forest. One road is also planned for reconstruction in an inventoried roadless area over the next 5 years to provide access to a heritage site on this forest. If the proposed rule is finalized before the final decision to build or reconstruct these roads is signed, it will not be permissible to build or reconstruct them.

Overall, the action alternatives would not have a significant long-term national effect on road construction to provide access to heritage sites located in inventoried roadless areas, because the amount of road construction that takes place for this purpose is so small. There may be small, localized impacts on individual forests that would be prevented from constructing roads for this purpose in the future. Existing means of gaining access to inventoried roadless areas to visit heritage sites would be maintained under Alternatives 2 through 4. These alternatives would not preclude building new trails to provide access to heritage sites. The short-term effects of the action alternatives would likely be insignificant due to the relatively small percentage of inventoried roadless areas to be roaded and logged over the next 5 years and the legal protections already in place. The exception would be if a major site were discovered in the development or management process. The long-term effects of the action alternatives could be significant, however. The most significant long-term effects of the action alternatives would likely be conservation of heritage resources located in inventoried roadless areas over time due to a reduction of disturbance and vandalism, and a persistent lack of knowledge and documentation of the heritage resources these areas contain.

Effects of Social and Economic Mitigation on Heritage Resources

If mitigation measures are implemented for mineral leasing, an estimated 59 miles of roads could be built in inventoried roadless areas over the next 5 years, with additional road miles added over the medium and long term. These roads would be single-use roads that could not be used to provide public access to heritage sites. Road construction would take place in compliance with Federal laws designed to protect heritage resources from ground disturbing activities. However, additional road construction could cause unintended damage and character alteration to historic and prehistoric sites located near it, as described under Alternative 1. It could also lead to the inventorying of unrecorded heritage resources in the areas where roads would be constructed. It is unlikely that any sites discovered in this process would be restored or developed for education and tourism, since the mining roads constructed would not generally be open for public access.

Other Indirect and Cumulative Effects on Heritage Resources

NFS lands contain a substantial share of the nation's heritage resources, and roadless areas contain a large proportion of the heritage resources that occur on NFS lands. Given the widespread destruction of heritage resources located on private lands to date, and the rapidly growing interest in heritage tourism nationwide, heritage sites on NFS lands can be expected to become increasingly unique and valuable resources that more people wish to visit in the future. These trends will pose a dilemma for their management with regard to providing a balance of protection and visitation opportunities. The cumulative effects of these trends and of the action alternatives would be an emphasis on heritage resource and site conservation in inventoried roadless areas due to reduced disturbance and visitation, and a focus on inventory, restoration, interpretation, and tourism opportunities on NFS lands that are developed and that would allow future road construction.

A number of laws were passed during the 1960s and 1970s to protect heritage resources on public lands, as described under Affected Environment. The laws mandate procedures designed to protect heritage resources when ground-disturbing projects such as road construction and timber harvest are implemented on NFS lands. Under Alternative 1, these laws would provide protection to heritage resources and sites if development and management activity occurred in inventoried roadless areas. The action alternatives would provide an additional increment of protection to the foundation provided by these laws by prohibiting road construction, road reconstruction, and possibly some timber harvest in inventoried roadless areas, thereby preventing accidental damage to sites and reducing visitation and disturbance to them.

Wilderness

Affected Environment

The National Wilderness Preservation System (NWPS) includes almost 105 million acres; of these, approximately 34.7 million acres are NFS lands. Designated Wilderness is managed to preserve its primeval character and maintain a condition affected primarily by the forces of nature. Wilderness is a cornerstone for protecting biodiversity (especially in the West and Alaska), is valuable for scientific and educational uses, serves as a benchmark for ecological studies, and preserves historical and natural features (for a more detailed discussion refer to the Biodiversity section). Wilderness is a special place that provides vast areas for solitude, primitive and unconfined recreation, sacred sites, and opportunities to experience adventure, challenge, and self-reliance. Congress has the sole authority for designating additions to the NWPS (Hendee and others 1990).

Potential Wilderness areas are identified in land management plans and have prescriptions to preserve their Wilderness attributes. Lands are identified as potential Wilderness through the land management planning process and by congressional designation. Congress uses recommendations in land management plans as a basis for additions to the NWPS; however, the Congress could designate fewer or more acres as Wilderness depending on its own analysis.

Inventoried roadless areas are distinguished in land management plans by their prescription. Approximately 4.2 million acres are managed to maintain Wilderness attributes, 20 million acres restrict road construction and reconstruction, and 34.3 million acres are available for road construction, reconstruction, timber harvest, and other resource management developments. A substantial number of inventoried roadless areas are near or in close proximity to designated Wilderness areas. Of the 58.5 million acres of inventoried roadless area, 20 million acres (Table 3-29) are adjacent to designated Wilderness areas.

These areas serve as a natural transition between lands with road-based resource management activities and lands affected substantially by natural processes.[15] Maintaining the roadless character of these transition areas would sustain existing levels of Wilderness value protection. This would occur in two ways. First, inventoried roadless areas adjacent to or near Wilderness areas are usually more accessible than Wilderness areas and are an alternative for recreation uses. Second, the additional distance from intense management activities would provide more opportunities for natural processes (for example allowing fire to play its natural role or maintaining the integrity of wildlife habitat) to occur uninterrupted.

Some of the key characteristics of inventoried roadless areas lie in their unique Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation opportunities (refer to the Recreation section for a discussion of the ROS). Activities that are prohibited in designated Wilderness areas and that are not readily available in areas with classified roads can occur in inventoried roadless areas. These areas provide popular, appropriate alternatives to Wilderness areas because, although they contain many Wilderness attributes, a wider range of recreation opportunities with fewer restrictions is available.

Threat to Wilderness character and values by activities or other sources is the measure for evaluating the alternatives. Both potential (identified in a land management plan) and existing designated Wilderness could be threatened when resource management activities change human patterns or ecological values in a manner that diminishes Wilderness character or values. In general, maximizing national prohibitions would result in a low level of threat; those that have fewer prohibitions would result in a higher level of threat. Therefore, relative level of threat between the alternatives will be used to describe effects on potential additions to the NWPS and existing Wilderness areas

Another form of impact comes from the potential threat to inventoried roadless areas not covered by a management prescription that maintains Wilderness attributes. Although inventoried roadless areas may be managed to sustain their roadless characteristics, they are still the reservoir for future designated Wilderness areas. Those alternatives that

[15] The Forest Service is mindful that Congress did not intend Wilderness designations to compel the creation of protective perimeters or buffer zones around Wilderness Areas. Congress has made clear that the fact that non-Wilderness activities or uses can be seen or heard from within any Wilderness Area shall not, of itself, preclude such activities or uses up to the boundary of Wilderness Areas. The Forest Service may consider the effects on a Wilderness Area in determining the uses of adjoining lands, however, as long as the Agency considers other factors as well in its decisions concerning the adjoining lands. The purpose of this portion of the FEIS is to disclose potential consequences of the proposed action and alternatives to Wilderness resources to fulfill the Agency's responsibilities under NEPA. The Forest Service estimates that 34% of the inventoried roadless areas are adjacent to designated Wilderness Areas.

provide the highest level of protection would result in the least amount of threat to the reservoir for future Wilderness areas; conversely, those that provide the least protection would result in more threats, thereby reducing the size of the reservoir.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land management-plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those currently protected could be affected over the long term as local conditions and situations change.

Alternative 1 – No Action

Alternative 1 would provide the least protection because no national prohibitions would be applied to inventoried roadless areas. Over time, the supply of inventoried roadless areas available would decrease resulting in more developed recreation use, fewer opportunities for Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation, increased resource management activity, and reductions in the size of lands available for uninterrupted natural processes. This trend of shifting human patterns, increased resource management activity, and reduced ecological integrity in and around potential and designated Wilderness might increase the threat to their Wilderness character. In addition, this alternative would provide the least protection for inventoried roadless areas in general, causing the greatest reduction of the reservoir for future Wilderness areas. For these reasons, Alternative 1 receives a relative rating of high (highest threat to designated and potential Wilderness in relation to Alternatives 2, 3, and 4).

Alternatives 2 through 4

Alternatives 2 and 3 would allow timber harvesting that could result in short term disturbances, such as impacts on the visual resource, displacement of wildlife, or shifts in recreation use. However, the amount and types of timber harvest allowed in inventoried roadless areas would enhance vegetative health and reduce fuel loading, thereby providing protection from pests, diseases, and large wildland fires spreading into designated Wilderness. No short-term disturbances from commercial timber harvesting or long-term benefits from timber harvesting for stewardship purposes would accrue under Alternative 4.

Overall, inventoried roadless areas would remain intact in and around potential and designated Wilderness. Human use would increase in inventoried roadless areas, but at a much slower pace than Alternative 1. Patterns of recreation and other uses would be managed to maintain or enhance roadless characteristics. Large tracts of land where natural processes occur uninterrupted would be maintained. Effects on the reservoir for future Wilderness would be minimized. All action alternatives would provide substantial protection from threats and, from a national perspective, are barely distinguishable from each other. Thus, threats to Wilderness character in potential and existing Wilderness is rated low in these alternatives.

Effects of Social and Economic Mitigation on Wilderness

Some road construction and reconstruction associated with mineral development would be allowed in inventoried roadless areas. The amount of activity associated with mineral exploration and development would create very little threat to designated Wilderness. However, those areas that are developed would reduce the reservoir of roadless area available for future designation of Wilderness. Even so, the effects from a national perspective would be minimal.

Other Indirect and Cumulative Effects on Wilderness

Inventoried roadless areas are managed under a variety of forest prescriptions. Implementation of Alternatives 2 through 4 would help to establish a uniform approach to managing all unroaded areas. Because many inventoried roadless areas are adjacent to designated Wilderness areas, large tracts of land would remain unroaded and essentially undeveloped.[16] Managing these large tracts of land for undeveloped characteristics would be unique in a country as highly industrialized as the United States. A wide range of human uses and activities would be allowed, yet, large areas would be affected solely by the forces of nature or managed to enhance the health of ecosystems. Large tracts of undisturbed lands would provide reference landscapes, biological strongholds and refuges, and intact plant and animal communities at an unparalleled scale.

In the past, inventoried roadless areas were managed as a bank for future resource development or special designation. If these areas were managed for their own inherent values, there could be less pressure to designate these lands as Wilderness or other special designation to shield the land from development. This action may reduce controversy and result in more stability. Threats to Wilderness character and values by activities or other sources were the measure used to evaluate alternatives. If an action alternative were selected, the supply of inventoried roadless areas would be stabilized at close to 58.5 million acres.

Data are unavailable to identify the number of available NFS acres outside designated Wilderness and inventoried roadless areas that are restricted from road construction and reconstruction or other types of development. However, a conservative estimate would place this figure at approximately 15 million additional acres that have land management plans with some form of road construction or development restrictions in land management plans. Although this is a rough estimate, the total acreage of inventoried roadless areas and other NFS lands with restrictions on road construction can serve as a baseline for discussion of cumulative effects. Areas without restriction total 84.1 million acres. These lands are more of a threat to existing and potential Wilderness areas because

[16] For example, six existing Forest Service Wilderness Areas encompass over 1 million acres each. There are 10 Wilderness plus adjacent inventoried roadless areas over 1 million acres. Twenty-two existing Wilderness Areas encompass 250,000 to 1,000,000 acres in size. There are 33 Wilderness plus adjacent inventoried roadless areas 250,000 to 1,000,000 acres in size. (Figure 3-27).

they generally have management prescriptions that allow a wide range of resource management and development activities.

Within the context of NFS lands, analysis identified factors that may have major, minor, or no effect on the baseline. The reasonable foreseeable factors that could cause a major shift in the baseline supply of Wilderness acres are the proposed Roads Policy and new Wilderness designation. The most common scenario associated with road decommissioning under the proposed Roads Policy would be to reduce road density, not create unroaded areas. However, if a conservative estimate were realized, there would be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This would increase the number of acres providing an elevated level of protection and a reduced level of threat from resource management activities. This action could change human patterns or environmental conditions in a manner that enhances the character or values of designated or potential Wilderness.

The other factor that would influence a major shift in the baseline is Wilderness designation. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventoried roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8% (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline but increase protection from threats to Wilderness character. This would decrease the number of inventoried roadless areas or other NFS lands with development restrictions. However, the net benefit of increased protection provided by Wilderness designation would increase.

Factors that might have minor effects include lands acquired through purchase, exchange, or legislation and reduced access because of private property, fish and wildlife protection, or other types of closures. These factors may cause the level of threat to designated or potential wilderness to shift in localized areas or cause small incremental shifts over long periods. However, they typically would not cause a major shift in the national baseline of protection.

Actions by other land managing agencies can be important factors in providing additional protection from threats to existing and potential Wilderness. For example, designated Wilderness and other special areas managed by the National Park Service and Bureau of Land Management are often adjacent to NFS lands or near enough to complement each Agency's effort to minimize threats to potential and designated Wilderness. In many cases, special management areas function as transition areas between lands managed to allow for natural ecological processes and lands managed more intensely for human uses. These situations add additional protection from threats to potential and designated Wilderness.

There is considerable controversy over expansion of the National Wilderness Preservation System. However, potential for additions from lands managed by the Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and, to a lesser extent, other Federal agencies remains fairly high. There continues to be high public and political interest in creating a wide range of special

designations throughout the Federal lands that would manage for particular amenity or ecological resources. Additional designations of lands for special purposes would provide additional protection from threats to potential and designated Wilderness areas. Because of increased development of private lands and growing public interest in maintaining open space, the trend to create special areas on Federal lands would most likely continue for the first decade unless there was a national or global crisis such as a recession or war. But, because Federal lands are a finite resource and there is continued interest in maintaining and creating open space, protecting the environment, and providing for a wide range of recreation opportunities and amenity values, the emphasis would most likely shift from Federal lands to private, State, and locally managed lands in the second decade.

Other Special Designated Areas

Affected Environment

Certain specific areas of NFS lands not designated as Wilderness and containing outstanding examples of plant and animal communities, geological features, scenic grandeur, or other special attributes merit special management. These areas are designated by law, or may be designated administratively by executive order or through Agency planning efforts, as special areas. Areas so designated are managed to emphasize specific values identified in their enabling legislation or order, such as, recreation, geology, or history. Other uses are permitted in the areas to the extent that these uses are in harmony with the purpose for which the area was designated.

Inventoried roadless areas in the following NFS special areas were considered in this rulemaking:

- National Primitive Areas,
- National Scenic Research Areas,
- National Scenic Areas,
- National Wild and Scenic Rivers,
- National Recreation Areas,
- National Game Refuges and Wildlife Preserves,
- National Monuments,
- National Volcanic Monuments,
- National Historic Areas,
- Wilderness Study Areas,
- Research Natural Areas, and
- Other Congressionally designated areas.

The law or executive or administrative order designating each area provides specific objectives and guidelines for management of the area. Some are quite prescriptive with management details written right into the law (for example, the designation of eight management areas depicted on a map in the Smith River National Recreation Area Act). Others are more descriptive, providing the Forest Service with more management discretion (for example, the provisions for general purpose, prohibitions, and exceptions

identified in the Presidential proclamation creating the Sheep Mountain National Game Refuge and Wildlife Preserve in Wyoming). Despite these differences, the Agency's policies, which guide the management of most special areas, have some similarities. The Forest Service manages each special area as an integral part of NFS lands with an emphasis on the primary values and resources as directed by the law or order that established the area. Secondly, the Forest Service manages values or resources not emphasized or prohibited by law in a manner that complement or enhance the primary values of the area and are compatible with overall national forest management objectives. Lastly, special areas are managed as showcases to demonstrate national forest management standards for programs, service, and facilities.

With the exception of National Game refuges, Wildlife Preserves, and Research Natural Areas, one of the objectives for management of special areas involves providing for public enjoyment of the area for outdoor recreation. However, the special values (that is, scenic, cultural, historic, wildlife, geologic, or other values) and attributes that contribute to public enjoyment are to be protected. Other resource values that are present in the area are to be managed in a manner that does not impair the public recreation values or the special attributes of the area.

As indicated in Table 3-49, there are approximately 6 million inventoried roadless area acres in special designated categories. Of this, about 1.2 million acres (20%) are identified in land management plans or other completed assessments as allocated to a prescription that allows road construction or reconstruction. There are approximately 4.8 million acres (80%) allocated to a prescription that does not allow road construction or reconstruction. Of this, 2.1 million acres (35%) are further recommended, in land management plans or other completed assessments adopted by the Agency, for addition to the National Wilderness Preservation System. Table 3-49 displays the inventoried roadless area acreage by type of special designated area and management prescription.

The demand for motorized and non-motorized dispersed recreation opportunities is increasing (Cordell and others 1999b). Demand for special use permits to provide outfitting and guiding services is also on the rise (see Recreation Special Uses, Dispersed Activities section in this chapter). As previously discussed, a key characteristic of inventoried roadless areas is their ability to supply P (Primitive), SPNM (Semi-Primitive, Non-Motorized), and SPM (Semi-Primitive Motorized) settings for a wide range of dispersed recreation activities (see Recreation, Dispersed Activities section in this chapter). Applying this concept to special designated areas, it is generally more applicable in the categories of areas which feature dispersed recreation (or don't emphasize recreation at all) in their management plans. Examples of these areas are National Primitive Areas, National Scenic Research Areas, National Wild and Scenic Rivers, National Game Refuges and Wildlife Preserves, Wilderness Study Areas, and Research Natural Areas.

At the same time, the demand for new developed and road based recreation is also increasing (Cordell and others 1999b; see Recreation, Developed Sites, and Road Dependent Activities sections in this chapter). This demand affects developments managed by both the public and private sectors. New developed recreation would likely

Table 3-49. Special designated areas, in thousand acres, on National Forest System lands.

		Inventoried roadless areas allocated to a prescription . . .			
	National summary[a]	…that do not allow road construction and reconstruction	…that allow road construction and reconstruction, and the land management plan recommends as Wilderness	…that allow road construction and reconstruction	Total
Areas with single designations	NGRWP	0	0	56	56
	NM	79	0	0	79
	NRA	214	212	749	1,175
	NSA	51	0	0	51
	NVM	25	0	2	27
	NWSR	81	0	81	162
	NSRA	1	0	2	3
	OCD	1,266	16	50	1,332
	RNA	166	28	55	249
	WSA	782	1,820	194	2,796
Areas with multiple designations	NM NWSR	4	0	0	4
	NM OCD	23	0	0	23
	NM OCD NWSR	2	0	0	2
	NRA NWSR	11	0	11	22
	NRA RNA	4	0	0	4
	NWSR OCD	1	0	0	1
	NWSR RNA	0	0	1	1
	OCD NRA	1	0	0	1
	OCD RNA	12	0	0	12
	WSA NSA	0	7	0	7
	WSA RNA	5	0	3	8
	Total	**2,728**	**2,083**	**1,205**	**6,015**

[a] NPA - National Primitive Area
NVM - National Volcanic Monument
NWA - National Widerness Area
NSRA - National Scenic Research Area
OCD - Other Congressionally Designated Areas
RNA - Research Natural Area
NRA - National Recreation Area
NM - National Monument
NWSR - National Wild & Scenic Rivers
NGRWP - National Game Refuge/Wildlife Preserve
NHA - National Historic Area
NSA - National Scenic Area
WSA - Wilderness Study Area
(Roadless Database 2000)

expand into or occur in unroaded areas. This situation is generally most acute in National Scenic Areas, National Recreation Areas, National Monuments, and National Volcanic Monuments because these areas are more likely than other categories of special designated areas to feature developed recreation.

The alternatives, then, exist in an environment that is characterized by increasing demands for incompatible recreation activities and opportunities competing for a finite resource (roadless areas). What sets special designated areas apart from general forest areas is the special values, attributes, or unique features for which they were established. The effects of the rulemaking will vary depending upon the management emphasis for each area.

The alternatives are compared by the degree to which they maintain the existing supply of inventoried roadless areas coupled with the appropriateness of that supply for both dispersed and developed recreation opportunities. The special designated areas in which management emphasizes dispersed recreation would benefit more from alternatives that create safeguards to maintain the most NFS lands in an unroaded condition. The special designated areas in which management emphasizes greater visitor access and developed recreation would benefit more from alternatives which place the fewest restrictions on access and other management.

Alternative 1 – No Action

This alternative would provide the most flexibility to local land managers of special designated areas to determine the long-term disposition of unroaded lands to meet developed and dispersed recreation needs within the context of the law or order that established the area.

In special designated areas, about 1.2 million acres (20%) are in areas with management prescriptions that permit road construction (Table 3-49). These areas would be available for resource management activities that could degrade their unroaded characteristics. If road construction, timber harvesting, and other resource management activities occur in inventoried roadless areas (where land management plan prescriptions allow it), then the supply of acres available for dispersed recreation opportunities in SPM, SPNM, and P classes (including outfitter and guide assisted dispersed recreation opportunities) probably would diminish. This effect would also mean a decline in the land base on which to resolve conflicts between motorized and non-motorized dispersed recreation activities.

On the other hand, opportunities to shift from Primitive and Semi-Primitive settings to road based and developed classes of recreation would be offered in this alternative.

In general, Alternative 1 would have the least direct effect on the management of National Game Refuges/Wildlife Preserves, National Scenic Research Areas, and National Volcanic Monuments categories of special designated areas. Nationally, these categories have the fewest acres of inventoried roadless area and relatively more roadless areas with management prescriptions that permit road construction (Table 3-49). This alternative would not change the plans for areas where management prescriptions prohibit road construction. However, over the long term, there would be no safeguards preventing management prescriptions from being changed when land management plans are revised to permit road construction.

In this alternative, projects associated with private entities that hold special use authorizations (such as resorts and marinas) would proceed with planning even if those plans could affect inventoried roadless areas. Implementation of those plans would be dependent on existing local policy and direction rather than an overlay of the prohibition alternatives.

Alternatives 2 through 4

In Alternatives 2 through 4, a national prohibition on road construction in inventoried roadless areas in special designated areas would apply. These alternatives would provide less flexibility than Alternative 1 to local land managers of special designated areas to determine the long-term disposition of unroaded lands to meet developed and dispersed recreation needs within the context of the law or order that established the area.

Over the long term, these alternatives would maintain the highest relative supply of lands with dispersed recreation potential. Availability of roadless areas for forest visitors seeking Primitive and Semi-Primitive recreation opportunities (including outfitter and guide assisted dispersed recreation) would be highest in Wilderness Study Areas, National Recreation Areas, and National Wild and Scenic River categories of special designated areas because they have the greatest number of inventoried roadless acres. A stable supply of roadless acres would result from implementing any of these alternatives. This would provide more opportunities than in Alternative 1 for resolving the issues between motorized and non-motorized dispersed recreation activities.

Minor shifts in recreation use might occur because of timber harvesting allowed in Alternatives 2 and 3. For instance, most outfitters and guides prefer natural appearing landscapes, so cutover areas probably would be avoided until they grow back. On the other hand, timber harvested areas might attract use because of increased hunting, wildlife viewing, or berry picking opportunities. These shifts, however, would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities. Therefore, Alternatives 2, 3, and 4 would have roughly equivalent effects on dispersed recreation.

Conversely, these alternatives would result in a lower supply of lands than in Alternative 1 with developed recreation potential or with access for forest visitors seeking road based or developed recreation experiences. The road prohibition would be the same in each of these alternatives, therefore the effect of reducing the possibility of shifts from primitive and semi-primitive ROS setting to Roaded Natural or Rural experiences would be the same.

Proposed expansion of ski areas, resorts, or other recreation developments into inventoried roadless areas would be allowed to continue under existing Forest Service procedures if special use permits are in existence and proposed activities take place within boundaries established by the special use permit. Proposed expansion or new construction, inside or outside of a special use permit boundary, in an inventoried roadless area that has been approved by a signed Record of Decision, Decision Notice, or Decision Memo before implementation of the final rule, would also not be subject to the prohibitions.

New construction or projects proposed outside the authorized special use permit boundary in inventoried roadless areas could be subject to the prohibitions depending upon the type of project. For example, if a proposed project could be designed and implemented without road construction or reconstruction, it could proceed under normal

Forest Service procedures in Alternative 2. If a proposed project could be designed and implemented without road construction or reconstruction and timber harvesting, it could proceed under normal Forest Service procedures in Alternatives 3 and 4.

Effects of Social and Economic Mitigation on Other Special Designated Areas

Special Designated Areas are managed to emphasize specific values identified in their enabling legislation, order, or land management plan. Other uses are allowed in the areas to the extent that these uses are in harmony with the purpose for which the areas were designated. Road construction and reconstruction would be allowed unless these lands were withdrawn from mineral exploration and development by statute or other action. However, if it were allowed, there could be minor shifts in recreation uses and substantial deviation of the characteristics landscape in localized areas. These occurrences would be rare and would have minimal effects from a national perspective.

Other Indirect and Cumulative Effects on Other Special Designated Areas

Inventoried roadless areas in special designated areas are a subset of all inventoried roadless areas included in this rulemaking. Each special designated area also has an overlaying level of protection based on what type of designation was bestowed on it by Congress or by proclamation. Refer to the other FEIS sections for discussions on cumulative effects. These references would apply when there is no conflict with the enabling legislation or order.

Real Estate Management

The fundamental purpose of the real estate management program is to conserve and manage the public's real property of NFS lands. This purpose is complicated because landownership within NFS boundaries includes parcels of lands owned by States, private individuals, and other Federal and non-Federal entities. Issues connected with real property may be resolved through boundary management, landownership adjustments (land exchanges and direct purchase acquisitions), and properly authorized and administered special uses on NFS lands.

Boundary Management and Landownership Adjustments

Affected Environment

Within the exterior boundaries of NFS lands are lands that are under private, State, and other Federal and non-Federal ownerships. Private, State, and other Federal and non-Federal ownership lands constitute approximately 17% of the acreage within NFS land boundaries. The Forest Service engages in land exchanges and direct land purchases to consolidate the national forest ownership pattern to facilitate efficient real estate and resource management. The Agency has conveyed an average annual 70,755 acres in the last 12 years and has acquired an average of 124,470 acres over the same period through

the Land Exchange Program. These land transactions resulted in a fractional increase in total NFS lands over the last decade.

Inventoried roadless areas generally have fewer roads, improvements, and development and therefore, real property issues are not usually a major consideration. However, issues do arise around access to non-Federal inholdings that are in inventoried roadless areas. Less than 1% of inventoried roadless areas are estimated to be blocks of non-Federal land.

Alternative 1 – No Action and Alternatives 2 through 4

All alternatives would have only minor effects on NFS boundary management and land adjustments. In some isolated instances, recognized roadless characteristics of inholdings in inventoried roadless areas may enhance mutual interest in land adjustments to consolidate NFS lands as part of the overall management of roadless areas. However, in other isolated instances, maintaining roadless characteristics surrounding inholdings may be a desirable feature, which reduces the likelihood that landowners would be interested in land adjustments. Regardless, none of the alternatives will directly change the ownership status of non-Federal lands. For lands acquired through exchange, Forest Service regulation states that those lands within areas having an administrative designation set through the land management planning process, shall automatically become part of the area within which they are located, and shall be managed in accordance with the laws, regulations, and land management plans applicable to the area (36 CFR 254.3(f)). For lands acquired through purchase or other means, Forest Service policy provides similar direction.

Access to Non-Federal Ownership within the National Forest System

Affected Environment

Non-Federal ownership of lands or interests in lands may include rights granted pursuant to a reserved or outstanding right or as provided in statute or treaty[17]. These rights include, but are not limited to, rights of access provided in the Alaska National Interest Lands Conservation Act (ANILCA) (Public Law 96-487) and recognized highway rights-of-way granted over NFS lands under Revised Statute 2477(R.S. 2477) (Public Law 94-579). The most common type of access pursued in conjunction with these two prominent statutes is roaded access.

ANILCA (Public Law 96-487) ensures access to non-Federal land in-holdings. The authorized officer shall authorize such access deemed adequate to secure the landowner the reasonable use and enjoyment of their land (36 CFR 251, Subpart D). Landowner access need not be the most direct, economical, or convenient route for the landowner. Adequate access may not be road access in all cases. Alternative routes and modes of

[17]Rights of access provided in ANILCA and highway rights-of-ways granted under R.S. 2477 are two examples of these types of rights. Rights provided under the 1872 Mining Act (17 Stat. 91) are discussed in the Mineral and Geology section of the FEIS.

access may be considered. If a landowner has an adequate alternative route or mode of access, including access across other land ownerships, the Forest Service is not obligated to authorize roaded access. Reasonable access is currently determined on a case-by-case basis. The Forest Service recognizes valid ANILCA (Public Law 96-487) access as a statutory right.

R.S. 2477 (Public Law 94-579) provides a means by which rights-of-way were granted for public highways constructed across public domain lands in the late 1800s to early 1900s. A R.S. 2477 (Public Law 94-579) highway must have been constructed across public domain lands before the date of the national forest reservation. R.S. 2477 (Public Law 94-579) did not require the issuance of any formal authorization to exercise and perfect rights-of-way. The Federal Lands Policy Management Act repealed R.S. 2477 (Public Law 94-579) in 1976. However, rights-of-way that predate the establishment of the national forest are still in effect, unless they have been subsequently relinquished. The Forest Service recognizes valid R.S. 2477 (Public Law 94-579) rights-of-way as outstanding rights.

Alternative 1 – No Action and Alternatives 2 through 4

Requests for access to non-Federal ownership of lands or interests in lands pursuant to a reserved or outstanding right, or as provided by statute or treaty, including valid ANILCA (Public Law 96-487) or R.S. 2477 (Public Law 94-579) assertions, would continue to be recognized on a case-by-case basis. Under Alternative 1, an estimated 50 projects involving an estimated 130 miles of road would be undertaken to provide access for reserved or outstanding rights, or as provided by statute or treaty. It is assumed that the level of road construction and reconstruction in the future would remain at levels comparable to what is being projected for the next 5 years.

Although, Alternatives 2 through 4 include prohibitions on road construction and reconstruction, all action alternatives provide an exception for roads needed pursuant to reserved or outstanding rights or as provided for by statute or treaty. Under all action alternatives, the Forest Service would continue to recognize and honor requests for access to non-Federal ownership of lands or interests in lands, pursuant to a reserved or outstanding right, or as provided for by statute or treaty, including valid ANILCA (Public Law 96-487) and R.S. 2477 (Public Law 94-579) assertions. All alternatives provide access for reserved and outstanding rights, or as provided for by statute or treaty.

Non-recreation Special Uses

Affected Environment

Commercial and non-commercial interests, not associated with a right granted pursuant to a reserved or outstanding right, or as provided by statute or treaty, often use and occupy NFS lands for a variety of purposes. The Agency administers more than 46,000 non-recreation authorizations to use and occupy NFS lands (USDA Forest Service 2000b). More than 80 different types of non-recreation special uses are authorized most often by issuing special use authorizations. The more common of these non-recreation special uses include communication sites, utility corridors (oil/gas pipelines, fiber optic, telephone

lines, and power lines), linear irrigation facilities (pipelines, ditches, canals), and public and private roads.

These more common types of non-recreation uses generally, but not always, rely on road access to accommodate construction, operation, and maintenance. As such, the majority of existing and proposed uses are either located or proposed to be located where roads currently exist. However, a small percentage of these types of uses can exist without road access and do occur within inventoried roadless and unroaded areas.

Alternative 1 – No Action

Authorized use and occupancy of NFS lands including roads associated with these uses would be continued (as provided within the authorization) in all inventoried roadless areas throughout the term of existing authorization. Upon expiration, re-authorization and proposals for new roads or uses would be evaluated and authorized in compliance with existing rules, regulations, and agency policies.

Alternatives 2 through 4

No action alternative would suspend or modify any existing permit, contract, or other legal instrument authorizing the occupancy and use of NFS lands. Existing roads included as a part of an authorized use and occupancy of NFS lands would be continued as provided in the authorization in all inventoried roadless areas through the term of existing authorization.

The alternatives would not affect the re-authorization of an existing use or occupancy unless such re-authorization involved road construction or reconstruction, however road maintenance is not precluded under these alternatives. Upon expiration, re-authorization would be evaluated and authorized in compliance with existing rules, regulations and Agency policies. Effects related to the management of existing roads, including classified, unclassified and temporary roads that may be associated with a non-recreation special use is discussed in the Access and National Forest Roads sections in this chapter.

Under all action alternatives, potential effects on non-recreation special uses in inventoried roadless areas would be limited. Non-recreation special uses may be authorized in inventoried roadless areas if the use could be accommodated without road access. Under these alternatives, all or part of the more common types of uses could occur without road construction, but most likely, at a higher cost than if road construction was allowed to occur. In some circumstances, the cost to construct, operate, and maintain a facility without a road would make the use and occupancy economically or technically infeasible.

Special use authorization data is very limited regarding road construction beyond the next 5 years, but it is estimated that within the next 5 years, fewer than 20 non-recreation special use projects, with an estimated 35 miles of associated road construction or reconstruction may be affected by Alternatives 2 through 4. These estimated 35 miles are

distributed throughout the nation, and as such, there is not a good means of differentiating the impacts specific to each region or national forest.

Designation of major utility corridors is generally incorporated into land management plans. A review of the Western Regional Corridor Study (Clayton and others 1992) conducted in 1993, is as a valuable resource by the Forest Service and BLM for making reasonably foreseeable estimates of utility corridor needs. Because of this study, many of the existing and proposed utility corridors are identified throughout the Western United States. The study indicates that only a couple of proposed corridors in the Western States may be affected by the prohibitions in Alternatives 2 through 4. However, at this time, it is unknown if these proposals would be precluded from consideration for authorization in an inventoried roadless area under these alternatives, since all or part of the corridor, if proposed, could still be considered depending on the design, location, and implementation of the project.

Current uses and occupancies authorized in inventoried roadless areas would not be affected by any of the action alternatives. Since fewer than 20 proposed uses over the next 5 years, most involving small development and uses, would be affected by the action alternatives, it is reasonable to conclude that the effects on businesses, individuals, or communities would be minimal.

Effects of Social and Economic Mitigation on Non-recreation Special Uses

A potential mitigation is identified in Chapter 2 for Federally assisted State highways. The Federal Highway Administration and State Department of Transportation work cooperatively in planning for new State and interstate highways. Regulations and a Memorandum of Understanding (Title 23 Section 317, and CFR 23, 712.03, August 28, 1998) between the Forest Service and FHWA describe the process used for land transfers between the Forest Service and States in support of approved highway projects.

Numerous State and interstate highways run adjacent to inventoried roadless areas. One project currently proposed, but not yet approved, would cross through an inventoried roadless area on the Chugatch National Forest. If mitigation was adopted, existing State highways included, as a part of an authorized use and occupancy of NFS lands, would be allowed in inventoried roadless if authorized by the Secretary of Agriculture. All alternatives would have minimal effects on federally assisted State highway planning over time. Such mitigation would pose no known conflict with other special use authorizations that might be reasonably foreseeable nor would this mitigation affect other aspects of real estate management.

Other Indirect and Cumulative Effects on Non-recreation Special Uses

Boundary Management and Landownership Adjustments – Alternatives 2 through 4 would have minimal effects on boundary management and land adjustments over time. In some isolated instances, recognizing roadless characteristics may actually enhance

interest in land adjustments, while in other isolated instances roadless characteristics may deter interest in land adjustments.

Access to Non-Federal Ownership within the National Forest System – Alternatives 2 through 4 would have minimal effect on access to non-Federal ownership within NFS lands over time. The Forest Service would continue to recognize and honor requests for access to non-Federal ownership or lands or interests in lands pursuant to a reserved or outstanding right, or as provided by statute or treaty, including ANILCA (Public Law 96-487) and R.S. 2477 (Public Law 94-579) assertions.

Nonrecreation Special Uses – As discussed, the majority of these types of uses are located where roads already exist because they are generally dependent on road access for construction, operation, and maintenance. Therefore, the current and expected future demand to locate these types of uses in inventoried roadless areas is minimal. The effect of the action alternatives is further minimized by the fact that all or part of many types of the more common non-recreation special uses could be constructed, operated, and maintained without road access but likely at a higher cost. Non-recreation special uses may be authorized in inventoried roadless areas when the use and occupancy is consistent with the management objectives of an area's roadless values.

With all action alternatives, approximately 50% of all NFS lands would be available for road based non-recreation special uses. Since so few non-recreation special use proposals would be affected, NFS land outside the inventoried roadless areas, should be adequate to accommodate the majority of non-recreation uses that may be displaced as a result of the action alternatives.

Demand for special uses authorizations in roadless areas that would involve road construction and reconstruction may increase in the future as the population grows and use of national forests increase. However, it is uncertain what future levels of demand will be, and if these demands can be met by lands outside inventoried roadless areas. It is not anticipated that these increased demands will be substantially different from the types of uses currently being requested. Therefore, the economic, social, and biological impacts are not believed to be significant given the limited number and small scope of these requests.

Minerals and Geology

On NFS lands, minerals are classified according to the law under which they are managed. Minerals are classified as locatable, leasable, and salable (most common). This distinction is important because each classification is subject to different requirements for exploration and development, and in some cases, the Forest Service cannot prohibit exploration and development. Other related topics discussed in this section are abandoned and inactive mines and geological and paleontological resources.

Locatable Minerals

Affected Environment

Most valuable mineral deposits on lands open to mineral entry are considered locatable unless otherwise determined to be leasable or salable. Locatable minerals include commodities such as gold, silver, copper, lead, zinc, barite, gypsum, and certain varieties of limestone, which are subject to appropriation under the General Mining Law of 1872 (17 Stat. 91, as amended). This law provides United States citizens with the right to prospect, explore, and develop these minerals on public domain lands, applies to NFS lands by virtue of the Organic Administration Act (16 U.S.C. §§ 482), and provides for reasonable access to conduct these activities. Depending on the stage of exploration or development, reasonable access can range from unimproved temporary roads for prospecting or drilling to more permanent improved roads for full mine development and ore transportation.

Valuable deposits of locatable mineral resources do occur in inventoried roadless areas, principally west of the 100th meridian (Figure 1-1). Therefore, over the long term, it is reasonable to assume that future exploration, mining, and mineral processing activities will continue to occur in inventoried roadless areas where valuable deposits exist.

Exploration and development of locatable mineral resources are non-discretionary activities. This means that the Forest Service cannot prohibit reasonably necessary activities associated with the exploration, prospecting, or development of valuable mineral deposits. However, the Forest Service has authority to regulate locatable mineral operations to prevent or minimize damage to NFS surface resources.

Currently, there is a trend of decreasing exploration and development of domestic locatable mineral resources. This may be a function of fluctuating commodity prices, higher environmental and permitting costs associated with resource development in the United States, declining accessibility to mineral resources, and apparent lack of public support for mineral resource development on Federal lands.

Alternative 1 – No Action

All proposals for locatable mineral exploration or development would be subject to the planning and design requirements governing locatable minerals in 36 CFR 228, Subpart A. If proposed activities cause significant disturbance to NFS surface resources, a plan of operation would be required of the mining operator, and an analysis of environmental effects would be conducted under NEPA. This plan of operation would be binding on the operator. An estimated 61 miles of road construction or reconstruction for locatable minerals would occur in inventoried roadless areas under this alternative during the next 5 years. This same rate of mineral exploration and development was assumed for future decades since we have little information that would lead to higher or lower expectations of development.

Alternatives 2 through 4

Road construction and reconstruction for locatable mineral exploration and development would be considered a right of access as provided by the General Mining Law. Therefore, locatable mineral exploration and development would be excepted from the prohibition on road construction or reconstruction, and it would not be affected under these alternatives. Under these alternatives, the effects on locatable mineral exploration and development are the same as those under Alternative 1.

Several public comments indicated that some people thought the proposed Roadless Rule included mineral withdrawal. Mineral withdrawal would involve further public notice and analysis that is more specific. Mineral withdrawal is not proposed in any of the alternatives

Leasable Minerals

Affected Environment

Leasable minerals are those that can be explored for and developed under one of the several mineral-leasing acts. They include energy mineral resources such as oil, gas, oil shale, coal, gilsonite, and geothermal. They also include non-energy minerals, such as phosphate, and minerals important for their sodium, potassium, or sulfur content. Moreover, for lands acquired or administered under the Weeks Act (Public Law 61-435) (mostly in the Eastern United States) and the Bankhead-Jones Act (Public Law 75-210), they include deposits of otherwise locatable minerals like gold, copper, lead, barite, and gypsum.

Exploration and development of leasable mineral resources are discretionary activities. This means that leasing may or may not be allowed by the Bureau of Land Management, the agency that has the authority to dispose of leasable mineral resources on NFS lands. Most leasable mineral resources, however, may only be leased subject to Forest Service concurrence. Exceptions are gilsonite, sodium, potassium, sulfur, and phosphate, which may be leased without Forest Service concurrence. The holder of a lease or permit has a contractual agreement with the government that allows reasonable access for exploration and development of the leased commodity.

After a lease is issued, it can be modified and adjusted for economic or technical reasons. Often, during mine development small areas of mineral will be identified that are not included in the original lease. To promote recovery or prevent environmental damage, these small areas may be added to the existing leases. As an example, it may be more environmentally sound to locate ancillary facilities, such as topsoil and overburden stockpiles, in areas outside the boundaries of the issued lease. This would require a modification of the lease and possibly expanding the lease boundary.

Environmental impact statements are generally prepared before the issuance of mineral leases in inventoried roadless areas. The effects of any future lease exploration or development are also addressed in subsequent environmental analysis, which may be

another site-specific environmental impact statement. Presently, coal, oil and gas, and phosphate mineral exploration and development would be most affected by the action alternatives.

Oil and Gas - Area-wide environmental impact statements are generally prepared before accepting lease nominations for oil and gas. Leases are generally issued for 10 years. The effects of oil and gas exploration and development activities on the surface resources of NFS lands are controlled by the Forest Service and require surface use plans of operations, monitoring of surface disturbing activities, and enforcement of surface-use requirements and reclamation standards.

With the exception of the Los Padres National Forest in California, discussed below, inventoried roadless areas, with oil and gas potential, are located in the Rocky Mountain Area (Gautier and others 1998). Table 3-50 shows, by Forest Service region, the number of acres of inventoried roadless areas with the potential to produce oil and gas in the Rocky Mountain Area; however, the location and extent of the possible reserves are unknown. A recent natural gas study indicates that as much as 137 trillion cubic feet of gas may be contained within Federal lands in the Rocky Mountain Area, but the study did not determine what proportion of this estimate may be found on NFS lands (National Petroleum Council 1999).

Since the RARE II environmental impact statement, the USGS completed a petroleum resource estimate for the entire United States. Because inventoried roadless areas are not delineated subsets of the geologic areas, the amount of petroleum resource contained within inventoried roadless areas cannot be extrapolated from the analysis (Gautier and others 1998).

Table 3-50. Potential oil and gas resource acreage in inventoried roadless areas by Forest Service regions in the Rocky Mountain area.

Region	Inventoried roadless area acres of oil and gas potential (thousands)
Region 1	2,029
Region 2	2,484
Region 3	83
Region 4	3,045

(Roadless Database 2000)

Because of the downturn in the domestic oil and gas industry, the amount of NFS lands under oil and gas lease dropped from about 35 million acres in the mid-1980s to about 5 million acres today. However, United States consumption of natural gas has increased 14% between 1992 and 1998 and is projected to increase an additional 32% by 2010 (National Petroleum Council 1999). This increased consumption and recent technological advances have caused a significant increase of interest in development of coal-bed methane. Current interest is focused on the Powder River Basin of Wyoming and Montana. Other areas, including the Dakota Prairie Grasslands, may have coal-bed methane resources. Their acreages are included in Table 3-50.

Oil and gas lease sales are scheduled on a regular basis for lands where there is interest in leasing and where environmental analyses have been completed. Since 1992, more than 30 environmental impact statements have been completed for NFS lands where there is current industry interest. Remaining to be completed are the Los Padres National Forest, parts of the Custer National Forest, and several areas on the Bridger-Teton National Forest. The Records of Decision for the 30 environmental impact statements did concur with some leasing in inventoried roadless areas. For example, the Grand Mesa, Uncompahgre, and Gunnison National Forest issued a Record of Decision that concurred to lease approximately 171,500 acres of inventoried roadless areas under standard lease terms (USDA Forest Service 1993). Field information gathered during the analysis for the Interim Roads Policy indicated that 334,000 acres in inventoried roadless areas were scheduled for lease auction on the Beaverhead-Deerlodge, Custer, San Juan-Rio Grande, White River, Bridger-Teton, Manti-La-Sal, and Monongahela National Forests (USDA Forest Service 1999r).

In August 2000, the Targhee National Forest released its decision for oil and gas leasing on the forest. Some large blocks of land with a high-development potential are located in inventoried roadless areas and were made available for leasing with a no-surface occupancy stipulation (Robison 2000a).

The Los Padres National Forest will soon release a draft environmental impact statement for oil and gas leasing on the forest. Its Reasonable Foreseeable Development scenario identified five areas on the forest as having high potential for oil and gas development. These areas comprise 222,000 acres (12.5% of the forest), some of which are in Wilderness or otherwise withdrawn from mineral leasing. A total of 21.4 million barrels of oil are estimated to exist in these high- potential areas and, consequently, they are the most likely to have industry interest for leasing. The Cuyama High-Potential Area is the largest-high potential area. This area is comprised of about 85,000 acres, and it estimated to contain 18 million barrels (84% of the total estimated reserves in high-potential areas). Nearly all of the Cuyama High-Potential Area is in inventoried roadless areas (Riddle 2000).

Coal – Federally owned coal plays a major role in the energy supply of the United States. Large reserves of low-sulfur coal are located in Wyoming, Utah, Montana, Colorado, and New Mexico, where the Federal government owns the rights to the majority of coal reserves (USDI Geological Survey 1998). USGS estimates that approximately 60% of the area underlain by coal-bearing rocks in the contiguous United States is under Federal surface. Approximately 30 billion tons of minable coal is located on NFS lands (USDI Geological Survey 1995). Coal produced from Federal leases has tripled from about 12% of the total United States production in 1976 to almost 34% in 1995. This increase is because of the demand for low-sulfur coal for use in power plants, and the existence of large reserves of low-sulfur coal in the Western Interior United States where the Federal government owns the rights to most of the coal reserves (USDI Geological Survey 1997a). Currently, 57.3% of United States electric power is generated from coal (National Mining Association 1999). Domestic demand and consumption of coal will continue to increase. Because of its low-sulfur and high air quality-compliance status,

Western Interior United States coal will be increasingly relied upon to meet future demand.

There are approximately 2,539,000 acres of coal-bearing rocks (geologic formations of known coal-bearing potential) within inventoried roadless areas (Roadless Database 2000). Of this, it is important to note that approximately 308,000 acres (12%) are in Region 1, approximately 886,000 acres (35%) are in Region 2, and approximately 1,171,000 acres (46%) are in Region 4. Together, these three regions contain approximately 93% of the total acres of coal-bearing rocks in inventoried roadless areas. Each of the remaining regions contain one-sixth or less of the 308,000 acres of coal-bearing rocks in inventoried roadless areas in Region 1. There are no known significant occurrences of coal within the national forests of Alaska (Region 10) (USDI Geological Survey 1995).

Table 3-51 shows acres not currently leased in inventoried roadless areas containing known coal reserves or resources near or adjacent to active mines. Some of these reserves or resources would likely be developed within the next 5 years if offered for lease. Other inventoried roadless areas contain coal resources; however, they are not listed because the extent of the resource is unknown and there is no demonstrated industry interest in these areas (or in some cases, their development is precluded by the Surface Mining Control and Reclamation Act of 1977 [Public Law 95-87, as amended]).

Table 3-51. Known coal resources or reserves in inventoried roadless areas by forest.

National forest	Mining method	Inventoried roadless area acres not leased	Estimated resources/recoverable reserves (million tons)
Grand Mesa, Uncompahgre, and Gunnison	Underground	47,400	237 - 1,300
Manti La-Sal	Underground	13,800	71

(USDA Forest Service 1999r)

The coal mining from the national forest inventoried roadless areas is not extensive, but there are two national forests with active coal mining. In March 2000, the Grand Mesa, Uncompahgre, and Gunnison National Forest consented to lease approximately 500 acres in an inventoried roadless area for development of coal resources by underground methods (USDA Forest Service 2000f). In addition, the forest received an application for coal lease modification encompassing approximately 300 acres in inventoried roadless areas, also to be mined using underground methods. Access for this new mining would be from existing underground mines, not from surface roads on NFS lands (Mattson 2000). On the Manti-La Sal National Forest, three potential coal tracts remain on the Wasatch Plateau that total 36,200 acres and contain recoverable reserves of 185 million tons of high-BTU bituminous coal; however, none of these tracts have been leased. Approximately 40% of these reserves are in inventoried roadless areas (Table 3-51). One tract would require full development of an underground mine (e.g., transportation and portal facilities) in an inventoried roadless area; surface development of another could be

done outside any inventoried roadless area. The third tract could be developed from an adjacent underground mine. However, development of the three tracts would depend on the ability to conduct both pre-lease exploration drilling and post-lease development drilling. Included in the above figures are approximately 22 million tons of recoverable coal reserves in inventoried roadless areas that were transferred to the State of Utah School and Institutional Trust Lands Administration under the Utah Schools and Lands Exchange Act of 1998 (Public Law 105-335) (Reed 2000). These reserves would be considered outstanding rights. Additional discussion of the coal situation on the Manti-La Sal and Grand Mesa, Uncompahgre, and Gunnison National Forests is included in the Energy and Non-energy Minerals section.

Phosphate – Table 3-52 shows known phosphate resources on the Caribou-Targhee National Forest in inventoried roadless areas adjacent to active mines. Some of these resources would likely be developed within the next 5 years, if offered for lease. There are other inventoried roadless areas containing phosphate resources; however, they are not listed because the extent of the resources is unknown and there is no demonstrated industry interest in those areas.

Table 3-52. Known phosphate resources in inventoried roadless areas by forest.

National Forest	Mining method	Inventoried roadless areas acres not leased	Estimated resource (million tons)
Caribou	Surface	7,939	873.3

(USDA Forest Service 2000g)

Currently, the Caribou-Targhee National Forest has 46 phosphate leases affecting 23,843 acres of NFS lands. Of these, approximately 6,282 acres are in inventoried roadless areas. In addition, 7,939 acres of inventoried roadless areas have been identified as Known Phosphate Lease Areas, a U.S. Geological Survey designation to identify lands known to contain phosphate deposits and, thus, subject to competitive leasing. More than 1,000 acres in inventoried roadless areas are included in pending lease modifications (to be mined by surface methods), exploration licenses, and prospecting permits that could result in additional lease acreage (Robison 2000b).

Alternative 1 – No Action

Under this alternative, management of leasable mineral resources in inventoried roadless areas would not change from the way they are currently managed. Environmental impact statements are expected to be prepared for leasing decisions in these areas. Areas with management prescriptions that prohibit construction or reconstruction of roads either may not be leased or may be leased with a no-surface occupancy stipulation. Areas with management prescriptions that allow road construction or reconstruction may be leased subject to standard lease terms, and any other supplemental stipulations deemed appropriate and necessary by the Forest Service.

Overall, an estimated 103 miles of road construction or reconstruction in inventoried roadless areas over the next 5 years would occur for exploration or development within

existing leases. An additional 59 miles of road construction or reconstruction would occur outside of existing leases in inventoried roadless areas over the next 5 years.

Alternatives 2 through 4

The prohibition alternatives would not directly prohibit mineral leasing in inventoried roadless areas, Instead, they would prohibit construction or reconstruction of roads associated with future leasing. Proposals for exploration or development of leasable minerals using existing roads or not requiring use of roads may be allowed in inventoried roadless areas. Construction or reconstruction of roads that are reasonable and necessary for development of existing energy or mineral leases, for access to existing energy or mineral leases, and for access to associated product conveyance lines would be allowed as necessary to fulfill the terms of the lease. When existing leases expire, any renewals would have to be considered in light of the prohibition directed by these alternatives. In addition, this would apply to any modifications of existing leases. Prohibition of road construction or reconstruction in inventoried roadless areas may influence reanalysis of lands available for lease when land management plans are revised or amended.

The prohibition on road construction or reconstruction would restrict or preclude the opportunity for exploration or development of presently undiscovered leasable mineral resources in inventoried roadless areas.

Oil and Gas – Alternatives 2 through 4 could affect exploration and possible development of five high-potential oil and gas areas on the Los Padres National Forest. The prohibitions could preclude possible future development of up to an estimated 21.4 million barrels of oil on this forest. In the Rocky Mountain Area, up to an estimated 7,641,000 acres of inventoried roadless areas with varying levels of potential to contain oil and gas would be affected by Alternatives 2 through 4. Consequently, any exploration for or development of these resources would likely be restricted and possibly precluded in some areas. The Grand Mesa, Uncompahgre, and Gunnison National Forest would be required to review, for conformance to the prohibition alternatives, its 1993 decision to allow leasing of oil and gas on approximately 171,500 acres of inventoried roadless areas. Plans to auction for lease 334,000 acres in inventoried roadless areas on the Beaverhead-Deerlodge, Custer, San Juan-Rio Grande, White River, Bridger-Teton, Manti-La Sal, and Monongahela National Forests would require review for conformance with the prohibition alternatives. The outcome of these reviews would likely include a recommendation of no-surface occupancy stipulations in inventoried roadless areas without present access, yet still feasible to develop, and no Forest Service consent to lease in areas without present access and not feasible to develop without road construction or reconstruction.

In cases where oil or natural gas resources in inventoried roadless areas cannot be developed because of the prohibition alternatives and are likely to be drained by wells on adjacent non-Federal lands, the recourse is to lease them with no-surface occupancy stipulations and recover them by off-site directional drilling methods. When this is not technically and economically feasible and minimum drill-spacing requirements are being

observed in resource recovery, the Federal government cannot recover the value of the resources being drained.

Coal – Throughout the National Forest System, Alternatives 2 through 4 would affect up to an estimated 2,539,000 acres of inventoried roadless areas with various levels of potential to contain coal resources. Consequently, exploration for or possible development of this resource would likely be restricted to some degree and possibly precluded in some areas. The Grand Mesa, Uncompahgre, and Gunnison National Forest's recent consent to lease 500 acres for underground coal development in inventoried roadless areas was conditioned on the outcome of the proposed Roadless Rule. If road construction or reconstruction are necessary for coal mining (e.g., construction of required ventilation shafts), development would likely be restricted or possibly precluded. This is also the case concerning a proposed 300-acre coal-lease modification on this forest. Recovery of coal reserves within the three tracts identified on the Manti-La Sal National Forest would be affected under Alternatives 2 through 4. On one tract, the prohibition alternatives could preclude construction of the portal and transportation facilities; thus, they could preclude development of 135 million tons of recoverable coal reserves within the entire tract. However, these facilities would be necessary for the State of Utah School and Institutional Trust Land Administration to develop its 22 million tons of recoverable coal reserves within the tract, and thus, as an outstanding right, they would be excepted from the prohibition alternatives. On all three tracts, the prohibition alternatives could affect pre-lease exploration drilling, post-lease development drilling, and construction of ventilation shafts; thus, increasing costs and likely lowering the bonus bids for the three parcels if they are leased.

Phosphate – On the Caribou-Targhee National Forest, there are 7,939 acres that are not leased that are designated as Known Phosphate Lease Areas in inventoried roadless areas that would probably be affected by Alternatives 2 through 4 (Table 3-52). Because development of new phosphate surface mines or expansion of existing phosphate surface mines would require road construction or reconstruction in inventoried roadless areas, leasing would probably be denied, thus precluding development of an estimated 873.3 million tons of phosphate resource (see Energy and Non-energy Minerals section).

Some areas will not be affected by the prohibitions. These include forests and grasslands within the Powder River Basin area of coal-bed methane potential area and any reasonably foreseeable future leases areas for lead mining on the Mark Twain National Forest because there are no inventoried roadless areas in those existing or potential lease areas.

Salable Minerals

Affected Environment

Salable minerals are common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. Generally, they are widespread and of low value; they are primarily used for construction or landscaping materials. Their value is dependent upon market factors, quality of the material, and availability of transportation.

The Forest Service is the principal user of material from borrow pits on NFS lands. The Agency develops borrow pits to obtain surfacing material for construction and maintenance of forest roads. Other Federal agencies, State and local governments, and non-profit organizations may obtain free use permits for these materials for public projects. The public may purchase these materials from the Forest Service. Disposal of these resources is at the sole discretion of the Forest Service.

Alternative 1 – No Action

The Forest Service would have no need to develop future sites in inventoried roadless areas except as incidental to new road construction or reconstruction. This alternative would not depend on nor require the Forest Service to use salable minerals from inventoried roadless areas. There would not likely be an interest in development of material sites in inventoried roadless areas by others because inventoried roadless areas are generally remote and thus, would not be cost-effective to develop. Generally, other sources of similar material are available outside inventoried roadless areas.

Alternatives 2 through 4

For the same reasons discussed under the No Action Alternative, there would not likely be an interest in development of material sites in inventoried roadless areas by others. The effects under Alternatives 2 through 4 are the same as those under Alternative 1; consequently, there are no anticipated effects to salable minerals because of the prohibition alternatives.

Abandoned and Inactive Mines

Affected Environment

Abandoned mines, oil and gas wells, quarries, and other mineral sites may pose human health or environmental or safety risks that require some type of reclamation or mitigation. According to the USDA Office of the Inspector General (Office of Inspector General 1996), there are an estimated 38,500 abandoned and inactive hard rock mines located on or affecting NFS lands. An estimated 2,000 of these sites are releasing, or have the potential to release, a hazardous substance that would require some type of response action under CERCLA (USDA Office of Inspector General 1996). This act addresses emergency response, site remediation, and spill prevention. The Forest Service has authority for CERCLA enforcement on NFS lands under Executive Order 12580, Section 2(j).

Another 4,000 sites are estimated to require some type of reclamation to resolve violations of the Clean Water Act (USDA Office of Inspector General 1996). Inventoried roadless areas may contain sites that require some type of reclamation.

Alternative 1 – No Action

Management of abandoned and inactive mines would not change from what is described above under the affected environment. Various national forests have identified 42 abandoned mine-land projects in inventoried roadless areas that would require approximately 21 miles of road construction or reconstruction to meet reclamation objectives.

Alternatives 2 through 4

An exception under these alternatives provides for road construction or reconstruction needed to conduct a response action under CERCLA or to conduct a natural resource restoration action under CERCLA, Oil and Hazardous Substance Liability, Section 311 of the Clean Water Act, or under the Oil Pollution Act.

These alternatives would not change the Agency's response to CERCLA violations at abandoned mines, oil and gas wells, quarries, and other mineral sites. Construction or reconstruction of any necessary temporary roads for this activity would be excepted from the prohibition alternatives.

Geological and Paleontological Resources

Affected Environment

Paleontological resources are recognized as important for their scientific and natural resource values and for the active protection required in their management. Identification of fossil resource probability in an area and the appropriate management prescriptions is accomplished in the land management planning process. The Forest Service only recently began to inventory paleontological resources on NFS lands for purposes of land management planning (Kuizon 2000).

Karst and cave resources can be expected to occur on NFS lands underlain by limestone or marble or areas having exposed basaltic flows. Some of the values associated with karst and cave resources are their ability to store and transmit groundwater, their importance as subterranean wildlife habitats, their importance as cultural resource or paleontological sites, and their ability to provide interpretive sites or recreational opportunities for spelunkers or cavers. They can also present hazards, such as sinkholes, to resource use and development.

Road construction or reconstruction activities and other developments are sources of sediment, debris, and other pollutants that, when entering karst or cave systems, can damage them and their associated resources.

Alternative 1 – No Action

Management of geological and paleontological resources would not change from what is described above under the affected environment. Access would depend on whether land

management prescriptions prohibit road construction or reconstruction. Access may be affected in those areas with management prescriptions that currently do not allow road construction or reconstruction.

Alternatives 2 through 4

Roads provide access to paleontological sites for purposes of research, restoration, teaching, and interpretation. By making these sites accessible, it is possible to raise public awareness and help protect resource values. Alternatively, by making sites accessible to the public, roads can provide increased opportunities for vandalism or unauthorized removal of paleontological resources, especially now when some specimens are commanding record high prices by collectors (Flynn 2000). The discovery of significant vertebrate fossil sites and collecting sites for rocks, minerals, and invertebrate and plant fossils usually occurs in areas having roaded access. Although other forms of access may be used (e.g., off-road vehicles, helicopters, etc), Alternatives 2 through 4 could reduce the possibility for discovery of new sites and subsequent efforts to locate, interpret, remove, and preserve vertebrate fossils from erosion or corrosion by natural elements. Alternatively, prohibiting road access to undiscovered vertebrate fossil sites could lessen the possibility of vandalism or unauthorized removal of fossils. Overall, these alternatives are not likely to adversely, or favorably, affect paleontological resources and activities associated with management of these resources.

Alternatives 2 through 4 could reduce potential damage to karst and cave systems in roadless areas from sedimentation, debris, and other pollutants associated with roads, as well as vandalism or unauthorized removal of speleothems or other valuable cave features. Consequently, the functions of karst systems and the protection of cave resources would be maintained.

Effects of Social and Economic Mitigation Measures on Minerals and Geology

The social and economic mitigation measures would permit road construction or reconstruction associated with future leasable mineral exploration and development activities in inventoried roadless areas; the effects of the action alternatives on leasable minerals described above would not apply. Any mineral lease decision would be made on a case-by-case basis after completion of environmental analysis. Construction or reconstruction of roads, where no other feasible alternatives exists, would be allowed as necessary to fulfill the conditions of the lease. The effects of this mitigation on mineral development are discussed in the section on Energy and Non-energy Minerals. Additional discussion of these effects is in the National Forest System Roads section in this chapter.

Other Indirect and Cumulative Effects on Minerals and Geology

Under Alternatives 2 through 4, leasable and salable mineral exploration and development opportunities in inventoried roadless areas would be limited, and their costs would increase. This could contribute to a greater reliance on some mineral resources

from abroad where foreign political and economic influences would factor into their price and availability. A reduction in the potential for leasable and salable mineral development may reduce revenues to Federal, State, and local governments (see Energy and Non-energy Minerals section).

Social and Economic Factors

NFS lands are used, enjoyed, and valued by people everywhere, including those who live in nearby communities, those who visit them from cities, States, and countries farther away, and those who never visit, but benefit from the ecosystem services and passive use values they provide. Because of this, policy decisions that influence the management of NFS lands have the potential to affect almost anyone.

Some people, however, are more directly affected than others because of the interest that they have in forest management. Those who have the strongest interests in NFS lands, and those whose livelihood or recreational pursuits are most closely tied to the national forests, are most directly affected by Forest Service policy. It is these forest stakeholders who are the focus of the socioeconomic effects analysis.

This analysis centers on eight broad categories of forest stakeholder interest: 1) non-commodity values, 2) recreation, 3) hunting and fishing, 4) livestock grazing, 5) non-timber forest products, 6) timber harvest, 7) energy and non-energy minerals, and 8) road construction. Forest-dependent communities and local involvement are also addressed because they were identified as key issues during the scoping and public comment periods. American Indian and Alaska Native issues, civil rights and environmental justice concerns, and the effects of the alternatives on them are also discussed. In addition, Agency costs associated with the proposed rule are analyzed. Additional detail is provided in the Socioeconomic Specialist Report (Langner and Charnley 2000). The section concludes with a discussion of cumulative social and economic effects.

An extensive Civil Rights Impact Assessment and analysis of Environmental Justice issues was prepared in conjunction with this rulemaking to provide a better understanding of how populations protected by civil rights and environmental justice legislation and policies might be affected by the proposed rule, as required by the U.S. Department of Agriculture. This document is available upon request.[18]

Three measures are assessed in the socioeconomic effects analysis. These are: 1) the ability of people to continue to engage in their preferred uses of NFS lands, and the quality of their experience; 2) economic impact on individuals, communities, and revenues to State and local governments; and 3) peoples' abilities to maintain their social and cultural integrity and forest-related values.

The socioeconomic effects analysis does not detail the ecological impacts of the human activities and interests discussed here on inventoried roadless areas. During the public comment period on the DEIS, many people commented that specific human activities

[18]To request this document, refer to the contact information at the front of this FEIS.

should be prohibited in roadless areas due to their ecological impacts. After careful review of public responses to the Notice of Intent, the Forest Service determined it would consider prohibiting only those activities that are likely to significantly alter and fragment landscapes at the national scale. Therefore, the Agency decided to analyze alternatives that would limit road construction, reconstruction, and timber harvest only**.** These activities are most likely to result in immediate, irretrievable, and long-term loss of roadless characteristics. The reason for the focus on roads and timber harvest is described in the Purpose and Need section of Chapter 1. The ecological impacts of some human activities are discussed in the Ecological Factors section of this chapter.

Several assumptions underlie this analysis:

- Any individual may hold one or more of the interests in NFS lands described in this section. Consequently, the impacts of the alternatives on specific individuals may be a cumulative one, and mixed, depending on how many of these interests he or she holds. For purposes of this analysis, it is only possible to outline the effects of the different alternatives on each individual interest category.
- Maintenance of social and cultural integrity among forest stakeholders depends in part on peoples' abilities to maintain their current and historic uses of NFS lands.
- The ability of forest stakeholders to continue to engage in their current uses of NFS lands, and to maintain the quality of their experience, is tied to the ecological health of the natural resources found there.
- Management actions that are inconsistent with peoples' forest-related values are perceived by them as threatening and undermining those values.
- Resource use is highest close to roads and decreases as the distance from roads increases.

Non-commodity Values

The Human Uses and Social and Economic Factors sections of this chapter address specific commodity uses and values of NFS lands, and the effects of the alternatives on these activities and their participants. This section discusses the non-commodity values and benefits associated with NFS lands. NFS lands provide a host of non-commodity values and benefits that can be grouped into three general categories: 1) recreation values, 2) ecological values, and 3) passive use/spiritual/aesthetic values (Bengston and others 1999). Recreation values are discussed in the Human Uses and the Social and Economic Factors sections of this chapter, and are not treated here.

Ecological values and benefits associated with NFS lands include:

- Maintenance of ecosystem health,
- Conservation of plant and animal species,
- Conservation of air and water quality, and
- Provision of undeveloped natural areas for research and teaching.

Passive use/spiritual/aesthetic values include:

- Valuing scenic quality (discussed in the Scenic Quality section under Human Uses in this chapter),
- The desire to experience solitude and personal renewal in wild areas,

- Feeling a sense-of-place attachment to a specific area,
- Wanting to know that natural areas exist for their own sake, and
- The desire to leave a legacy of natural areas for future generations to experience and benefit from.

A central purpose of the proposed Roadless Rule is to protect the characteristics of inventoried roadless areas, many of which are associated with these non-commodity values.

Natural Resource Protection Values – For some people, natural resource protection values are passive use values. In other words, they believe in protecting forests because they feel it is important, independent of any utilitarian motive. Other people believe that it is important to protect forests because they provide a number of benefits (Content Analysis Enterprise Team 2000a,b). These include:

- Watershed protection, clean drinking water, flood protection, and water for irrigation;
- Clean air quality;
- Maintenance of soil productivity;
- Stabilization of hillsides to prevent sedimentation of watercourses;
- Protection of fisheries;
- Protection of wildlife for viewing and hunting opportunities;
- Provision of recreation opportunities associated with primitive and semi-primitive classifications;
- Regulating climate and counter-acting the effects of global warming;
- Enhancing social and ecological sustainability;
- Preventing the spread of nonnative invasive species that degrade ecosystems;
- Cost savings from environmental protection versus future environmental restoration;
- Providing current and future supplies of medicinally valuable plants;
- Well-functioning ecosystems and biodiversity;
- Honoring treaty rights, and
- Enhanced quality of life.

The Ecological Factors section of this chapter discusses many of these characteristics in detail, and the effects of the alternatives on them.

Water and Air Quality – People have many reasons for believing it is important to maintain and enhance air and water quality. Water flowing from NFS lands is important to downstream users, such as municipalities, irrigators, and industrial users. In-stream uses for hydroelectric generation and recreation are also highly valued uses of NFS water. The EPA estimated in 1999 that 3,400 public drinking water systems are located in watersheds containing NFS lands. About 60 million people live in those 3,400 communities (Sedell and others 2000).

The most recent EPA water quality inventory found that **nonpoint source pollution** still accounts for the majority of water-quality impaired stream miles and lake acres (U.S. Environmental Protection Agency 1998a). Although agriculture is still, by far, the largest nonpoint source of water pollution, forestry and related activities are important

contributors in some areas of the United States. However, the proper implementation of best management practices and contract requirements has significantly controlled pollutants from forestry operations on NFS lands. The costs of water quality control in the United States are substantial and rising. A recent EPA survey indicates that community water systems in the United States will need to invest $138 billion over the next 20 years (Hertzler and Davies 1997). Water pollutants, such as sediment, increase treatment costs downstream.

Water quality also affects the value of water-based recreation activities. The impact of sedimentation and other water quality impairments has a negative effect on recreation user benefits. For example, a national study (Russell and Vaughan 1982) estimated that the total benefits to anglers of improving the water quality of lakes and streams ranged from $300 to $966 million (in 1982 dollars). Another national study estimated that the total damages to all recreational water uses from all types of pollution ranged from $1.8 to $8.7 billion (in 1978 dollars per year) (Freeman 1982).

Air quality can directly affect human health and indirectly affect visibility that can reduce scenic quality and the ability to enjoy outdoor recreation in natural areas. Several studies have documented peoples' willingness to pay to enhance air quality and corresponding visibility. A study of the benefits of conserving visibility in National Parks of the Southwestern United States determined that the benefits outweighed the treatment and regulatory costs (Schulze and others 1983). A study conducted in Utah County, Utah estimated that respondents were willing to pay an average of $37 per household per month to improve air quality to a level found in nearby areas in Utah and Idaho (Pope and Miner 1988).

Solitude and Personal Renewal – Many people visit inventoried roadless areas to interact with the natural world and experience solitude, and spiritual and psychological renewal. This includes visiting American Indian and Alaska Native sacred sites. Some would argue that interaction with the natural world is crucial for the human spirit and for emotional and psychological well being (Roberts 1999; Schroeder 1999; Wilson 1984; Kellert and Wilson 1993). Undeveloped natural areas can be viewed as a spiritual and psychological resource in this regard (Rolston 1999). One public commentator noted that protecting inventoried roadless areas on NFS lands is necessary for the soul of the nation (Content Analysis Enterprise Team 2000b). As more and more Americans spend most of their lives in urban and suburban environments, public lands increase in importance as places people can go to experience nature, solitude, and personal renewal. There is substantial evidence that doing so has a positive effect on the quality of life (Driver and others 1999).

Sense of Place – Sense of place is the physical locations that people have invested with meaning, value, and feelings because of their experiences there (Brandenburg and Carroll 1995). Some place values are use-oriented (Mitchell and others 1993). People value these places because they support a particular use that they like to engage in, such as a mushroom picking spot or a favorite fishing hole. Once the place no longer supports that use, it may lose its value to the individual and cause him or her not to return there. Other place values are attachment-oriented. People have emotional bonds to places, which are important to them for providing certain kinds of experiences they value. Even if

conditions change in these places, people may continue to revisit them. Sense of place can play an important role in fostering individual identity, influencing quality of life, reinforcing cultural traditions (e.g., subsistence), and shaping attitudes towards the land and how it should be managed (Roberts 1999).

Research and Teaching – Many people recognize the value of inventoried roadless areas as relatively undisturbed ecosystems that provide opportunities for research and teaching. They provide a setting for undertaking basic biological and ecological research on individual species. As reasonably intact ecosystems, they can provide a baseline for understanding the ecological impacts of development elsewhere. Inventoried roadless areas are also invaluable as reference landscapes for undertaking long-term research on large-scale ecological patterns, processes, and management activities. This landscape-level research is critical for understanding how to manage NFS land sustainably.[19] Because they are typically large ecosystems, inventoried roadless areas also serve as important training grounds for scientists, ecologists, wildlife biologists, foresters, and natural resource managers.

Passive Use Values – Passive use values are independent of any active or consumptive use of a natural area. Passive use values include existence and bequest values. Existence values are things, places, or conditions that people value simply because they exist, without any intent or expectation of using them (Peterson and Sorg 1987; Randall 1992). Bequest value is the desire to allow others, such as future generations, to benefit from a resource. Some natural resource protection values can also be considered passive use values. For example, many people believe that forests and wildlife have inherent worth in and of themselves, independent of their usefulness to humans, and should therefore be protected (Steel and others 1994).

Passive use values are often associated with T&E species, unique ecosystems, and biodiversity. Passive use values differ among individuals, groups, and landscape conditions. Under special conditions, the passive use value of an area can exceed the active use value served (or potentially served) by road access to that area (Walsh and others 1984; Driver and others 1987; Walsh and others 1990; Payne and others 1991; Brown 1993; Driver and others 1999; Bengston and Fan 1997). Walsh and others (1984) found that passive use values accounted for 38% to 54% of the value of protecting areas as Wilderness. Walsh and others (1996) focused on what proportion of natural areas should be protected and the willingness of residents to pay for protection. Residents of all regions preferred protection for most natural areas in the eastern United States, while the proportion preferred in the West ranged from 83% to 92%. Willingness to pay for protection of natural areas averaged $263 per person for all natural areas in the United States (including both use and passive use value). Most residents were willing to pay more for protection of areas within their own region than for protection in other regions. However, most residents were willing to pay more for protecting natural areas in Alaska than for any other region, indicating a significant passive use value for protection of areas in Alaska. Loomis and Richardson (2000) applied passive use values estimated in the literature to acreages of inventoried roadless areas, and estimated the total annual value of

[19]Refer to discussion of Reference Landscapes in Ecological Factors section.

protecting roadless areas to be $274 million in the Western United States and $6.2 million in the Eastern United States.

A review of studies on the economic benefits of endangered species indicated that peoples' willingness to pay for the protection of individual species ranged from a low of $6 per household for the striped shiner (a fish) to a high of $95 per household for the northern spotted owl and its old-growth habitat (Loomis and White 1996). Vincent and others (1995) reviewed studies of passive use values related to forestland. The value of protecting the northern spotted owl was estimated to range from $48 to $144 per United States household. A more focused study examined the value of preserving the northern spotted owl to residents of the State of Washington. The average value was $35 per household. A study of the willingness of residents of the Pacific Northwest to pay to double the size of Columbia River Basin salmon and steelhead runs by 2000 estimated that the value to nonusers was $27 per household. It was not possible to determine the passive use component of total value for users of the resource. However, in reviewing the literature, the authors concluded that it is clear that passive use values are an important component of total use values for natural resources.

Alternative 1

Alternative 1 would result in continued road construction and timber harvest in inventoried roadless areas. An estimated 1,160 miles of classified and temporary roads are planned to be constructed or reconstructed in inventoried roadless areas between 2000 and 2004. In addition, an estimated 1.1 BBF of timber could be offered for sale in inventoried roadless areas during this 5-year period. More people would gain access to these areas. Management of inventoried roadless areas would continue as prescribed in local land management plans. People, who believe that non-commodity values are compatible with multiple uses, including resource extraction and road development, may perceive no impact from Alternative 1. However, the Ecological Factors section of this FEIS indicates that Alternative 1 could have detrimental effects on ecosystem health including watershed health, forest health, and biodiversity. The Recreation section of this FEIS finds that Alternative 1 could reduce scenic quality and Primitive and Semi-Primitive recreation opportunities, which often make it possible to experience solitude and personal renewal, and opportunities to engage in long-term scientific study in natural settings using reference landscapes (see those sections for a detailed account). The long-term associated impacts on people who value the non-commodity benefits of inventoried roadless areas could include:

- Diminished air and water quality within the airsheds or watersheds of affected inventoried roadless areas they visit or live in;
- A degradation of scenic quality in affected inventoried roadless areas;
- Reduced opportunities to experience solitude and personal renewal;
- Alteration of special places within inventoried roadless areas that individuals or groups have a place attachment to, including sacred sites;
- A diminished legacy of undisturbed natural lands for future generations;
- A threat to existence values;

- A reduced supply of undisturbed natural areas where research and teaching can take place; and
- Threats to the conservation of some plant and animal species people care about.

Alternatives 2 through 4

Prohibiting road construction and reconstruction in inventoried roadless areas would shelter them from some forms of development and disturbance, including some planned timber harvest activity, depending on the alternative chosen. In contrast to Alternative 1, the action alternatives would maintain and conserve the current roadless characteristics of inventoried roadless areas. For example, the Ecological Factors section of this chapter concludes that, in general, the action alternatives would conserve ecosystem health on NFS lands to a greater degree than Alternative 1. Specifically, they would maintain water, soil, and air quality; maintain intact aquatic ecosystems; enhance land-based ecosystems; prevent habitat degradation, loss, and fragmentation; conserve species viability and biodiversity; and minimize human disturbance.

These findings indicate a positive effect on people who value ecosystem health and want to protect plant and animal species, and air and water resources. The action alternatives would also have a positive effect on people having passive use values including existence and bequest values. People who value inventoried roadless areas as places for research and teaching would also benefit from the action alternatives because these alternatives would help maintain the undisturbed character of natural areas and reference landscapes.

The Recreation Sections of this chapter find that the action alternatives would maintain high levels of scenic quality on NFS lands relative to Alternative 1. They also find that these alternatives maximize opportunities for dispersed recreation in primitive and semi-primitive settings. Hence, the action alternatives would have a positive effect on people who value scenic quality, and people who wish to experience solitude and personal renewal in undisturbed natural settings. People with a sense-of-place attachment to inventoried roadless areas would also benefit from the action alternatives, because these alternatives – and especially those that prohibit timber harvest – minimize the likelihood that the current character of special places, including American Indian and Alaska Native sacred sites, would be altered by disturbance.

Because the action alternatives conserve the roadless characteristics of inventoried roadless areas, they also conserve the non-commodity values associated with those characteristics. The alternatives that prohibit timber harvest, in general, would go further in protecting non-commodity values than the alternative that prohibits road construction and reconstruction alone.

Recreation, Scenic Quality, Wilderness, and Recreation Special Uses

Affected Environment

Nationally, the demand for most recreation activities continues to grow (Cordell and others 1999b). The 1994-95 National Survey on Recreation and the Environment found that 95% of the American population 16 years of age and older participated at least once in outdoor recreation during the year. This survey included recreation participation across the entire range of recreation settings on all ownerships, from urban parks and playgrounds to the most remote Wilderness. NFS lands provide recreation opportunities across a narrower range of settings, as described by the ROS (see Recreation section under Human Uses in this chapter).

Recreation activities associated with more developed portions of the ROS (e.g., developed camping, driving for pleasure, and visiting nature centers) tend to be more popular in terms of total participants and days of participation (Cordell and others 1999b). A smaller percent of the population engages in activities that are associated with more remote landscapes, such as backpacking, primitive camping, and semi-primitive motorized uses such as off-highway driving and snowmobiling. However, varieties of recreation activities occur in all of the ROS settings, including picnicking, hiking, wildlife viewing, off-highway driving, fishing, and hunting.

Table 3-53 shows changes in the national participation levels for outdoor recreation activities that are also available on NFS lands between 1982 and 1983, and between 1994 and 1995. Participation has increased in all activities but horseback riding.

Table 3-53. Number of Americans (16 years and older) participating in outdoor recreation activities available on National Forest System lands, 1982-1983 and 1994-1995.

Activity	1982-1983 (millions)	1994-1995 (millions)
Visiting an historic or pre-historic site	No data available	123.3
Picnicking	84.8	98.3
Biking	56.5	57.4
Bird watching	21.2	54.1
Hiking	24.7	47.8
Motor boating	33.6	47.0
Developed camping	30.0	41.5
Primitive camping	17.7	28.0
Off-Road driving	19.4	27.0
Skiing (downhill and cross-country)	15.9	23.3
Backpacking	8.8	15.2
Horseback riding	15.9	14.3
Snowmobiling	5.3	7.1

There are several reasons for the upward trend in outdoor recreation participation. Because 80% of the American population is now urban, recreation has become one of the few avenues people have for experiencing the outdoors. Moreover, people have become increasingly aware that outdoor recreation contributes to the quality of their lives (Driver and others 1999). One survey (The Recreation Roundtable 1997) found that participation in outdoor recreation, especially as a child, leads to a more satisfying and fulfilling life. People are also more aware of the numerous benefits that result from engaging in outdoor recreation (Driver and others 1999). These include:

- Spiritual and Psychological Benefits – better mental health, personal development and growth, personal appreciation and satisfaction, spiritual renewal, stress release, experiencing the natural world;
- Physical Health Benefits – exercise, spending time in relatively unpolluted environments;
- Social and Cultural Benefits – spending quality time with family and friends, learning about cultural and historical heritage resources, reinforcing cultural identity (including the practice of culturally important activities), improving environmental awareness, conflict resolution; and
- Economic Benefits – reduced health care costs, better job performance.

Participation in outdoor recreation is influenced by demographic variables such as gender, age, ethnicity, education, and income level. For example:

- During 1994 and 1995, 94.5% of the visitors to federally designated Wilderness areas were White (Cordell and Teasley 1998).
- Communities having a higher proportion of African American and low-income residents participate less in dispersed and winter recreation (Tarrant and others 1999).
- White Americans engage in recreational fishing more than African Americans and other racial and ethnic groups (Johnson 1999).
- People who have completed college participate more in hiking and backpacking than those with high school educations (Johnson 1999).
- People over 60 participate less in camping than do younger age groups (Johnson 1999).
- Men and middle-income groups are more likely than women or other income groups to camp (Johnson 1999).
- Hispanic populations prefer using developed recreational sites, and tend to regularly visit specific sites for day trips in large extended family groups (Magill and others 1993).

The Forest Service is the single biggest provider of outdoor recreation opportunities in the United States (Cordell and others 1999b). As the demographic characteristics of the American population change over time, there may be corresponding changes in demands for different types of recreational opportunities on NFS lands.

Future growth in recreation demand is projected to be greater for activities that require roaded access than for activities in more remote settings (Bowker and others 1999). As reported in the National Forest System Roads section of this chapter, recreation use accounts for 90% of daily traffic on system roads. However, most recreation traffic occurs on the 20% of NFS roads that are designed and maintained for passenger cars. In addition to those roads, recreationists also use the 54,600 miles of public roads maintained by States and Counties within NFS lands.

Federal lands are often the only source of remote recreation opportunities, such as those found in inventoried roadless areas. For example, in the Southern Appalachian region, Federal lands provide two-thirds of remote settings. Attributes that are highly demanded include scenic landscapes, wild rivers, high quality trout habitat, and historic sites (Southern Appalachian Man and the Biosphere 1996b). The scarcity of Federal lands in the East implies more limited opportunities for large, undeveloped recreation relative to the population base. The concentration of Federal lands in the West provides residents with much greater access to remote recreation experiences than in the Eastern United States.

Access to private land for public recreation is expected to decrease in the future; so public lands are likely to be the destination of choice for increasing numbers of people looking for high-quality recreation experiences in natural settings (Cordell and others 1999b). Increasing demand is likely to lead to more congestion and user conflicts and less user satisfaction across all ROS settings. Urban residents have fewer outdoor recreation opportunities than rural dwellers, leading to increased pressures on, and demand for, recreation opportunities closer to metropolitan areas (Tarrant and others 1999). Recreation use patterns show a trend for more trips closer to home (Cordell and others 1999b), which is most likely to impact public lands in close proximity to urban populations.

Data are not available on the amount of recreation use in roaded versus inventoried roadless areas. While many types of recreation activities can occur in the undeveloped settings of inventoried roadless areas, some activities are more strongly associated with these areas than others. These include backpacking, hiking, orienteering, horseback riding, off-road driving, primitive camping, mountain climbing, caving, and rock climbing, a group of activities described by Cordell and others (1999b) as “Outdoor Adventure.” Hiking is the only activity in this group that is among the 10 most popular in the United States. Mountain biking and wildlife viewing are among the 10 most popular activities not classified as Outdoor Adventure that do take place in inventoried roadless areas.

While Outdoor Adventure participants engage in recreation activities on other lands, and other recreation activities occur in inventoried roadless areas, the Outdoor Adventure category offers a reasonable indicator of recreation demand for the setting offered in inventoried roadless areas. Depending on the region of the country, from a third to a half of the United States population participates in Outdoor Adventure activities (Winter and Chavez 1999). Although the percentage of the population that participates in these activities is higher in the Western United States, the total number of participants is greater in the Eastern United States (Table 3-54). Outdoor Adventure activities are projected to grow between 10% and 49% by 2040. The lower growth rates are projected for off-road driving, while hiking and horseback riding are projected to each grow about 45%. Generally, Outdoor Adventure activities will be among the slowest to grow over the next 40 years (Bowker and others 1999).

Although demand for other recreation activities will increase more rapidly in the future, the availability of opportunities for remote recreation activities may be a limiting factor

in meeting future demand. Inventoried roadless areas provide an important setting for these types of recreation activities. Some of these activities can also take place in Wilderness, with the main exception of off-road driving. One indicator of the availability of recreation opportunities to meet future demand is to examine the acres of land available per participant. Table 3-54 displays the number of acres of Wilderness on all Federal ownerships, and inventoried roadless area acres on NFS lands by Resources Planning Act Assessment region. The Eastern United States (North and South regions) has the least amount of Wilderness and inventoried roadless acres per recreation participant. For activities that cannot take place in Wilderness (primarily off-road driving), the limited opportunities are even more pronounced. The Pacific Region has more land per capita than the Eastern United States, while participants in the Rocky Mountain Region have the greatest abundance of land suitable for Outdoor Adventure Activities in the lower 48 States. In Alaska, there are about 120 acres of Wilderness and inventoried roadless area per capita. Additional inventoried roadless areas may exist on other Federal ownerships, but only data on Wilderness were available for other Federal agencies.

Table 3-54. Acres of Wilderness and inventoried roadless areas available for Outdoor Adventure Activities in the lower 48 States, by Resources Planning Act assessment region.

	Outdoor adventure participants [a,c]			Designated Wilderness [b, c]		Inventoried roadless areas	
Region	Number (millions)	Percent of population	Distribution by region (%)	Distribution by region (%)	Acres per participant	Distribution by region (%)	Acres per regional participant
North	32.0	34.8	43.4	3.3	0.05	1.5	0.02
South	20.5	32.9	27.8	4.9	0.10	2.2	0.05
Rocky Mtn.	7.1	47.5	9.6	45.9	2.86	77.6	4.78
Pacific	14.1	45.1	19.1	46.0	1.44	18.7	0.58
Total	**73.7**	**36.8**	**100.0**	**100.0**	**0.60**	**100.0**	**0.79**

[a] Number of participants includes individuals 16 years or older.
[b] Wilderness includes acres administered by Forest Service, National Park Service, and Bureau of Land Management in the lower 48 States.
[c] Alaska acres are not included in Wilderness or inventoried roadless acres.

The availability of remote activities can be compared to total recreation opportunities per capita (Table 3-55). In addition to Federal lands, State parks and forests provide recreation opportunities that are similar to some types of NFS opportunities. The total acres in State forests, State parks, and all Federal land management agencies were summed by Resources Planning Act assessment region. It was not possible to calculate the number of acres available per participant in recreation, since no estimate of overall recreation participation was available for the regions. Total acres were compared to the total population 16 years of age and older, which underestimates acres available per recreation participant. Acres in the National Wilderness Preservation System were not included in Table 3-55. Acres available per person are shown both with and without acres in NFS inventoried roadless areas.

Table 3-55. Acres available for recreation on State and Federal lands, by Resources Planning Act assessment region.

Region	Population 16 and older (millions)	Acres of land per person [a]	Acres of land per person [b]
North	92.0	0.4	0.4
South	62.3	0.5	0.5
Rocky Mtn.	14.9	17.0	14.8
Pacific	31.0	3.2	1.8
Alaska	0.5	308.0	283.7
Total	**200.7**	**3.0**	**2.6**

[a] Including inventoried roadless areas.
[b] Not including inventoried roadless areas.

The per capita availability of recreation opportunities by region is similar to the availability of Wilderness and inventoried roadless areas shown in Table 3-54. The North and South regions have the least acres per person, while the Rocky Mountain Region has much more abundant resources.

Recreation is an important component of the travel and tourism industry. Travel and tourism is America's largest retail export industry, and is the third largest domestic retail sales industry, with sales in excess of $500 billion and direct employment of 7.6 million people. Approximately one out of every 17 United States residents was employed because of direct travel spending in the United States during 1999 (Travel Industry Association of America 2000). Tourism has been one of the three most important generators of outside income in Idaho, Oregon, and Washington, while Montana's economy has been driven largely by the tourism sector and an influx of new residents (Quigley and Arbelbide 1997b).

In the Columbia River Basin, recreation supported nearly 78,000 direct jobs (Crone and Haynes 1999). A study by English and Marcoullier (1999) estimated that 767,000 jobs and $11.8 billion of labor income are associated with expenditures by non-resident recreation visitors in all non-metropolitan Counties in the United States. In the Southern Appalachian region, outdoor recreation tourism was estimated to contribute almost $6 billion in business sales, and create employment for more than 100,000 workers in the region (Southern Appalachian Man and the Biosphere 1996b). In southeast Alaska, recreation and tourism levels more than doubled between the mid-1980s and the mid-1990s, accounting for an estimated 2,941 direct jobs in the region in 1995 (representing 7% of total employment in Southeast Alaska) (USDA Forest Service 1997d). Because of the high level of outdoor recreation use on NFS lands, the Forest Service has been shifting the focus of multiple-use land management away from commodity production and toward recreation and related amenity uses (Driver and others 1999).

Recreation use on NFS lands generates considerable economic benefits for businesses in local communities. Use by non-residents is particularly important, since non-residents bring "outside" dollars into communities. Based on recreation expenditure profiles

developed for Forest Service impact analysis, developed uses (such as winter sports) generate more jobs per recreation visit than dispersed activities, such as camping, picnicking, and hiking. For example, winter sports are estimated to generate 1,322 direct jobs per million visits, while wildlife viewing generates about 645 direct jobs. Hunting and fishing visits tend to generate smaller numbers of jobs per million visits (281 direct jobs for fishing and 480 direct jobs for hunting). However, more developed activities also impose higher infrastructure costs on communities, such as law enforcement, road maintenance, and sanitation facilities.

Landowners with property adjacent to public lands benefit from enhanced property values, and adjacent communities benefit because the amenity values of national forests attract businesses and residents. High population growth is occurring in areas with high recreation use (Johnson and Beale 1994). Counties with a high level of recreation use tend to be diversifying more rapidly than other Counties, which is at least partly attributable to the presence of public lands that attract both tourists and permanent residents (Ashton and Pickens 1995).

Recreation special uses on the NFS are important to many local businesses and generate economic activities in many adjacent communities. Recreation special uses include ski resorts, lodges, outfitter and guide services, marinas, and other resorts. Receipts from recreation special uses on NFS lands were almost $38 million in 1998.

Currently, the Forest Service has more than 26,000 recreation special use permits. The largest number of permits is for recreation residences (14,504), followed by outfitter and guide permits (5,777). Winter resorts accounted for 148 special use permits on NFS lands. Demand for recreation special use permits is expected to continue increasing in the future.

Outfitters and guides provide services to a wide variety of recreation participants. Hunting, fishing, hiking, horseback riding, rafting, and OHV tours are examples of the types of activities. Demand for most of these activities is expected to increase in the future, as described earlier. Although hunting participation is expected to decline overall, big game hunting is expected to increase. The availability of undeveloped lands is essential for many outfitter and guide businesses (Adams 2000).

The winter resort special use permits on NFS lands include most of the downhill skiing capacity in the Western United States. The number of ski areas has decreased since 1985, primarily through the closure of small ski areas. Most downhill skiing capacity has increased through expansion of existing resorts. New ski developments are unlikely. Development requires a high capital investment, and a lengthy approval process. For example, in the last 10 years every large ski area in the Rocky Mountain Region has expanded. No new developments have been proposed (Ryberg personal communication).

According to ski industry reports, the number of ski resorts went from 700 in 1986 to 519 in 1996. Resort consolidation is expected to continue, with ownership of resorts concentrated in fewer companies. Downhill skiing participation has been relatively flat in the last few years. Annual variations are often related to weather conditions. Future

demand for downhill skiing depends largely on whether the participant base is expanded. White males have historically made up the majority of customers, and they are decreasing as a proportion of the total population (Gardner 1999).

Recreation was an important topic for people commenting on the Notice of Intent and the DEIS. The majority of public comment related to recreation focused on the issue of whether or not motorized vehicles should be allowed in inventoried roadless areas (Content Analysis Enterprise Team 2000a, b). Many of the people commenting believed existing roads and OHV trails would be closed by the alternatives.

Public sentiment regarding motorized recreation in roadless areas is polarized. At one end of the spectrum are people who believe that motorized recreation in roadless areas should be restricted or eliminated. This group values these areas as places to go to escape noise, development, and pollution. They believe that such areas are increasingly hard to find. Many believe that existing NFS roads are sufficient. Others oppose the use of OHVs in roadless areas because they believe they are ecologically destructive, and that these areas deserve environmental protection.

At the other end of the spectrum are those who believe that roadless areas should be open to motorized recreation. These people believe in their right to use public lands, and assert that many people would be denied this right if motorized access were prohibited in the future. Many believe that limiting motorized recreation discriminates against the physically disabled, elderly people who cannot hike long distances, and people who do not otherwise have the time, money, or inclination to visit roadless areas.

Comments were also received about the growing demand for recreation. Some believe that increasing demand for developed uses would degrade the experience and environment in roaded areas if no future development is allowed in inventoried roadless areas. These people generally believe that certain places in inventoried roadless areas should be roaded to accommodate this demand. Others were concerned about maintaining existing inventoried roadless areas to meet demands for recreationists seeking solitude.

The potential effect on local economies was also a concern to many respondents. Some believe the prohibitions could have negative impacts on local communities, while others believe inventoried roadless areas are essential to maintaining the resource base for recreation-related economic activities.

Alternative 1 – No Action

Recreation use on NFS lands is expected to continue increasing across a wide spectrum of activities. Road construction and reconstruction in inventoried roadless areas would occur to varying degrees by location, increasing access for motor vehicles and decreasing inventoried roadless area acreage. New roads in entry into inventoried roadless areas would occur primarily for access to timber harvest, mineral development, and other special uses. A high percentage of those roads would likely be closed when no longer needed for the development activity, except in Region 10, where the majority of roads

would be maintained for future use. Therefore, planned road development would not provide many miles of additional access for recreationists in the short term.

Alternative 1 would increase the opportunities for recreation activities in more developed ROS classes at the expense of opportunities in the undeveloped ROS classes (Table 3-55). This would benefit people who prefer more developed outdoor recreational experiences but would be detrimental to those who value dispersed primitive and semi-primitive recreational opportunities. Declines in these opportunities would affect recreationists in the Eastern United States and urban areas of the Western United States, where the land base is already very limited relative to the land base available for more developed types of recreation activities. Given the abundance of the land base in most parts of the Interior West and Alaska, such declines would have relatively little effect on recreationists, at least in the short term. Increased access may affect the ability of Tribes to practice treaty-protected rights.

Additional roaded access into inventoried roadless areas would provide new opportunities to view scenic vistas, and develop new recreation sites, which would respond to increasing demands for road-based recreation. Increased access can also provide people with the opportunity to enjoy unique and sensitive areas, but it can make protection of these areas difficult.

There would be a decline in the land base available for recreation opportunities in relatively undisturbed landscapes outside of Wilderness. Development, such as road construction, would be likely to negatively affect scenic quality on affected areas. Since inventoried roadless areas tend to have high scenic integrity, management actions would likely reduce scenic integrity, which could negatively affect recreation values and adjacent property values.

Within the inventoried roadless areas, there would likely be increasing congestion, which negatively affects the quality of the recreation experience. Increased access and use in areas adjacent to Wilderness would increase the potential for illegal uses and degradation of Wilderness attributes. In addition, some users may transfer use to Wilderness areas as a substitute for the loss of acres of inventoried roadless areas, increasing congestion in Wilderness areas.

A decline in the acres of inventoried roadless area is likely to affect the Agency's ability to accommodate increasing demands for recreation special use permits that are based on remote recreation experiences, such as outfitter and guide permits. This could have a negative economic impact on outfitters and guides. Alternative 1 would allow new recreation developments in inventoried roadless areas, such as campgrounds, resorts, and ski area expansions. Such new development would expand developed recreation opportunities.

The net effect of the changes in opportunities would vary by national forest and grassland, depending on existing use patterns, density of use, and preferences of users. Overall, increases in use are mostly likely to occur on NFS lands in the Eastern United

States where opportunities are already scarce, and areas in close proximity to urban populations throughout the United States.

Thirty-three miles of roads were planned for construction or reconstruction in the next 5 years for recreation projects. However, recreationists usually use roads built for other purposes to gain access. If all of the proposed projects that required roads were implemented, about 258 miles (that would not be closed) of timber roads would be available for recreational use over the next 5 years. Almost 48% of those timber roads would be in Region 10. Of the 528 non-temporary miles of roads associated with other projects, data are not available on what proportion would remain open for other use over the long term.

Alternatives 2 through 4

Similar effects on recreation resources would occur under these three action alternatives. It is important to note that the action alternatives do not directly address the balance between motorized and nonmotorized recreation in roadless areas. This issue is outside the scope of the national prohibitions. Furthermore, no existing roads would be closed under the national prohibitions. Thus, the prohibitions should have no negative effects in the short term on people who engage in motorized recreation activities in inventoried roadless areas. To the extent that new roads would have been built for activities such as timber harvest, those roads would not be available for motorized recreation activities.

Opportunities for remote recreation would be maintained under the prohibition alternatives, compared to Alternative 1. In areas where remote opportunities are scarce, particularly in the Eastern United States, maintaining these opportunities would be particularly valuable. Although recreation use is likely to increase in these areas, maintaining the existing land base would result in smaller increases in density than under Alternative 1. The effects of the prohibitions would be positive for people who engage in activities such as backpacking, mountaineering, cross-country skiing, off-highway driving, horseback riding, hiking, mountain biking, wildlife viewing, hunting, and fishing.

Maintaining inventoried roadless areas in their current state would reduce the need for recreationists in search of remote experiences to move to Wilderness areas to enjoy a comparable experience. This would lessen the visitation pressure on Wilderness areas and help maintain the quality of Wilderness experiences.

Lack of roading would maintain scenic quality in inventoried roadless areas, although timber harvest may reduce scenic quality where it occurs. Therefore, Alternative 4 may maintain scenic quality to a greater degree than Alternative 2. Alternative 3 could offer the most opportunity to maintain or enhance scenic quality, since stewardship harvest to address forest health and fire risk problems would be allowed.

The road prohibition would limit roaded recreation access to inventoried roadless areas, which may cause increased congestion in existing roaded areas of NFS lands. This could have negative effects for people who prefer roaded recreation activities, such as pleasure

driving, visiting heritage sites or interpretive nature centers, and camping or picnicking in developed areas. The prohibition on road construction and reconstruction would affect a maximum of 258 road miles associated with timber harvest in the next 5 years. These road miles would have remained open, and they might have been used for recreation access in the next 5 years. However, almost 48% of those miles would be in Region 10, and therefore there would be little effect on recreation access in other regions. Another 244 road miles would be prohibited for other planned projects in the next 5 years. These impacts would be greatest in those forests with current high densities of roaded recreation use. In parts of the NFS, recreation use density is far below capacity across all settings in the ROS, while other areas are congested. Therefore, the net effect would vary widely by location.

As with recreation use, there are likely to be tradeoffs between businesses that benefit and those that are constrained by reduced development opportunities. Maintenance of inventoried roadless acreage could be beneficial to meeting increasing demand for outfitter/guide permits. Non-resident recreationists may be more likely to use these services, so increases in use could generate additional external revenue for local communities. Special uses that require roading would not occur in inventoried roadless areas. However, developments such as campgrounds are likely to have substitute sites available.

The special use most likely to be impacted is future ski-area development in inventoried roadless areas. If historic trends continue, future increases in ski area capacity are most likely to occur through expansion of existing areas. Such expansion is not prohibited within existing permit boundaries. However, expansion beyond existing permit boundaries, and new ski developments that require road construction, would not be allowed under the prohibitions unless a decision to approve them is made prior to rule implementation. The likelihood of such proposals being approved under current policy is difficult to predict, given the complex procedures and increased public interest in these projects. The potential economic effect of national prohibitions on the ski industry is difficult to assess. Some increase in capacity would be possible in the future even with prohibitions implemented. If demand remains flat, then any new development would be competing for market share. Many ski areas have developed into 4-season resorts, reducing their dependence on downhill skiing as the sole source of revenue, and providing year-round economic activity in local communities.

Hunting and Fishing

Affected Environment

Recreational, subsistence, Tribal treaty rights, and commercial hunting and fishing occur on and around NFS lands. Hunting and fishing on NFS lands is regulated by individual States, although the Forest Service can close areas for public health and safety purposes or to protect certain species. As human populations increase and land conversion from rural to urban uses continues on private lands surrounding NFS lands, public and private lands that contain open space will become increasingly important as places that provide quality hunting and fishing opportunities. In addition, fishing and hunting activities on

NFS lands provide national, State, and household economies with important sources of jobs, income, food, and other benefits. Inventoried roadless areas provide important habitat for fish and game species, and management of these areas has direct consequences for hunting and fishing.

Recreational hunting and fishing takes place on NFS lands throughout the United States. Approximately 9% (47 million) of the total United States freshwater fishing participation days in 1996 occurred on NFS lands mostly on inland waters (Loftus and Flather 2000; Maharaj and Carpenter 1999; USDI Fish and Wildlife Service and USDC Bureau of the Census 1997). Of the total national expenditures on recreational fishing, about 12% ($2.9 billion) were associated with activities on NFS lands. The number of people participating in cold-water recreational fishing increased consistently throughout the 1970s and 1980s (Flather and Hoekstra 1989). Recent projections indicate that this trend will continue, with the number of fishing participants increasing 36% and participation days of fishing increasing 27% by 2050. The largest increases are expected to occur in the Rocky Mountains (Bowker and others 1999). This growth in participation will result from population growth. The percentage of the total United States population that is participating in recreational fishing is actually declining (Loftus and Flather 2000).

Although demand for freshwater fishing is predicted to increase in the future, the supply of desirable native and nonnative fish will be affected by human-induced aquatic habitat degradation and competition with undesirable nonnative species (Flather and Hoekstra 1989). Adequate data do not exist for most fish species for assessing population trends. Insufficient aquatic resource information for NFS lands makes it difficult to determine whether the supply of angling opportunities is meeting demand (Loftus and Flather 2000). It is expected that a gap between the supply of and demand for fishing opportunities will develop, increase over time, and be particularly large for coldwater fishing (Flather and Hoekstra 1989). This implies an increased density of use and decreasing catch rates, which may degrade the quality of the recreational fishing experience for some participants and put further pressure on fish populations. However, research indicates that time, interest level, and family and work obligations are the most common limiting factors on fishing participation (Loftus and Flather 2000). While crowding and competing uses of water resources are also factors, the condition of aquatic resources does not currently appear to be limiting fishing participation (Loftus and Flather 2000).

Recreational hunting is another socially valued and economically important activity in the United States, though not as many people participate compared with fishing. Recreational hunting participation days on NFS lands represented 11% (28 million) of the national total in 1996 (Maharaj and Carpenter 1999; USDI Fish & Wildlife Service and USDC Bureau of the Census 1997). Expenditures on recreational hunting on NFS lands represented 10% ($2.1 billion) of the national total in 1996.

Hunting trends appear to be mixed. Recent trends reflect an overall increase in hunting participation days (Maharaj and Carpenter 1999). Big game hunting has been increasing since the 1960s, and it is predicted to continue to increase on NFS lands through 2040 (Flather and Hoekstra 1989). NFS lands provide much of the big game habitat in the West. Migratory bird hunting had been declining, but increased slightly between 1991

and 1996 (USDI Fish and Wildlife Service and USDC Bureau of the Census 1993, 1997). Most migratory bird hunting occurs near wetland habitats, where waterfowl occur. In general, big game populations have increased substantially nationwide since 1975 (Flather and others 1999). Duck, geese, and swan populations are also on the rise (Flather and others 1999).

In contrast, small game hunting has been declining, and it is predicted to continue to decline through 2040 (Flather and Hoekstra 1989). The decrease is due in part to declining populations of some small game species, reduced access to hunting areas on private lands, and declining numbers of rural residents (Flather and others 1999). Small game populations associated with rangeland and agricultural habitats have been declining, while those associated with forest habitats have shown mixed trends throughout the country (USDA Forest Service 2000e). The overall number of hunters is projected to decline about 11% by 2050, although the number of days should remain stable (Bowker and others 1999).

Game species that adapt well to human activity or that are highly valued and therefore carefully managed are expected to continue to do well in the future (USDA Forest Service 2000e). Game species that require large, undeveloped landscapes or special habitats that are vulnerable to development pressure may not do as well (USDA Forest Service 2000e). Although hunting activity is expected to increase on NFS lands in the future, the greatest amount of hunting participation takes place in the Eastern United States and occurs on private land (Maharaj and Carpenter 1999).

Subsistence Hunting and Fishing – The majority of subsistence hunting and fishing on NFS lands occurs in Alaska. Localized activity occurs in the contiguous United States where American Indian populations are concentrated, such as the Pacific Northwest, California, the Southwest, and the Rocky Mountains. In the lower 48 States, treaties between the Federal government and federally recognized American Indian Tribes guarantee subsistence rights that allow Tribes to harvest fish and game on Federal lands. In Alaska, rural Alaskan residents have subsistence rights on Federal lands by Federal law (Alaska National Interest Lands Conservation Act; Public Law 96-487) and by Alaska State law (AS16.05.258).

Subsistence hunting and fishing can be important to the economy, culture, and health of rural families and communities. In Alaska, for example, the annual subsistence harvest of wild foods is estimated at 43.7 million lbs. of usable weight annually (Alaska Department of Fish and Game 1998). This total represents 375 lbs. per person per year for rural residents and 22 lbs. per person per year for urban residents. Sixty-two percent of this total is comprised of fish, 36% is comprised of game, and the remaining 2% comes from plant material.

These harvests represent a substantial portion of the caloric and protein requirements of rural Alaskans. They also have substantial economic importance, with a **replacement value** of $131.1 to $218.6 million annually. In addition, subsistence hunting and fishing play a central role in the culture, traditions, and social fabric of many cultural groups in Alaska. The Alaska case illustrates the importance of subsistence hunting and fishing to

those who participate in it. Inventoried roadless areas may support limited and localized subsistence hunting and fishing activity, especially in Alaska.

Treaty Hunting and Fishing – Off-reservation hunting and fishing rights vary depending on treaty language, subsequent legislation, and court decisions. Some Tribes believe that the Federal government is obligated to manage wildlife and fish habitats to protect the Tribes' treaty rights. In some treaties in the Pacific Northwest, the Federal government is obligated to protect the Tribes' rights to access "usual and accustomed grounds and stations" (where those grounds and stations are on Federal lands).

Commercial Fishing – Demand for edible fish has been on the rise since the 1960s, resulting in an upward trend in commercial fishing activity. The number of commercial fishing vessels in the United States has remained stable over the last decade (Loftus and Flather 2000). Commercial fishing in the United States supports more than 30,000 full time jobs (Loftus and Flather 2000). NFS lands support commercial anadromous fisheries based on fish species that spawn in rivers and streams. The most important commercial fish species supported by NFS lands are salmon and steelhead trout, which occur primarily in Alaska and the Pacific Northwest (including northern California). Federal lands in these three States support 259 of the 314 anadromous fish stocks at risk (USDA and others 1993). In 1998, almost 19 million lbs. of salmon were landed offshore of the Pacific Coast States (Washington, Oregon, and California), having a value of $15.3 million dollars (USDC National Marine Fisheries 2000). In 1994, 284 million lbs. of salmon were harvested in Alaska, for an estimated value of $121 million. Approximately 80% of the salmon harvested in Southeast Alaska originate on the Tongass National Forest (USDA Forest Service 1997d). However, reduced Pacific salmon stocks have caused a substantial reduction in commercial fishing opportunities in the Pacific Northwest (Loftus and Flather 2000).

Many members of the public who commented on hunting and fishing during the scoping period for the Notice of Intent and on the DEIS supported a prohibition on road construction and reconstruction in inventoried roadless areas (Content Analysis Enterprise Team 2000a,b). Some people perceive that hunting success always decreases because of additional roads. Others feel that the quality of the hunting experience is greater in roadless areas than in roaded areas. Still others enjoy the outdoor experience they have when hunting or fishing in an undisturbed natural setting. One person noted that roads increase hunting pressure on wildlife species and are therefore undesirable. Some respondents believe that logging destroys wildlife habitat and leads to reduced hunting success. Some people believe that game species leave roaded areas due to increased traffic.

Some respondents commented that although inventoried roadless areas are generally positive for wildlife, there are certain species that depend on the edge effect of roads. Some stated that certain timber harvesting practices are essential, as they create forage for some game species. Additional comments were received that expressed concern over the fact that clearings, which had been created by fires or timber harvesting, were disappearing and that multiple levels of forests or a mosaic were needed to provide habitat for all wildlife species, including game species. There was also concern that a decline in revenue and wildlife conservation dollars would occur if hunting becomes

more difficult because of poor access, and forests become too dense to support deer and other wildlife.

Other commentators believe that hunting and fishing should be prohibited in inventoried roadless areas to protect fish and game species. These respondents believe roadless areas provide habitat with a high level of ecological integrity and should be protected to conserve and enhance species populations. Many other commentators noted the importance of maintaining healthy ecosystems to support the commercial fishing industry and tourism, which is based on recreational hunting and fishing.
Tribes expressed different viewpoints about whether road construction in inventoried roadless areas would be desirable with regard to subsistence hunting and fishing. In some locations, they do not support a prohibition on road construction and reconstruction. They desire improved access to existing hunting and fishing locations. In other locations, Tribal members expressed the view that road construction was a major cause of ecological degradation. These respondents support a prohibition on road construction, believing it would protect subsistence and treaty rights resources.

In December 1999, the Theodore Roosevelt Conservation Alliance surveyed 600 hunters and anglers to solicit their opinions regarding road management in existing inventoried roadless areas of NFS lands (Theodore Roosevelt Conservation Alliance 1999). Eighty-six percent of the anglers and 83% of the hunters surveyed supported a policy to prevent future road construction in inventoried roadless areas. These hunters and anglers highly value many attributes of NFS lands, including the habitat they provide for endangered species, the protection of water quality, the opportunity to experience solitude and nature, and the hunting and fishing opportunities in remote places having few roads and people.

Alternative 1 – No Action

In the next 5 years, an estimated 1,160 miles of permanent and temporary road construction and reconstruction are planned in inventoried roadless areas. Based on historic levels of road construction, it is anticipated that 5% to 10% of inventoried roadless areas are likely to have roads constructed in them over the next 20 years. By 2040, between 18% and 28% of inventoried roadless acres would be roaded, with an estimated 16,000 miles of new and existing roads. However, a portion of these roads would be single-purpose roads closed to other uses. Some roads would be decommissioned after use. The remaining roads would provide hunters and anglers with increased roaded access to hunting and fishing sites in inventoried roadless areas. In light of projected increases in hunting and fishing activity on NFS lands, this could redistribute use from more crowded sites near currently roaded areas to less crowded sites in inventoried roadless areas, decreasing overall user density in the short-term. However, this redistribution would depend on a number of factors including access management strategies, State fish and game regulations and strategies, and whether the new roads lead to areas with high fish and game population densities that would draw hunters and anglers to them.

To the extent that new roads increase access to hunting and fishing sites, they could also introduce more hunters and anglers to both roaded and roadless areas, causing increased

crowding. This could increase the potential for conflict within and between user groups. Alternative 1 would reduce the area available for primitive, dispersed hunting and fishing opportunities.

Additional roaded access to inventoried roadless areas would make it easier to conduct some fish and wildlife management activities. Roads also provide easier access for habitat restoration and enhancement projects. In some instances, where access is provided to fishing and hunting areas, associated law enforcement activities would also be facilitated, helping to manage species populations.

The Aquatic Animal Habitat and Species section of this chapter indicates that road construction, maintenance, use, and the presence of roads can adversely affect aquatic systems and the species supported. Timber harvest can also adversely affect aquatic habitat, although stewardship timber harvest may potentially provide some beneficial effects to some species. Some of the resultant effects to fish species include loss of spawning and rearing habitat, increased mortality of eggs, increased mortality and reproductive failure, barriers to fish passage, higher vulnerability to disease and predation, greater likelihood of nonnative species introductions, and increased susceptibility to over harvest.

Under this alternative, there is the greatest potential for adverse effects to fish species relative to the action alternatives. This alternative also has the greatest potential for adverse effects to recreational, commercial, treaty rights, and subsistence fishing because it could cause declines in the populations of desirable fish species. For example, roads have been linked to the decline of salmonid populations in the Pacific Northwest, which are important to all fisheries in this region. If fishing success rates decline, the quality of the recreational fishing experience could also decline. However, this would likely be a long-term rather than short-term effect to recreational fishing because the condition of the fishery is not currently a limiting factor on fishing participation for most recreational anglers (Loftus and Flather 2000). Reduced catches could have important short- and long-term effects on subsistence and treaty rights fishing. A reduction in per capita harvests and consumption could negatively affect the health, economy, and culture of American Indians and Alaska Natives, in particular. Declines in anadromous fish populations dependent on NFS lands could also reduce the allowable catch by commercial anglers, having negative economic consequences, and potentially threatening livelihoods. By providing additional access for hunters, roads facilitate the illegal poaching of many big game species such as caribou, pronghorn, mountain goat, bighorn sheep, deer, and elk. In addition, roads increase the incidence of species mortality from road kills.

The Terrestrial Animal Habitat and Species section of this chapter indicates that road construction and timber harvest can have mixed habitat-related effects on game species populations. Game populations are significantly influenced by changes in their habitat. For example, elk and bighorn sheep can exhibit strong road avoidance in some areas. Inventoried roadless areas provide the large, high quality core habitat required by game species such as elk and black bear. Road construction and timber harvest cause habitat fragmentation and disturbance that can be detrimental to these species. When timber harvest activities and road densities are poorly planned and managed, habitat quality or

habitat loss can be negatively affected. However, timber harvest activity that results in the creation of a mix of habitats and a variety of age classes is generally beneficial to most game species. Deer and elk populations, for example, can benefit from improved forage conditions created by some timber harvest activities.

The impacts of road construction and timber harvest on habitat change, and consequently on the game species associated with those habitats, will depend on species needs, and the extent, duration, timing, and intensity of timber harvest and road construction activity. It is difficult to generalize about the effects of Alternative 1 on species population trends, and their impact on hunting success rates. For game species that benefit from the habitat pattern changes associated with timber harvest and associated roads, encounter rates and hunting success rates could potentially increase, heightening the quality of the recreational hunting experience. For species that are disturbed or displaced by these ground-disturbing activities, encounter rates could decline, potentially reducing hunting success rates and the quality of the recreational hunting experience. Increases in hunting success would be beneficial for subsistence and treaty rights hunters. Declines in hunting success would decrease per capita game harvests by subsistence and treaty rights hunters, with negative consequences for the health, economy, and culture of American Indians and Alaska Natives in particular.

Road construction has been found to have some negative impacts on subsistence hunting and fishing in Alaska. One study on the relationship between roads and subsistence in Alaska found a significant association between the presence of roads and reduced subsistence productivity (Wolfe and Walker 1987). This study found that subsistence harvests in rural communities located along road networks or marine highways were 69% lower than those of communities located off the road network. Reduced harvests are associated with new settlement that takes place along roads. New residents engage in hunting and fishing locally, increasing competition for fish and game resources, and reducing the catch available to traditional subsistence users. Roads built in rural areas also draw urban residents who use them to gain access to new areas for recreational hunting and fishing. For example, residents of Ketchikan in southeast Alaska use timber roads built on Prince of Wales Island on the Tongass National Forest for deer hunting. This increases competition between recreational and subsistence users, reducing subsistence harvests (Ellanna and Sherrod 1987; Turek and others 1998).

Alternatives 2 through 4

National prohibitions on road construction and reconstruction in inventoried roadless areas would not alter existing access for hunting and fishing on NFS lands. Existing access for hunting and fishing opportunities in inventoried roadless areas would be maintained. Roaded access to inventoried roadless areas for hunting and fishing would not increase in the future. As the number of people participating in hunting and fishing on NFS lands increases, a prohibition on road construction in inventoried roadless areas could contribute to crowding (depending on State hunting regulations and strategies) at hunting and fishing locations that are easily accessible by roads.

Both the Terrestrial and Aquatic Animal Habitat and Species sections of this chapter find that a prohibition on road construction and reconstruction would reduce the potential for increased levels of human-caused disturbance, and degradation of terrestrial and aquatic habitat quality, quantity, and distribution relative to Alternative 1. Therefore, this prohibition would also reduce the potential for road-related adverse effects on fish and game species populations.

The amount of timber harvest that would occur in inventoried roadless areas under Alternatives 2 through 4 would be reduced relative to Alternative 1 and would vary depending on the specific alternative chosen. Alternative 3, which would allow stewardship timber harvest as a management tool but would prohibit commercial timber harvest, would likely be more beneficial to fish and game species than Alternative 2, which would allow commercial timber harvest. Alternative 4, which would prohibit all timber harvest in inventoried roadless areas (except to meet T&E species objectives), is not expected to have an adverse impact on fish or game species. Alternative 4 could benefit some game species, such as black bears in the Eastern United States. However, Alternative 3 could potentially be more beneficial to game species than Alternative 4 by maintaining the capability of the Agency to manage for diverse habitat structures using timber harvest. In contrast, Alternative 4 would likely be more beneficial to fish species than Alternative 3 because it would minimize the likelihood of adverse effects to aquatic ecosystems caused by timber harvest activity. The beneficial effects of Alternatives 2 through 4 on fish and game populations would translate into corresponding beneficial effects for fishing and hunting.

Many complex variables influence fish and game species populations. However, Alternatives 2 through 4 have more potential than Alternative 1 for conserving commercial fisheries, maintaining recreational hunting and fishing resources (thereby contributing to the quality of the experience), and supporting subsistence and treaty rights hunting and fishing. They would therefore help to maintain the economy and culture of participants.

Livestock Grazing

Affected Environment

Forest and rangelands in the United States provide forage and browse for more than 100 million cattle and 8 million sheep (USDA Forest Service 2000e; Joyce 1989). About 20% of all beef cattle and 50% of all sheep in the United States are located in 11 Western States (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) (Council for Agricultural Science and Technology 1996; Field 1990). About half of these beef cattle and sheep rely on land managed by the Forest Service and the Bureau of Land Management for grazing (Harris and others 1996). Some 80% to 85% of all Federal lands in the West are grazed by livestock (Harris and others 1996, Council for Agricultural Science and Technology 1996). Although only a small percentage of the national forage supply for livestock is produced on public lands, some Western livestock operations are highly dependent on Federal-land grazing because a high percentage of rural land in the West is publicly owned.

In 1998, about 92 million acres of NFS lands were in grazing allotments, 84 million of which were actively in use. Some 2,114,000 cattle and sheep grazed on NFS grazing allotments in 1998 (Herman, personal communication). On NFS lands, all areas that are suitable for grazing have already been placed in allotments and the opportunity to expand is negligible.

In 1998, there were 8,395 permittees using NFS lands, as compared with 9,126 in 1990. Approximately 81% of Forest Service permittees run small- to medium- sized family ranch operations specializing in beef cattle production (Council for Agricultural Science and Technology 1996). Cow-calf and cow-calf-yearling operations are the most common of these. Although the number of permittees has decreased over the last decade, this trend is affected more by the consolidation of permits than by declining use.

Although the per capita consumption of beef and veal has been and should continue declining, total demand for beef is expected to increase due to population growth. The annual increase in demand through the year 2020 is expected to be less than 0.5% (USDA Forest Service 2000e). Livestock grazing on public and private forest and rangelands is expected to decline, especially in the West (Van Tassell and others 1999). The Forest Service projected a decline in grazing on NFS lands in the West by 2030 (Council for Agricultural Science and Technology 1996). This decline is expected to result from changing land management policies that respond to public demands for other uses such as recreation and the protection of wildlife and habitat. The supply of private grazing land will also decline due to the conversion of rural land to urban uses, and the sub-division and development of private ranches. Nevertheless, forage production on private lands is expected to compensate for the loss of public land grazing through increased production made possible by range improvement.

Ranching is a way of life that is deeply rooted in the West. One survey of Western ranchers found that individual ranchers had spent an average of 31 years on the same ranch, and had come from families that had ranched for an average of 78 years (Fowler and others 1994). Despite the fact that ranch families generally depend on a combination of farm and non-farm employment to remain economically viable, preserving the ranching lifestyle is important to many. Ranchers often value the rural way of life, having an agricultural occupation, feeling close to the natural world, their independence, and other associated social and psychological benefits of their occupation (Ruyle and others 2000). American Indians in the Southwest depend on livestock for their subsistence and market values, ceremonial and ritual purposes, crafts, gifts and exchanges, and for raising and educating children (Brugge and Gerow 2000). Ranching also plays an important role in the social and cultural systems of Hispanic communities in the Southwest (Raish 1996; Raish in press). Because of the dependency of some Western ranchers on Federal grazing allotments, Forest Service lands can play an important part in maintaining the society and culture of ranchers in the West.

Western American Indian Tribes have treaties that provide for pasturing animals on off-reservation land. The allocation of grazing permits on NFS lands depends on the treaty language. The Regional Forester may authorize treaty-based grazing under a Memorandum of Understanding. Tribal governments are exempt from the Forest Service

policy against issuing term grazing permits to governments. Treaty grazing permits are free of charge.

Roads provide ranchers with motorized access to their allotments, which is important for transporting livestock and for maintaining fences and water developments. Allotments located in roadless areas are usually reached on horseback or by OHV. The roads used by ranchers are usually constructed for other purposes; seldom are roads built on NFS lands for the primary purpose of providing access to grazing allotments.

NFS roads have both positive and negative effects on range forage quality. Because roads have largely replaced stock driveways as the means of getting livestock to grazing allotments, driveways that were historically used for moving livestock have dramatically improved in health (USDA Forest Service 2000h). However, roads also introduce unpalatable, nonnative, invasive plant species that reduce overall forage quality.

Timber harvest activities, like fires, often increase the forage supply for livestock by opening the forest canopy and increasing the production of understory vegetation. These increases are temporary, lasting up to 10 to 20 years (Council for Agricultural Science and Technology 1996). This effect is particularly evident in habitats dominated by ponderosa pine, which are widespread on NFS lands (Daryl Herman, personal communication).

Public comments received in response to the Notice of Intent and the review of the Draft Environmental Impact Statement expressed a variety of viewpoints regarding grazing in and near inventoried roadless areas (Content Analysis Enterprise Team 2000a,b). Some individuals stated that grazing is one of the multiple uses that is appropriate on NFS lands, and should be continued. Several people wanted current roaded access to allotments protected so that permittees could engage in range management activities and infrastructure maintenance. Others pointed out that permittees who have successful livestock businesses are able to retain rather than sell their ranches, thereby preventing the sub-division and development of private ranchlands, and keeping these areas in open space. Comments also reflected a belief that grazing can reduce fire risk on NFS lands.

In contrast, other people believe that grazing is environmentally destructive, and that it undermines the ecological integrity of inventoried roadless areas. They believe, therefore, that it should be eliminated, restricted, or monitored and evaluated, with permits cancelled if it is found to cause environmental damage. At a minimum, they believe that no new grazing allotments should be opened up in inventoried roadless areas. Some people believe that no new roads should be built to accommodate grazing on NFS lands in the future. Several sets of comments underscored the point that livestock are grazed on Federal lands for lower than market value, and want to see this issue addressed.

Alternative 1

Under this alternative, 260 miles of road construction and reconstruction are planned in inventoried roadless areas in the 11 Western States to provide access to 503 MMBF of planned timber offer. If these roads were built, 71 miles would remain open following

timber harvest, and be available for use by ranchers to improve their access to current allotments. They could also be used by American Indians to access their grazing treaty rights in inventoried roadless areas. An additional 422 miles of roads may be built in the next 5 years in the Western States for non-timber project purposes. Use of those roads might reduce the operating costs of ranchers where they occur in close proximity to access points for grazing allotments. However, new road construction could have the effect of introducing undesirable plant species, offsetting some of the economic gains from improved access. Timber harvest would open up the forest to understory growth in many areas, temporarily increasing forage for livestock. These short-term effects would be amplified over the medium- and long-term.

Alternatives 2 through 4

Prohibiting road construction in inventoried roadless areas would not affect existing routes of access to grazing allotments. Nor would it affect the future supply of grazing allotments. Data collected from NFS lands indicate that there is currently no planned road construction relating directly to range activities. The 260 miles of roads planned to facilitate timber harvest over the next 5 years would not be built under the action alternatives. About 201 miles of roads associated with other projects may also be prohibited by these alternatives.

Prohibiting road construction is estimated to reduce total timber harvest in inventoried roadless areas by 73% over the next 5 years. This could limit the growth of understory vegetation and reduce the amount of livestock forage that would otherwise be available in some areas. The action alternatives would have a positive effect on range condition by reducing the potential for introducing nonnative invasive species.

Non-timber Forest Products

Affected Environment

There are five broad categories of non-timber forest products: wild food plants, such as mushrooms, fruits, nuts, and berries; medicinal plants and fungi; floral greenery and horticultural stocks; plants, lichens, and fungi used for fiber and dyes; and other chemical plant extracts such as oils and resins (Weigand and others 1999). Woody materials, such as firewood, poles, and boughs, are included in this discussion because they, too, are commonly used non-timber forest products. Data on the distribution and abundance of non-timber forest products, and on their biology, ecology, and productivity are inadequate (Molina and others 1997; von Hagen and Fight 1999). They are gathered on both private and public lands. Public lands in the Pacific Northwest are believed to be the most heavily used public lands in the country for the harvest of floral greens and botanicals (Molina and others 1997). The role of NFS lands as a source for non-timber forest products varies regionally, but is particularly important in the Pacific Northwest and in the northern Rocky Mountains (Weigand Personal communication).

Non-timber forest products have three main kinds of social value: 1) livelihood (both market and non-market), 2) cultural, and 3) recreational (Emery 1999). For example, in

parts of California and in the Southwest, many rural Hispanic communities depend on gathering firewood from NFS lands for both cooking and heating (Raish in press). In Southern California, Asian Americans gather bracken ferns on NFS lands for food, basket-making, dyes, astringents, soaps, medicine, and other uses that are important to their cultural traditions (Chavez and Gill 1999). Many recreational users, such as amateur mushroom collectors, also gather non-timber forest products (Fine 1998). The size, structure, and dynamics of the non-timber forest products sector remain poorly understood (Jones and others 2000; von Hagen and Fight 1999).

The traditional way of life of many American Indian and Alaska Native Tribes involves gathering and using products from their natural surroundings. In some treaties, these rights were included under the term "gathering rights." In negotiating treaty terms, many Tribal governments reserved off-reservation rights to gather miscellaneous forest products such as berries, roots, bark from trees, mushrooms, basket making materials, tepee poles, cedar for totem poles, and medicinal plants. The availability of these materials, and discretion about how they are grown (such as without pesticides) or raised, and the conditions under which they are gathered are important to American Indians.

In addition to their treaty, subsistence, and recreational values, non-timber forest products have gained increasing commercial importance since the mid-1980s. The number of requests to harvest non-timber forest products on public and private lands for commercial use has risen exponentially in the last two decades (Jones and others 2000). The non-timber forest products industry provides economic opportunities for producers, buyers, dealers, and for those who add value to them by manufacturing them into products, such as medicinals. Roughly 1,400 plant species found in the United States are traded for commercial purposes (USDA Forest Service 2000h). Knowledge of the commercial role of non-timber forest products in the United States is sketchy, though the following statistics allude to their importance.

The market for herbal products in the U. S. was about $2.5 billion in 1996, and it has been growing at a rate of 13% to 15% annually (von Hagen and Fight 1999). More than 50% of the 25 top selling botanicals in the United States come from native plant species. American ginseng (*Panax quinquefolius*), goldenseal (*Hydrastis canadensis*), Echinacea species, and common St. Johns Wort (*Hypericum perforatum*), all found on NFS lands, are major contributors to this herbal and botanical industry (USDA Forest Service 2000h).

Mosses and lichens, which are harvested extensively from public forestlands and are exported to worldwide markets, were valued at more than $14 million in 1995. In 1992, the wild edible mushroom industry contributed more than $41 million to the regional economy of the Pacific Northwest, employing more than 11,000 people full or part time (von Hagen and Fight 1999). By 1995, harvests of Christmas boughs in the Pacific Northwest had reached nearly 20 million lbs. annually. The sale of permits and leases to collect non-timber forest products on NFS lands in fiscal year 1998 generated $2,977,626 (USDA Forest Service 1999o). Growing markets for non-timber forest products make it safe to assume that demand for these products will continue to rise in the coming years, increasing harvest pressure on NFS lands.

The harvest of non-timber forest products for both personal use and commercial sale is a traditional activity that has taken place for generations by American Indians and rural people living in locations throughout the United States, such as in the Appalachians, the Ozarks, Michigan's upper peninsula, and the Pacific Northwest. Participants in the timber industry have also long-gathered non-timber forest products to supplement their incomes (Freed and Davis 1997). Non-timber forest products provide opportunities for some people who live in rural communities characterized by instability to diversify their household livelihood strategies by serving as subsistence resources, as well as a source of cash income (Emery 1999). They provide insurance against economic hard times, and help to supplement household incomes as necessary. Edible, ceremonial, and medicinal products are especially valuable as subsistence goods, while products used for crafts and decoration are important for their market value (Emery 1999).

Beginning 10 or 20 years ago, people from a wide variety of ethnic backgrounds (many of them recent immigrants) started harvesting non-timber forest products, and relying on them as their sole source of income. For example, Hispanics and Southeast Asians are active producers in the Pacific Northwest (Love and Jones 1997). Evidence suggests that a disproportionate number of harvesters and processors are members of the rural and urban poor, and that a large percentage of participants in the industry are women, children, and elderly people (von Hagen and others 1996).

In 1999, Congress passed legislation requiring the Secretary to establish a 5-year pilot program to monitor and assess fees for the harvest of forest botanical products on NFS lands (Section 339 of the Department of the Interior and Related Agencies Appropriations Act 2000, Public Law 106-113 – Appendix C, 113 Stat. 1501A-199). The legislation also requires the Secretary to manage non-timber forest-product species on a sustainable basis. Under the pilot program, the Secretary must collect fair market value for forest botanical products and must recover all costs to the Department associated with granting, modifying, or monitoring the authorization for harvest of forest botanical products, including the costs of any environmental or other analysis (the Secretary may waive these charges). The Forest Service is currently assessing how-to implement the law. This legislation will lead to increase future management of non-timber forest-product species on NFS lands.

Because non-timber forest products are economically valuable, and can generally be extracted from forests while leaving the forests structurally and functionally intact, these types of products have the potential to provide opportunities for the sustainable economic use of forests. Such opportunities may be particularly important for residents of forest-dependent communities who have suffered lost jobs and revenues due to declining timber sales on public forest lands. However, because non-timber forest-product industries are seasonal, cyclical, and competitive, with generally low rates of return to producers, few individuals previously employed in the timber industry have diversified into the non-timber forest-product sector to date (von Hagen and Fight 1999). Non-timber forest products are better viewed as a supplementary source of income, than as a substitute for employment in the timber industry (von Hagen and others 1996).

Members of the public commenting on the Notice of Intent and the Draft Environmental Impact Statement expressed the importance of harvesting non-timber forest-product species to their way of life (Content Analysis Enterprise Team 2000a,b). They believe they should be allowed to continue to gather non-timber forest products in inventoried roadless areas, including those products gathered for commercial purposes. Some believe that without roads they would no longer be able to gather non-timber forest products because they would not be able to access certain areas. The majority of the uses mentioned were for subsistence, such as edible plants and fuel wood. Some commentators asserted that the production of non-timber forest products from NFS lands was of much greater economic value than the production of timber. Other people feared that the negative ecological impacts of road construction could threaten some species. Several people felt that inventoried roadless areas should be protected because they may contain species that could prove valuable for medicinal or other purposes in the future.

Alternative 1 – No Action

Under Alternative 1, some road construction and timber harvest would take place in inventoried roadless areas in the future. Roads and timber harvest create openings and disturbance that benefit some populations of non-timber forest products, and harm others. For example, one assessment found that 30% of non-timber forest products in Oregon occur in openings and along roadsides (USDA Forest Service 2000h). In contrast, road construction and timber cutting harms some species, such as wild gingers (*Asarum* spp.), pitcher plants (*Sarracenia* spp.), and shade-loving mosses that require undisturbed forest. Some non-timber forest products species that are highly sensitive to harvest pressure are threatened in areas close to roads where they are easily accessible.

Timber harvest and road construction alter the opportunities available to harvest different species. Depending upon the species of interest to a particular person, roads and timber harvest may be viewed as either ecologically (and economically) beneficial, or detrimental. Biological evidence suggests that managing forests for joint production of timber and non-timber forest products is economically and ecologically viable for North American forests, though more research is needed (Von Hagen and others 1996).

Roads may degrade those populations of non-timber forest products growing along them, because of pollution or herbicide and pesticide spraying (though this is rarely done along roads on NFS lands). Of more concern, roads can promote the spread of invasive weeds, which are often more competitive and drastically reduce native species valued as non-timber forest products. Nevertheless, some invasive species are also valuable non-timber forest products.

People who harvest non-timber forest products use roads built for other purposes, mainly timber harvest, to access non-timber forest-product species (USDA Forest Service 2000h). Some products, such as firewood, are not usually harvested far from roads because of their weight. Other products can be gathered away from roads, but the time and labor investment increases. Some people use OHVs to harvest these products, which offsets this increase. People who depend on roaded access to forests for gathering non-timber forest products would benefit from any additional roaded access to inventoried roaded areas that would occur under Alternative 1.

Harvest pressure on non-timber forest products is likely to be greatest in the areas that are closest to roads, and to decrease in areas that are more remote. Therefore, harvest areas away from roads may be worth using if product quality and net returns are better. Using areas distant from roads is not feasible for all products or all individuals. For example, American Indian elders who are traditional healers may not be able to collect traditional cultural non-timber forest products away from roads because of difficulty walking long distances. While roads facilitate the illegal taking of non-timber forest products, they also facilitate the monitoring and enforcement of harvest activities by Forest officials.

New roads would have the short-term effect of enabling harvesters to disperse along more roads, better distributing harvest pressure on non-timber forest products located close to roads. It would also provide new opportunities to those people whose harvest activities are generally restricted to roadsides, such as the elderly or firewood gatherers. By increasing access to currently roadless areas, individuals who now use those areas in their roadless condition would experience greater competition with other harvesters.

Alternatives 2 through 4

A prohibition on road construction and reconstruction in inventoried roadless areas would not alter current access conditions for the harvest of non-timber forest products, and would therefore have no impact on existing physical access to harvest opportunities. A prohibition on road construction and reconstruction could limit future opportunities to harvest non-timber forest products in roadless areas for those people who lack OHVs and can only engage in non-timber forest products harvest along existing roads, for example elderly people or people gathering firewood. New trails could be built in inventoried roadless areas under Alternatives 2 through 4, which would help provide access.

Assuming that harvest pressure on non-timber forest products is greatest along roads, and decreases with increasing distance from roads, maintaining current access conditions could have the long-term effect of heavily impacting those species populations that are located close to roads by failing to provide new opportunities to harvest products in areas that are currently less accessible. This impact could be important in the context of rising demand for non-timber forest products, accompanied by a proliferation of harvesters. However, species populations located in roadless areas, especially those that are remote from existing roads, would be protected from heavy harvest pressure by preventing roaded access to them. People who harvest non-timber forest products close to roads could see dwindling economic returns over time, while those who harvest non-timber forest products away from roads would be less likely to do so. This effect could be offset however if more people used OHVs to gain access to harvest opportunities in roadless areas.

To the extent that prohibiting road construction and reconstruction protects biodiversity and limits the spread of invasive weeds, the action alternatives would have a positive impact on non-timber forest-product species populations. They would also shield species from road-related pollution and from pesticides and herbicides. A prohibition on road construction and reconstruction would especially favor those species that are adverse to disturbance, not only because it would prevent road construction, but also because it

would limit timber harvest in inventoried roadless areas. Individuals who gather non-timber forest products that do not tolerate disturbance would benefit economically from the prohibitions. Those who depend on non-timber forest products that grow in disturbed areas would not see those species populations increase through road-building and associated timber harvesting (though they could do so as a result of other types of disturbance), and would not have this added economic benefit.

The effect of additional prohibitions on timber harvest under Alternatives 3 and 4 would be to further reduce or eliminate timber harvest activities from inventoried roadless areas. Species populations that need or prosper from ground disturbance and higher levels of light, and people who harvest them, would be at a disadvantage. Plant species that do not tolerate disturbance and individuals who harvest them would benefit.

Timber Harvest

Affected Environment

Substantial changes have occurred in the timber industry in the last two decades because of fluctuations in wood product prices, international markets, technology, industry restructuring, and declines in Federal timber harvest. Gains in timber-related employment have occurred primarily in the Eastern United States, which accounts for more than 75% of total forestry services and wood products manufacturing jobs. Employment associated with NFS harvest declined 50% between 1992 and 1996. In 1996, NFS related jobs accounted for 3% of total timber-related employment.

Although its share of the market has declined markedly, the harvest of timber from NFS lands continues to generate jobs and income for both the local and national economy. The distributional effects on jobs, income, and Payments to States are estimated for all alternatives. In addition, data on net revenues are used to predict whether sales in inventoried roadless areas are likely to be below cost. A section on the effects on other ownerships and global resources completes the economic analysis, and it is followed by a discussion of related social effects.

For several years, the Administration has been working with Congress to stabilize payments to States and Counties for schools and roads. Historically, 25% of all receipts generated from national forests were returned to States and Counties to spend on schools and road maintenance. The decline of timber harvests from national forests over the past decade has resulted in decreasing payments to States and Counties.

As of the printing of this FEIS, both the Senate and the House of Representatives have passed legislation that allows States to choose between 25% payments or a new payment formula based on historic payment levels. This legislation, if signed by the President, will diminish the economic impact of each of the action alternatives considered in this FEIS.

The quantified effects look forward through the next 5 years of planned offer. The effects of the associated harvest are assumed to occur in the same period but may occur beyond those 5 years, since harvest may take place up to 4 years after sales are made. The longer-

term effect on timber availability is also important to consider. Some national forests that did not plan to enter inventoried roadless areas in the next 5 years may plan to enter those areas in the longer term.

Over the long term, the effects of prohibitions may be greater than estimated for those forests that intended to rely on inventoried roadless areas for a considerable portion of their harvest volume. In addition, reductions in inventoried roadless areas may affect scheduling harvest on remaining areas of NFS land. Given the controversial nature of entries into those areas, it is difficult to predict whether those plans would ever be implemented.

Many members of the public commented that NFS lands should provide an economic base for rural communities. They believe that the proposed Roadless Rule would cost jobs in the timber industry, hit small timber producers especially hard, and have negative consequences for loggers and forest-dependent communities, particularly in the West. Forest product jobs are often well paid relative to others, and cannot adequately be replaced by jobs in other sectors, such as recreation and tourism. Concern was also raised that prohibiting road construction and limiting logging in inventoried roadless areas would concentrate harvest on other private and public lands, and increase environmental impacts in these areas. Reduced NFS harvest was also seen as leading to increased prices for wood products, and increasing imports from countries that may have few environmental safeguards for harvesting.

Some believed that timber-related job losses would exacerbate unemployment problems in some communities, amplify social problems, and undermine community integrity. The loss in Payments to States would also place financial stress on communities. People also believed that cumulatively, these effects could degrade the social fabric of communities.

Other respondents believed that timber-dependent communities would be caught in a continuous boom-bust economy if they remain tied to NFS harvest. The importance of diversifying economies was mentioned, with frequent mention of the importance of tourism and other sectors that benefit from maintaining inventoried roadless areas.

Some individuals believe that timber harvest on NFS lands is not an economically sound practice, and does not produce enough revenue to cover costs. Some suggested that the Forest Service should re-direct money towards forest and watershed restoration projects, which could provide jobs for environmentally beneficial purposes. Others believe no logging should occur in inventoried roadless areas, including helicopter logging, because of the negative environmental consequences.

Alternative 1 – No Action

Harvest volume in fiscal years 1996 to 1999 was used in developing the baseline for Alternative 1. These years most accurately reflect current condition and likely harvest volume in the near future. Volume harvested, rather than volume offered or sold, creates economic effects. Average annual harvest volume for the baseline is approximately 3,300

MMBF (Table 3-56). It is assumed that the timber program on NFS lands will continue to range from 3,000 to 4,000 MMBF.

The estimate of jobs and income associated with NFS harvest is based on response coefficients from the **IMPLAN** model. Employment and total income effects can include direct, indirect, and induced effects. Direct employment and income effects include jobs and income associated with the harvest of timber and primary wood and paper products processing. Indirect effects include jobs and income associated with industries that supply inputs to the harvesting and processing sector. Induced effects include jobs and income associated with spending in the economy from the salaries created by the direct and indirect effects.

Regional direct and total (the sum of direct, indirect and induced effects) job and income effects were estimated using regional job and income response coefficients calculated from regional data reported in TSPIRS. Regional data on jobs and income for fiscal years 1996 through 1998 were used to create response coefficients for average total jobs per MMBF and average income per MMBF that were applied to the baseline harvest levels. Estimates of these measures are in Table 3-56.

Table 3-56. Total average annual jobs, income, receipts, and Payments to States associated with timber harvest from National Forest System lands under Alternative 1 (1997 dollars).

Region	Total harvest (MMBF[a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Timber receipts [b]	Payments to States [b]
Northern (1)	320	3,196	8,950	$99,493	$276,369	$61,369	$15,342
Rocky Mtn. (2)	143	861	2,008	22,730	53,037	23,524	5,881
South-western (3)	77	690	1,380	18,059	36,117	4,982	1,245
Inter-mountain (4)	199	1,794	2,990	104,038	173,397	29,105	7,276
Pacific SW (5)	492	3,442	5,409	165,306	259,767	107,678	26,919
Pacific NW (6)	694	5,551	9,714	159,627	279,347	140,847	35,212
Southern (8)	663	6,627	12,591	208,853	398,821	100,727	25,182
Eastern (9)	596	4,172	6,556	246,453	387,284	60,795	15,199
Alaska (10)	125	625	1,000	28,645	45,832	10,995	2,749
Total	**3,308**	**26,957**	**50,596**	**$1,053,204**	**$1,907,970**	**$540,022**	**$135,006**

[a] Million board feet
[b] In thousands

Some of the receipts generated from the sales of timber are returned to the United States Treasury. States also receive a portion of timber sale receipts based on congressionally determined formulas, generally referred to as Payments to States. Receipts from timber sales historically have been the largest source of Forest Service Payments to States. The

baseline receipts are a 3-year average of National Forest Fund receipts from 1996 to 1998. Payments to States are estimated to be 25% of total receipts. Actual Payments to States in those years averaged about $100 million higher because of guarantee payments to Regions 5 and 6, put in place to mitigate the effects of protecting the northern spotted owl.

To offer timber sales, the Forest Service spends money on preparing sales, doing environmental analyses, and other administrative and associated planning activities. Timber sales are offered for sale competitively, so stumpage prices received for NFS timber reflect market prices. However, the Forest Service does not necessarily recover its cost from timber sale revenues. Below-cost sales have long been a controversial issue for the Forest Service. As a result, TSPIRS was developed and put into place to create a consistent accounting framework for comparing revenues and costs associated with the Agency timber sales program.

The TSPIRS data from 1996 to 1998 were used to estimate the average revenues and costs associated with the timber sales program in each region. In the timber sales program, stewardship sales are undertaken to accomplish ecosystem management objectives. Although revenues do exceed costs for some stewardship sales, it is more appropriate to evaluate those sales based on whether they are the least-cost method for achieving the management objective. Commodity sales are undertaken to deliver fiber to the market, and therefore it is appropriate to assess the "profitability" of the program. On average, revenues exceeded costs in the commodity component for most regional timber sales programs (Table 3-57). Three regions had average costs in excess of average revenues between 1996 and 1998.

Table 3-57. Average volume harvested for commodity purposes and average net revenue per thousand board feet harvested.

Region	Average volume commodity harvest (MMBF [a])	Average net revenue ($/MBF [b])
Northern (1)	248	-8
Rocky Mountain (2)	85	44
Southwestern (3)	12	-179
Intermountain (4)	126	7
Pacific Southwest (5)	130	21
Pacific Northwest (6)	320	77
Southern (8)	366	67
Eastern (9)	439	49
Alaska (10)	115	-178
Total	**1,841**	**29**

[a] Million board feet
[b] Thousand board feet

Under Alternative 1, the volume planned for offer in inventoried roadless areas would be part of the total land management planned program offer. The data on planned offer for inventoried roadless areas looks out into the next 5 years. The planned volume is likely to

be reduced because of further analysis of the planned sales location. Changes in planned offer can occur for various reasons, such change in land condition or as a need to mitigate for T&E species. Once the final volume to be offered is determined, bids are taken on the offered volume. Not all volume for sale is purchased. Therefore, the likely harvest volume from inventoried roadless areas would be less than the planned offer volume. The process for adjusting the planned offer volume is described in the following section.

Alternatives 2 through 4

Alternatives 2 through 4 limit the amount of timber volume that can be harvested from inventoried roadless areas. Forest-level data on planned offer from inventoried roadless areas for the next 5 years were the starting point for economic effects. Total planned offer for the 5-year period was converted to average annual offer volume, since actual timing of harvest can occur within the contract period, often 3 to 4 years.

As mentioned above, planned offer was adjusted to estimate a likely harvest from inventoried roadless areas. A 2-step process was used to adjust average annual planned offer volumes. First, an adjustment was made to account for differences between planned offer and actual offer. No data are available that directly address this difference. A comparison of offer targets to offer accomplishments by national forest was examined. One drawback of these data is that salvage volumes are included that inflate accomplishments, since salvage is not included in offer targets. Data comparing volume sold in inventoried roadless areas from 1993 to 1999 were also compared to future planned offer in inventoried roadless areas. The differences in volume ranged from 15% to 50%. Neither of these sources provided a clear basis for an adjustment. The planned offer was reduced by 30% to account for volume reductions between planned offer and volume offered for sale on all forests in the lower 48 States. On the Tongass National Forest, planned offer was reduced by 10%.

The second step addressed the difference between volume offered and volume sold. This adjustment was straightforward, based on the TSPIRS data for offer and sold volume between 1996 and 1999. The average percent difference between volume offered and volume sold was applied by national forest. The estimates of average annual harvest volumes based on the 2-step adjustment are in Table 3-58.

Nationally, average annual planned offer in inventoried roadless areas was 220 MMBF. The estimated average annual harvest volume after the adjustment is 147 MMBF. Under Alternative 2, only volume that requires road construction and reconstruction would be foregone. The estimated average annual harvest volume foregone under Alternative 2 is 108 MMBF per year. Alternative 3 results in a further reduction since only stewardship harvest that does not require roads could take place. An estimate of the percent of volume that would be offered for stewardship purposes was provided by the national forests. This percentage was applied to estimate an average annual harvest foregone of 126 MMBF under Alternative 3. Under Alternative 4, the entire 147 MMBF would be foregone.

The effects of the prohibitions are not evenly distributed across forests within Forest Service regions. Therefore, rather than apply the regional job and income coefficients

Table 3-58. Average annual harvest volume reductions, in million board feet, in inventoried roadless areas associated with national prohibitions.

Region	Road prohibition	Road prohibition and commodity harvest prohibition	Road prohibition and all timber harvest prohibition
Northern (1)	3.7	4.4	11.0
Rocky Mountain (2)	4.0	5.3	5.7
Southwestern (3)	0.2	0.3	0.4
Intermountain (4)	15.6	17.1	23.8
Pacific Southwest (5)	0.9	3.1	4.2
Pacific Northwest (6)	3.6	8.0	10.9
Southern (8)	2.2	3.3	3.8
Eastern (9)	5.2	8.3	10.3
Alaska (10)	72.8	76.6	76.6
Total [a]	**108.2**	**126.4**	**146.7**

[a] Totals may not be exact due to rounding.

used in calculating the baseline, a weighted average was estimated using forest-level impact coefficients from those forests planning to offer volume in inventoried roadless areas. Effects on regional jobs, income, and Payments to States under Alternatives 2 to 4 were estimated for each year using a volume-weighted average of forest-level coefficients. As of the printing of this FEIS, both the Senate and the House of Representatives have passed legislation that allows States to choose between 25% payments or a new payment formula based on historic payment levels. This legislation, if signed by the President, will diminish the economic impact of each of the action alternatives considered in this FEIS.

A national prohibition on road construction in inventoried roadless areas (Alternative 2) would affect about 607 direct jobs associated with timber harvest nationwide; about 1,054 total jobs would be affected nationwide (Table 3-59). Compared to Alternative 1, jobs and Payments to States would be about 2% less. The largest share of the impacts would occur in Region 10, while Region 4 would have the largest impacts in the lower 48 States.

Since 73% of the annual average harvest in inventoried roadless areas would be reduced by Alternative 2, the additional impacts associated with Alternatives 3 and 4 are relatively small. Compared to the baseline, job, income, and Payments to States decline by about 3%, as shown in Table 3-60 and Table 3-61. The impacts of the prohibitions are not evenly distributed across national forests within the regions. More detailed information about those forests most affected by prohibitions is provided in the Forest-dependent Communities section of this chapter.

For some Counties, decreases in Payments to States may be partially offset by an increase in payments in lieu of tax (PILT) payments. Other offsets are currently being made in

Table 3-59. Estimated average annual economic impacts from a national prohibition on road construction in inventoried roadless areas (1997 dollars), Alternative 2.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	3.7	35	100	$1,064	$2,991	$179
Rocky Mountain (2)	4.0	23	52	498	1,172	164
Southwestern (3)	.2	2	4	54	108	4
Intermountain (4)	15.6	96	162	5,497	9,235	570
Pacific Southwest (5)	0.9	6	10	321	505	49
Pacific Northwest (6)	3.6	32	51	957	1,513	185
Southern (8)	2.2	17	41	848	1,724	82
Eastern (9)	5.2	32	51	1,880	3,008	131
Alaska (10)	72.8	364	582	16,730	26,769	1,602
Total [c]	**108.2**	**607**	**1,054**	**$27,850**	**$47,025**	**$2,966**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

Table 3-60. Estimated average annual economic impacts from national prohibitions on road construction and commodity-purpose timber sales in inventoried roadless areas (1997 dollars), Alternative 3.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	4.4	41	117	$1,252	$3,520	$211
Rocky Mountain (2)	5.3	31	69	660	1,553	217
Southwestern (3)	.3	3	5	68	137	5
Intermountain (4)	17.1	105	178	6,029	10,128	625
Pacific Southwest (5)	3.1	22	34	1,107	1,739	170
Pacific Northwest (6)	8.0	70	112	2,095	3,312	405
Southern (8)	3.3	25	62	1,268	2,578	124
Eastern (9)	8.3	52	83	3,030	4,849	212
Alaska (10)	76.6	383	613	17,604	28,166	1,685
Total [c]	**126.3**	**730**	**1,273**	**$33,112**	**$55,982**	**$3,652**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

Regions 5 and 6 because of owl guarantee payments, although this supplement is scheduled to end after 2003.

Substitution Effects – The estimated economic impacts do not account for any potential substitute harvest from other ownerships or substitute job opportunities. The potential for substitute harvest can be estimated using United States harvest trends by region and

Table 3-61. Estimated average annual economic impacts from national prohibitions on road construction and all timber harvest in inventoried roadless areas (1997 dollars), Alternative 4.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	11.0	103	293	$3,131	$8,805	$527
Rocky Mountain (2)	5.7	33	74	707	1,664	233
Southwestern (3)	.4	3	6	82	165	6
Intermountain (4)	24.0	146	247	8,374	14,068	868
Pacific Southwest (5)	4.2	30	46	1,507	2,367	231
Pacific Northwest (6)	10.9	96	153	2,876	4,547	555
Southern (8)	3.8	29	72	1,474	2,997	144
Eastern (9)	10.3	64	103	3,768	6,029	263
Alaska (10)	76.6	383	613	17,604	28,166	1,685
Total [c]	**146.7**	**886**	**1,608**	**$39,523**	**$68,808**	**$4,512**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

ownership (Haynes and others 1995). The percent change in regional harvest by ownership between 1990 and 1995 is shown in Table 3-62. During this period, NFS harvest levels declined 41% nationally, while total United States harvest increased 1%. Increased harvest on other ownerships, particularly from non-industrial private lands, more than offset declines on NFS lands. The contribution of NFS harvest is extremely small in the Eastern United States, where private lands have always been the dominant source of wood fiber. In the Western United States, increased harvest on non-industrial private ownerships provided some substitute harvest to offset declines on all other ownerships. These data indicate there is some potential for substitution in those regions, although these opportunities probably occur primarily in Regions 1, 4, 5, and 6. Little substitute volume is likely to exist in Regions 2, 3, and 10.

To the extent that harvest substitution occurs, the jobs and income effects from reduced NFS harvest would be offset. In the absence of substitute harvest, it is difficult to provide substitute opportunities for direct and some types of indirect effects (particularly effects associated with purchases of supplies unique to wood product manufacturing). However, in a growing economy, there are opportunities for substituting induced job and income effects. Employment increased in all major sectors of the economy except mineral industries between 1992 and 1997 (USDC Bureau of the Census 2000).

The effects of the alternatives on net revenues of the timber sales program cannot be estimated with any certainty, since costs and revenues vary greatly between sales. However, the average historic net revenue of the commodity portion of the timber sales program should be indicative of whether future sales are likely to be below cost. The average net revenue for commodity-purpose timber sales was calculated for each of the national forests planning to offer volume from inventoried roadless areas. Applying the

Table 3-62. Percent change in timber harvest levels between 1990 and 1995 on all ownerships.

Region	Forest industry	Farmers and other private	National Forest	Other government	Total
Pacific Northwest (Regions 6 and10)	-8	22	-67	-45	-25
Pacific Southwest (Region 5)	-29	61	-62	-3	-30
Rocky Mountain (Regions 1-4)	-10	41	-46	-20	-15
Northern (Region 9)	26	-7	15	45	7
Southern (Region 8)	17	13	13	-15	13

(Haynes and others 1995)

average net revenue to the estimated commodity harvest volumes provides a rough estimate of the change in net revenues from the alternatives.

Using data from the affected forests, rather than regional averages, the net revenue associated with commodity harvest was estimated and summed by region. Negative figures shown in Table 3-63 identify regions where more timber sales are likely to be below cost in inventoried roadless areas. Commodity harvest in inventoried roadless areas in Regions 1, 4, 5, 8, and 9 under Alternative 2 (no commodity harvest that requires roads) are likely to be above cost and result in positive net revenues. These revenues would be foregone under Alternative 2. Implementation of Alternative 2 should reduce losses identified in the remaining regions. Under Alternatives 3 and 4 (no commodity harvest), positive net revenues would also be foregone in Region 6. The effects within an individual region vary widely by forest. In Region 6, the most “profitable” forests do not require roads for harvest. Therefore, prohibiting roads could eliminate some below-cost sales, while allowing some above-cost sales.

The negative net revenue in Region 10 partly reflects the large share of harvest volume in Region 10, but also reflects the high costs of preparing and administering sales and road construction in Alaska. Regions 2 and 3 had negative average net revenues between 1996 and 1998, and the portion of commodity harvest from inventoried roadless areas is likely to also have negative net revenues (Table 3-63). Since it is likely that preparing sales in inventoried roadless areas may have higher average costs than other sales, the actual net revenue may be even less than using historic averages.

The reductions in NFS harvest resulting from the prohibitions are not likely to affect timber prices. Therefore, none of the alternatives should affect consumers. Total United States wood consumption would likely be unaffected by the reduction in NFS volume. The total affected volume is less than 0.5% of total United States production. There would be opportunity to substitute timber from other ownerships to replace reduced volume in the Eastern United States. In the West, some substitution is also possible. Increased imports from Canada are also a likely result of reduced harvest on NFS lands.

Table 3-63. Estimated net revenue associated with reduced commodity harvest in inventoried roadless areas (1997 dollars).

Region	Reduction in commodity harvest volume from Alternative 2 (MMBF [a])	Net revenue associated with commodity harvest volume (dollars)	Reduction in commodity harvest volume from Alternatives 3 and 4 (MMBF [a])	Net revenue associated with commodity harvest volume (dollars)
Northern (1)	0.1	211	0.5	-14,995
Rocky Mountain (2)	3.4	-122,177	4.7	-82,741
Southwestern (3)	0.1	-39,802	0.2	-68,613
Intermountain (4)	4.0	24,092	5.7	70,519
Pacific Southwest (5)	0.5	36,842	2.7	116,898
Pacific Northwest (6)	1.3	-157,928	4.3	388,057
Southern (8)	1.6	113,911	2.6	179,017
Eastern (9)	3.0	32,402	6.5	237,903
Alaska (10)	72.8	-12,958,400	76.6	-13,634,800
Total	**86.7**	**-12,808,755**	**103.9**	**-13,067,851**

[a] Million board feet

Long-term Effects – The effects described for the alternatives are based on planned volume for the next 5 years. Long-run effects are projected in the Timber Harvest section under Human Uses of this chapter. The potential range of impacts on harvest volume, jobs, income, and Payments to States at the national level are shown in Table 3-64. The range of effects estimated for the long run encompasses the 5-year effects described for the alternatives.

Table 3-64. Estimated annual effects of harvest reductions in inventoried roadless areas on jobs, income, and Payments to States over the long-term.

	Road prohibition, Alternative 2	Road and commodity harvest prohibition, Alternative 3	Road and timber harvest prohibition, Alternative 4
Reduction in harvest volume (MMBF[a])	95 -118	118 -147	130 -162
Number of direct jobs	570 -708	708 -882	780 - 972
Number of total jobs	950 -1,180	1,180 -1,470	1,430 -1,782
Direct income (millions)	$24.5 - $30.4	$31.0 - $38.7	$35.1 - $43.7
Total income (millions)	$41.4 - $51.4	$52.5 - $65.4	$61.2 - $76.3
Payments to States (millions)	$2.7 - $3.4	$3.7 - $4.6	$3.8 - $5.2

[a] Million board feet

The projected effects are based on current technology and economic conditions. As the last 2 decades have shown, the timber industry will continue to change. Timber prices, technology, trade policy, and other economic factors are likely to change in the future. However, these changes will not change the relative differences between alternatives.

Effects on Other Ownerships and International Effects – A number of comments raised a concern about the economic and environmental effects of the roadless proposal on other ownerships in the United States. Some respondents believe that increased harvest on State and private lands will have negative environmental effects because Federal lands have stricter environmental standards. Two main concerns were raised relative to global economic and environmental effects. One was the potential to increase U. S. dependence on foreign wood products, with a resulting increase in trade deficits and loss of domestic jobs. The second concern addressed the environmental consequences of increasing timber harvest in other countries that may have less stringent environmental regulations.

The reduction in timber harvest on NFS lands in the past decade resulted in increased harvest on other ownerships in the United States and increased imports, primarily from Canada. Most of the NFS harvest reductions occurred in the Pacific Northwest. The market responses to the reduced supply of timber were an increase in regional prices, a high degree of competition that eliminated a number of marginally profitable facilities, reduced regional production of lumber and pulp, and reduction in logs exported. While production in the Pacific Northwest declined, tighter supplies and higher prices provided incentives to other suppliers to increase harvests. Substitute harvest came from private timberlands in the South (primarily non-industrial private forest land), and increased imports from Canada (Sedjo and others 1999).

Harvest from NFS lands is substantially reduced from the late 1980s and early 1990s and now plays a much smaller role in timber markets. The alternatives examined in this section would affect from 3% to 4% of total NFS harvest and less than 0.5% of national timber supply. The reductions in roadless area harvest would transfer some harvest effects to other ownerships, but these effects will be small and difficult to isolate from the expected trends in the supplies from other ownerships contributing to total United States production. For example, much of the future United States production of softwood sawtimber is expected to come from plantations in the South.

The environmental effects of timber harvest on private and other public lands in the United States will vary depending on State forest practice acts and implementation of requirements established by laws such as the Clean Water and Endangered Species Acts. These controls along with market incentives such as certification for sustainable forestry management have done much to improve forest and range management practices to minimize negative ecological effects.

The United States is the largest producer and consumer of sawnwood, wood-based panels, and wood pulp for paper and paperboard. The United States is a major importer of softwood lumber, but also is a significant exporter of logs, sawnwood, and woodpulp for paper. Except for hardwood plywood from Southeast Asia, much of the import volume over the years has come from Canada. Although imports from other countries have

increased, Canada remains the dominant supplier to the United States and supplies more than 95% of the softwood sawtimber (Martin and Darr 1997).

Softwood sawtimber imports from Canada increased through the early 1990s, but have stabilized between 35 and 36% of the total United States softwood lumber market since 1996. Most of these imports are from British Columbia, although an increasing share is coming from Quebec.

The harvest effects of the alternatives would have little effect on total imports. The largest total harvest effect (147 MMBF annually) is less than 1% of average softwood lumber imports in the last 4 years. Therefore, the economic impacts of the roadless proposal on global forest production are negligible.

Other countries are willing to supply wood products to the United States and other nations. The environmental oversight on harvest in other countries varies dramatically. British Columbia and Quebec, the main suppliers of United States imports, have environmental regulations governing harvest. It is possible that increasing concerns over old-growth harvest in Canada will change production and imports from this country in the future. Other suppliers, such as New Zealand and Chile, provide supplies from intensively managed plantations.

Social Effects of the Alternatives – The social effects that may result from any reduced employment opportunities for timber workers associated with the action alternatives are expected to be variable. These effects would be experienced differently by individuals and communities, depending upon their circumstances. For example, a person's ability to adapt to job loss is profoundly influenced by such things as family and community (Carroll and others 2000a). This section provides a range of potential social effects that could be felt by timber-related workers. Actual effects will vary across the country, depending upon the differential localized impacts of the rule, and the people affected.

The majority of research that is available regarding the effects of job loss on timber industry workers comes from the Northwestern United States. According to this research, job loss in the timber and other natural resource-based industries is not just an economic issue; it also raises issues relating to professional and social identity, place attachment, and the rural way of life (Carroll and others 2000a; Kusel 1996). These variables affect the decisions of displaced workers regarding whether they will choose to stay in the same place following job loss and look for another job, or whether they will move elsewhere in search of a similar job (Carroll and others 2000a).

Forest products-related workers, and particularly loggers, have been found to maintain a strong sense of professional and social identity that revolves around being a logger, working hard and being productive, and living and working in their preferred rural setting (Carroll 1995; Carroll and Lee 1990). Their social networks are based in the logging community, and they participate in a common logging culture. For some, logging is a way of life that has been passed down from generation to generation (Carroll 1995; Carroll and Lee 1990; USDA Forest Service and others 1993). Though individuals may

commonly change jobs, they remain in the same occupation over the long-term (Carroll 1995; Carroll and Lee 1990).

For timber workers, the loss of timber jobs might not only mean the loss of a good source of income; it could also mean the loss of a way of life and a sense of individual and cultural identity. Similar people in other occupations whose identities are strongly tied to their jobs, many timber workers also identify with their jobs, enjoy their work, regard its product as useful to society, and appreciate the associated lifestyle. Therefore, taking on other work and adapting to other occupations may not be a simple substitution. It may be resisted, because it disrupts not only their work life, but also their lifestyle, culture, and social interactions. Job loss in any profession can often lead to reduced economic opportunities, psychological stress, domestic strain, and changed quality of life. These problems can be compounded if workers have to move away from the rural communities that are home to them, in search of new job opportunities.

The effects of job loss on people whose sense of identity is not strongly tied to their jobs may not be as extreme. For example, research from the Pacific Northwest indicates that in general, mill workers identify as much with organized labor as with sawmill work (Carroll 1995; USDA Forest Service and others 1993). They do not wish to lose their jobs any more than loggers do; however, they expressed a greater willingness to accept equivalent employment in another sector, if available. Mill workers were found to be more concerned about having to relocate, particularly to urban areas, than about switching occupations (Carroll 1995; USDA Forest Service and others 1993).

Two studies, one from northeastern California, and one from northern Idaho, examine the effects of job loss on logging-related employees that occurred as a result of industrial restructuring and consequent layoffs of timber company employees (Kusel and others 2000; Carroll and others 2000b). Most displaced workers found new logging-related jobs in the same communities, often working for independent contractors, within a few months. Some workers found new jobs locally that were unrelated to logging, but that utilized their existing skills. Retraining for a new job requiring new skills was chosen by only a small number of displaced workers. A small number of older workers chose or were forced to retire. Few, if any, displaced workers moved out of the study areas. They wanted to maintain a rural way of life, and they were attached to their local communities and social networks (Kusel and others 2000; Carroll and others 2000b).

However, most workers experienced reduced income levels, which increased the financial burden on other family members. They also experienced reduced benefits and job security. Some had to work longer hours. Many were dissatisfied with their new jobs. Negative emotional and psychological impacts were noted. No positive effects of adaptation to job loss were reported by these authors (Kusel and others 2000; Carroll and others 2000b).

While job loss in the two cases cited above was caused by company restructuring to remain economically competitive, and not by reductions in timber harvest levels from public lands, it is reasonable to expect some of these same social effects from the latter. Most of the timber workers in these studies were able to find new jobs in the same occupation relatively quickly by working for independent contractors. The effects could

be more severe where job loss is related to reductions in timber harvest from public lands, without increasing the harvest from nearby private lands to maintain local timber-related employment. In the case of harvest reductions from public lands, the impacts of job loss can be expected to be greater on people who work for small timber companies that do not own land, than on people who work for large companies that own their own land and can more easily compensate (Carroll 1995).

In some places, opportunities to find work in the woods are disappearing (Carroll and Lee 1990). Oregon is a State that is undergoing a structural shift in its economy, with permanent reductions in timber employment (Daniels and others 2000). Research on reemployment programs for dislocated timber workers in Oregon found that some displaced timber workers undergoing retraining were experiencing difficulty adjusting to the dislocation, while others had made successful job transitions and were prospering (Daniels and others 2000).

For many people, as described above, timber-related work represents a long-term occupation. However, this is not the situation for all people who work in the woods. One study found that in 1991, the **median** tenure of employment in the wood products industry was 5.3 years (Power 1996). According to this author, the greatest hardship of job loss for these shorter-term workers is the challenge of finding equivalent paying jobs without obtaining additional education or training, which is not always feasible.

Several studies cite the instability of timber communities, due to the migratory nature of the industry (Carroll 1995; Kaufman and Kaufman 1990; Drielsma and others 1990; Krannich and Luloff 1991). Because timber jobs migrate in response to the expansion and contraction of the industry in local areas, so do some of the workers. Significant effects of job loss on these workers may include the stress of migration and relocation, disruption of social networks and sense of community, and the stress of reintegration into new communities.

Regardless of the level of personal investment in the timber industry individuals employed there may have, all can be expected to experience the negative psychological effects of uncertainty regarding forest management on NFS lands, and how it will affect their lives and livelihoods (USDA Forest Service and others 1993).

Energy and Non-energy Minerals

Affected Environment

Many different mineral commodities are produced from NFS lands. Production levels for some of those commodities are shown in Table 3-65. Other mineral outputs from NFS lands include crushed stone, sand and gravel, dimension stone, perlite, pumice, quartz crystals, molybdenum, helium, sulfur, carbon dioxide, and geothermal energy.

Output from NFS lands accounts for a large share of total United States mine production for some commodities. For example, the Stillwater Mine on the Custer National Forest is the only United States mine producing platinum and palladium as primary products. In

Table 3-65. Production of selected minerals from National Forest System lands in 1999.

Precious metals (troy ounces)	
Gold	558,238
Silver	9,787,684
Platinum	95,000
Palladium	315,000
Base metals (short tons)	
Copper	105,935
Lead	319,869
Zinc	147,713
Energy minerals	
Oil (million barrels)	8.5
Natural Gas (billion cubic feet)	76.4
Coal (million short tons)	69.4
Industrial minerals (short tons)	
Limestone	1,388,962
Mica	135,585
Phosphate	4,852,617

(USDA Forest Service 1999t; U.S. Securities and Exchange Commission 2000))

addition, the Riley Ridge area on the Bridger-Teton National Forest provides a significant portion of the country's helium. (The helium is extracted from helium-rich natural gas.) Even where the NFS' share of total United States supplies is small, NFS production can be very important to local markets. In some areas, the only sources of sand and gravel or crushed stone within a reasonable shipping distance may be on NFS lands. Figure 3-32 shows the percentage of United States mine production coming from NFS lands for selected commodities.

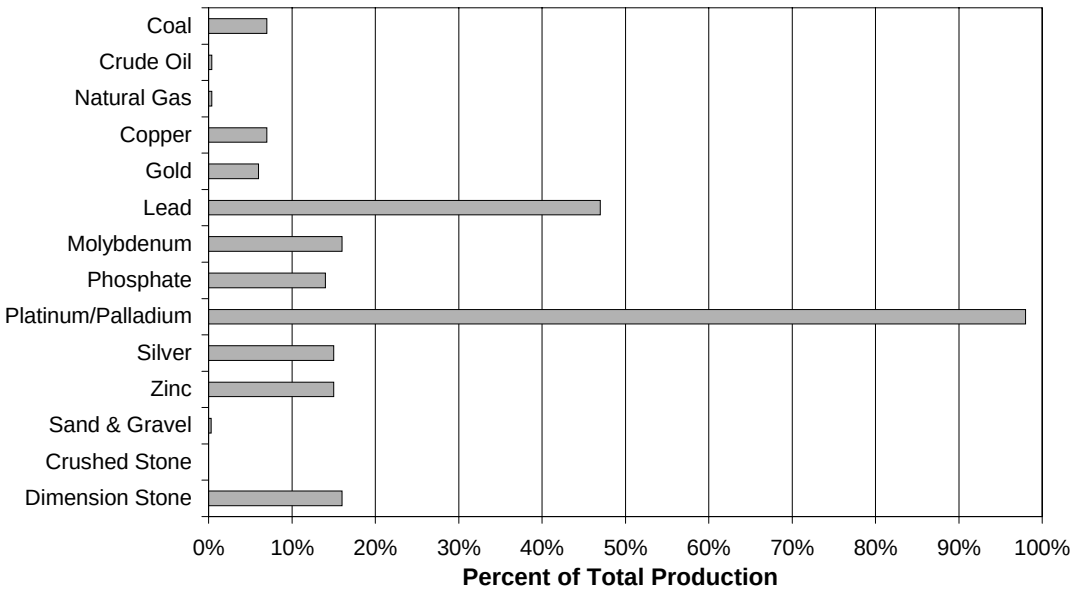


Figure 3-32. Forest Service mineral production as a percentage of total United States production, 1998.

(USDI Geological Survey 2000; USDA Forest Service 1999w; USDA Forest Service 1998d; U.S. Department of Energy 1999; U.S. Securities and Exchange Commission 2000)

An input-output model called IMPLAN was used to estimate the number of jobs and the amount of income attributable to mineral production on NFS lands in fiscal year 1999 (Table 3-66). Total economic impacts generated from the IMPLAN analysis are the aggregation of three types of effects. The direct impacts are the effects on the initial sector (e.g., mining) experiencing a change in output. Indirect effects are the impacts on those industries that provide goods and services to the initial sector, and induced impacts are the effects associated with the expenditure of new household income generated by the direct and indirect effects of the output changes.

Mineral activities on NFS lands generated about $104 million in receipts to the United States Treasury in 1999 (Table 3-67), most of which is attributable to royalty payments on leasable mineral production. A portion of the United States Treasury receipts is returned to States and Counties to be used for schools and roads. States receive 50% of leasable receipts on public domain lands, except in Alaska, where the State receives 90%. This same 50% share applies when the surface is managed as national grassland, but the mineral estate is determined to be public domain. On acquired lands of the national forests, States receive 25% of receipts with the requirement that the funds be used for the benefit of the Counties where the national forest is located. Where the mineral estate underlying national grassland is acquired, 25% of leasable receipts are returned to the Counties in which the grassland is located. States also receive 25% of receipts from salable minerals, and those funds are passed down to the Counties in which NFS lands are located.

Despite higher interest in some commodities (e.g., coal bed methane), the total number of energy and non-energy operations processed by the Forest Service declined about 24% from 1997 to 1999.

The Energy Information Administration (EIA) forecasts that coal and natural gas production in the United States will rise steadily through 2020, while the downward trend in domestic crude oil output is not expected to be reversed until 2010 (United States Department of Energy 1999). Activity levels on NFS lands should correlate fairly well with EIA's forecasts. As mentioned previously, coal bed methane is currently attracting a lot of exploration attention. NFS lands where coal and natural gas production are the dominant energy activities are likely to fare better from an economic standpoint (i.e., jobs, income, Payments to States and Counties) than those where the emphasis is on crude oil. Industry interest in phosphate also remains high.

Demand for phosphate in the United States has steadily increased since the early 1960s, primarily because of demand for phosphate fertilizer. World demand is expected to continue to grow in the future, although at a slightly slower rate since environmental concerns are reducing fertilizer application rates. The majority of phosphate production occurs in the eastern United States, but production in the Western United States has increased, and it is expected to make up an increasing share of total production in the future (Jasinski 1999).

In 1999, a decline in fertilizer demand in the East and Midwest resulted in a reduction of phosphate rock production in the eastern United States. Several mines and fertilizer

Table 3-66. Employment and labor income attributable to mineral production from National Forest System lands in fiscal year 1999.

Sector	Number direct jobs	Number total jobs	Labor income Direct (millions)	Labor income Total (millions)
Agriculture	0	681	$0.0	$12.3
Mining	5,902	9,139	374.5	594.4
Construction	0	1,126	0.0	39.5
Manufacturing	2,619	5,999	241.9	411.9
Transportation, communications, public utilities	0	1,904	0.0	96.3
Trade	0	7,574	0.0	185.2
Finance, insurance, real estate	0	2,590	0.0	93.6
Services	0	10,980	0.0	337.1
Government	0	434	0.0	23.9
Total	**8,521**	**40,427**	**$616.4**	**$1,794.2**

(IMPLAN 2000)

Table 3-67. Fiscal year 1999 United States Treasury receipts and Payments to States/Counties from mineral activities on National Forest System lands.

Region	Total receipts (millions)	Payments to States/Counties (millions)
Northern (1)	$8.8	$2.7
Rocky Mountain (2)	34.2	16.1
Southwestern (3)	6.0	2.6
Intermountain (4)	40.0	20.0
Pacific Southwest (5)	2.4	1.1
Pacific Northwest (6)	0.1	0.0
Southern (8)	6.4	1.7
Eastern (9)	6.4	1.8
Alaska (10)	0.1	0.0
Total	**$104.4**	**$45.9**

(USDA Forest Service 1999q; USDA Forest Service 1999k)

production plants closed as a result. Western producers were largely unaffected, because their products are sold regionally. The short-term outlook for the domestic phosphate industry is for a lower than average production of phosphate rock in the East, although eastern production will continue to account for more than 80% of total production (Jasinski 1999).

The majority of Western phosphate production occurs on the Caribou National Forest, accounting for about 12% of national production. Southeastern Idaho has extensive

phosphate reserves. In 1999, about $2.2 million was paid to the State of Idaho as their share of royalty payments on NFS phosphate leases.

United States coal production steadily increased from the early 1960s through most of the 1990s. While production has increased, increases in worker productivity reduced direct employment by nearly half between 1986 and 1997. The number of operating mines has also decreased, but average production per mine has increased. Coal prices have declined through the 1990s, and they are expected to continue to decline in the near future, which will continue to limit investment in exploration and new development. Although the United States has extensive coal reserves, lack of investment in development of new reserves could result in a shortage of coal in the next 20 to 30 years, as existing reserves are depleted (Bonskwoski 1999).

In the short-term, there will be continued interest in coal development. Production is expected to increase in the Western United States, especially in the Powder River Basin where low-sulfur coal can be surface mined at relatively low cost (Bonskowski 1999). Western coal reserves are primarily found in Federal ownership. Federal coal production is concentrated in Colorado, Montana, Utah, and Wyoming, with smaller amounts of production in Alabama, Kentucky, New Mexico, North Dakota, Oklahoma, and Washington.

The United States has considerable reserves of oil and gas. Despite recent price increases for crude oil, total United States production of crude oil is expected to continue to decline through 2010. Increased prices for natural gas are expected to lead to increases in production of natural gas (U.S. Department of Energy 1999). Federal leases are an important source of oil and gas, but most of the production is from offshore leases. Production from NFS lands accounts for 0.4% of total United States oil and gas production.

Prices for some metals (copper, gold) have declined in the past few years, providing less of a financial incentive for firms to explore for and develop those commodities. The continuing low prices have resulted in the shutdown of a number of mines or a reduction in production levels. In addition, lengthy processing times, increasing environmental mitigation and permitting costs, less public acceptance of resource extraction activities, and delays caused by appeals and lawsuits are often seen as a disincentive to explore and develop on Federal lands.

Public comments on mining were diverse (Content Analysis Enterprise Team 2000b). Some people believe that mining should be prohibited in inventoried roadless areas because they think it has a negative impact on human health and the environment. Some noted that the Federal government should be promoting alternative sources of energy.

Other people believe roadless areas contain valuable mineral resources that should continue to be available for development. Concern was raised about the potential economic impact to mining-dependent communities, and increasing dependency on foreign sources of supply. Others expressed concern that the proposed rule would not

protect access to existing claims. Some believe that banning mining in roadless areas would be contrary to existing laws.

Alternative 1 – No Action

Under the No Action Alternative, land management plans, and other lease, license, permit, or sales decisions would be implemented and mineral operations would be approved under existing authorities. Mineral activity on NFS lands will continue to depend upon such factors as market conditions, environmental regulations, tax policies, technological advances, and mineral potential.

Within the next 5 years, several new metal mines on NFS lands should begin producing, and some existing metal mines will expand their output. Thus, the amount of copper, gold, silver, platinum, and palladium produced from NFS lands should increase over current levels. Over the long term, however, the overall interest in exploring for and developing metal deposits domestically is likely to continue to decline unless prices for certain commodities increase substantially and mining companies perceive a significant improvement in the regulatory and policy framework. Eventually, the lack of exploration activity will result in a drop in metals production and associated decreases in jobs and income.

Phosphate mining is expected to continue to expand on NFS lands in southeastern Idaho. Operators of current mines all have plans to expand existing operations. These operators also own processing facilities for production of either phosphate fertilizer products or elemental phosphorus production. Current production levels should be maintained or possibly increase in the near future.

In 1998, coal production from Federal leases on NFS land accounted for almost 7% of total national production, and about 22% of production from Federal leases (USDA Forest Service 1999o and USDI 1998). Based on planned projects in the next 5 years, there is industry interest in expanding current operations in Colorado and Utah to replace reserves as they become depleted. With continuing declines in coal prices, the long-term outlook is more difficult to predict. Although production is expected to increase, productivity increases are still expected to result in further reductions in direct jobs associated with coal mining (United States Department of Energy 1999).

Interest in natural gas development may increase on NFS lands in response to increasing prices and increasing demands. Although much of the increased development is expected to be offshore, a number of national forests and grasslands either have current leases, or have applications for permits to explore for natural gas. Therefore, increased activity in this area is likely. Increased activity for crude oil is not expected, given the outlook for crude oil.

Alternatives 2 through 4

The economic effects focus on how the alternatives affect future exploration and development of energy and non-energy minerals. The effects would be similar under

Alternatives 2 through 4. The Minerals and Geology section of this chapter provides an analysis of the general effects of the alternatives on locatable, leasable, and salable minerals. For locatable minerals, the construction and reconstruction of roads reasonable and necessary for exploration and development would be allowed under the General Mining Law of 1872.

The alternatives would not affect road construction and reconstruction providing access to and development within existing lease boundaries, but the prohibitions would likely prevent expansion of existing lease areas into adjacent inventoried roadless areas except in situations where development can be done without road construction. In many cases, such expansion is more economically advantageous to the operator than developing new deposits. In addition, expansion could result in less environmental damage than beginning new development outside of inventoried roadless areas, if leasable deposits are available.

Where reserves of leasables are known to occur in inventoried roadless areas, the alternatives are likely to preclude future development. In some situations, mineral deposits can be developed under a lease with no surface occupancy stipulations. The economic effects of precluding development depend on the availability of alternate resources in areas that may be available for leasing (either on NFS lands or on other ownerships). Since mineral deposits tend to be concentrated in some geographic areas, it is likely that impacts would also be concentrated in a few areas. The immediate economic effects of the prohibitions are associated with current proposals to expand existing leases into adjacent inventoried roadless areas for phosphate and coal mining.

Phosphate mining on the NFS currently occurs only on the Caribou National Forest in southeastern Idaho. There are eight Known Phosphate Lease Areas[20] in southeastern Idaho, totaling more than 81,000 acres. About 48% of those acres are on NFS lands administered by the Caribou National Forest Land and Resource Management Plan. Almost 60% of the Known Phosphate Lease Areas lands on the Caribou National Forest are currently leased, with 26% of the leased acres within inventoried roadless areas. However, these areas include leases on areas that have already been developed and that contain no more minable phosphate rock.

Three mines are currently operating on the Caribou National Forest, with a fourth operation scheduled to begin soon. One of the mines is currently operating partially within an inventoried roadless area, and accounts for about half of the phosphate rock production in Idaho. Future production at this site depends on Interior Board of Land Appeals decision on a lease that was issued within an inventoried roadless area, and on approval of an expansion into a contiguous area that is not within an inventoried roadless area. The lease appeal is not related to the lease being within an inventoried roadless area. If production is allowed to go forward at either or both sites, then no short-term effects are expected related to phosphate mining on the Caribou.

[20]A Known Phosphate Lease Area is land known to contain phosphate deposits and is classified by the USGS as subject to competitive leasing.

If production is not allowed to go forward at either site, then production will be interrupted. The operator would not have sufficient time to do the required permitting and construction necessary to develop substitute reserves before reserves at the existing operation are depleted. Other mine operators in southeast Idaho are not likely to have sufficient excess capacity to provide substitute production in the short-term. The potential interruption in supply is not related to the possible imposition of a road prohibition, but a road prohibition could constrain future options for developing substitute reserves. Therefore, the economic impacts of interrupting the production of 3 millions tons of phosphate rock per year (estimated current production level) were estimated to illustrate the level of impacts that could occur if the road prohibition precludes development of reserves within inventoried roadless areas (Table 3-68). An interruption in supply would also affect jobs at the production facility that is owned by the mine operator, but those impacts are not included in the table.

Over the long term, phosphate leasing potential on NFS and non-NFS lands outside of inventoried roadless areas is generally limited to small areas that are contiguous to existing leases or deposits with a low development potential. More than 1,000 acres in the Caribou have been formally applied for through Lease Modifications, Exploration Licenses, and Prospecting Permits. Most of the applications would be significantly affected by road prohibitions.

The short-term effects for coal mining are linked to expanding existing mines into inventoried roadless areas. On the Grand Mesa, Uncompahgre, and Gunnison National Forest, one coal-mine operator is interested in expansion into surrounding inventoried roadless areas. Although the mine is an underground operation, expansion may require road access for exploration and development drilling, and construction of ventilation shafts. The mine currently produces about 7 million tons per year (not entirely from NFS leases). The operator will need access to new reserves to maintain production levels in 4 to 5 years. If production cannot be expanded into inventoried roadless areas, the mine could close when current reserves are exhausted. The potential effects on jobs and labor income of reducing production by 7 million tons per year are shown in Table 3-68. The impacts of a closure would be concentrated in the local communities where the workers reside (see Forest-dependent Communities section of this chapter). If substitute coal development occurs within the same geographic area, then these effects could be offset.

The Manti-LaSal National Forest has identified three potential coal tracts with proven reserves that are partially within inventoried roadless areas. Even though these tracts would be mined underground, road access is often needed for pre-lease exploration drilling in order for interested bidders to gather sufficient information for bidding. Bonus bids are likely to be reduced if the tracts are offered for lease, since bidders will not have complete information about the deposits, and will be uncertain about access to portions of the reserves. Recent bonus bids for two major leases on the forest were $16.9 and $25.2 million, for lease tracts with estimated recoverable reserves of between 60 and 63 million tons of coal. A reduction in bonus bids reduces returns to the United States Treasury, and the share of receipts to the States. Two of the potential tracts on the Manti-LaSal have relatively small recoverable reserves, but the third tract has an estimated 135 million tons of recoverable reserves, of which 50 million tons are within inventoried roadless areas.

None of the tracts have been offered for lease to date. It is difficult to predict possible bonus bids, and likely future production levels.

There is interest in new natural gas development on several forests, and continuation of oil and gas leasing in other areas. Although oil and gas production on NFS lands is a minor portion of national production, it is an important source of economic activity in some communities. For example, the Little Missouri National Grasslands in North Dakota accounted for about half of total NFS production in 1999. The prohibition on road construction and reconstruction will have no effects on current leases, and therefore no short-term economic impacts are expected. If road prohibitions are implemented when leases expire, there is little likelihood that future exploration and development could occur. However, oil and gas can sometimes be produced under a lease with a no surface occupancy stipulation using technologies such as directional drilling. A number of other forests have identified areas of high oil and gas potential within inventoried roadless areas (see the Minerals and Geology section of this chapter).

Table 3-68. Annual economic impacts of prohibitions on road construction and reconstruction in inventoried roadless areas for selected mineral commodities and national forests.

Commodity	National Forest	Labor income (millions) [b]		Employment (number of jobs)		Payments to States [a] (millions) [b]
		Direct	Total	Direct	Total	
Coal	Grand Mesa, Uncompahgre, and Gunnison	$25.8	$89.3	361	2119	$2.1
Phosphate	Caribou	10.4	38.5	185	976	1.3
Total		**$35.8**	**$127.8**	**546**	**3095**	**$3.4**

[a] Payments to States estimates are based on 1999 prices for coal and phosphate.
[b] 1999 dollars.

For salable minerals, the prohibition on road construction and reconstruction would reduce the demand for mineral materials (e.g., crushed stone) used in building roads on NFS lands. The most likely reason for developing salable deposits in inventoried roadless areas for NFS administrative use is in support of road construction in nearby areas and road maintenance in those areas. In the absence of road construction activities, development of these areas is unlikely for Agency use. However, there could be impacts on State and local governments and on commercial businesses that would propose development of such sites, even though transportation costs could be substantial. These effects should be highly localized, primarily in areas where substitute deposits are scarce on NFS lands outside of inventoried roadless areas or non-NFS lands.

For both locatable and leasable minerals, there may also be impacts associated with potential increases in the costs of permitting and environmental mitigation of activities within inventoried roadless areas. This could affect future exploration and development for leasable and locatable minerals. Most proposed activities, particularly if they are proposed within an inventoried roadless area, are already subject to intense scrutiny through preparation of environmental impact statements. However, it is possible that in

some cases, the requirements for environmental analysis may increase, mitigation requirements may increase, and the processing time may increase.

Over the long term, higher costs and longer processing times might cause some portion of the mineral resources in inventoried roadless areas to become uneconomic. If that occurred, the level of development would be reduced, resulting in fewer mining-related jobs, less income, and a reduction in United States Treasury receipts and Payments to States and Counties. There is not enough information available, however, to quantitatively estimate the degree to which jobs, income, and revenue would be reduced by increased costs.

USGS has conducted assessments of undiscovered deposits of numerous mineral resources. Based on knowledge of the geologic environment and a comparison with known deposits having similar geologic attributes, the USGS has estimated the amount of undiscovered mineral resources for areas that seem conducive to the existence of such deposit types. These areas are referred to as permissive tracts for metallic minerals and as provinces for oil and gas resources. The estimates were provided in the form of probability distributions, which describe the likelihood of existence of varying amounts of mineral resources in the tract or province.

The USGS maps of undiscovered resources were overlaid with the location of inventoried roadless areas. Permissive tracts and provinces that did not contain inventoried roadless areas were eliminated. Table 3-69 to Table 3-71 contain the results of the comparisons for gold, silver, copper, lead, zinc, oil, and natural gas. In Table 3-69 and Table 3-70 the quantity and value of undiscovered resources are shown at the 50th percentile, which means there is an equal chance that the actual quantity is higher or lower. The mean (or average) estimate of the quantity and value of oil and gas that could be extracted with current technology is shown in Table 3-71.

The data in Table 3-70 and Table 3-71 indicate that there are potentially valuable mineral deposits within these permissive tracts and provinces. The probability of these deposits occurring within inventoried roadless area is unknown. In most cases, inventoried roadless areas account for a small portion of the area within the permissive tract or province. This is particularly true in the East, where NFS lands account for a small portion of total land area, and inventoried roadless areas are a small percentage of total NFS lands. In addition, oil and gas resources in the Gulf Coast include offshore resources. The likelihood of deposits occurring within inventoried roadless areas is higher in the Intermountain West, where many areas of inventoried roadless areas are located, and where most of existing mining activity occurs on NFS lands.

Market conditions play an important role in determining the level of exploration and development interest for a particular mineral commodity, and prices for some commodities would have to increase significantly over current levels to generate much interest in exploration and development. If operators face higher costs in inventoried roadless areas, Alternatives 2 through 4 would reduce the investment attractiveness of conducting activities in inventoried roadless areas and cause some portion of the mineral resources to go undeveloped. The amount of the resources that would be affected and the

Table 3-69. Estimates at the 50th percentile of undiscovered resources of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas (metric tons). [a]

Region	States	Gold	Silver	Copper	Lead	Zinc
Colorado Plateau	AZ, CO, NM, UT	0	0	0	0	0
Central/Southern Rocky Mountains	CO, NM, TX, WY	619	4,853	4,468,980	832,000	919,000
East-Central U.S.	AL, GA, IL, IN, KY, MD, MI, MS, NC, NJ, NY, OH, PA, TN, VA, WV	0	910	0	4,450,000	36,200,000
Great Basin	AZ, CA, ID, NV, OR, UT	1,891	52,991	16,937,217	4,800,500	6,700,900
Great Plains	AR, IA, IL, IN, KS, KY, MI, MO, NE, NM, OH, OK, TN, TX, WI	0	440	9,400,000	1,900,000	10,000,000
Lake Superior	IA, KS, MI, MN, MO, ND, NE, SD, WI	488	13,003	25,600,000	570,000	10,000,000
Northern Appalachian Mountains	CT, MA, ME, NH NY, VT	20	1,636	840,000	383,000	2,946,000
Northern Rocky Mountains	ID, MT, SD, WA WY	550	34,968	13,490,800	2,170,100	3,865,000
Pacific Coast	CA, ID, NV, OR, WA	389	5,612	6,855,030	67,100	516,900
Southern Appalachian Mountains	GA, NC, TN, VA	12	430	910,000	0	250,000
Southern Basin and Range	AZ, CA, NM	715	27,193	63,664,000	3,228,000	3,703,000
Total		**4,684**	**142,036**	**142,166,027**	**18,400,700**	**74,570,800**

[a] The above numbers refer to overall resources in permissive tracts that contain roadless areas, not in the roadless areas themselves. As explained in the text, resources actually located inside roadless areas are likely to be an insignificant portion of total resources.
(USDI Geological Survey 1996b)

Table 3-70. Estimates at the 50th percentile of the number of undiscovered deposits and the value of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas. [a]

Region	Number of deposits	1998 Gross value of contained metal (billion dollars)				
		Gold	Silver	Copper	Lead	Zinc
Colorado Plateau	0	$0	$0	$0	$0	$0
Central/Southern Rocky Mountains	27	5.9	0.9	7.4	0.8	0.9
East-Central United States	9	0	0.2	0	4.4	35.9
Great Basin	120	17.9	9.4	28.0	4.8	6.1
Great Plains	6	0	0.1	15.5	1.9	9.9
Lake Superior	100	4.6	2.3	42.3	0.6	9.9
Northern Appalachian Mountains	1	0.2	0.3	1.4	0.4	2.9
Northern Rocky Mountains	51	5.2	6.2	22.3	2.2	3.8
Pacific Coast	52	3.7	1.0	11.3	0.1	0.5
Southern Appalachian Mountains	6	0.1	0.1	1.5	0	0.2
Southern Basin and Range	85	6.8	4.8	105.3	3.2	3.7
Total	**467**	**$44.5**	**$25.3**	**$235.1**	**$18.3**	**$74.0**

[a] The probability of these deposits occurring in inventoried roadless areas is unknown. In most cases, inventoried roadless areas account for a small portion of the area within the permissive tract.
(USDI Geological Survey 1996b)

magnitude of the related economic impacts would depend, in part, upon the availability of alternative investment opportunities.

Table 3-71 indicates that there may be as much as 20.80 billion barrels of technically recoverable oil resources in provinces containing some national forest inventoried roadless areas. However, while the amount of such deposits actually beneath inventoried roadless areas has not been estimated, the Agency believes it is unlikely to be more than an insignificant percentage of this amount for the following reasons. First, the table refers to technically recoverable – not economically recoverable – oil and gas deposits. Second, about one third of the 20.80 billion barrels is located in the Gulf Coast, Mid-continent, and Eastern regions where there are only a few widely scattered inventoried roadless areas. Third, the vast majority of inventoried roadless areas have been open to leasing for decades; thus, areas with economically recoverable deposits are likely to have already been leased, and existing leases are not subject to the prohibition alternatives. Moreover, total oil and gas production from the all NFS lands is currently about 0.4% of the current national production.

Table 3-71. Mean estimates of undiscovered technically recoverable conventional resources of crude oil and natural gas for provinces containing inventoried roadless areas. [a]

	Crude oil		Natural gas	
Region	**Billion barrels**	**1998 gross value (billion dollars)**	**Trillion cubic feet**	**1998 gross value (billion dollars)**
Alaska	0.96	10.4	2.16	4.2
Pacific Coast	4.01	43.6	12.00	23.2
Colorado Plateau/Basin and Range	1.31	14.2	8.56	16.6
Rocky Mountains/Northern Great Plains	4.51	49.0	21.98	41.6
West Texas/ Eastern New Mexico	2.88	31.3	18.71	31.8
Gulf Coast	5.40	58.7	98.02	190.2
Mid-continent	0.26	2.8	19.58	6.5
Eastern	1.47	16.0	11.54	18.4
Total	**20.80**	**226.1**	**171.34**	**332.4**

[a] As explained in the text, the amounts referred to above are estimates for all provinces that contain roadless areas, not in the roadless areas themselves. For reasons explained in the text, the amount of economically recoverable oil and gas beneath inventoried roadless areas is not accurately known but is unlikely to be more than an insignificant percentage of the above amounts.
(USDI Geological Survey 1996a)

The USGS has also conducted coal resource assessments for several regions in the United States. Estimates from the Northern Rocky Mountains and Great Plains assessment are shown in Table 3-72. The figures represent coal that should be used over the next 20 to 30 years. Coal resources in several other Tertiary basins in the Northern Rocky Mountains and Great Plains were not assessed, because they were less likely to be used during that time. The estimates do not include resources within mine or lease areas, or resources in coal beds less than 2.5 feet thick.

Table 3-72. Estimates of coal resources, in million short tons, in the northern Rocky Mountains and Great Plains regions in Counties containing inventoried roadless areas. [a]

Basin	**States**	**Measured (<1/4 mile)**	**Indicated (1/4-3/4 mile)**	**Total**	**1998 gross value (billion dollars)**
Powder River	MT, WY	77,870	295,180	373,050	6,532
Williston	ND	622	4,038	4,660	82
Greater Green River	WY		no roadless areas		
Hanna-Carbon	WY		no roadless areas		
Total		**78,492**	**299,218**	**377,710**	**6,614**

[a] The above numbers refer to overall resources in regions that contain roadless areas, not in the roadless areas themselves. As explained in the text, resources actually located inside roadless areas are likely to be an insignificant portion of total resources.
(USDI Geological Survey 1999)

The estimates are presented at two levels of geologic assurance, which relate to the distance from drill holes. Measured coal resources are those within a 0.25-mile radius from a drill hole, while indicated resources are within 0.75 mile. The USGS reported resources for two other categories (inferred and hypothetical), but these are not presented in Table 3-72 as they represent lower levels of geologic assurance. Similar to the oil, gas, and metal resources discussed above, the USGS coal estimates have been adjusted where coalfields within a basin clearly contain no inventoried roadless areas. Even so, for the reasons mentioned previously for undiscovered oil and gas and metal deposits, the percentage of resource estimates in Table 3-72 within inventoried roadless areas is unknown. For example, in the Powder River Basin, 87% of the coalfield containing inventoried roadless areas is federally owned coal, while in the Williston Basin, 37% of the coal is federally owned. As with undiscovered oil and gas and metal deposits, however, over the long term some coal resources would likely not be developed under Alternatives 2 through 4, which will reduce the number of jobs, the amount of income, and the level of payments to the Federal treasury, States and Counties.

Social Effects of the Alternatives – Alternatives 2 through 4 would prohibit road construction and reconstruction in inventoried roadless areas for the exploration and development of salable minerals and leasable minerals that are not currently within existing lease boundaries. Exploration and development of locatable minerals could be affected if costs are increased because of additional environmental mitigation and/or delays. The social impacts of Alternatives 2 through 4 on communities located near inventoried roadless areas having **mineral reserves** would be variable. These impacts would in large part depend on whether the communities affected are already impacted by ongoing mining activity, or have not previously been impacted by mining. The assumption in this discussion is that a prohibition on road construction and reconstruction would preclude development of new salable deposits and new leasable deposits in inventoried roadless areas, but would not affect existing operations that are operating within the scope of their current approvals.

If mineral development activity is underway near an affected community, and Alternatives 2 through 4 preclude expansion or new development under new leases in nearby inventoried roadless areas, then these communities are likely to experience negative social and economic impacts over the medium to long-term. Some of the communities expected to fall into this category are listed in the Forest-dependent Communities section of this chapter. If Alternatives 2 through 4 preclude new leasable or salable mineral development in inventoried roadless areas where none currently exists, then local communities not already impacted by mining will forego opportunities for future economic development based on mining. Mineral development could still occur elsewhere on NFS lands, however, partially offsetting these effects.

The social and economic effects of mineral development vary by the type of activity being undertaken. Exploration activities generally have a minimal social and economic impact on surrounding communities because they involve little ground disturbance and a small work force (Wenner 1992).

Site development, which is often the most labor-intensive phase of new mining operations, is likely to have the greatest impacts, especially if it occurs within a short

time (Wenner 1992). Site development, which can entail extensive construction work, can create numerous relatively high paying jobs in local communities that often pay better than other local employment opportunities. Depending on the mining company and the supply of locally available skilled labor, local residents may be employed. However, a substantial number of non-local people generally migrate into these communities to take advantage of the employment opportunities as well. Typically, these people have a history of mineral sector employment, and related skills. The workforce of most mining operations includes an average of 30% to 60% local workers (Wenner 1992). The jobs associated with the construction phase are relatively temporary, lasting from a few months to a few years (Power 1996).

If a large number of migrants move into the local community within a short time frame, there will be a strain on existing infrastructures, housing shortages, and local price inflation, especially if the company does not provide housing and other facilities for its workers (Wenner 1992). However, local businesses tend to benefit, and property values increase. Local governments also gain tax revenues. Often a disproportionate number of newcomers are single males, which brings a new set of social dynamics to the community, as does an influx of new families. Existing residents will need to try to adapt to these social changes. Residents who favor the amenity values of their communities, who are adverse to development and its environmental impacts, who prefer the small community feeling, or who are engaged in the recreation and tourism business may feel adverse impacts from these changes. While many local residents may be economically better off, they do not necessarily experience an improved quality of life due to the social problems that can arise because of these community impacts (Corkran 1996; Wenner 1992).

The construction phase of mineral development has greater social and economic impacts on local communities than the production phase does (Wenner 1992). The production phase requires fewer workers, and is the most stable and long lasting phase of mineral development. Although it offers fewer jobs, the jobs provide more stable employment. The length of the production period will depend on the size of the mineral deposit, and on market conditions. Production may last 10 to 50 years or longer, providing medium to long-term economic stability to communities. Some of the new residents who came for construction jobs will remain, and some local workers will obtain stable employment. However, when the mining operation eventually shuts down, it can be a great shock to the local community. People who were employed lose high paying jobs, some residents move away, local businesses decline, local governments lose revenue, and property values decline. The success of a community in adapting to this phase-down will depend in part on how economically diverse it is, and what kinds of other employment opportunities are available. Communities that are also timber dependent and experiencing simultaneous declines in timber-related employment, and communities that are not recreation and tourism destinations, could be especially affected. The cycles of expansion and decline that characterize many mining dependent communities, and their associated adverse social and economic impacts, have been well documented (Freudenburg and Frickel 1994; Krannich and Luloff 1991; Power 1996). It is important to note that the impacts of mining development and dependence on community well-being will vary, and

depend to some degree on the type of mineral involved, the technology used to extract it, and the resulting industrial organization (Nord and Luloff 1993).

Alternatives 2 through 4 could have negative economic and social impacts on communities with a history of mining dependency if future production requires access to minerals in inventoried roadless areas. If road prohibitions prevent the future expansion of development opportunities in these areas, the downturn phase of minerals activity could occur sooner than under the No Action Alternative. Communities that do not have a history of involvement in the mining sector, and are located near inventoried roadless areas that contain leasable and salable mineral reserves, are unlikely to experience either the positive or the negative social and economic effects of mineral development if one of the action alternatives is implemented. They could experience these effects however if mineral development takes place elsewhere on NFS lands located near them.

Effects on Other Ownerships and International Effects – The United States is a net importer of phosphate rock. Despite having large reserves, projected growth for phosphate rock for production facilities in the East will be met by increased imports, primarily from Morocco. High transportation costs currently prohibit Western phosphate rock from being economically competitive with imports in supplying eastern production facilities. Phosphate rock imports to eastern facilities are used primarily in producing value-added products, primarily fertilizers. The United States is a net exporter of numerous phosphate fertilizer products and elemental phosphorous (Jasinski 1999).

Western phosphate production is used to provide raw materials to Western processing plants. The only two elemental phosphorous plants in the United States are in southeast Idaho. Phosphate reserves in the West are sufficient to provide raw materials to Western processing facilities for the foreseeable future. Restrictions on development in inventoried roadless areas may cause some temporary disruptions as production moves to other areas. Over the long term, lack of development of reserves within inventoried roadless areas would result in reserves being depleted at an earlier date.

The United States is a net exporter of coal, although exports have declined in recent years because of increasing competition from other countries, declining coal consumption in Europe, and a strong United States dollar. International competition has had minor impacts on national production and prices, with the exception of certain premium coal and steam coal producers (mostly mines in northern Appalachians, Colorado, and Utah) (Freme and Hong 1999).

The potential reductions in coal production associated with road prohibitions in inventoried roadless areas are unlikely to have any effect on national production or prices. The majority of Federal production in the near future is expected to continue to come from surface-mining operations in the Powder River Basin. Current production in that area is primarily from other Federal lands, and there is little inventoried roadless area within the basin area. If reserves within inventoried roadless areas are unavailable for future development, reserves on other Federal land and other ownerships are likely to be developed.

United States imports of crude oil are expected to continue to increase. The share of petroleum consumption met by net imports is projected to increase from 52% in 1998 to 64% in 2020. The United States was essentially self-sufficient in natural gas until the late 1980s. Net imports as a share of consumption more than tripled from 1986 to 1999. Production has declined, and most imports are from Canada. Despite increases in domestic production, net imports are expected to increase through 2020, from 14.6% to 16.3% of total gas consumption (United States Department of Energy 1999). Production from NFS lands is a small part of total United States production of oil and natural gas and is unlikely to have any appreciable effects on import dependence.

Road Construction

Affected Environment

Users of the National Forest System depend on road access for both commercial and amenity uses of NFS lands. The economic effects of those uses are captured in previous sections. However, road construction, reconstruction, maintenance, and decommissioning activities also generate jobs that are not captured in the resource-specific analyses.

Road construction and reconstruction activities generate about 20 jobs per million dollars expended on roads. About 10 million of those jobs are direct jobs, while the remaining are indirect and induced jobs. The cost of road construction varies widely, depending on the type of road, intended use, environmental conditions, and other factors. Roads to access timber sales are most likely to be **local roads**. In the lower 48 States, average cost to construct a local road ranges from $50,000 to $60,000 per mile, while average reconstruction cost varies from $8,000 to $16,000 per mile. Temporary road construction cost was estimated to range from $5,000 to $10,000 per mile. In Alaska, road construction is more expensive. The cost of constructing permanent roads was estimated to be $140,000 per mile, and the cost of constructing temporary roads was estimated to be $120,000 per mile.

Alternative 1 - No Action

Under Alternative 1, road construction and reconstruction needed to implement planned projects is assumed to go forward. A total of 537 miles of roads were projected in association with non-timber projects over the next 5 years. Of that total, 448 miles would be new construction, 80 miles would be reconstruction, and 9 miles would be temporary. It is unlikely that all planned projects would go forward, so that the total number of miles would be less than 537. Since most of the planned projects are associated with mineral development and special uses, most are likely to be single use local roads.

A total of 623 miles were projected in association with planned timber offer over the next 5 years. Of the total, 346 miles are new construction, 99 miles are reconstruction, and 178 miles are temporary construction. Although there is not a direct correlation between harvest volume and road miles, the same process used to adjust planned offer volumes for harvest was also applied to road miles to get an estimate of miles likely to be constructed and reconstructed for estimated timber harvest. Using this process, total timber roads

were estimated to be 404 miles over the next 5 years. Of that total, 226 would be new construction, 62 would be reconstruction, and 116 miles would be temporary roads.

To estimate effects on jobs, the total miles of roads were converted to average annual figures (Table 3-73). The total annual cost of constructing, reconstructing, and building temporary roads was estimated using the costs per mile described above. If all of the road development activity were implemented, annual costs would range from $12.2 to 13.4 million. Using this range of costs, direct jobs associated with road activities would range from 122 to 134, while total jobs would range from 244 to 268, as shown in Table 3-73.

Alternatives 2 through 4

The economic effects of the national prohibitions are the same for Alternatives 2 through 4, since road construction and reconstruction are prohibited under all three alternatives. Of the 537 miles of roads planned for non-timber projects, up to 244 miles may be prohibited by the alternatives. The remaining 293 miles would not be prohibited. If all of the prohibited projects were assumed to proceed in the absence of the proposed rule, then jobs associated with the 244 miles would be affected. The road miles planned for timber harvest would also be affected by the prohibitions.

Table 3-73. Total jobs associated with average annual road construction and reconstruction for estimated timber harvest and planned activities in inventoried roadless areas.

Region	Average annual miles for non-timber projects	Average annual miles for timber harvest	Range of direct jobs affected	Range of total jobs affected
Northern (1)	17	7	9-11	18-22
Rocky Mountain (2)	14	7	8-10	16-20
Southwestern (3)	4	0	2	4-5
Intermountain (4)	31	14	14-18	28-36
Pacific Southwest (5)	12	1	6-7	12-15
Pacific Northwest (6)	7	2	4-5	9-11
Southern (8)	6	3	3-4	6-8
Eastern (9)	3	6	2-3	4-5
Alaska (10)	14	40	73	147
Total [a]	**107**	**81**	**122-134**	**244-268**

[a] Totals may not be exact due to rounding.

The range of affected direct and total jobs is shown in Table 3-74. All of the jobs associated with timber harvest are affected. Since only 45% of non-timber project road miles are affected by the road prohibitions, the impacts on road jobs associated with those activities are less. As discussed in the Timber section of this chapter, there may be substitution opportunities for jobs related to road construction and reconstruction. Between 1992 and 1997, total employment in the construction industries increased by 20% (USDC Bureau of the Census 1999). Although substitution may be possible, whether those opportunities would exist in the affected communities cannot be predicted.

Table 3-74. Jobs affected by prohibitions on road construction and reconstruction in inventoried roadless areas.

Region	Average annual miles prohibited for non-timber projects	Average annual miles prohibited for timber harvest	Range of direct jobs affected	Range of total jobs affected
Northern (1)	3	7	2-3	5-7
Rocky Mountain (2)	9	7	5-7	11-14
Southwestern (3)	1	0	1	1-2
Intermountain (4)	19	14	10-12	19-25
Pacific Southwest (5)	6	1	3-4	7-8
Pacific Northwest (6)	2	2	2	4-5
Southern (8)	2	3	1-2	3-4
Eastern (9)	2	6	2-3	4-5
Alaska (10)	4	40	59	118
Total [a]	**49**	**81**	**86-93**	**171-186**

[a] Totals may not be exact due to rounding.

Forest-dependent Communities

Affected Environment

The well being of rural communities connected to Forest Service administered lands has been an important factor in forming many social and economic policies enacted by the Forest Service and Congress. The concept of stability, in reference to economy, community, and industry, has been a dominant theme of management especially in relation to timber. In examining community economic stability, the distinction between industry business needs and community economic needs is often overlooked (Society of American Foresters 1989). While employing local residents, industry interests, such as mining, tourism, and timber, inevitably differ from the communities in which they are located.

Forces beyond their control substantially affect both communities and industry. The community has little influence on the business decisions made by firms operating in their area, while the firms have little influence on macroeconomic forces that influence their operations. As such, rural communities often find themselves vulnerable to boom and bust cycles, commodity price fluctuations, and national and regional recessions (DeVilbiss 1992). Among the economic factors that affect the relationship between a community and local firms are alternative sources of supply, geographic isolation (proximity to larger labor markets), inter-community competition for jobs, international markets, and changing technology.

Timber Dependency – The concept of community stability has been closely tied to timber dependency. Timber dependency has been extensively studied, particularly concerning the relationship between NFS lands and rural communities in the Western United States.

Historically, the remedy favored by the Forest Service for the boom and bust cycles has been to maintain a relatively even flow of timber offerings, transferring a large share of cyclic economic adjustment costs from the community to the Federal Treasury (Boyd and Hyde 1989). The intent was to maintain a constant supply of timber so that mills and jobs in rural Western communities were protected from external market changes.

The literature is ambiguous about whether sustained yield policies resulted in more stable employment in the timber industry (Force and others 1993). Macroeconomic forces and associated changes in the timber industry probably influenced rural communities more than the Forest Service could with even flow policies. Today, with NFS harvest levels are at a fraction of earlier levels, the ability of Federal land managers to offset economic cycles with even flows of timber volume has been greatly reduced.

Even if land managers could provide an even flow of timber offerings, the industry has changed to such an extent that it can no longer be assumed that local mills will be the successful bidder for Agency timber sales, nor that local communities will receive logging and processing jobs as a result of those sales. In today's market, the destination of Federal timber is generally unpredictable as processors reach far to supply their mills. Log sorting yards and high efficiency mills disperse logs differently, directing logs to their most profitable use. These conditions undermine confidence that the Federal timber-supply policy is capable of supporting jobs in specific communities.

From Community Stability to Community Resiliency – Many social scientists are investigating new concepts to replace traditional notions of community stability. The common theme through most of these concepts is an ability to adapt to change. Beckley (1994) suggested that community adaptability might be a more useful concept than community stability in assessing those communities that will thrive in our rapidly changing world. Levels of human capital, the imagination of community leaders, the ability to access information, and the availability of a flexible, diverse resource base are variables that will likely affect community adaptability.

Community resiliency is a concept developed as an indicator of a community's health and vitality. Resiliency is a measure of the ability to successfully deal with the inevitable multiple social and economic changes that are evident in our society. Harris (1996) described community resiliency in the Interior Columbia River Basin as consisting of population size, economic diversity, attractiveness and surrounding amenities, strong leadership, and other factors such as community residents' ability to work together and be proactive toward change.

This definition of resiliency is similar to the concept of community capacity (USDA Forest Service and others 1993). Harris (1996) noted the most resilient communities tended to be larger in population, have an economy based on a mix of industries, view themselves as autonomous, and work as a community to develop strategies for the future. Horne and Haynes (1999) developed measures of socioeconomic resiliency based on a composite of economic resiliency, population density, and lifestyle diversity.

A study by Ashton and Pickens (1995) found that it was not the presence of resource-use employment in a County that caused communities to be vulnerable to change, but the

absence of other jobs that would contribute to a more diverse economy. Areas with proportionately high resource-use employment and Forest Service involvement tended to be less diverse. More favorably, these less diverse Counties tended to be diversifying more rapidly than others.

Because tourism and recreation, retirement settlement, and other uses of NFS lands can provide considerable sources of jobs, income, and personal enjoyment, communities value national forests and grasslands and other public lands for these uses (Society of American Foresters 1989). The presence of desirable environmental amenities, and especially the types supplied by public lands, can contribute to an area's population and economic growth. Scientists differ in their interpretation of the value of this benefit, which can vary depending on the scale at which it is measured. Some evidence to support this relationship is the high population growth occurring in areas with high recreation use (Johnson and Beale 1994).

Ashton and Pickens (1995) found that recreation Counties tend to be diversifying more rapidly than non-recreation Counties, attributing this to Forest Service multiple-use policy that provides an environment that attracts both tourists and permanent residents to the area. Rasker (1994) and Power (1994) have emphasized the role of a high quality natural environment, scenic beauty, and recreation opportunities in influencing population growth and shaping local economies.

Population and Community Resiliency – The population of a community and the rate of change the population experiences are often used as indicators of economic diversity, economic resiliency, and community vitality. Communities with larger populations have more businesses. Economic diversity provides a cushion to job losses in declining industries because the economy does not depend heavily on any single industry or firm. A larger economy also means that less money leaves the local economy to pay for goods purchased from the outside. The result is a more economically resilient community. It is unlikely that Forest Service land use decisions would substantially affect communities with larger populations and diverse economies. This is confirmed by the findings in the Assessment of Ecosystem Components of the Interior Columbia Basin (Quigley and Arbelbide 1997b).

The opposite is generally true for communities with small populations, having fewer industries and fewer firms per industry. Even where many industries are represented, each may include a few firms. A decline in one industry or loss of a firm, especially a major employer, can mean high job loss in the community until adjustments are made. This can be especially disruptive if the community is geographically isolated with few alternative employment opportunities. This situation describes many rural communities with a high proportion of employment in agriculture and natural resource commodity industries. It is reasonable to expect that Forest Service land use decisions can affect industries that are important to smaller communities near lands administered by these agencies, especially where the communities are geographically isolated.

Population growth is usually associated with economic growth and vice versa, but not always. A community can experience rapid growth followed by rapid decline, a boom

and bust situation. Finally, it must be determined whether economic growth is driving population growth or the other way around.

Economic Diversity – Economic diversity is considered an important component of economic resiliency, whether measured at community, County, or regional levels. Economic diversity is considered vital to quality of life attributes provided by economic opportunity and services, including infrastructure, medical care, education, commercial services, and the critical presence of job opportunities (Rojek and others 1975).

The Shannon-Weaver Diversity Index (Inventory and Monitoring Institute 2000) provides a measure of economic diversity for each County. It is based on the number and variety of industry sectors and associated employment using data from the IMPLAN input/output model. A greater number of industry sectors provide a greater diversity of employment opportunities. Therefore, the higher the diversity index, the more likely that a County's economy can absorb and rebound from changing conditions.

A study conducted in support of ICBEMP to calculate the economic diversity at the community level assessed the type and amount of employment in nearly 400 communities in the project area (USDA Forest Service and USDI Bureau of Land Management 1998). However, there is no consistent measure for community diversity nation-wide. The size of area over which economic diversity is measured is critical. The larger the area considered the greater the economic diversity and expected economic resiliency, especially if it includes a large metropolitan area (trade center). This explains why a multi-County region can be highly resilient, while individual Counties or communities in the region are not.

Public comments indicated that people are concerned about the potential effects of the Roadless Rule on local economies close to NFS lands. Some respondents believe that road prohibitions and limitations on timber harvest and mineral exploration and development will be economically devastating to nearby communities. Reductions in Payments to States related to declines in timber harvest and mineral development were a major concern, often raised in conjunction with concerns about maintaining funding for roads and schools. Lost revenue, decreased employment, and loss of community integrity were cited as negative impacts of the proposal. The importance of recreation to local communities was also raised, although comments varied as to whether protecting inventoried roadless areas would have a negative or positive community effects.

Alternative 1 – No Action

Under this alternative, management of NFS lands would continue according to current policies and land management plan direction. Flows of goods and services were described by resource area in the previous sections. Road construction and reconstruction in inventoried roadless areas would proceed, based on local decisions, and economic activity associated with that development would continue.

Alternatives 2 through 4

The alternatives would reduce future timber harvest and mineral exploration and development in inventoried roadless areas. Communities with significant economic activities in these sectors could be adversely impacted.

Potentially Affected Timber-dependent Communities – The effects of the alternatives on national, and to large extent regional, social and economic systems with the possible exception of timber harvest on the Tongass are minor. None of the alternatives are likely to have measurable impacts against the broader social and economic conditions and trends observable at these scales. However, the effects of the alternatives are not distributed evenly across the United States.

A subset of national forests has been identified that is likely to experience the greatest timber-related impacts on local communities in the next 5 years, based on planned offer volumes described previously. Sixty-one administrative units planned to offer timber from inventoried roadless areas during the next 5 years. Of those 61 administrative units, the effects of timber reductions on 34 units were considered most likely to affect local communities.

The selected units either were planning to offer 5 MMBF or more in the next 5 years (32 units) or the average annual planned offer was greater than 10% of the historic offer between 1996 and 1999 (an additional two units). The effects of the prohibitions on the 34 units are considered in detail in this section.

Table 3-75 contains a list of the 34 administrative units, the average annual planned offer from inventoried roadless areas over the next 5 years, the planned offer as a percent of the average total between 1996 and 1999, and communities potentially affected by the prohibitions. The list of communities is based on several sources described below, and may not reflect the most current circumstances. Some communities that could be affected may not be represented on this list, and this list may include communities that will not be affected.

The starting point for the list of communities was a list of timber dependent communities compiled by the Forest Service in 1987. The criteria for being on that list was that forest products employment in a community was at least 10% of total employment and that local wood processing firms used at least 50% NFS timber. This list is dated, given the major declines in the timber program since that time. A second source was an analysis of communities in the Interior Columbia River Basin (USDA Forest Service and USDI Bureau of Land Management 1998) that estimated employment specialization ratios for 423 communities. Communities from the 1987 list that were rated as having no or low wood product specialization were removed from the initial list. Communities from the Interior Columbia River Basin with high to very high timber specialization and with ties to the 34 forests (part of the forest is in the County) were added to the list.

This combined community list was then refined. If the community's County was classified, based on Economic Research Service (ERS) County Typology (USDA

Table 3-75. National Forest System administrative units and communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
Northern (1)	Clearwater	2.9	8	Kamiah, ID[b] Kooskia, ID[b] Orofino, ID[b] Pierce, ID Weippe, ID[b]
	Helena	1.6	20	Townsend, MT
	Idaho Panhandle	8.6	12	Bonner's Ferry, ID[b] Clark Fork, ID Hope, ID, Moyie Springs, ID[b] Oldtown, ID Pinehurst, ID, Plummer, ID[b] Princeton, ID[b] Priest River, ID[b] Sandpoint, ID St Maries, ID[b] Thompson Falls, MT
	Nez Perce	2.0	10	Elk City, ID Grangeville, ID[b] White Bird, ID
Rocky Mtn. (2)	Bighorn	0.6	12	Sheridan, WY[b]
	Medicine Bow/ Routt	2.4	11	Saratoga, WY[b] Olathe, CO[b]
	Shoshone	2.0	42	Cody, WY[b]
	White River	2.0	14	Saratoga, WY[b] Olathe, CO[b]
Southwestern (3)	Lincoln	.3	15	None identified
Intermountain (4)	Ashley	1.0	10	LaPoint, UT Vernal, UT
	Boise	4.1	9	Cascade, ID[b] Council, ID Emmett, ID Horseshoe Bend, ID[b] Montour, ID Sweet, ID
	Caribou	2.1	23	Ovid, ID[b]

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
	Dixie	8.3	44	Escalante, UT[b] Panguitch, UT
	Fishlake	4.1	45	Beaver, UT[b] Bicknell, UT[b] Lyman, UT[b] Sigurd, UT[b]
	Manti-Lasal	6.6	80	Gunnison, UT[b] Old La Sal, UT[b] Wellington, UT[b]
	Payette	10.9	21	Cambridge, ID Casade, ID[b] Council, ID Emmett, ID New Meadows, ID[b]
	Targhee	1.0	17	Ashton, ID Driggs, ID Salmon, ID St. Anthony, ID Tetonia, ID Victor, ID
	Uinta	1.0	31	Fairview, UT [b] Heber, City, UT [b]
Pacific Southwest (5)	Klamath	1.5	4	Happy Camp, CA Yreka, CA
	Shasta-Trinity	3.7	6	Burney, CA [b] Hayfork, CA Weed-Mt.Shasta-McCloud, CA [b] Weaverville-Douglas City, CA [b]
	Six Rivers	1.1	6	Burnt Ranch-Willow Creek, CA
Pacific Northwest (6)	Okanogan	2.6	14	Omak, WA [b] Oroville, WA [b] Pateros, WA Twisp, WA Winthrop, WA
	Rogue River	3.3	15	None identified
	Siskiyou	1.0	4	Brookings, OR [b] Glendale, OR [b] Gold Beach, OR Powers, OR

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
	Umatilla	1.7	3	Elgin, OR Clarkston WA
	Wenatchee	1.7	3	CleElum, WA
	Willamette	5.3	7	None identified
Southern (8)	George Washington/ Jefferson	1.0	4	None identified
	Ozark/St. Francis	3.6	7	None identified
Eastern (9)	Chequamegon/ Nicolet	4.8	4	None identified
	Monongahela	3.6	30	Marlinton, WV [b] Richwood, WV [b] Webster Springs, WV [b]
	Superior	5.2	8	Grand Marais, MN [b] Two Harbors, MN [b] Isabella, MN Tofte, MN
	White Mountain	1.6	9	None Identified
Alaska (10)	Tongass	103.0	56	Coffman Cove, AK Craig, AK Hoonah, AK[b] Ketchikan, AK[b] Klawock, AK[b] Metlakatla, AK[b] Petersburg, AK[b] Thorne Bay, AK Wrangell, AK[b]

[a] Million board feet
[b] Community has an operating sawmill.

Economic Research Service 1995), as metropolitan, urban, or next to a metropolitan area, the community was removed because it is likely to be resilient. This result was then combined with the list of communities potentially affected by the Interim Roads Rule. This information added communities, particularly in the Eastern United States where a limited number of communities were identified in 1987. Communities that currently have softwood sawmills based on a recent report (Spelter and McKeever 1999) or other primary wood products manufacturing facilities identified by regional data requests are noted. No communities were identified for six units: Lincoln, Rogue River, Willamette, George Washington/Jefferson, Ozark/St. Francis, and White Mountain.

The planned timber volume offer data are not specific to any particular inventoried roadless area, so it is not possible to link the planned offer to production sites in local communities. In fact, even with that information, it is not certain that local mills or communities would gain the jobs from volume sold. With increased haul distances, the effects of reduced volume may occur in communities at considerable distance from the forest. In some States there are a limited number of sawmills. These mills likely draw volume from a wide radius around the State.

Economic Effects – The analysis of community effects is based on County resilience to external shocks. It is founded on the premise that large populations and diverse economies can more readily adapt to changing social and economic conditions. The Shannon-Weaver Diversity Index (Inventory and Monitoring Institute 2000) is used to identify diverse economies, and population density is the indicator of large populations. Additional information from the ERS County Typology (USDA Economic Research Service 1995) is used to assess County urbanization, the importance of several economic components of Counties (farming, mining, manufacturing, government and services), and a sixth non-specialized type. The ERS classification scheme also identifies five overlapping rural policy-relevant types: 1) retirement-destination, 2) Federal lands, 3) persistent poverty, 4) commuting, and 5) transfers-dependent.

The County resilience measure needs to be placed in perspective. This process compares one County to other Counties in the Bureau of Economic Analysis (BEA) region (USDC Bureau of Economic Analysis 1999) in which it occurs. Comparison within a BEA region provides a local analysis that is more locally relevant than comparing Counties nation-wide. The BEA regions selected are those containing components of the 34 national forests.

The communities that are located in Counties with diversity indices less than the average of all Counties in the BEA region, and with population densities less than the average, are designated as low in resiliency. Counties that have higher than average population densities and diversity indices are designated as high in resiliency. Where the population and diversity indices split, a medium designation is assigned. Finally, if a community is in a County with a population of less than five people per square mile, it is specified as low in resiliency. A low, medium, or high resiliency has no positive or negative connotation. It means that communities that are less resilient would have more difficulty adapting to policy shifts such as decreases in timber harvest levels.

The ERS typology is then used to provide an indication of additional considerations that may lessen or contribute to County resiliency. It should be remembered that those communities classified as metropolitan or urban next to metropolitan areas are not included on the list of potentially affected communities. This is not to say that individuals or businesses in these communities would not be affected, but the inherent diversity of larger economies and populations would allow these communities to more readily adapt to the effects of the alternatives.

Table 3-76 displays results of the resilience determination and the direct timber jobs affected by the range of alternatives. The alternatives would not generally alter overall

population trends so that the component of resiliency is not affected. The alternatives would affect timber harvest and associated employment. Change in employment is another important factor affecting socioeconomic resiliency. Although a change in jobs within one industry or one firm within an industry may have minimal impact on overall employment diversity, it is assumed that decreases in employment would have negative effects on employment diversity, and that increases in jobs would have a positive effect.

The direct jobs associated with timber harvest were based on the estimated change in timber harvest for each of the 34 administrative units. The range of jobs displayed in Table 3-76 is based on the range of effects that would occur from prohibiting road construction and reconstruction (Alternative 2), to those that would occur from prohibiting all timber harvest (Alternative 4) in inventoried roadless areas. These job effects would be spread over a number of communities, depending on the location of the sales and the type of product harvested.

Although it is not possible to identify the communities that would be affected, it is reasonable to discuss the types of effects given general community ties to national forest resources and resilience to social and economic change. A note of caution is advisable for interpreting Table 3-76. The current resiliency rate of a County does not suggest that timber jobs or the lack of timber jobs is the basis for a County's resiliency rating. The interpretation is that the Counties identified in Table 3-76, with existing ties to national forest timber, would adapt more easily to timber supply changes if their resilience were higher.

Region 1 – Changes in timber harvest under Alternative 2 would have the largest effects on communities with timber resource ties to the Idaho Panhandle National Forest and, to a lesser extent, to the Helena and Clearwater National Forest. Ten of the communities have existing softwood manufacturing facilities and six of these communities are located in Counties ranked low in resilience. Implementation of Alternative 4 would result in further reductions in timber harvest, with more pronounced and widespread employment effects. Communities with ties to the Clearwater and Helena are located in Counties with low resilience rankings. All of the communities are in Counties that share in receipts from timber sales under Payments to States.

A predominant feature from the ERS typology for most of the Counties where the affected communities are located is that Federal land comprises 30% or more of each County's land area. In addition, the majority of the Counties are nonspecialized. Only five Counties showed specialization based on employment statistics from 1987 to 1989.

They are Shoshone County, Idaho (mining), Clearwater, Bonner, and Benewah County, Idaho (manufacturing), and Latah County, Idaho (government).

Region 2 – Changes in timber harvest under Alternatives 2 and 4 would be approximately the same. The largest decreases, nine, seven, and six jobs, respectively, would occur in timber-related direct employment opportunities for communities with timber resource ties to the Shoshone, Medicine Bow-Routt, and White River National Forests. The four communities identified for the four national forests in Region 2 all have existing

Table 3-76. Resilience of Counties containing communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
Rocky Mtn. (2)	Clearwater	5-19	Kamiah, ID[a]	Idaho, ID	Low
			Kooskia, ID[a]	Idaho, ID	Low
			Orofino, ID[a]	Clearwater, ID	Low
			Pierce, ID	Clearwater, ID	Low
			Weippe, ID[a]	Clearwater, ID	Low
	Helena	12-13	Townsend, MT	Broadwater, MT	Low
	Idaho Panhandle	23-46	Bonner's Ferry, ID[a]	Boundary, ID	Medium
			Clark Fork, ID	Bonner, ID	Medium
			Hope, ID	Bonner, ID	Medium
			Moyie Springs, ID[a]	Boundary, ID	Medium
			Oldtown, ID	Bonner, ID	Medium
			Pinehurst, ID	Shoshone, ID	Low
			Plummer, ID[a]	Benewah, ID	Low
			Princeton, ID[a]	Latah, ID	Medium
			Priest River, ID[a]	Bonner, ID	Medium
			Sandpoint, ID	Bonner, ID	Medium
			St Maries, ID[a]	Benewah, ID	Low
			Thompson Falls, MT	Sanders, MT	Low
	Nez Perce	0-13	Elk City, ID	Idaho, ID	Low
			Grangeville, ID[a]	Idaho, ID	Low
			White Bird, ID	Idaho, ID	Low
	Bighorn		Sheridan, WY[a]	Sheridan, WY	High
	Medicine Bow/ Routt	4-7	Saratoga, WY[a]	Carbon, WY	Low
			Olathe, CO[a]	Montrose, CO	Medium
	Shoshone	8-9	Cody, WY[a]	Park, WY	Low
	White River	6	Saratoga, WY[a]	Carbon, WY	Low
			Olathe, CO[a]	Montrose, CO	Medium
Southwestern (3)	Lincoln	1-2	None identified		
Intermountain (4)	Ashley	0-4	LaPoint, UT	Uintah, UT	Medium
			Vernal, UT	Uintah, UT	Medium
	Boise	2-16	Cascade, ID[a]	Valley, ID	Low
			Council, ID	Adams, ID	Low
			Emmett, ID	Gem, ID	Medium
			Horseshoe Bend, ID	Boise, ID	Low
			Montour, ID	Gem, ID	Medium
			Sweet, ID	Gem, ID	Medium
	Caribou	3-7	Ovid, ID[a]	Bear Lake, ID	High
	Dixie	19-20	Escalante, UT[a]	Garfield, UT	Low
			Panguitch, UT	Garfield, UT	Low

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
	Fishlake	15	Beaver, UT[a]	Beaver, UT	Low
			Bicknell, UT[a]	Wayne, UT	Low
			Lyman, UT[a]	Wayne, UT	Low
			Sigurd, UT[a]	Sevier, UT	Medium
	Manti-Lasal	17-28	Gunnison, UT[a]	Sanpete, UT	Low
			Old La Sal, UT[a]	San Juan, UT	Low
			Wellington, UT[a]	Carbon, UT	Low
	Payette	32-45	Cambridge, ID	Washington, ID	Medium
			Casade, ID[a]	Adams, ID	Low
			Council, ID	Adams, ID	Low
			Emmett, ID	Gem, ID	Medium
			New Meadows, ID[a]	Adams, ID	Low
	Targhee	0-4	Ashton, ID	Fremont, ID	Medium
			Driggs, ID	Teton, ID	Medium
			Salmon, ID	Lemhi, ID	Low
			St. Anthony, ID	Fremont, ID	Medium
			Tetonia, ID	Teton, ID	Medium
			Victor, ID	Teton, ID	Medium
	Uinta	4	Fairview, UT[a]	Sanpete, UT	Low
			Heber City, UT[a]	Wasatch, UT	Medium
Pacific Southwest (5)	Klamath	0-7	Happy Camp, CA	Siskiyou, CA	Low
			Yreka, CA	Siskiyou, CA	Low
	Shasta-Trinity	5-18	Burney, CA[a]	Siskiyou, CA	Low
			Hayfork, CA	Siskiyou, CA	Low
			Weed-Mt.Shasta-McCloud, CA[a]	Siskiyou, CA	Low
			Weaverville-Douglas City, CA[a]	Trinity, CA	Low
	Six Rivers	0-4	Burnt Ranch-Willow Creek, CA	Humboldt, CA	Low
Pacific Northwest (6)	Okanogan	13-14	Omak, WA[a]	Okanogan, WA	Low
			Oroville, WA[a]	Okanogan, WA	Low
			Pateros, WA	Okanogan, WA	Low
			Twisp, WA	Okanogan, WA	Low
			Winthrop, WA	Okanogan, WA	Low
	Rogue River	14-18	None identified		
	Siskiyou	0-7	Brookings, OR[a]	Curry, OR	Low
			Glendale, OR[a]	Douglas, OR	Medium
			Gold Beach, OR	Curry, OR	Low
			Powers, OR	Coos, OR	High
	Umatilla	0-6	Elgin, OR	Union, OR	High
			Clarkston WA	Asotin, WA	High
	Wenatchee	0-7	CleElum, WA	Chelan, WA	Medium
	Willamette	0-36	None identified		

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
Southern (8)	George Washington/ Jefferson	3-6	None identified		
	Ozark/St. Francis	10-17	None identified		
Eastern (9)	Chequamegon/ Nicolet	11-26	None identified		
	Monongahela	1-9	Marlinton, WV[a] Richwood, WV[a] Webster Springs, WV[a]	Pocahontas, WV Nicholas, WV Webster, WV	Low Medium Low
	Superior	19	Grand Marais, MN[a] Isabella, MN Two Harbors, MN[a] Tofte, MN	Cook, MN Lake, MN Lake, MN Cook, MN	Low Low Low Low
	White Mountain	2-10	None Identified		
Alaska (10)	Tongass	364-383	Coffman Cove, AK Craig, AK Hoonah, AK[a] Ketchikan, AK[a] Klawock, AK[a] Metlakatla, AK[a] Petersburg, AK[a] Thorne Bay, AK Wrangell, AK[a]	Unorganized, AK Unorganized, AK Unorganized, AK Ketchikan-Gateway, AK Unorganized, AK Unorganized, AK Sitka, AK Unorganized, AK	Low Low Low Low Low Low Low Low Low

[a] Community has an operating sawmill.

softwood manufacturing facilities. The locations of these communities in relation to the national forests reveal the long distances many wood processing facilities now haul sawlogs and pulpwood. Two of these communities are in Counties that rank low in resilience. In Region 2, a predominant feature from the ERS Typology is that Federal land comprises 30% or more of each County's land area for most of the Counties. Sheridan and Park Counties, WY, are government specialized, and Carbon County, WY, is nonspecialized. Montrose County, CO, ranks high in services, which is consistent with it being a retirement destination.

Region 3 – Changes in timber-related direct employment under Alternative 2 and 4 would be small and about the same, ranging from one to two job opportunities annually. No communities were identified as potentially affected communities.

Region 4 – This region would experience the second largest reductions in timber-related direct jobs under Alternatives 2 through 4. The largest impacts would occur on three forests. Alternative 2 would result in 83 fewer jobs associated with the Dixie, Fishlake, Manti-Lasal, and Payette National Forests. Among the 18 communities associated with these forests, 11 are located in Counties rated low in resilience. The Ashley and Targhee would have no jobs affected under Alternative 2. The Boise and Caribou National Forests combined would have five jobs potentially affected, which are spread across seven communities, three of which have softwood sawmills. These communities are located in Counties generally split between low and medium resiliency rankings. Ovid, ID, is the only community located in a County ranking high in resilience. The Uinta National Forest with a reduction of four direct jobs under both Alternatives 2 and 3 has two communities identified as potentially affected.

The Dixie, Fishlake, Manti-Lasal and Payette National Forests would have a combined effect of 108 direct timber jobs under Alternative 4. These decreases potentially affect nine communities, three of which contain softwood sawmills. Three of these communities, Escalante, UT, and Casade and New Meadows, ID, are in Counties ranked low in resilience. Under Alternative 4, the Ashley and Targee National Forests would each show about four direct timber job decreases. Reductions on the Boise National Forest could affect about 16 jobs.

Every County identified in Region 4 has 30% or more of the land area in Federal land based on the ERS Typology. One County ranks as nonspecialized; six Counties show farming specialization and nine Counties rank high in government employment. Horseshoe Bend and New Meadows, ID, both rank high in manufacturing and have sawtimber facilities. None of the Counties are highly specialized in services, and Boise County, ID, and Wasatch County, UT, are commuter Counties.

Region 5 – The changes in timber harvest under Alternative 2 would affect five direct timber job opportunities associated with the Shasta-Trinity National Forest. These reductions are spread across four communities, of which three have softwood sawmills. Alternative 4 would result in larger direct timber job decreases. The Klamath National Forest shows reductions of seven jobs, the Shasta-Trinity National Forest job decreases would approach 18, and jobs associated with the Six Rivers would decrease by four. All of the communities identified in Region 5 are located in Counties that have low resilience rankings.

In Region 5, two out of the three Counties have Federal land comprising 30% or more of each County's land area. Siskiyou County, CA, is nonspecialized and a retirement destination. Trinity County is government specialized and Humboldt County ranks high in services.

Region 6 – Changes in timber harvest under Alternative 2 would have minimal effects on all communities except those associated with the Okanogan and Rogue River National Forests where 13 and 14 jobs, respectively, would be affected during the next 5 years. A mill in Omak, WA, has recently closed. Communities with resource ties to the Okanogan also are in a County with low resilience and with a high proportion of Federal land. With implementation of Alternative 4, the effects on employment are more pronounced and

widespread. Reductions on the Willamette National Forest would incur approximately 36 fewer job opportunities, and on the Rogue River there would be potentially 18 fewer jobs. No communities are identified with Rogue River or Willamette since they are located in Counties that are classified as metropolitan or urban next to metropolitan.

A predominant feature from the ERS typology in Region 6 for most of the Counties where the communities are located is that Federal land comprises 30% or more of each County's land area. Half of the Counties are nonspecialized. Based on employment statistics, four Counties showed farming specialization and the rest are distributed between manufacturing, government, and services. Curry, OR, is a retirement destination County.

Region 8 – The George Washington/Jefferson and the Ozark/St. Francis National Forests in Region 8 have no identified communities. The direct timber job losses for these forests would be 13 jobs under Alternative 2 and 23 jobs under Alternative 4.

Region 9 – Changes in timber harvest under Alternative 2 would result in the largest decreases in timber-related direct employment for communities with timber resource ties to the Chequamegon-Nicolet and Superior National Forests totaling 30 potential jobs. To a lesser extent, the Monongahela and White Mountain National Forests affect a combined total of three jobs. Two of the communities associated with the Superior National Forest have existing softwood manufacturing facilities, and both of these communities rank low in resilience. No communities were identified as tied to the Chequamegon-Nicolet. Implementation of Alternative 4 would result in further reductions in timber harvest. Reductions in employment would increase to 9 direct timber jobs on the Monongahela, and 10 jobs on the White Mountain. The Superior National Forest would remain at 19 jobs affected, and the Chequamegon-Nicolet would increase to 26 potentially affected direct jobs. For the Monongahela National Forest, the ERS Typology identifies Pocahontas County, WV as nonspecialized with 30% or more Federal land. Lake and Cook County, MN associated with the Superior National Forest have a large component of Federal land and both are government specialized.

Region 10 – The effects of reduced timber harvest are greatest on the Tongass because of the relatively high harvest likely to occur in inventoried roadless areas. Because of the isolated nature of most Alaskan communities, all communities were rated low in resilience. Mill closures, and reduced logging activity can be expected to trigger direct job losses of 350-369 employees in the private sector. These job losses will occur in communities where mills and logging companies are located, including Ketchikan, Coffman Cove, Craig, Thorne Bay, Klawock, Metlakatla, Wrangell, Petersburg, and Hoonah. The distribution of effects by community depends on the location of harvest.

Effects on National Forest System Employment – Forest Service headquarters and ranger stations are often located in small communities in or near National Forest System lands. Historically, these offices have provided relatively secure permanent and many seasonal jobs. Federal employees generally have stable wages and are often among the better-paid residents in a community. The Agency has already downsized in response to significant

declines in NFS harvest and offices have been combined or eliminated, leaving many small communities with fewer or no Forest Service employees.

Additional changes in the timber harvest program could affect Forest Service employment. Jobs may be fewer under the alternatives since reductions in harvest volume directly affect funds in support of timber management. Between two and three jobs per million board feet of timber harvest – nationally 2.6 jobs in 1999 – are associated with all aspects of the timber program and include planning, preparation, and administration of timber sales.

The small harvest declines associated with the alternatives are not likely to affect employment on most forests, especially during the next 5 years. However, there are some exceptions. Because of the large volume being offered from inventoried roadless areas on the Tongass National Forest, the alternatives could have a significant impact on Forest Service employees on that forest. About 30% of the Tongass workforce could be affected by harvest reductions associated with Alternative 4, or about 141 direct Forest Service jobs. These effects are described in more detail in the Tongass section of this chapter.

Effects in the lower 48 states are most likely to occur on those forests with larger timber sale programs in the inventoried roadless areas previously identified in Table 3-76. These same forests are displayed in Table 3-77 along with the range of Forest Service jobs potentially affected by Alternatives 2 through 4. Table 3-76 also identifies the communities with Forest Service offices that are in Counties that are not classified as metropolitan or urban and next to a metropolitan area (USDA Economic Research Service 1995). It is difficult to link employment changes to a particular community. District offices and Forest headquarters are sharing employee services on a wider basis. It is also difficult to assume the potential job losses identified will occur. The current shifts in program emphasis to forest health, road decommissioning, fuels management, and other ecosystem restoration activities are changing the foundation for employment.

Table 3-77. Forest Service jobs potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
Northern (1)	Clearwater	1-5	Kamiah, ID[a] Kooskia, ID[a] Orofino, ID[a] Lolo, MT Potlach, ID	Idaho, ID Idaho, ID Clearwater, ID Missoula, MT Latah, ID
	Helena	1-3	Townsend, MT[a] Helena, MT Lincoln, MT	Broadwater, MT Lewis&Clark, MT Lewis&Clark, MT
	Idaho Panhandle	7-13	Bonner's Ferry, ID[a] Priest River, ID[a] Sandpoint, ID[a] St Maries, ID[a] Silverton, ID Avery, ID	Boundary, ID Bonner, ID Bonner, ID Benewah, ID Shoshone, ID Shoshone, ID
	Nez Perce	0-4	Elk City, ID[a] Grangeville, ID[a] White Bird, ID[a] Kooskia, ID	Idaho, ID Idaho, ID Idaho, ID Idaho, ID
Rocky Mountain (2)	Bighorn	1	Sheridan, WY[a] Lovel, WY Buffalo, WY Greybull, WY Worland, WY	Sheridan, WY Big Horn, WY Johnson, WY Big Horn, WY Washakie, WY
	Medicine Bow/ Routt	2-3	Saratoga, WY[a] Laramie, WY Encampment, WY Douglas, WY Steamboat Springs, CO Yampa, CO Walden, CO Kremmling, CO	Carbon, WY Albany, WY Carbon, WY Convers, WY Routt, CO Routt, CO Jackson, CO Grand, CO
	Shoshone	4	Cody, WY[a] Lander, WY Dubois, WY	Park, WY Fremont, WY Fremont, WY
	White River	3	Glenwood Springs, CO Aspen, CO Meeker, CO Silverthorne, CO Eagle, CO Minturn, CO Carbondale, CO	Garfield, CO Pitkin, CO Rio Blanco, CO Summit, CO Eagle, CO Eagle, CO Garfield, CO
Southwestern (3)	Lincoln	0-1	Carlsbad, NM Ruidoso, NM	Eddy, NM Lincoln, NM

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
Intermountain (4)	Ashley	0-2	Vernal, UT[a] Duchesne, UT Roosevelt, UT	Uintah, UT Duchesne, UT Duchesne, UT
	Boise	1-6	Cascade, ID[a] Emmett, ID[a] Idaho City, ID Lowman, ID Mountain Home, ID	Valley, ID Gem, ID Boise, ID Boise, ID Elmore, ID
	Caribou-Targhee	1-5	Ashton, ID[a] Driggs, ID[a] St. Anthony, ID[a] Pocatello, ID Dubois, ID Island Park, ID Montpelier, ID Idaho Falls, ID Soda Springs, ID Malad, ID	Fremont, ID Teton, ID Fremont, ID Bannock, ID Clark, ID Fremont, ID Bear Lake, ID Bonneville, ID Caribou, ID Oneida, ID
	Dixie	10-11	Escalante, UT[a] Panguitch, UT[a] Cedar City, UT Teasdale, UT	Garfield, UT Garfield, UT Iron, UT Wayne, UT
	Fishlake	6	Richfield, UT Beaver, UT[a] Fillmore, UT Loa, UT	Sevier, UT Beaver, UT Millard, UT Wayne, UT
	Manti-Lasal	7-12	Price, UT Ferron, UT Moab, UT Monticello, UT Ephraim, UT	Carbon, UT Emery, UT Grand, UT San Juan, UT Sanpete, UT
	Payette	12-17	Council, ID[a] New Meadows, ID[a] McCall, ID Weiser, ID	Adams, ID Adams, ID Valley, ID Washington, ID
	Uinta	2	Heber, UT[a]	Wasatch, UT
Pacific Southwest (5)	Klamath	0-3	Happy Camp, CA[a] Yreka, CA[a] Mt. Hebron, CA Orleans, CA Fort Jones, CA	Siskiyou, CA Siskiyou, CA Siskiyou, CA Humboldt, CA Siskiyou, CA
	Shasta-Trinity	2-6	Hayfork, CA[a] Mt.Shasta, CA[a] Weaverville, CA[a]	Siskiyou, CA Siskiyou, CA Trinity, CA
	Six Rivers	0-1	Willow Creek, CA[a] Eureka, CA	Humboldt, CA Humboldt, CA Del Norte, CA

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
			Gasquet, CA Orleans, CA Bridgeville, CA	Humboldt, CA Humboldt, CA
Pacific Northwest (6)	Okanogan	4	Twisp, WA[a] Winthrop, WA[a] Okanogan, WA Tonasket, WA	Okanogan, WA Okanogan, WA Okanogan, WA Okanogan, WA
	Rogue River	4-5	None Identified	
	Siskiyou	0-2	Brookings, OR[a] Gold Beach, OR[a] Powers, OR[a]	Curry, OR Curry, OR Coos, OR
	Umatilla	0-3	Hepner, OR[a] Pomeroy, WA	Wheeler, OR Garfield, WA
	Wenatchee	0-2	Wenatchee, WA Chelan, WA Cle Elum Entiat, Wa Leavenworth, WA	Chelan, WA Chelan, WA Kittitas, WA Chelan, WA Chelan, WA
	Willamette	0-9	None Identified	
Southern (8)	George Washington/ Jefferson	1-2	Wise, VA Bridgewater, VA Natural Bridge Station, VA Covington, VA Marion, VA Edinburg, VA Newcastle, VA Hot Springs, VA	Wise, VA Rockingham, VA Rockbridge, VA Allegheny, VA Smyth, VA Shenandoah, VA Craig, VA Bath, VA
	Ozark/St. Francis	4-6	Rusellville, AR Hector, AR Ozark, AR Jasper, AR Paris, AR Clarksville, AR Mountain View, AR Marianna, AR	Pope, AR Pope, AR Franklin, AR Newton, AR Logan, AR Johnson, AR Stone, AR Lee, AR
Eastern (9)	Chequamegon/ Nicolet	3-9	Glidden, WI[a] Park Falls, WI[a] Washburn, WI[a] Laona, WI [a] Eagle River, WI Florence, WI Lakewood, WI	Ashland, WI Price, WI Washburn, WI Forest, WI Vilas, WI Florence, WI Oconto, WI
	Monongahela	1-6	Marlinton, WV[a] Richwood, WV[a] Elkins, WV Parsons, WV Petersburg, WV	Pocahontas, WV Nicholas, WV Randolf, WV Tucker, WV Grant, WV

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
			Bartow, WV	Pocahontas, WV
			White Sulphur Springs, WV	Greenbrier, WV
	Superior	9	Grand Marais, MN[a]	Cook, MN
			Tofte, MN[a]	Cook, MN
	White Mountain	1-3	Laconia, NH	Belknap, NH
			Bethlehem, NH	Crafton, NH
			Gorham, NH	Coos, NH
			Bethel, ME	Oxford, ME
			Plymouth, NH	Crafton, NH
			Conway, NH	Carrol, NH
Alaska (10)	Tongass	134-141	Craig, AK[a]	Unorganized, AK
			Hoonah, AK[a]	Unorganized, AK
			Ketchikan, AK[a]	Ketchikan-Gateway, AK
			Petersburg, AK[a]	Unorganized, AK
			Thorne Bay, AK[a]	Unorganized, AK
			Wrangell, AK[a]	Unorganized, AK
			Sitka, AK	Sitka, AK
			Yakutat, AK	Unorganized, AK

[a] Community is also identified as potentially affected timber-dependent.

Region 1 – About 7 out of 9 timber related Forest Service jobs in Region 1 potentially affected under Alternative 2 would be associated with the reduced timber program on the Idaho Panhandle National Forest. Alternative 4 increases these potential reductions to 25 jobs, with half of those jobs related to the Idaho Panhandle timber program. Eleven out of the 18 communities with Forest Service offices included in this analysis are also timber-dependent (Table 3-76).

Region 2 – Alternatives 2 and 4 potentially affect the national forests in Region 2 for a maximum of 11 Forest Service jobs. Those effects are distributed evenly across the affected national forests. Saratoga, Sheridan, and Cody, WY are the communities with Forest Service offices that are also identified as timber-dependent.

Region 3 – In Region 3, the small reduction in timber harvest potentially affects 1 job on the Lincoln National Forest.

Region 4 – Region 4 has the second greatest potential impact on Forest Service employment. The potential impacts on the Ashley and Uinta are small, ranging from 0 to 2 jobs per forest. Effects on the Boise, Caribou-Targhee, and Fishlake range from 1 to 6 jobs per forest. The largest effects occur on the Dixie, Manti-LaSal, and Payette because of the level of planned offer on those forests. Under Alternative 4, about 61 Forest Service jobs related to the timber program could be affected across the region. Thirty-six communities with Forest Service offices are identified, ten of which are timber-dependent.

Region 5 – In Region 5, the largest decreases in timber program related employment could occur on the Shasta-Trinity National Forest where decreased timber harvest

projections are greatest. The result would be a potential decrease in Forest Service employment ranging from 2 to 6 jobs. The Klamath and Six Rivers would not be affected under Alternative 2 and the Six Rivers would have potential reductions of 3 jobs under Alternative 4. About half of the communities with Forest Service offices are timber-dependent.

Region 6 – Under Alternative 2, no Forest Service jobs would be affected on the Siskiyou, Umatilla, Wenatchee and Willamette National Forests. Four jobs could be affected on the Okanogan and Rogue River. About 25 Forest Service jobs could potentially be impacted across all these forests under Alternative 4. Nine of these jobs would be the result of a reduced timber program on the Willamette. All of the Siskiyou National Forest associated communities included in this analysis were also identified as timber-dependent.

Region 8 – In Region 8, the effects of the alternatives on the George Washington/ Jefferson National Forest would be about 1 to 2 Forest Service jobs. Impacts on the Ozark/St. Francis employment would be from 4 to 6 jobs. None of the communities identified with Forest Service offices were previously identified as timber-dependent.

Region 9 – Alternative 2 would primarily affect Forest Service employment on the Superior National Forest, potentially affecting 9 jobs. The remaining forests would see potential declines of 1 to 3 jobs under this alternative. About 27 jobs associated with Forest Service employment could be reduced under Alternative 4 across all of these forests. One half of the identified communities with Forest Service offices are also identified as timber-dependent.

Region 10 – Alternatives 2 through 4 would have a direct effect on Forest Service operations in Alaska. Unless budget allocations reflect a significant change in programs and priorities, Alternatives 2 through 4 are likely to reduce Forest Service employment in the region. The potential job effects range from 131 to 141 jobs. The number of Forest Service jobs lost will be greatest in those communities with both a Supervisor's Office and a District Office presence. These include Sitka, Petersburg, and Ketchikan. (see Tongass section in this chapter)

Effects on Mining Communities – Of the more than 3,000 Counties in the lower 48 states, mining earnings exceed 15% of total earnings in 109 Counties. A disproportionate number of the mining-dependent Counties are within or close to national forests. Of the 796 United States Counties containing NFS lands, 67 have mining earnings greater than 15% of total earnings. These 67 Counties are geographically dispersed throughout the lower 48 states (Table 3-78).

Table 3-78. National Forest Counties that are also mining-dependent Counties.

Region	National Forest administrative unit	County/State	Percent of total earnings from mining
Northern (1)	Clearwater, Idaho Panhandle	Shoshone, ID	18.3
	Custer	Big Horn, MT	23.5
		Rosebud, MT	21.9
		Stillwater, MT	35.7
	Beaverhead-Deerlodge, Helena	Jefferson, MT	34.1
Rocky Mountain (2)	Arapaho-Roosevelt, Pike/San Isabel	Clear Creek, CO	25.6
	Black Hills	Lawrence, SD	22.1
	Black Hills, Thunder Basin	Crook, WY	15.3
		Weston, WY	22.7
	Grand Mesa, Uncompahgre, and Gunnison White River	Gunnison, CO	19.2
	Medicine Bow-Routt, White River	Moffat, CO	25.0
		Rio Blanco, CO	27.4
	Pike/San Isabel	Costilla, CO	25.2
Southwestern (3)	Apache-Sitgreaves	Greenlee, AZ	64.6
	Coronado, Tonto	Pinal, AZ	24.7
	Gila	Grant, NM	25.5
	Lincoln	Culberson, TX	47.5
		Eddy, NM	24.1
Intermountain (4)	Ashley	Sweetwater, WY	26.9
	Caribou	Caribou, ID	20.8
	Bridger-Teton, Shoshone (Region 2)	Sublette, WY	18.8
	Humboldt-Toiyabe	Eureka, NV	86.9
		Humboldt, NV	38.2
		Lander, NV	55.6
		Nye, NV	18.8
		White Pine, NV	30.3
	Humboldt-Toiyabe, Inyo (Region 5)	Mineral, NV	31.5
	Manti-La Sal	Carbon, UT	25.4

Region	National Forest administrative unit	County/State	Percent of total earnings from mining
		Emery, UT	36.6
	Salmon-Challis, Sawtooth	Custer, ID	18.3
	Wasatch-Cache	Uinta, WY	19.9
Pacific Southwest (5)	Inyo	Esmeralda, NV	53.7
Southern (8)	Chattahoochee-Oconee	Twiggs, GA	60.7
	Daniel Boone	Bell, KY	18.6
		Breathitt, KY	15.5
		Harlan, KY	32.5
		Knott, KY	53.3
		Leslie, KY	47.9
		Perry, KY	16.1
	George Washington and Jefferson	Buchanan, VA	40.5
		Letcher, KY	30.5
		McDowell, WV	28.2
		Pike, KY	34.5
		Wyoming, WV	38.4
	National forests in Alabama	Walker, AL	18.7
	National forests/grasslands in Texas	Hemphill, TX	17.2
		Jack, TX	17.1
		Leon, TX	26.0
Eastern (9)	Hoosier	Greene, IN	16.4
		Pike, IN	22.3
	Mark Twain	Iron, MO	22.6
		Reynolds, MO	20.4
	Monongahela	Barbour, WV	18.4
		Clay, WV	34.3
		Grant, WV	18.7
		Webster, WV	42.1
	Shawnee	Gallatin, IL	20.3
		Hardin, IL	20.8
		Livingston, KY	19.5
		Perry, IL	18.7
		Saline, IL	22.6
		Union, KY	40.5
		Webster, KY	42.9
	Superior	Lake, MN	20.1
	Wayne	Marshall, WV	17.3
		Meigs, OH	44.9
		Monroe, OH	22.0

(Vasievich 2000)

Mining earnings in the 67 Counties tend to be concentrated in one segment of the industry. For example, there are 33 Counties where coal mining accounts for more than 15% of total earnings. Another 20 Counties rely on metal mining, six Counties are dependent on oil and gas extraction, three Counties on other nonmetallic mining, and one County is dependent on mineral materials mining for more than 15% of total earnings. Eureka County, Nevada is the most mining-dependent national forest County in Nevada. This County derives 87% of total earnings from metal mining.

The contribution of production from NFS lands to mining earnings in these Counties can vary widely. For example, earnings in Caribou County, Idaho are largely dependent on phosphate mining on the Caribou National Forest. The Counties associated with the Monongahela National Forest depend on coal mining, although no coal mining occurs on the national forest. County-level characterization may miss some communities that have a high level of dependence on mining, even though the County does not. For example, no County in close proximity to the Little Missouri National Grassland has total mining earnings more than 15%. However, a number of communities may be greatly influenced by activity on the grasslands.

Counties with a heavy dependence on processing facilities are not included in this list, because processing is included in the manufacturing sector rather than the mining sector. In some cases, nearby processing facilities could be impacted by changes in levels of production from NFS lands.

The potential effects of Alternatives 2 through 4 would most likely occur in those Counties where the mining dependence is primarily associated with leasable minerals, where NFS production provides a relatively significant contribution to total production, and inventoried roadless areas are likely to provide future production capacity. Existing mining activity is one indicator of likely future activity. Counties in the East are not likely to be affected because the area of inventoried roadless areas on eastern forests is relatively small, and most of the current production occurs outside of NFS lands.

Because of the uncertainty about the effects of the road prohibitions and likelihood of development in inventoried roadless areas, a community list was not developed for each national forest and grassland listed in Table 3-78. A list of potentially affected communities was developed for those national forests where impacts are likely in the near future (Table 3-79). The Dakota Prairie National Grasslands were also considered because of public concerns about the potential effects on future oil and gas production. Several Counties are listed that are not mining dependent but may be potentially impacted. Some communities were added where processing or transportation facilities are located, if those communities were not part of a metropolitan area. Communities in Delta County, CO, were included because the coal transport facilities from mining are located in Delta County, even though mining occurs in Gunnison County. Communities such as Mandan, ND, and Pocatello, ID, were not included because they are within a metropolitan area.

Table 3-79. Resilience of Counties containing a sample of communities potentially affected by prohibitions on road construction and reconstruction on leasable mineral exploration and development in the next 5 years.

Region	National Forest administrative unit	Potentially affected communities	County/State	County resilience
Northern (1)	Dakota Prairie National Grasslands	Bowman, ND	Bowman, ND	Low
		Baker, MT	Fallon, MT	Low
		Watford City, ND	McKenzie, ND	Low
		Sidney, MT	Richland, MT	Medium
		Belfield, ND	Stark , ND	High
		Dickinson, ND	Stark, ND	High
		Williston, ND	Williams, ND	High
Rocky Mountain (2)	Grand Mesa, Uncompahgre, and Gunnison	Paonia, CO	Delta, CO	Medium
		Hotchkiss, CO	Delta, CO	Medium
		Somerset, CO	Gunnison, CO	Low
Intermountain (4)	Caribou	Soda Springs, ID	Caribou, ID	Low
		Afton, WY	Lincoln, WY	Low
	Manti-Lasal	East Carbon, UT	Carbon, UT	Low
		Helper, UT	Carbon, UT	Low
		Price, UT	Carbon, UT	Low
		Scofield, UT	Carbon, UT	Low
		Welington, UT	Carbon, UT	Low
		Castle Dale, UT	Emery, UT	Low
		Cleveland, UT	Emery, UT	Low
		Elmo, UT	Emery, UT	Low
		Emery, UT	Emery, UT	Low
		Ferron, UT	Emery, UT	Low
		Huntington, UT	Emery, UT	Low
		Orangeville, UT	Emery, UT	Low
		Ephraim, UT	Sanpete, UT	Low
		Fairview, UT	Sanpete, UT	Low
		Manti, UT	Sanpete, UT	Low
		Mount Pleasant, UT	Sanpete, UT	Low
		Spring City, UT	Sanpete, UT	Low

The resilience of each of the Counties in Table 3-79 was assessed, using the same procedures described previously for Counties associated with potentially affected timber-dependent communities. The current resiliency rating may not be tied to economic activity related to mining. The tie is likely to be strongest for Counties identified in Table 3-78 as mining-dependent (Gunnison, Carbon, and Emery Counties). Most of the Counties listed in Table 3-79 have low resiliency. Except for Sanpete, Stark, and William Counties, these Counties have a population density of five or fewer people per square mile. The potential impacts on these communities depend on the future role of inventoried roadless areas as a source of leasable mineral deposits. The information available indicates there is likely to be new development for coal and phosphate leasing, and possibly for oil and gas development. Lack of access to those areas could have negative social and economic impacts on these communities, including reductions in payments to states if no substitute deposits are available for development within the same Counties.

Local Involvement

Affected Environment

The Forest Service recognizes many levels of public involvement: national, multi-regional, landscape, regional, forest, and project. Generally, local planning focuses on land management plans, area analyses, and site-specific projects. Local-level Agency decisions are usually made at the land management plan- and project-level, and depending on the delegation of authority, by the Forest Supervisor or District Ranger.

Interested members of the public are invited to participate by commenting on or by providing information for NFS land management planning and site-specific project decisions under the Agency's NEPA provide notice and opportunity to comment and allow for administrative appeal of actions implementing land management plans and appeal procedures. Regional Foresters, Forest Supervisors, and District Rangers are encouraged to seek input and participation by State, local, and Tribal officials and other affected interests early in land management planning and project planning processes regarding inventoried roadless areas. The deciding official is required by regulation and policy to comment. This process is detailed at 36 CFR 215, 217, 219, and 251, and in FSH 1909.15. For area analyses like watershed assessments, the public and American Indian and Alaska Native Tribes may be asked to comment or to provide information. However, no Agency decisions are made in these analyses. Rather, they are generally used to establish background information and purpose and need for planning or site-specific projects. Furthermore, States, Tribes, and local governments are encouraged to participate as cooperating agencies under NEPA as per the Council on Environmental Quality's July 28, 1999, memorandum to heads of Federal agencies.

One of the main issues of public concern raised during the scoping period on the Notice of Intent and during the public comment period on the DEIS was local involvement (Chapter 1 of this FEIS and Content Analysis Enterprise Team 2000a, b). Concerns were raised about how the national prohibitions would affect local involvement in decision-making at the land management plan and project levels. Some people believe that by prescribing national prohibitions on activities, the action alternatives would reduce local involvement (Content Analysis Enterprise Team 2000a, b). They fear this would undermine the collaborative land management planning process, and existing trust between agency officials and local citizens. Some believe the time and effort they have already invested in the land management plan-revision process will have been wasted if national prohibitions are applied. This contributes to the feeling that regardless of their input, decisions will ultimately be made by officials in Washington, D.C., further undermining trust. Other people believe that local involvement and decision-making is necessary for developing management approaches that are sensitive to the unique social and ecological conditions of individual forests and grasslands, and that national policies lack this sensitivity. Many believe local managers are in the best position to solve local management problems, with public participation, due to their knowledge of the local situation. Many also believe that local concerns are more important than non-local concerns (Content Analysis Enterprise Team 2000a, b). Some people oppose the national prohibitions not because of the nature of the prohibitions themselves, but because they

prefer all issues relating to project and forest plan decision-making to be addressed and resolved locally. In contrast, many people believe that it is appropriate for the Forest Service to make decisions regarding roadless area protection at the national level because these issues have not been resolved in an expedient fashion at the local level, and because they believe that local officials are subject to the influence of local interest groups.

Alternative 1 – No Action

Under this alternative, there would be no change to the current local involvement process. There would also be no change to the current scope of issues to be decided upon locally regarding the management of inventoried roadless areas.

Alternatives 2 through 4

Under Alternatives 2 through 4, any national prohibitions would apply to inventoried roadless areas. Local involvement at the forest level would not reverse the prohibitions. The prohibitions would eliminate debate on whether road construction or reconstruction would occur within inventoried roadless areas on NFS lands. Depending on the specific alternative, national prohibitions could also eliminate debate on whether certain forms of timer harvest should occur within inventoried roadless areas.

These issues have been discussed locally for several decades, and they have proven highly contentious. Because they have not been effectively resolved at the local level in many places, the national prohibitions, which are based on public input through the NEPA process, are intended to bring these issues to resolution. In reaching its final decision, the Forest Service hopes to reduce the amount of conflict that pervades the local involvement process, and shift the local discussion about inventoried roadless areas to focus on managing them in the manner prescribed by the final decision.

The national prohibitions in Alternatives 2 through 4 would not affect the local involvement process. They would narrow the scope of what is to be decided upon locally with regard to the management of inventoried roadless areas. While the prohibitions may undermine local communities' trust in the public involvement process over the short-term, this trust may be regained over the long-term.

American Indian and Alaska Native Issues

Affected Environment

Presently, there are 558 Federally recognized Tribes located on 315 reservations, and numerous other forms of Tribal lands that are not reservations within the United States. According to the 1990 census, there are approximately 2 million American Indians and Alaska Natives--half living on or adjacent to Indian reservations; half in urban areas.

American Indians and Alaska Natives have land bases totaling about 615,210 square miles. Indian Tribes and individual Tribal members own approximately 56.6 million acres of land in the contiguous 48 States. Alaska Natives own an additional 44 million

acres in Alaska. Together, Tribes own about 4.2% of the land area within the United States.

Many reservations are adjacent to NFS lands. Figure D-1 in Appendix D of this analysis shows the 1990 distribution of the American Indian population in the United States in relation to inventoried roadless areas. The highest concentrations of American Indians near roadless areas occur in the Pacific Northwest, California, the Southwest, and Alaska. These are the geographic locations where one can expect the greatest use of roadless areas by these populations and the greatest potential impacts of the alternatives.

The unique relationship between American Indian Tribes and the Federal government is reflected in the U.S. Constitution, Articles I and VI. Federally recognized American Indian Tribes have a government-to-government or Nation-to-Nation relationship with the Federal government. The fact that Tribes are sovereign nations with their own Tribal governments makes them equal to other sovereigns or other governments and they are not to be considered as simply being part of the public. Tribes have a special recognized status, and interaction with Tribes reflects and respects this special status. Refer to the "Roadless Rulemaking: Consultation re: American Indian and Alaska Native Tribes" document for a description of the consultation process undertaken with Tribes on this proposed rule, which is available upon request.[21]

Treaties between Indian Tribes and the United States were negotiated primarily to extinguish Indian title to the land being described in the treaty that would be ceded to the United States. The goal of treaty making was to transfer the land into the public domain thereby creating new territories and making way for settlement. Other goals were to: make or maintain peace between Tribes, and end wars and create peace between Indian Tribes and the United States military, as well as non-Indian pioneers and settlers. Treaties were also used to create permanent living reserves for Indian people. Not all Tribes have treaties. In Alaska, acts of Congress serve to outline the legal rights and relations of Alaska Natives with the United States and the State of Alaska. Indian Tribes in Alaska exercise subsistence rights with other rural users. Agreements between the United States and Indian Tribes after 1871 were addressed by executive orders, which were later codified into the general statutes. These documents obligate the United States to certain legal and political responsibilities to care for Indian owned assets, and to consult with Indian Tribes as governments for proposed federal actions that have the potential to affect property or resources important to Indian Tribes and their members.

In the treaties, executive orders, and other agreements between the United States and Indian Tribes, Indian Tribes reserved for themselves certain rights and uses originally held exclusively by them. These uses and rights to take natural resources were to be exercised outside the boundaries of their respective Indian reservation. These are known as treaty-reserved off-reservation rights. Today, those treaty rights exist generally in the States of Washington, Oregon, Idaho, Western Montana, and the Great Lakes states. They apply to most public lands except, in some instances, national parks, and most military installations.

[21]To request a copy of this document, refer to the contact information on the title page of the FEIS.

Off-reservation hunting and fishing rights vary depending on treaty language, subsequent legislation, and court decisions. Some Tribes maintain that the United States government is obligated to manage wildlife and fish habitats to protect the Tribes' treaty rights.

Some Western Tribes have treaties that provide for pasturing animals on off-reservation land. These rights, which have been upheld by the courts, have been exercised in various ways. The allocation of grazing permits on NFS lands depends on treaty language. The Regional Forester may authorize treaty-based grazing under a Memorandum of Understanding. Tribal governments are exempt from the Forest Service policy against issuing term grazing permits to governments (FSM 2204.2(13)). Grazing on NFS lands is free of charge to Tribes as part of their treaty rights.

The traditional way of life for many American Indian and Alaska Native Tribes involves gathering and using products from their natural surroundings. In some treaties, these rights were included under the term "gathering rights." In negotiating treaty terms, many Tribal governments reserved off-reservation rights to gather miscellaneous forest products such as berries, roots, bark from trees, mushrooms, basket making materials, tepee poles, cedar for totem poles, and medicinal plants.

Tribes use many existing Forest Service roads to access sacred sites, spiritual grounds, ceremonial sites, gathering areas, and hunting and fishing sites. The rights of Tribes to practice particular activities on NFS lands, as are provided for in treaty language, are greatly dependent on the Tribe's ability to access national forests. The ability of Tribes to access NFS lands for purposes of practicing treaty reserved rights must be upheld. However, treaty rights and cultural interests that Tribes possess do not include the requirement that the Forest Service provide vehicular access to such sites and areas.

President Clinton issued E.O. 13007, which states that in managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, accommodate access to and ceremonial use of American Indian scared sites by American Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. The E.O. also called for procedures to ensure reasonable notice is provided of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites.

American Indians expressed a range of opinion by on the Notice of Intent and the DEIS during scoping and the public comment process (Content Analysis Enterprise Team 2000a,b). Some favored protection of roadless areas because it would provide environmental protection, and conserve resources, such as plants, fish, and wildlife, used by them. Others emphasized the need for road development to increase access to lands needed for economic uses, recreation, subsistence resource harvesting, and treaty-rights activities. Still others wanted to ensure that the policy would not keep the Forest Service from honoring its treaty rights obligations with Tribes. Most respondents favored local decision making regarding roadless area management.

Alternative 1 – No Action

Under Alternative 1, inventoried roadless areas outside Wilderness and other special designated areas are available for resource management activities that may affect their roadless status or character. Impacts on Tribal governments and Tribal practices from resource management activities that require roads or other modifications to the landscape would be minimal because of consultation requirements. However, there are sacred sites where American Indians and Alaska Natives conduct ceremonies that require privacy. If a road were built to or near such a site, the associated increase in visitation could make it impossible to conduct ceremonies there, undermining important cultural practices. Roads and extraction activities may also alter the character of places that have historic or cultural value, thereby diminishing their value. However, historic and prehistoric cultural resources and traditional cultural properties would be protected by law as described in the Heritage Resources section of this chapter. The effects on treaty rights of no action might be adverse depending on the actions taken. Refer to the Hunting and Fishing section of this chapter for a discussion of how Alternative 1 could affect subsistence and treaty rights hunting and fishing. The Livestock Grazing and Non-timber Forest Products sections of this chapter discuss the impact of Alternative 1 on these activities, which American Indians or Alaska Natives may engage in.

Alternatives 2 through 4

These alternatives provide prohibitions for the highest number of total acres. Alternatives 2 and 3 allow timber harvesting that might conflict with Tribal interests or disturb sacred sites. There would be less conflict between interest groups and Tribes over the use and management of areas that may contain sacred sites. If privacy were necessary for sacred sites, a roadless state would increase the privacy. A roadless state might improve the habitat of plants that Tribes use during gathering activities. Without future roaded access to inventoried roadless areas, it would be difficult for some Tribal members (such as elders) to access cultural sites, hunting grounds, fishing grounds, and gathering grounds located there. Refer to the Hunting and Fishing section of this chapter for a discussion of how Alternatives 2 through 4 could affect subsistence and treaty rights hunting and fishing. The Livestock Grazing and Non-timber Forest Products sections of this chapter discuss the impact of Alternative 1 on these activities, which American Indians or Alaska Natives may engage in.

Civil Rights and Environmental Justice

This section evaluates how the alternatives proposed in this FEIS might affect subsets of the general population identified through Civil Rights legislation and policies, and Executive Order 12898 (Environmental Justice). These subsets include ethnic minorities (American Indians, Hispanics, African Americans, and Asian and Pacific Islander Americans), disabled people, and low-income groups. American Indian and Alaska Native Tribal issues are government-to-government issues and are addressed in the American Indian and Alaska Native Issues section of this chapter.

The material presented here summarizes a more extensive Civil Rights Impact Analysis and Environmental Justice issues document associated with the this rulemaking that was prepared for internal U. S. Department of Agriculture review. This document is available upon request.[22]

Affected Environment

Maps showing the location of inventoried roadless areas in relation to the distribution of Hispanic, African American, and Asian and Pacific Islander populations, and areas of persistent poverty are located in Appendix D.[23] The maps show that populations of these groups, areas of persistent poverty, and NFS inventoried roadless areas are not uniformly distributed across the country. The region of the U. S. having the greatest amount of inventoried roadless area (the Rocky Mountain States) is also an area that shows low population densities in general; the lowest populations of minorities; and, the lowest areas of persistent poverty. These data provide a basis for the conclusion that many of the effects of the alternatives would be regional or local in nature, rather than national in scope. Some of the assumptions based on the mapped data include:

- Inventoried roadless areas that receive the greatest use by minority/low income groups are likely to be those that are close to population centers or historically occupied lands. These uses would continue to include activities such as recreation in undeveloped areas (e.g., hiking and camping), subsistence hunting, gathering, and fishing, and traditional cultural or spiritual activities.
- Under Alternative 1, populations living closest to inventoried roadless areas would continue to engage in economically oriented forest uses such as employment in timber-related fields, grazing, and harvesting of special forest products.
- Cultural, spiritual, and sense-of-place values pertaining to roadless areas may be considerable among those people who live immediately adjacent to these areas; among people who were historically displaced from these areas; and among people who have moved far away from them.
- The same cultural values regarding NFS lands and communication styles do not occur uniformly across the continental United States, Alaska and Hawaii because ethnic groups and areas of persistent poverty are localized. Some adjustment of outreach strategies on a local basis would be necessary to encourage full participation by traditionally underserved publics in the management of roadless areas.
- Minority populations and persistent poverty are high in the southeastern United States where the fewest acres of roadless area are located. Inventoried roadless areas in the southeast are anticipated to be in high demand in the future by these groups because of their relative scarcity relative to the distribution of these sub-populations.

The following sections discuss minority employment and Hispanic, African American, Asian and Pacific Islander American, and disabled populations in terms of their uses of and interests in NFS lands, and their communication styles. The extent of the discussion for each group is limited by the availability of published information on these topics. The

[22]To request the Civil Rights Impact Analysis and Environmental Justice Issues document, refer to the contact information at the front of this FEIS.
[23]Demographic information and maps used for this section were prepared by M. Vasievich, USDA Forest Service Natural Resources Information System, Human Dimensions Module, Branch Chief.

section concludes with an analysis of the effects of the alternatives on these sub-populations.

Employment – Data are not readily available regarding the percentage of minorities and people with disabilities employed in the timber, mining, and road construction sectors, which are the most likely sectors to experience localized impacts in the future from this rule. Any impacts to minorities employed in these sectors are not expected to be different than those to other groups employed in these sectors.

The Forest Service does contract with minority businesses for activities such as road construction, road maintenance, and timber harvest. There has been a decline in the total dollar amount of the contracts awarded to minority businesses by the Forest Service since Fiscal Year 1998, reflecting a decline in the total Forest Service budget. The USDA Office of Small and Disadvantaged Business Utilization and the Small Business Administration determine the percentage of Forest Service contracts that must be reserved for minority contractors. The action alternatives are expected to have no impact on this process. It would be difficult to distinguish the cause of any potential future declines in dollars allocated to Forest Service contractors following implementation of the alternatives. Such declines could be associated with reduced future demand for the services provided by minority contractors, which the action alternatives could contribute to; with declining Forest Service budgets; with the percentage allocation process undertaken by the Office of Small and Disadvantaged Business Utilization; or, with other social and economic factors.

Hispanics – The two kinds of readily available data regarding use of NFS lands by Hispanics concern urban uses centering on recreation, and rural uses centering on grazing and rural lifestyles. Most of the information on recreational uses of NFS lands by Hispanics comes from the Southwest and southern California. Family values, with the extended family as the predominant social unit, result in recreation opportunities structured for all ages that are designed to incorporate the maximum number of people for social interaction (family togetherness) (Garcia 1999; Gramann and others 1993). These visits are shorter, more intense, and commonly take place on major holidays. Attachment to specific spots with regular visitation patterns may be characteristic (Garcia 1999). Picnicking at developed sites, playing, and relaxing near creeks are common activities. Sites on NFS lands are also used by Hispanic church groups that hold church services there (Carr and Chavez 1993).

Information on rural uses of NFS lands comes primarily from northern New Mexico. Hispanic peoples colonized rural lands that are located in what is now the Southwestern United States after the Spanish conquest in 1519 (Wildeman and Brock 2000). During the 1700s, land use and ownership were confirmed by land grants from the Spanish Crown or Mexican government. These land grants were often community land grants that, following the Mexican War, were not acknowledged by the American government (Eastman and others 2000). The land grant boundaries were uncertain, original titles were lost, and community ownership patterns were inconsistent with the American system. Grants that were never confirmed became part of the public domain and, in Northern New Mexico, later became parts of the Carson and Santa Fe National Forests. Hispanic

communities traditionally used these lands for grazing on cooperatively owned pastures (Eastman and others 2000).

Small Hispanic communities now located near these NFS lands are characterized as suffering from continued land loss, economic decline, and poverty, forcing people to leave villages for migrant labor or urban lifestyles. This situation has resulted in tension between the Forest Service, environmental groups (perceived as threatening traditional uses and favoring preservation), and local Hispanic communities (Garcia 1999.)

Current uses of NFS lands by these rural communities are the logical outcome of what was historically communal use of large tracts of unsettled land for livestock grazing. Because of deep traditional ties to these specific lands, domesticated animals have special importance to their owners in small communities, a significance which may be out of proportion to their strict numbers or economic value (Garcia 1999; Eastman and others 2000).

Historically, subsistence harvest of wild resources was also important, including trees, shrubs, herbs, grasses, roots, tubers, berries, and large and small game. These resources were used for food, fuel, building materials, tools, clothing, and medicine (Garcia 1999). Contemporary communities still attempt to use forest commodities, but the subsistence economy has recently been supplemented by developing tourism, though jobs tend to be low paying and seasonal. In Northern New Mexico, the preservation of the subsistence life style is associated with preserving a working relationship with the land, and a tradition of self-sufficiency and frugality (Raish in press, Raish 2000).

Regarding communication styles, Hispanics often maintain the use of Spanish as a first language, and rely on personal experience as a source of information, especially recreation information (Garcia 1999). Raish (2000) describes the communication style of Hispanic communities in Northern New Mexico as having been muted or silent in previous generations because people lacked the opportunity to express themselves in their own terms and languages. They also suffered from an absence of power, and from isolation. However, educated sons and daughters often return home with a desire to preserve their heritage and ties to the land, thereby changing the silent image of previous generations (Raish 2000). In fact, in Northern New Mexico, the conflict between the Forest Service, environmental groups, and Hispanic communities has become vocal, litigious, and violent, which is a further departure from the more traditional muted communication of previous generations.

African Americans – African Americans use NFS lands for recreation, though little information is available on their recreation preferences. Johnson (1999) and West (1993) note that African Americans are less likely than White Americans to recreate in remote or dispersed settings or to travel to regional recreation areas, preferring instead to recreate in parks and forests close to urban areas. Cordell and others (1999a) note that White Americans and others camp more frequently than African Americans. The National Survey on Recreation and the Environment found that during 1994 to 1995, roughly 19% of African Americans participated in fishing. Some NFS lands in the Eastern United States contain historic sites that are important to African Americans, such as underground

railroad sites. Information is not readily available on other uses of NFS lands by African Americans, or on African American communication styles.

Asian and Pacific Islander Americans – Sense of place or place perception can be influenced by race and ethnicity (Johnson 1999). Like other ethnic groups, Asian and Pacific Islander Americans may identify strongly with sites preserved under the National Historic Preservation Act, such as historic Chinese mining and railroad sites. The success of tourism targeted at later generations of Asian and Pacific Islander Americans wishing to explore their historic roots on NFS lands and surrounding communities suggests a strong sense of place among them (Hom 1996). Families with ties to these places may no longer be local residents in the areas of interest, either due to choice or because of forced relocation. Sense of place can also influence perceptions of appropriate behavior or decorum when visiting these special places (Johnson 1999).

Particularly in the Pacific Northwest, Southeast Asian immigrants, Hispanics, and other ethnic groups use NFS lands for the commercial collection of wild mushrooms, floral greens, and other non-timber forest products (Otani and others 1996). Established Asian and Pacific Islander American groups may regard excursions to NFS lands for the collection of mushrooms for personal use as a fall ritual (Otani and Shon 1994). In southern California, Korean and Japanese Americans harvest bracken ferns on NFS lands (Chavez and Gill 1999).

Information on Asian and Pacific Islander American communication styles is also lacking, but observation would suggest that many diverse Asian and Pacific Islander languages are in use in the United States, and that English is not the first language between all Asian and Pacific Islander Americans. Recently arrived Southeast Asian immigrants with low English language skills may still communicate through a spokesperson, for example when mushroom harvesting on NFS lands. Among established Asian and Pacific Islander American groups, a record of academic achievement suggests that communication in English, oral or written, is not a limiting factor. However, certain styles of communication (e.g., indirect vs. direct) may still be the cultural preference. For example, Hart (1998) reports that for someone of Chinese descent, it would be unusual to seek help from an unknown official, or to expect reliable information from someone to whom he or she has not been properly introduced. At the same time, the Forest Service and other resource agencies have been using the persuasion communication model to "tell" the public what they want them to know and do (Magill and Chavez 1993). The result of these disparate styles illustrates how a lack of meaningful exchange can result.

Persons with Disabilities – Issues surrounding persons with disabilities appear to be primarily concerned with access to NFS lands and recreation. Access for persons with disabilities was a concern raised by members of the public in relation to the action alternatives. Some people believe a prohibition on road construction and reconstruction would discriminate against people having disabilities, or would violate the Americans with Disabilities Act, because they think it would limit access to NFS lands by persons with disabilities.

Recreation use in developed sites is not discussed here because of the presumption that it occurs in currently roaded areas where their status will not change. The National Survey

on Recreation and the Environment (Cordell and others 1999a) found that there is little difference in the percentage of disabled and able-bodied Americans participating in outdoor recreation activities of different types. Persons with disabilities engage in a wide range of activities in roadless areas, including use of COBRAs (motorized wheelchairs), OHV recreation, horseback riding, boating, outfitter guided trips, and roadless area skiing with helicopter drop off. Local Forest Service units work with individuals who have disabilities to assist them in accessing the recreation experiences they are seeking.

Barriers to outdoor recreation for people with disabilities are different from barriers to outdoor recreation for ethnic minorities. Personal health limitations are the greatest constraint, followed by lack of assistance for physical limitations (Johnson 1999).

People with disabilities do not necessarily want to build road in Wilderness Areas but want to experience nature in a way that is just as challenging and pristine as it is for others (McAvoy and Lais 1999). Many value undeveloped areas and do not want to be limited to areas designated for use by people with disabilities. One of the values of outdoor recreation for persons with disabilities is to experience a sense of freedom from socially imposed status hierarchies and limitations. The natural world is a place where they can escape the societal attitudes and stigmas that place limits on them (McAvoy and Lais 1999). Outdoor recreation is also a means of achieving social integration between people with and without disabilities, increasing the tolerance for differences among people.

People with mobility disabilities are presumed to have communication styles that are consistent with those of the public in general, or with members of their same ethnic group. Accommodation for other disabilities (e.g., hearing impaired) must be provided as necessary and appropriate.

Alternative 1 – No Action

Alternative 1 would provide for continuing road construction, reconstruction, and timber harvest in inventoried roadless areas. Impacts to protected classes are speculative because of a lack of readily available data regarding uses of NFS lands by minority groups, people with disabilities, and low-income populations. All current uses of NFS lands would be expected to continue. These uses include recreation, employment in the timber industry, grazing, harvesting of non-timber forest products, subsistence resource uses, and cultural/spiritual uses. The abundance and/or relative availability of some plant and animal species may change because of new timber sales and road construction. However, this effect is not anticipated to be uniform or simultaneous nationwide, nor would it have disparate impact on people with disabilities.

Members of different minority groups could be affected by changes in the availability of resources they use. If resources decline, conflicts with other, competing user groups could arise. Other negative impacts of Alternative 1 could be continuing conflict regarding those cultural/spiritual uses of NFS lands that are incompatible with development and increased human activity.

Developing roads in previously roadless areas would influence recreation opportunities. Hispanic populations appear to prefer to recreate in areas with roaded access, and the continued construction of roads may increase their use of specific local areas and newly developed sites. A full spectrum of opinion exists among disabled people as to whether road construction in previously roadless areas would increase their use and/or enhance their recreational experience.

For a detailed discussion of the impact of Alternative 1 on specific uses of NFS lands that the general public, including protected populations, engage in, see the other sections in this chapter under Social and Economic Factors.

Alternatives 2 through 4

The action alternatives would not change existing access to inventoried roadless areas. No existing roads would be closed by the action alternatives. Minority groups, low-income populations, and persons with disabilities would continue to gain access to inventoried roadless areas in the same ways they do now. Future roaded access to these areas would not occur.

A prohibition on road construction and reconstruction is not anticipated to have any disparate impacts on protected populations at the national level. While there may be adverse impacts to some protected populations at the local level, they are not expected to be greater than those experienced by other groups. Differences in national level effects and regional/local level effects are a result of the uneven geographic distribution of minorities and inventoried roadless areas, and variations in regional, cultural, and traditional land and resource uses. Any potential disparate impacts at the local level would be mitigated under the local planning process to reduce these impacts.

For example, some localized adverse impacts could result from limiting timber sales, which would be greater under Alternatives 3 and 4 than under Alternative 2. In Northern New Mexico, for instance, the commercial timber industry has historically provided a substantial number of logging and wood processing jobs, which employ people from small rural communities (Raish 2000). Reductions in timber volume harvested from NFS lands in northern New Mexico were a partial cause of sawmill closures and job loss in the 1980s and 1990s. In response, there have been local efforts to improve timber supplies in Hispanic communities, but these efforts are already having trouble (Raish 2000). The action alternatives could worsen this situation.

Forage for grazing and the harvest of non-timber forest products could be negatively affected by limiting timber harvests, if future opportunities for increasing availability of these resources in former timber sale areas are limited. Limits to future economic expansion (e.g., native-owned saw mills), and specific activities, such as livestock grazing on former timber sale sites, are not anticipated to be greater than those incurred by comparable non-protected communities.

In some locations, such as in northern New Mexico, Hispanics rely heavily on firewood harvested from NFS lands for fuel. Because firewood is most easily harvested near roads,

a prohibition on road construction in inventoried roadless areas would be likely to foreclose future opportunities for them to harvest firewood there.

Barriers to participation in outdoor recreation that have been identified for different ethnic groups would not be impacted positively or negatively by limits on future road construction or timber harvest. The three greatest barriers to recreation participation for White Americans, African Americans, Hispanics, and Asians and Pacific Islander Americans, are lack of time, lack of money, and personal health (Cordell and others 1999b). Lack of time, the greatest barrier to participation, should not be exacerbated by this alternative because developed recreation sites, generally the closest to national forest boundaries, would not be affected by this proposal. No disparate effect is anticipated on protected populations because all groups (including the general population) have identified the same three barriers in the same order of importance.

The other sections of this chapter under Social and Economic Factors discuss in detail the impacts of Alternatives 2 through 4 on specific uses that the general population, including protected classes, engage in.

Agency Costs

People who commented raised concerns about the effects of the proposal on revenues needed for management of NFS lands. They believed that less money would be available for law enforcement and other management actions. Public concern was raised about lost revenue from reduced timber sales, higher costs for fuels and forest health treatments, fire suppression, monitoring costs, and enforcement costs.

Alternative 1 – No Action

Under Alternative 1, Agency costs would continue in line with current and proposed budget requests. Emphasis would continue to be placed on watershed health and restoration, sustainable forest management, NFS roads, and recreation (Natural Resource Agenda for the 21st Century, March 2, 1998).

Alternatives 2 through 4

These alternatives are not expected to have major impacts on Agency cost. The effects have the potential to reduce some costs, while increasing others. A reduction in timber harvest would reduce sale preparation and other planning costs on sales that would have been offered from inventoried roadless areas. If the number of Forest Service employees were reduced in association with a reduced timber program on some forest, personnel costs would be reduced.

There would be little effect on appropriated funds used for construction or reconstruction, since the benefiting user would build most of the roads prohibited by Alternatives 2 through 4. However, there would be cost savings since Agency employees would not have to engage in planning, design, and oversight of these projects. If the planned roads were built, roads that remain part of the classified road system would be the Agency's

responsibility to maintain. Therefore, the reduction in new road miles would reduce the miles of road added to the system compared to the No Action Alternative. About 146 miles of new roads would be constructed for timber harvest[24], and remain open after harvesting was completed. Road miles for other projects are generally maintained by the operator (such as roads for mineral access or private road access), and are not an Agency cost. Maintenance costs are estimated at approximately $1,500 per mile. The potential savings in maintenance costs from not maintaining 146 miles of new roads would be $219,000 per year, once all the roads are in place. Since the Agency has a large maintenance backlog, this cost savings would allow limited funds to be allocated to existing maintenance needs.

The costs of fire suppression are not likely to change because of road prohibitions in inventoried roadless areas. Generally, fire suppression in inventoried roadless areas is a lower priority because threats to public safety and private property are less common. Annual pre-suppression and emergency fire suppression costs are expected to continue to fluctuate in the future (see the Fire Suppression section in this chapter).

The costs of fuels management in inventoried roadless areas would be higher because roaded access will not be available. However, priority for fuel management is focused on areas with the greatest threats to human populations, which is primarily in the wildland-urban interface. As described in the Fuel Management section of this chapter, most inventoried roadless areas are not located in close proximity to population centers and therefore, are not likely to be a high priority for fuel treatment. In the near future, fuel management dollars are not likely to be targeted towards inventoried roadless areas.

The national prohibitions are expected to remove some of the controversy over roadless area management from forest and project level planning. All alternatives would remove the controversy over road construction and reconstruction in roadless areas, while Alternative 4 would remove the controversy over timber harvesting in these areas. This may reduce the number of future local appeals and litigation, which would reduce Agency costs. However, there are likely to be litigation costs associated with implementation of the roadless rule, when promulgated.

Effects of Social and Economic Mitigation on Social and Economic Factors

Non-commodity Values – Mitigation measures for minerals leasing could result in an additional 59 miles of new road construction in inventoried roadless areas over the next 5 years. In the longer term, other new roads would likely be built for exploration and development purposes. In those areas where road construction and mining development occur the beneficial effects of the prohibition alternatives on non-commodity values would be lost.

Recreation, Scenic Quality, Wilderness, and Recreation Special Uses – If mitigation is implemented for mineral leasing and State highways, then an additional 65 miles of road

[24] A total of 257 miles (346 construction miles, plus 99 reconstruction miles, less 188 estimated closures of classified roads) of timber roads associated with timber offer were projected to remain open (Table 3-6). That total was adjusted downward to be consistent with adjustments between offer and harvest volumes.

may be built under the prohibition alternatives in the next 5 years. Roads for mineral leasing would be single use roads that will not contribute to road access for recreation use. In those areas where road construction and mining development occur, the beneficial effects of the prohibition alternatives for dispersed recreation users will be lost. However, the number of acres affected is expected to be small. Exceptions for State highway construction could have a beneficial effect by providing new access routes, but the overall impact would be expected to be negligible.

Hunting and Fishing – Mitigation measures for mineral leasing and State highways would lead to an estimated 65 miles of new road construction in inventoried roadless areas over the next 5 years, and more over the medium and long term. Roads for mineral leasing would be single-purpose roads that could not be used by hunters or fishermen. Thus, mitigation measures for mineral leasing would have no impact on access to hunting and fishing locations. In those areas where road construction and mining development occur, the beneficial effects of the prohibition alternatives on wildlife and fish habitat would be lost. However, the number of acres affected is expected to be small.

Livestock Grazing – If mitigation measures are implemented for mineral leasing and State highways, an estimated 65 miles of roads could be built in inventoried roadless areas over the next 5 years, with additional road miles added over the medium and long term. These roads would not increase roaded access to grazing allotments by permittees. No effects to livestock grazing are anticipated because of this additional road construction.

Non-Timber Forest Products – Mitigation measures for minerals leasing and State highways could result in an additional 65 miles of roads built in inventoried roadless areas over the next 5 years. Roads for mineral leasing would be single-purpose roads; they would not provide additional roaded access to non-timber forest-product harvesters. Existing access to inventoried roadless areas for gathering non-timber forest products would be maintained. However, this additional road construction could affect non-timber forest-product-species populations, and their distribution, as described under Alternative 1.

Timber Harvest – Mitigation for mineral leasing, reconstruction for public health, and State highways is expected to have no impact on timber harvest.

Energy and Non-energy Minerals – Implementing an exception for mineral leasing would reduce the economic effects to local communities, businesses, and individuals employed by mining where continuation of mineral production requires access to deposits in inventoried roadless areas. The most immediate relief would occur in locations where existing leases would have the option of being expanded into contiguous inventoried roadless areas. The loss of jobs and income associated with reductions in current production levels (Table 3-68) would be avoided. The exception does not guarantee future production; it merely allows the decision to be made at the local level.

The mitigation could lead to future minerals development in some communities where no mineral development currently exists, thereby causing those communities to experience the associated economic and social impacts described previously. The mitigation would

maintain opportunities for communities to expand their involvement in the leasable mining sector in the future. If leasable minerals development did occur in inventoried roadless areas it would provide jobs and income to these communities, at least in the short and medium term, enabling communities to experience the associated economic benefits.

Road Construction – Implementation of mitigation measures would increase the potential number of road miles in the next 5 years. A total of 65 miles of roads are projected to be associated with mineral leasing activities and State highways, which would be approximately 13 miles per year. The number of jobs affected by the prohibition alternatives would be reduced slightly because of job opportunities associated with these additional miles of road. The total average annual miles of roads prohibited would be reduced from 49 miles to 36 miles. Direct job effects would be reduced by about 8 to 9 jobs, and total job effects would be reduced by about 15 to 18 jobs. These effects would occur primarily in Region 2, where about 58% of the miles excepted occur.

Forest-dependent Communities – Implementing an exception for mineral leasing could reduce the economic impacts on mining-dependent communities in locations where continuation of production requires access to deposits in inventoried roadless areas. This could reduce the impacts on mining employment, as well as community revenues derived from Federal leasing royalties. The mitigation could also result in future mineral exploration and development in areas where no current mineral development exists. The exception would not guarantee future mineral development; it merely allows the decision to be made at the local level. Timber-dependent communities would not be affected.

American Indian and Alaska Native Issues – Mitigation measures for mineral leasing and State highways would lead to an estimated 65 miles of new road construction in inventoried roadless areas over the next 5 years, and more over the medium and long term. New roads for mineral leasing would not provide additional roaded access to American Indians or Alaska Natives for conducting subsistence or treaty rights activities, as they would be single-use roads. Mitigation measures for mineral leasing would therefore have no impact on access. However, they could have an impact on the physical, biological, and cultural attributes of inventoried roadless areas that are valued by American Indians and Alaska Natives. For example, sacred sites and traditional cultural properties could be disturbed by road construction. Privacy required for conducting ceremonies in the affected areas would also be disturbed. Negative impacts on plant and fish and game species populations could translate to negative effects for subsistence and treaty rights hunting, fishing, and gathering.

Agency Costs – If an exception is provided for mineral leasing and State highways, an additional 65 miles of roads may be built. Responsibility for construction and maintenance of these roads belongs to the lessee or State, although Agency employees would be involved in planning, design, and oversight. Therefore, cost savings to the Agency would be slightly less than under the prohibition alternatives, but the difference would be negligible.

Other Indirect and Cumulative Effects on Social and Economic Factors

This section traces changing trends in the management of NFS lands over the last century, and discusses the current trajectory in relationship to the Roadless Rule and other recent and ongoing rule-making efforts. Specifically, this section examines the cumulative effects of these policies on access to NFS lands, the balance of commodity and non-commodity uses and values on NFS lands, social controversy over the management of roadless areas, public involvement in forest management decision making, resource supply and demand, and forest dependent communities.

Trends in Management – From the early 1900s up until the mid-1940s and World War II, Forest Service management policy toward lands it was administratively responsible for was largely custodial (Giltmier 1998; MacCleery & Le Master 1999; Nelson 1995). Timber production from NFS lands was minimal because there were large supplies of timber available from private lands (Giltmier 1998; Nelson 1995). Livestock grazing was the predominant commodity use of NFS lands during this period (U.S. General Accounting Office 1999).

Following World War II, there was a dramatic increase in demand for lumber as veterans returned from the war, started families, and wanted homes (MacCleery and Le Master 1999). The timber industry turned to national forest timber to supplement or replace the supply from private forestlands, which had been heavily cut over (Williams 2000). Forest Service management between 1945 and 1960 was dominated by a major expansion of timber production, accompanied by extensive road construction activity to meet the demand for wood (Nelson 1995). By the 1960s, wood extracted from Federal lands supplied nearly 20% of the national demand (MacCleery and Le Master 1999).

At the same time that timber harvest on NFS lands was increasing, the demand for other uses, especially recreation was also on the rise (U.S. General Accounting Office 1999). In 1946, there was an estimated 18 million recreation visitor days on NFS lands (Dombeck 2000). By 1960, this number had risen to 93 million and by 1975, to 233 million recreation visitor days (MacCleery & Le Master 1999). As increasingly more people visited NFS lands, they saw the visual effects of timber harvesting. This sparked debate over the use of NFS lands.

The 1960s and 1970s saw a dramatic rise in the environmental consciousness of the American public (Dunlap 1991). People became concerned more about air and water quality and the environmental and aesthetic impacts of forest management practices (Cortner and others 1999). This growing environmental concern was reflected in a proliferation of environmental legislation that was passed in the 1960s and 1970s (MacCleery and Le Master 1999). In response to these shifting values, the Forest Service initiated RARE I and RARE II to identify and recommend to Congress areas suitable for inclusion as Wilderness Areas.

Public awareness of environmental problems and support for environmental protection increased steadily during the 1980s. By 1990, public concern for environmental quality

had reached unprecedented levels (The Roper Organization, Inc. 1992). Environmentalism among the American public has continued to increase as has public demand for the non-commodity values that NFS lands provide (Kempton and others 1995; Kennedy and Thomas 1995). In addition, the American public has continued to demand a larger role in public land management decision-making since the 1970s.

In response to these changing social values, the Forest Service implemented a major paradigm shift in its management approach to NFS lands in the 1990s. What emerged was ecosystem management. Ecosystem management expanded the objectives of public land management to include a broader spectrum of values, uses, than the multiple use-sustained yield approach that preceded it (MacCleery & Le Master 1999). Whereas multiple-use sustained yield emphasized maximizing the sustained production of resource outputs, ecosystem management emphasizes management to ensure the long-term health and sustainability of the ecosystem, using a collaborative stewardship approach.

Future Social and Economic Effects – It is highly likely that recent trends in social values relating to the management of NFS lands will continue into the future, both in the short- and long-terms. The growing national population, growing urban population, and increased conversion of open-space land to urban uses will cause more people to turn to NFS lands and other public lands as places that provide ecological, recreation, and spiritual and aesthetic values, which are increasingly difficult to find elsewhere. Americans are also likely to be increasingly vocal about how public lands are managed. The Roadless Rule is one of several recent and on-going Federal policies that reflect the desire of the public to see the environmental health of their public lands protected, and that emphasize the non-commodity values of NFS lands (see Cumulative Effects of the Proposed Rule with Other Federal Policies section in this chapter).

Access – People's ability to use NFS lands depends on their being able to gain access to them. As discussed in Chapter 3, the American public is very concerned about the impact that the Roadless Rule will have on their ability to gain access to NFS lands, and thereby to continue to use and enjoy them in the ways that they have historically. People are particularly confused about what the Roadless Rule implies for access in combination with the Roads Policy.

Although the Roadless Rule would not alter existing access to NFS lands, existing access could be affected by the Roads Policy. The combined and cumulative effects of the Roads Policy on **forest roads** are detailed in the Cumulative Effects of the Proposed Rule with Other Federal Policies and National Forest System Roads sections of this chapter. Generally, the effect of decommissioning would be to reduce road density in some areas; it would not close off roaded access to most areas. However, it is expected that acres of unroaded areas could grow by 5% to 10% because of implementing these policies together.

The cumulative effects of these two rules would be to minimize new roaded access to NFS lands in the future. This would have the greatest impact on people whose preferred uses of NFS lands are road-based, and on people who can only experience NFS lands that they can reach by roads. The Planning Regulations in concert with the Roads Policy and Roadless Rule could result in slower development of unroaded areas in the future.

Commodity and Non-commodity Values – As stated, Forest Service and other Federal proposed or recent policies all emphasize the non-commodity values of Forest Service lands. The Roadless Rule also emphasizes non-commodity values and uses of Forest Service lands on 58.5 million acres (roughly 31% of all NFS lands). This is in addition to the 18% of NFS lands classified as Wilderness, which already prohibit or restrict road construction. The remaining 51% of NFS lands are open to a wide range of uses and activities, both commodity and non-commodity-oriented. By prohibiting road construction in inventoried roadless areas, an estimated 73% reduction in timber harvest will take place there over the next 5 years compared to the No Action Alternative. Timber harvest in inventoried roadless areas could be further reduced if Alternative 3 or 4 is chosen. In addition, salable and leasable mineral extraction in inventoried roadless areas would likely be precluded by a prohibition on road construction and reconstruction unless mitigation measures are applied. Locatable mineral extraction, livestock grazing, and non-timber forest-product harvest in inventoried roadless areas would likely experience minor effects from the prohibitions.

In light of these proposed and recent rules and policies, the contribution of the Roadless Rule to the trend towards managing NFS lands for their non-commodity values is that it emphasizes managing for these values on a significant portion of NFS lands. It would bring to nearly one half the amount of NFS land that could not have roads. While the other policies and rules emphasize watershed protection and ecological sustainability, they do not directly apply to specific NFS land classifications. This shift has economic implications that are discussed further in this chapter.

Social Controversy over Roadless Area Management – Decisions about public land management are often controversial because of the different values that people attach to these lands, and competing interests in their use. As stated in Chapter 1, roadless area management has been a substantial point of conflict in adopting land management plans for NFS lands. It is the intent of the Forest Service that a national rule to guide roadless area conservation will reduce this conflict, which has not been adequately resolved at the local level to date. The Roads Policy also aims to address this debate and, similarly, to reduce conflict over roads management. The cumulative effects of the Roads Policy and the Roadless Rule are expected to be reduced public conflict over the management of roads and roadless areas, one of the four goals of the Natural Resource Agenda.

However, Roadless Rule may heighten social controversy over fire management in roadless areas. Under the Cohesive Fire Strategy, inventoried roadless areas are not likely to be a high priority for fuels reduction in the next 20 years. A prohibition on road construction and reconstruction could hinder fuel reduction treatments when they do occur in some inventoried roadless areas, as could a prohibition on timber harvest. This could increase the likelihood of large fires in some high priority areas, especially over the short- to medium-term. Added to this is a perception on the part of some members of the public that a prohibition on road construction would make it harder to fight wildland fires in inventoried roadless areas, should they occur there. Many people believe that roads are needed for fire suppression and for fuels management. Given the extensive wildland fires that occurred during the 2000 fire season, public sensitivity to this issue is heightened. The result could be increased social controversy over the Roadless Rule, and its

implications for fire management in roadless areas of NFS lands. Whether this social controversy increases or decreases in the future will depend on what happens with fires in inventoried roadless areas in the coming years, which cannot be predicted.

Local Involvement – The NFMA Planning Regulations, the Clean Water Action Plan and its Unified Federal Policy, and the Cohesive Fire Strategy all emphasize a collaborative approach between agencies, partners, and the public in ecosystem management, whether for fire and fuels management, watershed protection, or land use and management planning. Some members of the public perceive that the Roadless Rule contradicts the emphasis placed on collaboration by these other policies and therefore, reduces their cumulative focus on local involvement, because it imposes national level prohibitions that supercede local-level decision-making. The Roadless Rule would not affect the collaborative decision-making process itself. However, it could have the effect of reducing the public confidence that other programs will follow a collaborative planning path.

Resource Supply and Demand – Management choices made by the Forest Service affect the level of goods and services from NFS lands. A number of factors affect future demands for these goods and services including population growth, economic trends, and technology. These factors were described in the previous sections as they related to individual resources. The Forest Service has no control over most of the factors influencing future demand for resources. Because of the uncertainty associated with quantitative estimates of future demand and supply, the cumulative effects analysis relies on expected future trends. These general trends are sufficient for evaluating the differences between alternatives.

The Roads Policy and recent planning activities, such as the Northwest Forest Plan, Sierra Nevada Framework, and Interior Columbia Basin Ecosystem Management Project, have the potential to expand the area managed for roadless characteristics, further increasing the supply of roadless areas. The cumulative effect of increases in the area of roadless areas could increase the beneficial effects of the Roadless Rule on ecosystem services, natural resource protection values, passive use values, and some types of recreation use. Protecting more roadless areas through such efforts will further increase the Agency's ability to meet increasing public demand for goods and services that rely on extensive, undeveloped areas of NFS lands. Federal lands will continue to be the main source of large, undeveloped lands into the future. Other public lands and private lands tend to be smaller on a per unit basis and more developed than most Federal lands.

The cumulative effect of the current and proposed policies listed is likely to further reduce the available supply of resources, such as timber and minerals, from NFS lands as discussed elsewhere in Chapter 3. Reduced production from roadless areas may be partially offset by production from other portions of NFS lands, but such substitution potential is seen as limited. In addition to the policies already mentioned, listing of the lynx and future listings of other T&E species are likely to further restrict extractive activities on Federal lands.

Further reductions in Federal timber harvest will increase pressure for harvest on other public and private lands. If cumulative reductions are significant, prices may increase in

response and bring new sources of domestic supply onto the market. Increased imports are also likely. Price increases may result in a switch to substitute materials (such as steel) that are not derived from renewable resources. Influences that could offset the increased pressure on domestic and international supplies include technology changes that increase our ability to use small diameter wood products in processing, increases in recycling, and productivity increases in timber yields.

The cumulative effects on future mineral development are difficult to predict. Factors such as discovery of new resources, prices, and technology, determine which mineral deposits are economically recoverable. Estimates of likely future development would be highly speculative. The effect of reduced access to deposits that may be economically recoverable depends on the availability of deposits on other ownerships. Increased development could occur on other portions of NFS lands or other public and private ownerships, or imports could increase.

Roaded and developed recreation opportunities on NFS lands may also be affected by the combined policies. Protection of roadless areas will affect the Agency's ability to develop new developed recreation facilities. Since demand for these types of recreation activities is also growing, density of use will increase, and some type of rationing system may be required. Other Federal lands may also be restricted in developing future capacity because of many of the same policies affecting NFS lands. As a result, increased pressure on other public recreation lands is likely.

Forest-dependent Communities – A number of communities have strong economic ties to activities on NFS lands. In the past decade, the decline in timber harvest from NFS lands has created economic hardships in communities that depended on harvest flows from NFS lands to maintain harvesting operations and processing facilities. In addition to losing jobs and businesses, reductions in Payments to States reduced funds available for local schools and roads. Community effects depend on numerous factors including the availability of substitute harvest opportunities on other lands and other economic opportunities within the commuting area.

The reductions in timber supply estimated for the prohibition alternatives, and the associated effects on jobs, income, and Payments to States appear minor for most areas. However, these effects may be significant when added to changes in resource flows over the last decade. For example, a wood products manufacturing plant may have been reduced to marginal operating efficiency from restricted timber supply. Further reductions may result in the closure of a mill, which could result in jobs and income losses greater than previously estimated. These effects cannot be estimated with any degree of certainty since too many factors independent of this rulemaking affect future demand and supply.

Similar cumulative effects are likely for mining-dependent communities. Reduced access to roadless areas will restrict future exploration and development for some types of minerals. Communities that currently depend on mining would be affected if production cannot be maintained in the long-term without development of roadless areas. Such

communities would face declining jobs and reductions in Payments to States. For communities with both mining and timber sectors, the combined effects would be greater.

The protection of roadless areas will benefit communities with a strong economic tie to dispersed recreation uses and where the natural amenities provided by NFS lands attract new businesses and residents. The cumulative effect of proposed policies is likely to increase this benefit. However, it is possible that restrictions on some types of recreation use could have a negative effect on some sectors of the economy.

Effects of the Tongass National Forest Alternatives

Affected Environment

Encompassing approximately 17 million acres, the Tongass National Forest is the largest administrative unit in the National Forest System, in the nation's largest State (Figure 3-33). The Tongass is a naturally fragmented patchwork of temperate rainforest bordered by muskeg, alpine meadow, rock, water, and ice distributed across 22,000 islands and a narrow strip of mainland encompassing nearly all of Southeast Alaska.

Ecological Factors – Unlike many NFS lands in the contiguous 48 States, the Tongass National Forest does not have a long history of intense multiple-use management. Compared to other forests and regions, the Tongass has relatively few TES species. Management activities that have affected overall ecosystem health are tied predominantly to intensive roading and timber harvest that has occurred within the past few decades.

The Tongass National Forest is the majority of the northern Pacific coast ecoregion. This ecoregion occupies a narrow (160 km wide) coastal band extending from the southern portion of the Alexander Archipelago to Prince William Sound and eastern Kodiak Island. Containing more than one fourth of the world's coastal temperate rainforests, this ecoregion is one of the most pristine temperate rainforest and shoreline ecosystems in the world (Ricketts and others 1999).

The forest's high degree of overall ecosystem health is largely due to the quantity and quality of its inventoried roadless areas and other special designated areas. Approximately 84% of the forest is in land-use designations, such as Wilderness Areas and National Monuments, which limit road construction and timber harvest activities. The Tongass National Forest, because it is so large, is comparable to entire Forest Service regions in the contiguous United States. It has more inventoried roadless areas than any other Forest Service region except the Intermountain Region (Region 4). The percentage of total acreage on the Tongass in inventoried roadless areas is greater than that of any other Forest Service region. In addition, the Tongass has a higher percentage of inventoried roadless areas where road construction and reconstruction are prohibited in comparison to any other Forest Service region.

Conserving inventoried roadless areas is central to maintaining a high degree of ecosystem health. In naturally fragmented landscapes, such as the Tongass, there are

Figure 3-33. Comparison of Alaska and Tongass National Forest to continental United States at equal scales.
(Roadless Database 2000)

heightened concerns regarding fragmentation, isolation of populations, and local population extinctions (USDA Forest Service 1997d). Under these conditions, inventoried roadless areas may be critical in maintaining ecosystem health. Inventoried roadless areas help provide adequate quantity and quality of habitat, connectivity between habitats, and greater likelihood that populations would not be further isolated from one another. Because ecosystems in Southeast Alaska are naturally fragmented and may be less resilient to further fragmentation, the loss of inventoried roadless area conditions may pose a high risk to species existence and persistence.

Limestone karst topography characterized by numerous sinkholes, caves, underground streams, and fractured bedrock is prominent in many locations on the Tongass (Ricketts and others 1999). Serving as a major influence on ecological function and productivity, the karst landscape on the Tongass is a three-dimensional system that includes productive forests and peat lands on top of karst, surface and sub-surface interactions, and ground waters originating from these systems. Within the last decade, the karst topography of the Tongass has gained national attention. Exploration of caves and karst terrain during this time has led to unique ecological, hydrological, and archaeological discoveries (Julin and Shaw 1999)

Human Uses – The undeveloped character of the forest and the marine environment is important in attracting recreationists and tourists, and in meeting their expectations (USDA Forest Service 1997d). The main attractions for recreationists and tourists include

scenery, wildlife, feelings of remoteness, and a sense of vastness. The Tongass National Forest Land and Resource Management Plan Revision Final Environmental Impact Statement (TLMP FEIS) indicates that the recent rapid growth in recreation and tourism is likely to continue (USDA Forest Service 1997d).

Currently, on the Tongass, the recreation-opportunity demand is well below supply, and is expected to be met in the near future for all ROS classes (USDA Forest Service 1982) except Semi-Primitive Motorized (SPM). Areas suitable for SPM activities are primarily natural appearing shorelines, lakes, and rivers that provide semi-primitive experiences, but are classified as motorized due to boat and float plane activity in the vicinity (Table 3-44). The 1999 TLMP Record of Decision projected that unmet SPM demand was "expected to occur under any (land management plan) alternative," not by losing acres to development, but through "increasing resident population and tourism growth" (USDA Forest Service 1999n). The recreating public is drawn to the Tongass National Forest because of its natural appearing landscapes, and as a result, activities in SPM account for 62% of forest recreation use. These areas receive high levels of use because they are accessible by boat and floatplane. Accessing areas that are unroaded and without suitable water access is prohibitive to most users.

Most people visit Southeast Alaska by cruise ship or ferry during the summer season. Outfitters and guides provide services that help visitors and others experience Alaska via airplanes, boat tours, river rafting, and bus tours. Because people expect to experience Alaska wild and unspoiled, outfitters and guides seek natural appearing landscapes. Day use tours are a prominent feature of the 100-day tourist season, although longer duration recreation opportunities, such as big game hunting, skiing ice fields, and extended fishing, rafting, or sea kayaking trips, are also popular.

Hunting and fishing activities are highly valued in Alaska because of the pristine environments and high quality recreational experiences. On the Tongass, hunting and fishing is a large part of the total recreational activity (USDA Forest Service 1997d). Sport fishing user days increased from 60,000 in 1979 to nearly 150,000 in 1994. Recreation visitor days for hunting increased from roughly 75,000 in 1984 to 120,000 by 1995. Because of low population density in Alaska and high travel costs to visit Alaska, current user density is low relative to fishing and hunting opportunities.

Legislation[25] acknowledges the importance of subsistence hunting, fishing, and gathering in Alaska. Southeast Alaska is largely unroaded, and rural communities exhibit a high level of reliance on air and water transportation to support a subsistence lifestyle. Within Southeast Alaska, the estimated annual wild food harvest supplies all of the rural population's protein needs. The total wild food harvest in Southeast Alaska is approximately 5,065,000 lbs. valued at $15,194,000 (Alaska Department of Fish and Game 1998). Wolfe and Walker (1987) found that the presence of roads is extensively associated with reduced subsistence productivity. On the Tongass, decreased productivity may be associated with settlement of nonnative people along roadways in response to timber-related employment opportunities. This results in competition for subsistence

[25] The Alaska National Interest Lands Conservation Act (Public Law 96-487) and by Alaska State law (AS16.05.258).

resources, forcing native and rural people to either use roads for subsistence hunting and fishing or to conduct these activities in non-traditional areas.

The Tongass National Forest is unique because the majority of subsistence and game species, for example Sitka black-tailed deer, marten, wolf, brown bear, salmon, trout, and steelhead, are integrally linked to habitat qualities, including intact old growth and riparian habitats, often found in inventoried roadless areas. The dependence of terrestrial game and subsistence species on roadless conditions or old-growth habitat on the Tongass contrasts sharply with many game species, such as upland game birds, white-tailed deer, in other ecosystems that depend on early and midseral habitats and respond favorably to human-caused disturbances, such as timber harvest.

Currently, the Tongass National Forest has about 3,640 miles of classified roads, or about 90% of the classified roads in the Alaska Region. The majority of these roads were built to support timber harvest. About 20% of the forest roads on the Tongass are maintained for low-clearance passenger cars. Another 45% are designed and maintained for high-clearance vehicles. The remaining 35% are single-use roads that are closed for extended periods between uses. The Tongass has a $13.5 million backlog in deferred road maintenance. This includes costs for improving fish passage where older roadbeds cut across streams.

Most reconstruction and construction of new roads on the Tongass is accomplished to provide access for timber harvest. Most of the new road construction planned from 2000 through 2004 is within inventoried roadless areas. During that time, the estimated road construction in inventoried roadless areas consists of 214 miles of classified roads and 77 miles of temporary roads, mainly to access timber. Almost all of these roads will be maintained for high-clearance vehicles or closed between timber sales. An additional 13 miles of construction for non-timber sale purposes is planned in inventoried roadless areas from 2000 through 2004. This consists of access for special use permits, recreation, or hydropower projects.

Unlike most of the forests in the contiguous United States, wind, rather than fire is the predominant natural disturbance element in the cool rain forest of Southeast Alaska. Therefore, there is neither need nor ecological basis for constructing or reconstructing roads into inventoried roadless areas to address fire risks.

Similarly, insect and disease infestations on the Tongass National Forest are not likely to require road construction, reconstruction, or vegetative treatments in inventoried roadless areas to maintain or restore ecological condition. Instead, insects and disease predominantly affect loss of timber value. In general, relatively few forest health vegetative treatment opportunities exist on the Tongass in comparison to forests in the lower 48 States.

Timber harvest occurs almost exclusively to promote growth and yield using even-aged (clearcut) harvest methods and extensive road construction. The result has been a decline of old growth in some intensively managed areas (central and northern Prince of Wales Island and northeast Chichagof Island, in particular). Concerns exist over habitat loss or

increased species mortality rates within these intensively managed areas. About two-thirds of the forest's planned timber volume offered in the next 5 years would be from inventoried roadless areas. This volume is approximately half of the total planned volume offered in inventoried roadless areas nationally.

Over the last decade, timber harvest levels on the Tongass National Forest have declined by 69%. In 1990, 471 MMBF of timber were removed from the forest, compared to a 1999 harvest level of 146 MMBF. The harvest reductions have been a consequence of increased competition in global wood products markets coupled with the termination of two 50-year timber harvest contracts. The Southeast Alaska timber industry is undergoing a fundamental transformation, as operators work to regain a competitive niche in the international wood products market and reshape the industry to remain viable in the absence of large-scale pulp mills. One company in Ketchikan, Alaska plans to add a veneer mill to its operations this fall. The new veneer plant will be the only processing facility of its kind in Southeast Alaska. It is intended to process smaller diameter spruce and hemlock logs that are currently an underutilized component of the Tongass timber supply. When the veneer mill is operational, material that is now being stacked in log decks or chipped will instead be processed into thin sheets of veneer. This additional processing facility may increase the overall efficiency and economic viability of the company's operations and improve its competitive position in the Southeast Alaska timber market.

Most timber under private ownership in Southeast Alaska is exported directly without local mill processing. As a result, employment in the region's wood products industry depends on the supply of timber from NFS lands. However, some job losses in logging and road construction in recent years have also occurred because of harvest reductions on private lands. The volume of timber harvested from lands owned by the Alaska Native Corporations fell from an estimated 532 MMBF in 1989 to 239 MMBF in 1999.

Thirteen mineral deposits have been identified on the Tongass National Forest. Active mining is currently underway for gold, silver, zinc, and lead. Future mining developments are likely if prices remain high enough to support Alaska's high exploration, development, and production cost.

An estimated 3,500 people are employed in commercial fishing and seafood processing in Southeast Alaska. In 1994, the most recent year for which data are available, the seafood industry was the region's largest private economic sector. Most of the commercial fishing activity and roughly 60% of the processing activity focuses on the salmon species. As roughly 80% of the salmon stocks in Southeast Alaska originate from within the Forest boundaries, the Tongass plays an important role in sustaining this component of the regional economy.

Protection of stream and lake habitat for fish was identified as a key issue in the TLMP. At the direction of Congress, guidance for making timber harvest more compatible with aquatic habitat management was developed in the Alaska anadromous fisheries habitat assessment (AFHA) (USDA Forest Service 1997m). More than 50 scientists and managers participated in the development of AFHA. Recognizing AFHA as the most comprehensive and credible scientific review of measures needed to protect fish habitat

on the Tongass, the TLMP incorporated all recommendations made in the AFHA report. The 1999 TLMP Record of Decision reduced timber harvest activity levels in various locations on the forest, further reducing risk to fisheries and riparian resources (USDA Forest Service 1999n).

Social and Economic Factors – In 1998, wage and salary employment in the Southeast Alaska region accounted for 34,981 jobs, an increase of 2% relative to 1993. At a sub-regional level, increased employment in the Juneau area masked more troublesome economic conditions in the rural areas. For example, over the same period, total employment in the Ketchikan and Wrangell/Petersburg areas declined by 12% and 13%, respectively. Economic forecasts for the Southeast Alaska region suggest a similar growth pattern over the next 5 years. Region-wide, job growth is expected to continue at a rate of 1%, primarily tied to growth in tourism and health-related service industries, and to construction employment in several public works projects.

Market Demand for Tongass National Forest Timber – The size and reliability of the Tongass timber supply has been the subject of congressional scrutiny for many years. In 1990, Congress passed the Tongass Timber Reform Act "to make management of the Tongass consistent with the management of the other 155 forests in the National Forest System." In doing so, the unique timber supply provisions and fixed appropriations included in Section 705(a) of the Alaska National Interest Lands Conservation Act (Public Law 96-487) were repealed and replaced with the following more general direction in Section 101:

> *Subject to appropriations, other applicable law, and the requirements of the National Forest Management Act (P.L. 94-588); except as provided in subsection 9d of this section, the Secretary shall, consistent with providing for the multiple-use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each planning cycle.*

As the TLMP was being revised in 1997, research economists at the Pacific Northwest Research Station were asked to update their earlier projections of Alaska timber products output and timber harvest by ownership (Brooks and Haynes 1997). This work provides a basis for evaluating the extent to which the Tongass alternatives will enable the Forest Service to meet the projected market demand for timber from the forest.

The most recent projections of Tongass timber harvest account for several dramatic changes in Southeast Alaska's manufacturing capabilities, increased competition from a number of sources, and the steady erosion of North America's share of Japanese timber markets. The harvest projections are based on the expected outcome of three market scenarios developed by the Pacific Northwest Research Station's economists to portray alternative futures for Alaska's forest sector. Several key information sources indicate that the current state of Southeast Alaska timber markets most closely resembles that of the low market scenario. Currently, timber inventory is substantial, industry capacity-use rates are low, and there is no evidence of industry-wide changes in processing efficiency.

Under these conditions, average annual harvest is projected at 124 MMBF for the remainder of the forecast period (2000 to 2010).

In their report, the Pacific Northwest Research Station's economists emphasized the uncertainty inherent in predicting the future demand for national forest timber:

> *We characterize the future demand for National Forest timber as having a high degree of uncertainty because of the magnitude of recent changes in the Alaska forest sector, and because many of the factors that will determine the size and type of industry in the future cannot be predicted. The level and reliability of timber supplies from Alaska National Forests are only two among a number of sources of uncertainty; rates of economic growth in key markets, changing technology and tastes and preferences of consumers, and the strength of competition are among other sources of uncertainty (Brooks and Haynes 1997).*

Significant changes in Alaska's manufacturing capacity, product mix, or competitive position are indicative of change in market demand. Under these circumstances, a revision of the above-referenced harvest projections for the Tongass may be warranted.

Tongass Not Exempt Alternative

Prohibition alternatives selected for the rest of National Forest lands would apply to the Tongass National Forest

Under this alternative, the prohibitions (Alternatives 2 through 4) proposed for NFS lands in the lower 48 States would also apply to the Tongass National Forest. Exceptions under the final rule and decision would similarly apply to all NFS lands including the Tongass. For most resources, the effects of implementing the prohibitions may be more dramatic on the Tongass National Forest than on other NFS lands, since more roading in inventoried roadless areas is projected to occur on the Tongass than elsewhere. However, if issues related to a given resource area are relevant to the Tongass National Forest then the types of resource effects mentioned previously could also occur on the Tongass, and they are not reiterated in this section.

For the Tongass National Forest, no relevant differences have been identified among prohibition Alternatives 2 through 4. Nearly identical outcomes are expected among these prohibition alternatives because:

- Regional data indicate a 95% decrease in timber volume from the inventoried roadless areas under a road construction and reconstruction prohibition. Thus, the effects of a prohibition on road construction are not substantially different from the effects of a combined prohibition on road construction and timber harvest;
- Timber harvest on the forest is designed and implemented primarily to provide timber to meet market demand and maximize growth and yield. Thus, the effects of a prohibition of timber harvest, except where designed for stewardship purposes, is unlikely to be

substantially different from a prohibition of all timber harvest, particularly within the current planning cycle; and

- Initial estimates indicate that approximately 33% of the timber volume is scheduled to come from outside inventoried roadless areas. Under current management standards and guidelines, Agency policy, and applicable law, it is unlikely that the Tongass could substantially increase the amount of timber harvested outside inventoried roadless areas above what is currently planned.

Alternatives 2 through 4, if applied to the Tongass, may decrease the likelihood of gaps in species distribution, since an estimated 95% to 100% of the timber harvest scheduled to occur in inventoried roadless areas would be eliminated. Accordingly, Alternatives 2 through 4 may be very low risk to old-growth ecosystems, species viability, and diversity, and may have potential risk levels that are somewhat comparable to those predicted for TLMP FEIS Alternative 1 (USDA Forest Service 1997d).[26] The TLMP FEIS Alternative 1 emphasized high-quality fish and wildlife habitat and retention of unroaded areas. Timber management was limited to small-scale timber harvesting using silvicultural prescriptions to maintain forest structure and function.

Alternatives 2 through 4, if applied to the Tongass, would lower risk to fish and wildlife species that are valued for recreational hunting, fishing, and viewing opportunities and for subsistence. Similarly, the wild and unspoiled nature of many inventoried roadless areas would be maintained. Thus, current levels of remote and semi-remote recreational opportunities, which are commonly sought on the Tongass National Forest, would be maintained. Some detrimental effects to recreation uses may also occur. Prohibitions would likely reduce future development opportunities; particularly developments that would require short segments of roads.

Alternatives 2 through 4, if applied to the Tongass, can be expected to have a substantial effect on the forest's timber program. As previously noted, nearly two-thirds of the forest's timber sale volume is scheduled to come from inventoried roadless areas. Under Alternative 2, annual timber offerings from the Tongass would be reduced from 176 to 73 MMBF. Under Alternatives 3 and 4, annual timber offerings would be reduced to 68 MMBF. As a result, timber harvest activity, currently projected at 124 MMBF annually, would likely be reduced to around 50 MMBF. The prohibitions are unlikely to have an immediate effect on harvest activity as the industry currently has access to a supply of volume under contract that can be used to maintain operations for 2 to 3 years.

Alternatives 2 through 4 will restrict the timber supply available to the industry and bring about a fundamental shift in the region's timber market. Relative to current industry operations and projected timber demand, the prohibition alternatives may result in a harvest shortfall of approximately 73 to 77 MMBF of timber annually. In the short term, the immediate effect of supply shortages is likely to be intense competition and bidding

[26]On May 23, 1997, Regional Forester Phil Janik signed a Record of Decision (1997) approving the "Revised Land and Resource Management Plan for the Tongass National Forest" (1997 Land Management Plan). The Plan was accompanied by a final EIS that outlined the effects of the Plan as well as other alternatives to the Plan. Shortly following approval, 33 individual notices of appeal were filed on the 1997 Record of Decision. The Undersecretary of Agriculture issued a new Record of Decision in 1999. That 1999 Record of Decision is currently used to manage the Tongass National Forest.

activity for the timber sales that are made available. As time goes by, competition will drive out the least efficient operations, thereby reducing mill capacity and the associated long-term demand for Tongass timber. In the long term, a sustained harvest level of 50 MMBF may support some but not all of the existing and planned timber processing facilities in the region. It is impossible to predict which businesses will successfully compete for the remaining timber supply. Companies that have taken steps to diversify their product mix (e.g., adding veneer manufacturing capability) or increase the efficiency of the overall operations are more likely to remain viable.

The economic effects under Alternatives 2 through 4 would be concentrated in Southeast Alaska where mill closures and reduced logging activity would trigger direct job losses of 364 to 383 employees in the private sector and direct income losses estimated at $16.7 to $17.6 million. These job losses would occur in communities where mills and logging companies are located (Ketchikan, Coffman Cove, Craig, Thorne Bay, Klawock, Metlakatla, Wrangell, Petersburg, and Hoonah). Over the long term, as the effect of the direct job losses and business closures progressed through the economy, another 218 to 230 jobs may eventually be lost along with an additional $10.1 to $10.6 million in income. Because non-residents comprise a relatively high percentage (29.6%) of the workforce in the Southeast Alaska timber industry, the actual economic effects of Alternatives 2 through 4 within the State of Alaska may be smaller than estimated here. Non-residents are more likely to spend their earnings at home rather than in Alaska. Therefore, job losses affecting this segment of workforce would result in a slight reduction of economic activity in other States. The indirect effect would be more widely spread throughout the region, impacting retail and service providers in urban and rural communities. The immediate impact to mill operations would be buffered to some extent, as short-term operational needs would be met by the supply of volume under contract.

Alternatives 2 through 4 would have a direct effect on Forest Service operations in Alaska. Timber and road construction dollars accounted for more than 40% of the budget allocation for the Tongass National Forest in fiscal year 2000. For some Districts, these programs accounted for 60% to 70% of program dollars. Timber and road dollars also contribute to indirect project costs, thereby supporting the administrative workforce, office operations, and associated infrastructure on the forest.

The relationship between Forest Service employment and timber output is complex and difficult to quantify. Unless Forest Service budget allocations reflect a significant change in programs and priorities, Alternatives 2 through 4 would likely reduce Forest Service employment in the Alaska Region. Alternative 4 could reduce Forest Service employment by 141 jobs, or 30% of the current Tongass workforce. The associated loss in personal income is estimated at $7.1 million. Over time, cutbacks in Forest Service payroll and program expenditures would likely trigger additional job and income losses in other sectors of the economy. These indirect consequences may eventually lead to a loss of another 141 jobs and $3.4 million in personal income, with impacts occurring throughout the economic region. The number of Forest Service jobs lost would be greatest in communities with both a Supervisor’s Office and a District Office (Sitka, Petersburg, and Ketchikan).

The total effect of applying Alternatives 2, 3, or 4 to the Tongass National Forest is estimated to be a loss of 864 to 895 jobs and $37.3 to $38.7 million in personal income in Southeast Alaska. Job losses in the timber industry would likely occur over a 2- to 3- year period as mills deplete their stockpiles of volume under contract and face increasing competition for a smaller timber supply. A similar period would be expected for Forest Service employment reductions, as difficult choices would be made about office closures and personnel actions. Indirect effects from lost wages and cutbacks in program expenditures would occur over a number of years and may be offset by growth in other economic sectors.

As mentioned, impacts to sub-regions of the Southeast Alaska economy would likely be more significant than impacts to the region as a whole. Communities or sub-regions where the timber industry continues to be a cornerstone of the economy, and where the Forest Service has a strong presence would especially be at risk of economic decline. Under this assumption, the social and economic consequences under Alternatives 2 through 4 would likely be concentrated in the Prince of Wales Island sub-region, Wrangell, Petersburg, Hoonah, and Ketchikan.

Tongass Exempt

Alternative selected for the rest of
National Forest System lands
would not apply to the Tongass

Under this alternative, land management would continue as outlined in the 1999 Record of Decision for the TLMP (USDA Forest Service 1997d). Projected risk to ecosystem health would remain unchanged, human uses would continue at levels projected under the TLMP, and social and economic values would be affected as described within the current TLMP and TLMP FEIS (USDA Forest Service 1997d).

The 1999 TLMP Record of Decision is comparable to the other TLMP FEIS alternatives that were ranked among those having lower species risk ratings. Based on comparisons, under the current TLMP there is a moderate to high likelihood that habitat conditions will support well-distributed species. According to the TLMP (USDA Forest Service 1997d), it is likely that population interactions will occur with a possibility of limitations; permanent gaps in historic range are not likely to occur.

Within the Tongass, there are several areas (central and northern Prince of Wales Island and northeast Chichagof Island), which have been intensively managed for timber production. As a result, there has been a marked decline in the amount of productive old growth in these areas and concern over habitat loss or increased mortality rates due to increased human access. The relevance of this disturbance pattern is integrally tied to the heightened sensitivity of the Tongass to further fragmentation. Based on the extensive amount of roading and harvest currently projected under the current TLMP and the intensive even-aged techniques that are used to harvest timber on the Tongass, forest fragmentation may increase in the areas where harvest is scheduled. These include many areas that are adjacent to existing heavily fragmented areas. Thus, there is a higher

likelihood for less desirable species viability outcomes under the Tongass Exempt Alternative than under the other Tongass alternatives.

Under the current TLMP, the total projected timber offer in inventoried roadless areas on the Tongass in the next 5 years (fiscal years 2000 to 2004) is 539 MMBF, requiring 291 miles of road construction and reconstruction, including 77 miles of temporary roads. This represents nearly half the timber volume projected to be offered from inventoried roadless areas nationwide for this 5-year period. Given the projected offer level, it is estimated that 76.6 MMBF of timber would likely be harvested annually from inventoried roadless areas on the Tongass (Table 3-80). This level of harvest is estimated to support 383 direct jobs and accounts for $17.6 million in direct income and $1.7 million in Payments to the States. The projected offer under Alternative 1 would provide for a harvest level that is consistent with current projections of market demand.

Table 3-80. Estimated average annual economic impacts from Tongass alternatives (1997 dollars). [a]

Tongass alternative	Affected harvest volume (MMBF)	Direct jobs (number)	Total jobs (number)	Direct income ($1000)	Total income ($1000)	Payments to states ($1000)
Tongass Not Exempt	76.6	383	613	17,604	28,166	1,685
Tongass Exempt	0	0	0	0	0	0
Tongass Deferred [b]	76.6	383	613	17,604	28,166	1,685
Tongass Selected Areas	34.0	170	272	7,800	12,500	748

[a] For purposes of comparing the Tongass alternatives, the effects of applying Alternative 3 with mitigations on the Tongass are displayed.
[b] Effects would be delayed until 2004.

As stated, recreation opportunity demand is currently well below supply and is expected to be met in the near future for all ROS classes except Semi-primitive Motorized (SPM). Under the current land management plan, many land-use designations allow for certain types of site-specific recreation developments that may be important to help meet some of the increasing SPM demand. These developments have been termed “minor” or “major” developments depending on the amount of development possible. Cabins, hiking or cross-country ski trails, and small docks are examples of minor development; these could occur in most land use prescriptions. Major developments include lodges, destination resorts, and full-service campgrounds, which might require short segments of roads to connect them with existing roads or docking facilities. Major developments would be concentrated on relatively few acres but could take advantage of the surrounding undeveloped natural setting.

Tongass Deferred Alternative

No prohibitions at this time;
determine whether road construction
should be prohibited in inventoried roadless areas
on the Tongass as part of the 5-year Plan Review

This alternative defers a decision regarding prohibitions on the Tongass to the local level and to the 5-year Plan Review in 2004. At such time an evaluation of inventoried roadless areas on the Tongass would be completed to determine whether road construction and reconstruction should be prohibited in inventoried roadless areas of the Tongass. The responsible local deciding official would have responsibility for completing the analysis and making the decision on whether or not to apply prohibitions.

A substantial amount of timber harvest and roading (539 MMBF and 291 miles of road) is projected to occur in inventoried roadless areas of the Tongass in fiscal years 2000 to 2004. Under this alternative, the beneficial effects of prohibitions applied immediately to the Tongass would be foregone for some ecological resources. The delay would benefit local communities by providing them an opportunity to adjust to the 1999 TLMP Record of Decision.

Predicting the outcome of the analysis and decision to be made as part of the 5-year Plan Review is very speculative. Currently, most of the vegetative treatment needs identified in the current planning cycle are likely to be even-aged treatments that maximize timber volume yield within unroaded portions of the forest. Where they are implemented, such treatments are not likely to conserve roadless area characteristics. However, such treatments were evaluated in the current TLMP FEIS and provided for in the 1999 Record of Decision. Consideration of roadless areas and roadless area qualities was an important focus of the 1997 TLMP FEIS and 1999 Record of Decision

Issues and resources on the Tongass are managed in an extremely complex social, legal, and political context that is undergoing much change. The analyses and rational for the current Plan will be reviewed in the context of the social, legal, and political climate on the Tongass in 2004. Because of this complex social, legal, and political climate, the effects of the Plan Review in 2004 cannot be predicted with any accuracy. At best, it may be reasonable to project that after further review of all inventoried roadless areas on the Tongass prohibitions may be applied in some of the areas considered.

Tongass Selected Areas Alternative

Prohibit road construction and reconstruction in Old-growth Habitat, Semi-Remote Recreation, Remote Recreation land use designations, and LUD IIs within inventoried roadless areas on the Tongass

Under this alternative, prohibitions would be applied to inventoried roadless areas within Old-growth Habitat, Semi-Remote Recreation, and Remote Recreation Land Use Designations (LUDs), and LUD IIs. Collectively, these four LUDs encompass approximately 7 million acres (approximately 80%) of the land in inventoried roadless areas on the Tongass National Forest.

These four LUDs emphasize maintenance of mostly natural settings rather than development (Appendix E).[27] For this FEIS, they were categorized as inventoried roadless areas where roading is not allowed. However, on the Tongass, like other NFS lands, there are certain situations where roading is allowed in inventoried roadless areas that have been characterized as not allowing roading. There are perhaps more circumstances on the Tongass where allowances have been made for roading within these areas than on other national forests. For example, all four of the LUDs allow road construction to access adjacent lands for development purposes, such as timber harvest, if it is the only feasible option.

For most resources, the effects of this alternative would probably not be noticeably different from those under the Tongass Exempt Alternative. The amount of road construction that would be prohibited under this alternative is likely to be minimal relative to roading in other areas of the forest. Prohibitions applied in these four LUDs have important implications to timber, ecological, and recreation resources. Thus, the discussion for this alternative focuses on these resource areas. There are also social and economic effects that may occur because of changes in the timber, ecological, and recreation resource areas. These relationships and causative factors influencing expected effects were discussed previously this chapter.

The amount of road construction occurring under the 1999 Record of Decision in inventoried roadless areas within the Old-growth Habitat, Semi-Remote Recreation, and Remote Recreation LUDs, and LUD IIs can be predicted. Predictions can be made based on the situations in which road construction is permitted, the spatial distribution of the LUD on the forest, and the total acres of each LUD.

Based on the considerations outlined below, higher amounts of road construction might be anticipated to occur within the Semi-Remote Recreation LUDs and Old-growth Habitat relative to the Remote Recreation LUDs and LUD IIs.

- The Old-growth Habitat, like the other three designations, allows roading to access adjacent LUDs if it is the only feasible access option. These situations are more likely within the Old-growth Habitat because of the spatial distribution of Old-growth Habitat.

[27] The complete description of the goals, objectives, and desired future condition for the Old-growth Habitat, Semi-Remote Recreation, Remote Recreation, and LUD II, and land-use designations from the TLMP, Chapter 3 – Management Prescriptions (USDA 1997c) is in Appendix E.

Old-growth Habitat are often much smaller, more widely distributed, and often occur adjacent to and within moderate and intensive LUDs. In contrast, the other three LUDs usually occur in larger contiguous blocks that sometimes encompass entire small islands.

- New roads are not explicitly stated as inconsistent with the goals, objectives, and desired condition of the Semi-Remote Recreation LUDs. An exception to allow roading to link existing roads is described within the transportation standards and guidelines for Semi-Remote Recreation and exceptions for major recreation development, which could require road construction, are included within the recreation standards and guidelines. In contrast, the desired condition for Remote Recreation is characterized by extensive, unmodified natural environments, a goal to manage the LUD II areas in a roadless state, and the standards and guidelines for Old-growth Habitat describe roads as generally inconsistent with the objectives of Old-growth Habitat.

Despite the relative abundance of these LUDs on the Tongass National Forest, the amount of roading that is likely to occur within these four LUDs under the current TLMP would be a very small percent of the total amount of roading that is expected to occur on the forest. Most of the roading is projected to occur in inventoried roadless areas with moderate and intensive Development LUDs, which do not prohibit roading and timber harvest. In most cases, new road construction is likely to be minimal and to occur near the fringes of these areas. As with all projects, such road construction would require environmental analysis and mitigation, consistent with applicable law and Agency policy. Most of the roading projected to occur in inventoried roadless areas on the Tongass would take place on moderate and intensive Development LUDs, which do not prohibit roading and timber harvest.

Timber Volume Outputs – For purposes of analyzing this alternative, the Tongass National Forest estimated the acres of Development LUDs that would be isolated if roading through inventoried roadless areas within these four LUDs were prohibited (Table 3-81).

Table 3-81. Tongass National Forest land-use designations by road construction prohibitions.

Designation	Acres isolated	Percent of the timber base isolated
LUD II	0	0
Old-growth Habitat	54,461	6
Semi-Remote Recreation	11,528	1
Remote Recreation	540	0
Total	**66,529**	**7**

(Wilson Personal communication)

The analysis for Old-growth Habitat only considered large and medium sized reserves, since small reserves were not mapped in the 1999 TLMP Record of Decision. The Tongass reported that in most projects currently in process, small reserves would preclude access to the suitable land base needed to achieve the ASQ. They further estimated that an additional 4% of suitable land base could be isolated if roading through inventoried roadless area in small old-growth reserves was prohibited. Thus, an estimated 7% to 11% of the suitable land base would likely be isolated if the prohibitions were

applied to all Old-growth Habitat. The short-term effect of this loss of roading capability is estimated to be a 291 MMBF reduction from the current 10-year timber sale plan. Most of this decrease would occur in the first 5 years (241 MMBF in the first 5 years as compared to 50 MMBF in the last half of the 10-year period).

The preceding projections are based only on the availability of roading access and do not consider feasibility. Feasibility and the economics of the timber market including alternative harvest methods may play a role in whether the timber is harvested. However, feasibility considerations are unlikely to alter these predicted outcomes drastically since the economics generally do not support alternative harvest methods. The regional data for inventoried roadless areas as a whole indicate a 95% drop in timber volume outputs largely because the current economic situation does not support more expensive harvest techniques. Additionally, situations where extensive segments of road are needed to access some of the acres identified as isolated under this alternative may similarly not be supported economically.

The projections did not include road miles required to access the acres identified as potentially isolated under this alternative. Based on the discussion of projections with the forest, it is clear that the majority of roading needed for access among the four LUDs analyzed in this alternative would involve Old-growth Habitat. The forest estimated that there would be 13 instances where roading through large or medium reserves might be required to access adjacent Developed LUDs. Additionally, in a couple of those cases, the road segments required for access might be extensive.

The Tongass Selected Areas Alternative would have a significant effect on the short-term timber supply (i.e., the scheduled timber offer in the first 5 years of the 10-year schedule). Over this time, the forest would be prohibited from offering an estimated average of 48 MMBF per year. This equates to roughly one-third of the scheduled timber supply. The associated reduction in timber harvest may trigger the loss of up to 170 direct jobs, $7.8 million in direct income, and $748,000 in Payments to States. The job loss may come in the form of temporary layoffs or permanent mill closures as the industry adjusts to a short-term supply disruption. Companies with an ample supply of volume under contract are better prepared for a timber shortage and are not likely to be heavily impacted.

The reduced timber supply would cause a short-term disruption in the region's timber market. Relative to current industry operations and projected demand, the Tongass Selected Areas Alternative would lead to a shortfall in annual harvest of approximately 34 MMBF for the first 5 years in the 10-year schedule. Because of the long lead time involved in timber sale planning on the Tongass, it is unlikely that substitute volume could be made available to take the place of the sales dropped from the sale schedule. After the initial 5-year period, future timber offerings are planned for areas of the forest that are largely outside the focus of this alternative, which may allow the industry some chance of recovery.

Ecological Considerations – Beneficial effects to old growth and old-growth dependent and disturbance sensitive species could occur from a prohibition in Old-growth Habitat. Old-growth Habitat was chosen for their high value to old growth dependent and

disturbance sensitive species. Thus, roading within reserves, as has been projected by the region under the Tongass Exempt Alternative, would likely affect ecological resources. Based on the estimated frequency where roading is needed in Old-growth Habitat (approximately 10% of the large and medium reserves and other small reserves), the ecological benefits under the Tongass Selected Areas Alternative are not expected to lower forest-wide risks to species from that predicted under the current TLMP. Instead, the ecological benefits of the Tongass Selected Areas Alternative would likely be localized in nature. However, where these benefits occur at the local level, they could be quite meaningful and easily identified.

The effects to individual reserves, if roading occurs within the reserve, would depend on the location of the road and the extent that effective mitigation measures could be developed and implemented. Old-growth Habitat occurs in small, medium, and large reserves. Approximately 150 medium and large reserves were designated. Many small reserves are distributed throughout the forest. The value of large and medium reserves is better understood at the forest-plan level. The value of the smaller reserves is strongly related to site-specific information, which was difficult to obtain at the land management-plan level. A provision to adjust the location of the reserves was included in the TLMP based upon further consideration of the site-specific characteristics of individual small reserves.

Even a limited amount of roading in isolated small reserves could compromise their value. Thus, for smaller reserves the ability to adjust reserve boundaries to include old growth of equivalent or higher value would influence whether there are effects, and if so, the magnitude of the effects. A road that completely transects a larger unroaded area might also compromise its overall ecosystem health, although few such instances are expected to occur. Where roading through large and medium sized old-growth reserves may be necessary to access Development LUDs, the amount of road needed within the reserve is generally expected to be less than 5 miles.

Under the Tongass Selected Areas Alternative, projected effects to the timber base include isolation of more than 66,000 acres of suitable timberlands in moderate and intensive Development LUDs. In general, lands in the suitable timber base are often quality old-growth habitat. Retention of these lands in an unroaded, undisturbed condition would benefit ecosystem health by retaining more old-growth habitat and reducing fragmentation that would otherwise occur under the current TLMP. Some of these effects may be short-term and depend on the economics of the timber market in Southeast Alaska. For example, at some time in the future the value of the timber in some of the areas isolated by road access could be high enough to support other harvest methods that do not require additional road construction.

Roading through Old-growth Habitat under the current TLMP to reach Development land-use designations is likely to occur more commonly than in the Semi-Remote Recreation, Remote Recreation, and LUD IIs. Thus, the beneficial effects to ecological resources because of prohibitions within the Semi-Remote Recreation, and Remote Recreation LUDs, and LUD IIs are likely to be much less than a prohibition applied to the Old-growth Habitat.

Recreation – Road construction within Remote Recreation LUDs or LUD IIs could compromise primitive recreation opportunities. However, because of the spatial distribution of these two designations, roading through them to access adjacent LUDs is likely to be very uncommon. In fact, the Tongass National Forest did not predict any instances in which roading through LUD IIs would be necessary to reach adjacent lands available for timber harvest.

Roading through Semi-Remote Recreation for purposes other than semi-remote recreation may compromise semi-remote recreation opportunities. The Tongass National Forest predicted that roading through Semi-Remote Recreation LUDs to reach adjacent lands designated for timber harvest would be uncommon. Thus, a prohibition of roading in Semi-Remote LUDs is also likely to have beneficial effects to dispersed recreation and scenic values.

A prohibition of roading in Semi-Remote Recreation LUDs could have negative effects on certain new recreational development opportunities allowed for under the current TLMP. As described, many LUDs currently allow certain types of minor and major site-specific recreation developments that are expected to occur from the continued growth of the tourism industry in Southeast Alaska.

Recreation developments requiring road construction are discouraged and generally incompatible with the LUD II and Remote Recreation LUDs, but are considered compatible and likely to occur within the Semi-Remote Recreation LUDs. Their development is most likely to occur adjacent to marine access sites. Many sites with potential for such development have been identified, but no firm proposals exist at present and the actual future amount of development opportunities is unknown. If the current rate of recreation and tourism growth continues, it is possible that 1% to 3% of the acreage within the Semi-Remote Recreation LUDs could experience such development in the future. Conversely, if road construction were prohibited in Semi-Remote Recreation LUDs, potential future developments of this type would not be possible in these LUDs.

Effects of Social and Economic Mitigation on the Tongass National Forest

This FEIS identified social and economic mitigation measures where roading or timber harvest in inventoried roadless areas may be authorized. A complete description of these exceptions is included in Chapter 2. One of the mitigations that could be included under the Tongass Not Exempt Alternative would delay implementation of prohibitions on the Tongass until the 5-year Plan Review in 2004. The delay would allow roading and timber harvest in inventoried roadless areas to occur as currently projected under the 1999 Record of Decision (USDA Forest Service 1999n). Harvest would drop to approximately 50 MMBF total annual forest harvest when the prohibitions are applied in 2004. The delay would benefit local communities by providing them an opportunity to adjust to the 1999 TLMP Record of Decision and prepare for changes in 2004. Beneficial effects to ecological resources that could occur under prohibitions during that 5-year period would be foregone.

The Southeast Alaska economy is in a period of transition. Some sectors, such as tourism and other amenity-based industries, are growing rapidly. Forces outside of Southeast Alaska and even the United States can have a substantial effect on the growth and decline of industries within the region. For example, increased competition in the timber industry has eroded Alaska's market share and competitive position in the global timber market. If this trend continues, market demand may continue to decline. Thus, 5 years from now the effect of the prohibitions might have a very different effect on the local economy than what is projected today.

The deciding official, as part of the final rule, may select a mitigation that would allow the Secretary to approve State highway transportation projects, if they are in the public interest or consistent with the uses for which the land is reserved. Several proposals for State highway corridors are identified in TLMP, including a corridor between Juneau and Haines. Currently, none of the transportation corridors identified in TLMP have received serious local or State support, and none are on any approved project lists. For example, the Juneau and Haines corridor is not supported by the Governor or by local governments. Instead, increased attention is currently focused on the Alaska Marine Ferry System for transportation needs between Juneau and Haines. It appears that in the reasonably foreseeable future, construction of State highways through inventoried roadless areas in Alaska may not be an issue. In the absence of the proposed mitigation regarding State highways, future proposed transportation corridors would be prohibited within all inventoried roadless areas under the Tongass Not Exempt Alternative, and in Semi-Remote Recreation, Remote Recreation LUDs, Old-growth Habitat, and in LUD IIs under the Tongass Selected Areas Alternative.

The remaining mitigation measures were developed in conjunction with prohibition Alternatives 2 through 4. Where possible, roading or timber harvest that could occur under these exceptions has been identified for analysis purposes. On the Tongass, roading or timber harvest occurring under the mitigations is expected to be uncommon. For example, no roading needs for mineral leasing activities, and no vegetation management or timber harvest activities to benefit T&E species are currently identified on the Tongass. Therefore, the impact of roading or timber harvest actions occurring under these other mitigations is speculative and not likely to be noticeable on the Tongass.

Other Indirect and Cumulative Effects on the Tongass National Forest

Local Context – In 1999, Under Secretary of Agriculture Jim Lyons signed a new Record of Decision for the Tongass National Forest Land and Resource Management Plan Revision (USDA Forest Service, 1999n). The 1999 Record of Decision modified the 1997 Regional Forester's decision by strengthening a standard and guideline, adding another standard and guideline, and changing land use designation for 18 areas of the Tongass National Forest. The change in land use designations from development to mostly natural for the 18 areas encompassed approximately 234,000 acres. The standard and guideline that was added increased the timber harvest rotation from 100 to 200 years in 42 separate Wildlife Analysis Areas broadly distributed throughout the forest.

Collectively, the changes made in the 1999 Record of Decision built on the old-growth strategy and species-specific management contained in the 1997 decision.

The Under Secretary's 1999 Record of Decision incrementally reduced risk to: 1) deer abundance for subsistence use, 2) the amount and distribution of old-growth forest, and 3) areas of special interest valued for old-growth ecosystem viability, species viability, roadless condition, subsistence use, recreational opportunities, scenic quality, and tourism development. His decision also reduced the allowable sale quantity of timber from an annual average of 267 MMBF in the 1997 Record of Decision to 187 MMBF in the 1999 Record of Decision.

Over the long term, the Tongass Exempt Alternative, when considering the reasonably foreseeable increases in habitat fragmentation and loss of connectivity in adjacent landscapes, would pose a higher risk of adverse cumulative effects to biodiversity. In contrast, over the long term, the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative would be more likely to result in measurable beneficial cumulative effects on the forest's ecological resources. The Tongass Not Exempt Alternative, because it could apply prohibitions to all inventoried roadless areas, would likely have the greatest beneficial cumulative effects to biodiversity.

Over the long term, the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative may result in measurable cumulative effects relative to human uses. However, the effects may be either beneficial or detrimental depending on the particular type of use. For example, such alternatives would likely reduce the harvestable timber supply, which would have a negative cumulative effect on human uses that depend on that supply. The action alternatives may also preclude expansion of some developed recreation opportunities in inventoried roadless areas. Conversely, such alternatives would likely have a long-term positive cumulative effect on human uses that depend on sustainable fish and wildlife populations, natural scenery, and feelings of remoteness.

Over the long term, the cumulative social and economic effects of the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative on the Tongass National Forest would be commensurate with the type and extent of human use effects. Beneficial effects may be associated with the preservation of economic opportunity associated with remote recreation and adventure tourism. Detrimental effects may come from the loss of economic opportunity associated with timber-dependant industry and reduced opportunity for regional economic diversification. The net cumulative economic effects of such alternatives will depend on broader economic trends affecting resource-based industries, and the ability of the individual communities to take advantage of changing opportunities.

However, the economic and social effects of the Tongass Deferred Alternative, the Tongass Selected Areas Alternative, and in particularly the Tongass Not Exempt Alternative, may be of considerable consequence at local levels where the timber industry is a cornerstone of the local economy and where the Forest Service has a strong presence. The direct effects are expected to occur over a period of 3 years, as mills deplete their

stockpiles and face increasing competition for a smaller timber supply. In addition, Forest Service staffing levels may change and offices may close in response to expected timber output declines, further adding to the economic decline. The risk of economic decline would be highest under the Tongass Not Exempt Alternative and would most likely occur in Wrangell, Petersburg, Hoonah, Ketchikan, and communities on Prince of Wales Island. While the effects on local communities may be dramatic, particularly in the near future, those effects would likely be of lesser consequence to the Alaska economy over the long term. Indirect effects from lost wages and cutbacks in program expenditures would likely occur over a number of years and could be offset by the growth of other economic sectors. The effects of prohibitions are of no consequence to the national economy in either the short or long term.

Southeast Alaska Context – The Tongass National Forest comprises the majority of the land in Southeast Alaska and the Northern Pacific Coast ecoregion, a globally significant ecoregion. Because of its dominant status with respect to land ownership, the Tongass plays an important role in the cumulative effects occurring in Southeast Alaska and the Northern Pacific Coast ecoregion. Scattered throughout Southeast Alaska and adjacent to Tongass National Forest lands, Native Corporation lands comprise the second largest segment of the land base in Southeast Alaska. While Native Corporation lands comprise a smaller component of the land base, timber harvest outputs over the past decade on Native Corporation lands have been roughly the same as those from the Tongass National Forest. However, local communities depend on timber from National Forest lands because much of the timber from private land is not processed locally. Specifically, milling and the local economy that milling supports depend, almost solely, on timber from NFS lands. Outputs from NFS and Native Corporation lands have recently declined, as described in the affected environment section of this analysis, and they are projected to be similar in the future (around 150 MMBF annually).

The majority of species in the ecoregion are old-growth dependent or disturbance sensitive species, and the majority of habitat and strongholds supporting these species exists on NFS lands. Because the majority of lands in Southeast Alaska outside the Tongass have been intensively managed for timber harvest, the Tongass plays a critical role in conserving the biodiversity in Southeast Alaska and the Northern Pacific Coast ecoregion.

National Context – Within this FEIS and other literature cited, the ecological uniqueness of the Tongass National Forest has been noted, including the karst geology that underlies much of the Tongass and the island biogeography as it relates to forest fragmentation, metapopulations, and species endemism. Also unique is the quality and quantity of unroaded areas that contribute to the pristine character of the ecosystem and low numbers of federally TEP species on the forest and in the Northern Pacific Coast ecoregion as a whole. The ecologically unique character of the Tongass and current high degree of ecosystem health are important nationally and globally when considered in the context of changing social values.

Past social values and scientific information led to natural resource management throughout the United States, on private and public lands alike, that greatly impacted

biodiversity in many nationally and globally significant ecoregions. Currently, risk to biodiversity in many North American ecoregions remains high because of direct, indirect, and cumulative impacts, resulting from multiple-use management across all land ownerships (Ricketts and others 1999). Scientific understanding of ecosystems and societal values are changing (Botkin and others 2000). As a result, management approaches on Federal land are shifting from an emphasis that is primarily on sustainable resource outputs, to one where resource production outputs are often a consequence of management to achieve other ecologically oriented objectives (MacCleery and Le Master 1999). Current and reasonably foreseeable multiple-use management on Federal land is therefore, more likely to conserve or at least slow the loss of biodiversity within some ecoregions.

In most instances, the current shift in values and management is occurring after irretrievable loss of biodiversity has occurred, particularly in forest ecosystems (Ricketts and others 1999). Few opportunities remain to implement a management approach emphasizing resource production outputs as a consequence of ecological objectives that minimize incremental loss of habitat and species abundance in a largely pristine forest ecosystem. The Tongass, as the major land base within the Northern Pacific Coast ecoregion, presents such an opportunity.

Incremental loss of habitat and species abundance in various locations on the Tongass is expected to occur under the Tongass Exempt Alternative, without posing what is currently considered an unacceptable level of risk to biodiversity across the Tongass as a whole (USDA, Forest Service 1999, USDA, Forest Service 1997). Incremental loss, although less than losses expected under the Tongass Exempt Alternative, are also expected to occur under the Tongass Deferred and the Tongass Selected Areas Alternatives. In contrast, prohibitions could be applied immediately to the Tongass under the Tongass Not Exempt Alternative, greatly reducing much of the expected incremental loss of habitat and species abundance and posing very little risk to biodiversity.

The Tongass Not Exempt Alternative is somewhat similar to Tongass FEIS Alternative 1 (TLMP 1997d), which limited timber harvest to small-scale timber production to maintain forest structure, function, and dynamics similar to existing natural conditions. Such a management approach is consistent with the fundamental shift in societal values held by a growing segment of the American public, and the ongoing shift in Federal land management to emphasize outputs resulting from managing to achieve other ecologically oriented objectives. The rare opportunity to apply this approach to a large, unique, and largely intact ecosystem, before further incremental compromises to the ecosystem occurs, is what makes the Tongass alternatives consequential at a national scale.

Other Ongoing Rulemaking and Policy Effects – Immediately following this section is a Summary of Cumulative Effects of the proposed Roadless Rule alternatives with other Federal Policies. Some of these, such as the Forest Service Cohesive Fire Strategy, will have little or no effect on the management of the Tongass. Other policies, such as the Roads Policy, Planning Regulations, Unified Federal Policy, and Forest Service Strategic Plan may cumulatively affect the ecological, social, and economic conditions on the Tongass National Forest.

Collectively, other ongoing rulemaking efforts can be expected to result in additive beneficial cumulative effects to ecological resources when added to the incremental effects of the Roadless Rule. Specific aspects of these efforts include integrating the contributions of science into the planning process through science consistency evaluations and science advisory boards, giving priority to decommissioning unneeded roads, emphasizing the maintenance and upgrading of heavily used roads, and identification of priority watersheds through watershed assessment. The analysis prescribed under all ongoing rulemaking efforts can be expected to slow development activity, thereby retaining natural landscapes over the long term.

The cumulative effects of ongoing rulemaking efforts, including the proposed Roads Policy, may affect the timber supply available to meet market demand in the reasonably foreseeable future. Currently, the proposed Roads Policy contains language that requires a compelling need to build new roads for an interim period. The effects of the proposed Roads Policy on the timber supply would then depend on decisions made at the local level in response to analyses required by the policy.

Summary of Cumulative Effects

Effects of the Prohibition Alternatives Across Resources

Cumulative effects of past, present, and reasonably foreseeable future actions for individual resources were discussed under each resource section in this chapter. These sections disclose the cumulative effects of maintaining inventoried roadless areas in the context of the collective resource impacts. Using the benchmark dates of 2004, 2020, and 2040, these analyses assume the Roadless Rule will remain unchanged through the next three rounds of land management-plan revisions. While it is possible that changes to roadless area conservation could happen by legislative, executive, or Agency action during this time period, the possibilities for change are speculative and therefore, not discussed. This section presents the “synergistic interaction of different effects” disclosed under each resource section as they qualitatively relate to each other (Council on Environmental Quality 1997). The following discussion focuses on the cumulative effects of the proposed Roadless Rule in conjunction with ongoing and recently finalized Federal rules and policies.

The most consistent change exhibited across all resources, which directly or indirectly affects NFS lands management, is our growing population and our increasingly affluent standard of living. Population growth has intensified the pressure on our natural resources. There is a prolific demand for wood products, minerals, recreational activities, and, to a lesser extent, for special uses, such as power line rights-of-way, irrigation diversions, or communication sites, on both a national and global scale. Cumulatively, the pressure exerted on these resources is likely to increase the adverse effects to biodiversity.

Increasing national economic prosperity is driving the demand for more consumer goods, such as the softwood lumber needed for larger homes. Today's average American single-family home is 48% larger than it was in 1970 (MacCleery 1999). Economic growth is also influencing recreation demand, and the type of recreation activities that people are choosing. However, there is an increasing demand to provide recreation opportunities and facilities and access to those activities and facilities close to population centers. Mineral and energy development are also associated with intensified consumer demand from economic growth.

Population and economic growth are causing shifts in development patterns. More privately owned rural land is converted into housing developments, community infrastructures, commercial centers, and industrial sites. While these development patterns are not on NFS lands, some are adjacent to or surrounded by NFS lands. Between 1992 and 1997, this development trend converted nearly 16 million acres of privately owned forest, cropland, and open space into urban and other uses. This type of land conversion has escalated problems for rural firefighters and heightened the demand from homeowners for wildland fire protection at the wildland-urban interface. Nationally, there is growing concern over the loss of open space in and around urban areas and elsewhere. This reduction of open space is compromising the quantity and quality of available habitat for some aquatic and terrestrial animal and plant species. Accelerated demand for recreation and special uses on NFS lands is also linked to changes in development patterns.

Social values and paradigms are shifting across our nation as we learn more about ecosystem function and open space scarcity.[28] With the increasing urbanization of privately owned lands, a growing number of people are valuing Federals lands as a repository of biodiversity and conservation. Many people appreciate NFS lands more for their inherent "naturalness" than for the commodities, such as timber, minerals, and grazing, that these lands can provide. These societal changes, along with implementation of environmental laws, are changing some programs and activities for Federal land-management agencies like the Forest Service, National Park Service, and Bureau of Land Management. Examples include the recent National Park Service decision to limit snowmobile use in selected parks and the Bureau of Land Management announcement in January 2000 to develop a strategy to improve management of off-highway vehicle use.

Additionally, Forest Service actions have paralleled shifts in social values and responded to increasing environmental concerns. Past Agency actions that relate specifically to issues of roadless area management are Wilderness recommendations, road development, and timber harvesting. Understanding these three areas helps to understand the current need for action.

The Forest Service conducted the first inventory of roadless areas in 1972 in an effort to identify areas greater than 5,000 acres that were suitable for inclusion in the National Wilderness Preservation System as required by the Wilderness Act of 1964. Congress enacted the Eastern Wilderness Act in 1975, which affected specified NFS lands east of

[28]For a discussion on the recent changes in scientific viewpoints, see *Forces of Change: A New View of Nature* (Smithsonian 2000) and other works listed in the Reference Cited section of this analysis.

the 100th meridian (Figure 1-1). A second and final review (RARE II) was finalized in 1979 and resulted in an updated inventory of roadless areas, again to make Wilderness recommendations to Congress. In 1984, Congress passed 21 separate Wilderness Acts for individual States; Montana and Idaho did not receive an act. These State Wilderness Acts included language that released non-wilderness areas from further wilderness review until land-management plan revision. Since RARE II, additional reviews have been conducted through the land management planning process and other large-scale assessments. The debate continues concerning whether roadless areas that were released from consideration for Wilderness recommendation under current land management plans, should remain undeveloped. Road construction, reconstruction, and certain types of timber harvest are the principle Agency activities that initiate development of roadless areas.

From 1944 until the present, the number of road miles on national forests has risen from an estimated 100,000 miles to approximately 386,000 miles. The majority of these roads were constructed to support timber harvest activities. Partly because of the reduction in the timber program during the 1990s, the decline in available funding for road maintenance created the current backlog of $8.4 billion in deferred maintenance and capital improvement needs, which has raised some of the environmental concerns discussed previously. Agency priority under the Natural Resource Agenda has shifted road management from enlarging the forest road system to decreasing the deferred maintenance problem, providing for safe travel, and improving the balance between access and environmental protection.

Before the end of World War II, harvesting timber from the national forests was principally custodial. With the housing demands following World War II, harvesting from national forests increased rapidly from 1945 to 1965. Harvesting through the 1960s, 1970s, and 1980s continued at relatively high levels (7 to 12 BBF). To maintain these timber harvest levels, greater reliance on inventoried roadless areas was needed in many parts of the country. Greater environmental awareness in the late 1980s and throughout the 1990s brought a sharp decline in timber harvesting. The volume of timber sold from NFS lands declined from more than 11 BBF in 1987 to 2.2 BBF in 1999. The annual reductions in timber harvest (60 to 220 MMBF per year) under Alternatives 2 through 4 are only a small fraction of this prior decline in timber harvest across NFS lands, and adds little cumulatively to this past decrease.

As land management plans have been revised in recent years, there has been a substantial decrease in the allowable sale quantity and designation of suitable acres for timber harvesting. This decrease in timber harvesting coincided with the increased recognition that roadless areas are important for ecological and human-centered reasons. This section and other cumulative effects discussions in this FEIS demonstrate the interrelationship among water quality, biodiversity, and wildland fires, which are major resource areas of concern regarding road access and certain timber harvest practices in inventoried roadless areas.

Various factors, including land use activities, land conversions, and laws, rules, and regulations, affect water quality, biodiversity, and fuels management. On NFS lands, the Agency timber program has experienced a major decline in volume over the past 10

years. Entry into inventoried roadless areas to harvest timber has been controversial and costly to plan and implement. Nationally, inventoried roadless areas have not provided a large share of the timber program, yet on some forests, timber sales from inventoried roadless areas contribute to the local economy.

The Agency's fuels treatment program is focused on developed portions of NFS lands. Few treatments are expected in inventoried roadless areas over the next 20 years because of higher priorities for treating managed timber stands and protecting property. Roughly, 99% of all human-caused ignitions and 92% of all lightning-caused ignitions occur on State and Federal land outside of inventoried roadless areas. If the majority of the 14 million acres potentially needing fuel treatment in inventoried roadless areas remain untreated over the next 20 years, the number of large wildland fires and total average annual acres burned by wildland fires in inventoried roadless areas will increase slightly. However, when these 14 million acres are compared to the 580 million acres of Federal, State, and private lands outside of inventoried roadless areas that are ranked as potentially needing fuel reduction treatment, the increase (2.4%) is insignificant.

Approximately 31% of NFS lands are in inventoried roadless areas. Their value as biological strongholds for terrestrial and aquatic plants and wildlife and as sources of clean water have become increasingly important as habitat loss, habitat degradation, nonnative species invasions and development continues to occur on other NFS lands and other lands nationally. For example, dams, water diversions, stream-channel control projects, and development have affected more than 3 million miles, or about 98%, of the streams in the United States. In every State in this country, the Environmental Protection Agency (1998b) has found stream and lake sediments polluted by contaminants from surrounding watersheds, and this Agency estimates that about 10% of the stream and lake sediments in the United States contain contaminate levels sufficiently high to pose risks to fish-consuming wildlife and humans. In the mid-1980s, the U.S. Geological Survey estimated that the number of wetland habitats in the contiguous United States have diminished more than 50% since European colonization in the early 1600s; estimated change from 221 million acres to 103 million acres (USDI Geological Survey 1997b). With the exception of Alaska, few large, relatively undisturbed areas remain in this country outside of designated Wilderness Areas, increasing the relative value of the waters, wetlands, and other habitats that inventoried roadless areas support, and the biological diversity that they foster.

Conserving inventoried roadless areas will have mixed effects on recreation activities. Inventoried roadless areas have traditionally been viewed as places where future developed recreation, such as resort development, may potentially expand. A prohibition on road construction and reconstruction in inventoried roadless areas will maintain the current recreation land availability while preventing road-based recreational developments. The effects on dispersed recreation opportunities are especially mixed. Currently, inventoried roadless areas are seen as important places where dispersed motorized and mechanized uses nay sometimes occur. However, as motorized recreation expands into inventoried roadless areas, there are direct conflicts with other users who may be seeking quiet and solitude. Motorized and mechanized uses can also conflict with other resources including soil and water protection and plant and animal habitat quality. Maintaining a balance between competing uses in inventoried roadless areas has been

increasingly difficult as large areas available for dispersed recreation decline due to development.

Overall, NFS lands satisfy approximately 5% of the nation's timber demand. Inventoried roadless areas are anticipated to provide up to 7% of the Agency's total timber harvest or about one-third of 1% of the national demand. While this 7% is small in comparison to the national program, it can be critical to the economies of certain local communities. Nationally, any decrease in timber harvest from inventoried roadless areas would likely be compensated with offerings from private lands or imports. Mineral and energy resources from inventoried roadless areas can be of substantial value, and lack of road access for exploration and development could have effects on future development of these resources. On a national scale, mineral and energy contributions from inventoried roadless areas are small, but, similar to the timber resource, these contributions can have critical economic impacts on local communities. Other Federal, State, and private lands, or imports would likely offset any decrease in mineral and energy supply from inventoried roadless areas.

As population growth and land conversion due to urbanization and development in the United States increase, the value of the ecological and social characteristics of inventoried roadless areas will continue to increase relative to the economic values of the commodity resources, such as timber and mineral production, contained in these areas. In the Western, northeastern, and north central States, and in Southeast Alaska, rural communities that are highly dependent on timber harvest or mineral extraction from NFS lands view inventoried roadless areas as important economic resources. During the past 13 years, many of these communities experienced the economic effects of a reduction in national forest timber harvesting levels, which have dropped from more than 12 BBF in 1987 to less than 3 BBF in 1999. The majority of this harvest has always come from the roaded portions of NFS lands. Further economic loss from a reduced timber program, or additional loss from a reduction in the minerals program, without corresponding new local employment opportunities at the same wage scale, could add to the social and economic problems faced by rural communities unable to diversify. Reductions in resource production may require some residents to relocate to obtain comparable employment.

Other Federal Policies

The Forest Service and other Federal agencies have a number of ongoing or recently finalized rulemaking and policy efforts that alone or in combination with the Roadless Rule affects NFS lands management. As these public rulemakings and policies are finalized, the Agency may choose to integrate and clarify certain provisions within each rule or policy to ensure consistency, clarity, and effectiveness with other ongoing initiatives. The Forest Service recognizes that the Roadless Rule together with the other proposed and finalized rules and policies could have cumulative effects. These other efforts are discussed below.

National Forest Management Act Planning Regulations

The proposed Planning Regulations were published in the Federal Register on October 5, 1999 (64 FR 54074). This rule has been finalized. These regulations guide land management planning for the National Forest System and describe the required planning process for and content of land and resource management plans. Three key elements are emphasized in the Planning Regulations: 1) collaboration with interested and affected parties; 2) ecological, social, and economic sustainability; 3) science based assessments and planning. Key provisions include new requirements for integrating the contributions of science into the planning process through evaluations and advisory boards; collaboration and adaptive management planning with government, Tribal, and other interested groups; and a management priority to maintain and restore ecological sustainability.

In the final Planning Regulations, roadless areas and unroaded areas are recognized as possible special designations. The rule intends that direction for these areas would be integrated into land management plans to the extent possible. The rule does not specify criteria or characteristics for roadless area delineation or management. However, the rule does rule that all undeveloped areas that are of sufficient size as to make practicable their preservation and use in an unimpaired condition will be evaluated for Wilderness designation during the plan revision process (36 CFR 219.29). These are typically unroaded areas exceeding 5,000 acres.

The proposed procedural criteria and characteristics for specified roadless areas are identified in the proposed Roadless Rule at §294.13 (65 Federal Register 30276). This direction would provide the procedures that could be used to consider the roadless areas and unroaded areas called for in the final Planning Regulations for plan revisions. In other words, the proposed Roadless Rule would provide one of the tools that local land managers could use when implementing the special designations section of the final Planning Regulations. Therefore, in this context, the two rules (Planning Regulations and Roadless Rule) are complementary, not additive. However, given that a purpose of the Roadless Rule is to conserve roadless characteristics, if the two rule are implemented together, it is reasonable to predict that more inventoried roadless areas would be allocated to management uses that maintain undeveloped roadless characteristics then may have been allocated by the Planning Regulations alone. To what extent this would occur is not predictable since it would occur through the local decision making process.

Forest Service Transportation Policy

On February 12, 1999, the Forest Service issued a final Interim Roads Rule that temporarily suspended permanent and temporary road construction and reconstruction in certain unroaded areas[29] of NFS lands. This suspension was in effect until a final

[29]This final interim rule was published as 36 CFR Part 212 Administration of the Forest Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas; Interim Rule, February 12, 1999 (64 FR 7290). The rule expired according to its own terms on September 1, 2000.

National Forest System Transportation System policy was developed or for 18 months, whichever was sooner.

A final National Forest System Transportation System rule and policy (Roads Policy) is being developed. It was thought that a final Roads Policy would be in place before the expiration of the Interim Rule. However, as of the publication of this FEIS, a final Roads Policy has not been promulgated. The proposed Roads Policy would amend 36 CFR 212, 261, and 295 and Forest Service Manual 7700 and 1920. The proposed changes would shift the emphasis from transportation development to managing access within the capability of the land. The proposed rule would change definitions and road management objectives, establish information to be contained in the road atlas (maps and inventory), and direct officials to identify the minimum transportation system needed that would best serve current and anticipated management objectives and public uses of NFS lands.

Under the Roads Policy, unneeded roads would be given decommissioning priority if they were causing environmental impacts. Changes to the provisions in the transportation manual (FSM 7700) would prioritize unneeded road decommissioning, emphasize maintenance and reconstruction of heavily used roads, and established new definitions for the transportation system. In addition, changes to FSM 7700 would only permit construction of new roads or reconstruction of existing roads in inventoried roadless areas, and other certain unroaded areas, for compelling needs until a comprehensive road inventory and road analysis is accomplished and integrated into the applicable land management plan. A compelling need may include restoration and protection of critical resources, maintenance of public safety, or ensuring a legal right.

The proposed Roads Policy requires a determination of a compelling need for road construction and reconstruction in certain unroaded areas. Alternative 2 through 4 in this FEIS would augment the provisions of the proposed Roads Policy that address inventoried roadless areas, since under these alternatives road construction and reconstruction in inventoried roadless areas would be prohibited. However, projects would be allowed under an exception to the prohibitions of the Roadless Rule, would be subject to the analyses and guidance required by the Roads Policy until a forest-wide roads analysis process was completed and land management plans amended as necessary.

The proposed Roads Policy also requires that a science-based roads analysis process is accomplished forest-wide. The roads analysis process is also useful to help analyze effects to unroaded areas in conjunction with land management amendments or revisions and project planning.

The increased screening and analysis for certain unroaded areas of NFS lands provided by the Roads Policy is beyond the requirements of the Roadless Rule. Additionally, the proposed Roads Policy, through the roads analysis process, would result in better road planning and a probable decrease in road construction overall. The proposed Roads Policy is complementary to the proposed Roadless Rule and provides an additional level of review and analysis in certain unroaded areas of NFS lands.

Unified Federal Policy

On February 22, 2000, the Secretary of Agriculture and Secretary of Interior proposed a Unified Federal Policy (UFP) for watershed management in response to the President's Clean Water Action Plan (65 FR 8834). The UFP was finalized and signed by eight departments and agencies in October 2000. The Clean Water Action Plan is a blueprint for cleaning up America's rivers, lakes, and coastal waters. The Plan contains 111 action items, many of which are already underway. The UFP is one of the action items. The purpose of the UFP is to develop a consistent approach to watershed management among Federal agencies, States, Tribes, and interested stakeholders. The foundations of the policy are the "watershed approach" to Federal land and resource management and an emphasis on collaboration to identify and solve watershed problems. A key task of the UFP is identification of priority watersheds through watershed assessments. Agencies agree to work more collaboratively and cooperatively with Federal, State, Tribal and local governments; monitor water quality and management activities; and share training, information, and resources. The policy would be implemented only to the extent possible within existing planning programs.

There are no provisions within the UFP that address the management or role of inventoried roadless areas in fulfilling its goals and objectives. The UFP is consistent with the prohibitions on road construction and reconstruction in inventoried roadless areas in the proposed Roadless Rule and the proposed Roads Policy. The roads analysis process required by the Roads Policy can become a component part of watershed analyses required by the UFP. These watershed analyses are also consistent with the requirements of the Planning Regulations.

Report to the President on the Wildland Fires of 2000

On August 8, 2000, President Clinton asked Secretaries Babbitt and Glickman to prepare a report that recommended how best to respond to the severe fires of 2000, reduce the impacts of wildland on rural communities, and ensure sufficient firefighting resources for the future. This report, titled "Managing the Impacts of Wildland Fires on Communities and the Environment: A Report to the President in Response to Wildfires of 2000," was completed on September 8, 2000. The report recommended a large budget adjustment of $2.8 billion for fiscal year 2001 for Department of Interior appropriations to be used to increase cooperative programs in support of local communities, treat fuels, and restore burned areas. The report emphasizes a continuing priority on firefighting resources throughout the remaining 2000 fire season, restoring landscapes and communities, investing in projects to reduce future fire risks, working directly with communities, and being accountable.

All of the action items called for by the Report to the President are compatible with the proposed Roadless Rule. The alternatives will have little direct effect on prioritization of fuel treatment since most high priority treatment areas (the wildland-urban interface, municipal watershed, and threatened and endangered species) occur outside inventoried roadless areas.

The alternatives would prohibit road construction and reconstruction for burned area restoration in inventoried roadless areas. Seldom has road construction or reconstruction been necessary for emergency fire rehabilitation and recovery projects in the past. Therefore, the potential limitation of the alternatives would not be a significant impediment for implementing the restoration and recovery components outlined in the Report to the President.

The restoration of damaged landscapes could require removal of small diameter trees and brush. Under Alternatives 2 through 4, restoration work involving removal of trees in inventoried roadless areas would be limited without road construction or reconstruction. Tree removal under Alternative 4 would not be possible. Therefore, Alternatives 2 through 4 could limit certain long-term full attainment of the goals outlined in the Report to the President, however, such reductions are expected to be minimal.

Cohesive Strategy

Protecting People and Sustaining Resources in-Adapted Ecosystems: A Cohesive Strategy has been developed and is currently prepared for release to the public. This strategy is a management framework for restoring and maintaining ecosystem health in fire adapted ecosystems primarily in the Western United States. The Cohesive Strategy does not mandate where a specific fire-hazard reduction project should take place. However, it strategically guides land managers to place a high priority on forests and shrub lands that have historically burned frequently and can be classed as moderate to high risk from uncharacteristic wildfire effects. Specific Cohesive Strategy priorities are:

- Wildland-urban interface,
- Readily accessible municipal watersheds,
- Threatened and endangered species habitat, and
- Maintenance of existing low-risk Condition Class 1 areas.

The Cohesive Strategy contains three core elements: 1) institutional, 2) program management, and 3) social. Institutional elements would include linking the Cohesive Strategy to the Government Performance and Results Act of 1993 and establishing performance elements for annual reporting and procedures for assessing the status, risk, and priorities of projects and activities. The program management elements include the Forest Service budget structure, criteria for setting priorities, authorities, workforce and program review, and oversight. The social elements include emphasis of collaborative planning, science-based assessments, and assistance to local communities in fire planning. At full program implementation, the Cohesive Strategy will identify a need for mechanical or prescribed fire treatment annually on 3 million acres in the West, and 1.2 million acres in the Eastern and Southern United States over the next 15 years. The cost of such a program is estimated to be $825 million annually.

The highest fuel treatment priorities resulting from applying the Cohesive Strategy are for protection of communities and private property, community watersheds, T&E species, and air quality. The Strategy does not advocate treating all acres at risk but supports

strategically placing fuel treatment areas across a landscape to substantially reduce the adverse effects of fire.

Even though inventoried roadless areas are not identified as potentially needing fuel treatment in the short term, fuel management work may be required in these areas. Prohibitions on road construction and reconstruction in inventoried roadless areas (Alternatives 2, 3, and 4) could hinder fuel reduction treatments on some inventoried roadless areas that are at moderate to high risk from uncharacteristic wildfires effects. This would be due to the increased cost of treatments associated with using non-road dependent techniques to accomplish the fire hazard-reduction objectives. Some of these untreated areas would burn as wildland fires under a **natural management** regime with the anticipated effects to air, water, soil, and other resources as described previously in this chapter.

Forest Service Strategic Plan

The Forest Service Draft Strategic Plan became final in October 2000. This plan contains four broad strategic goals for the Agency: 1) ecosystem health, 2) multiple benefits to people, 3) science and technical assistance, and 4) effective public service. The Natural Resource Agenda, which is tied directly to the Strategic Plan, identifies road management as a key issue that needs to be addressed by the Agency. The Roadless Rule and Roads Policy are intended to initiate a change in road management emphasis.

The Strategic Plan is a framework strategy under which the Roadless Rule fits. There are no direct cumulative effects in connection with the Strategic Plan and the Roadless Rule since the Strategic Plan does not lead to any direct action on the ground or compel any policy development or implementation. The proposed Roadless Rule and proposed Roads Policy, with their emphasis on road management, would complement the Strategic Plan.

Sierra Nevada Framework

The Sierra Nevada Framework will amend 11 land management plans in the Sierra Nevada Range. The key issues being addressed are old-forest ecosystems, riparian ecosystems, fire and fuels, noxious weeds, and lower west-side hardwoods. Resolution of these issues is not dependent on the construction or reconstruction of roads in inventoried roadless areas. The DEIS of the Sierra Nevada Framework was made available to the public in April 2000. The analysis in the DEIS addressed effects that would result from the proposed Roadless Rule and proposed Roads Policy. The DEIS states that all alternatives are consistent with the proposed changes to the Roads Policy and the proposed Planning Regulations. However, depending on the scope of the final Roadless Rule, some aspects of some alternatives considered for the Sierra Nevada Framework could be affected. These effects are believed to be small and connected with the ability to treat fuels where road construction may be required. Road construction and reconstruction in inventoried roadless areas is unnecessary to attain the goals, objectives, or standards in the preferred alternative of the DEIS for the Sierra Nevada Framework. However, Alternatives 1, 4, and 7 in the Sierra Nevada Framework DEIS may be difficult to achieve under Alternatives 2 through 4 in this FEIS.

Interior Columbia Basin Ecosystem Management Project

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) will provide a context for Forest Service and Bureau of Land Management managers within the Columbia River Basin to make sound local decisions while considering effects, particularly cumulative effects, at a scale larger than individual administrative units. The preferred alternative of the March 2000 Draft ICBEMP Supplemental EIS, anticipated only minimal entry into inventoried roadless areas. The ICBEMP plan recognizes the importance of inventoried roadless areas to provide critical wildlife habitat and serve as key watersheds for supply of high quality water. The proposed ICBEMP is consistent with the purpose and need for the Roadless Rule. Therefore, the prohibition alternatives in this FEIS are expected to minimally affect the ICBEMP.

Lynx and Other Listings by the Fish and Wildlife Service

In response to the uncertain status of Canada lynx populations and habitat, an interagency lynx coordination effort was initiated in March 1998. The U.S Fish and Wildlife Service, Forest Service, Bureau of Land Management, and National Park Service have participated in this effort. In July 8, 1998, the U.S. Fish and Wildlife Service proposed a rule to list the lynx as a threatened species and, effective April 24, 2000 (65 FR 16051), the U.S. Fish and Wildlife Service listed the Canada lynx as threatened for the contiguous United States, pursuant to the Endangered Species Act of 1973, as amended.

Three products important to the conservation of the lynx on federally managed lands have been produced through the interagency effort the: 1) Scientific Basis for Lynx Conservation, 2) Lynx Conservation Assessment and Strategy, and 3) a Lynx Conservation Agreement. These products were developed to provide a consistent and effective approach to conserve the Canada lynx on Federal lands in the contiguous United States.

The Lynx Conservation Assessment and Strategy identifies a number of conservation measures to address lynx risk factors. One large-scale risk factor is fragmentation and degradation of lynx habitat affecting mortality and movement. The Strategy does not identify specific habitat areas, but rather generally identifies habitat conservation as an element in a long-term conservation strategy for lynx (and other large carnivores). Alternative 2, 3, and 4 of this FEIS would conserve inventoried roadless areas that contain significant amounts of habitat for species like the lynx. The inventoried roadless areas occur throughout the range of the lynx in the contiguous United States and therefore, this Roadless Rule cumulatively contributes to conservation of the lynx and other T&E species occupying similar habitats.

With more than 400 TEP species habitats on NFS lands, it is likely that more conservation strategies similar to the one for lynx will be implemented, especially for

wide-ranging furbearers, and where groups of species are combined under one strategy. In a few cases, these strategies may require manipulation of vegetation for the benefit of a specific species. However, it is anticipated that all alternatives in this FEIS would meet the need for management of future listed species.

Land Management Planning

The Forest Service has 36 forests and grasslands that have published notices in the Federal Register of their intent to revise or establish their land management plans. Six units anticipate completion of their plans in 2001, seven anticipate completion in 2002, and nine in 2003. Implementation of the prohibition alternatives in this FEIS may affect their analysis schedules.

The Roadless Rule does not require amendment or revision of any land management plans. Implementation of any of the prohibition alternatives will supercede direction contained in existing and newly revised land management plans. Therefore, it will remain up to the local responsible officer to determine how best to conform ongoing planning for a land management to the selected action resulting from this FEIS. Affect to land management-plan-revision schedules because of implementation of any of the prohibition alternatives cannot be predicted.

Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). The Multiple-Use Sustained-Yield Act (Public Law 104-333) defines productivity as part of multiple-use management. Specifically, “multiple use means that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.”

In this context, implementation of any of the alternatives does not require an on-the-ground action to occur; therefore, they do not compel short-term uses. If implemented, the prohibition on road construction and reconstruction in inventoried roadless areas would maintain long-term productivity by reducing loss caused by road construction to watersheds, soils, critical habitat, and dispersed recreation activities in inventoried roadless areas when compared to Alternative 1 (Tongass Exempt). Alternatives 3 and 4 would further maintain the long-term productivity of these resources by reducing effects caused by timber harvesting.

Among the Tongass National Forest alternatives, the effects of the Tongass Exempt Alternative would be similar to those under Alternative 1. Applying the requirements in

Tongass Deferred Alternative would maintain short-term uses, such as road construction and timber harvest, at current levels through 2004 and, in this regard, is similar to the Tongass Exempt Alternative. Implementation of the prohibitions in the four LUDs under Tongass Selected Areas Alternative would cause an immediate reduction of some short-term uses in these land use designations. Under the Tongass Not Exempt Alternative, not granting an exemption for effects is the same as those discussed under the prohibition Alternatives 2 through 4.

Unavoidable Adverse Effects

Selection of Alternative 1 would continue any unavoidable adverse effects of road construction and timber harvesting in inventoried roadless areas. Final implementation of Alternative 2, 3, or 4 would also cause some unavoidable adverse effects such as a reduction in the number of acres available for forest health and fuels management treatments (see Forest Health and Fire Ecology section this chapter).

Reduction in the timber program would have continued social and economic effects on some dependent communities (see Forest-dependent Communities section of this chapter). Because a reduction in timber demand is not expected, further reduction in the Agency's timber program would produce off-site adverse effects caused by increased substitution of timber harvest from private or foreign lands (see Timber Harvest section under the Social and Economic Factors section this chapter).

Tongass Exempt and Tongass Deferred Alternatives would avoid most adverse social and economic effects. Short-term unavoidable social and economic effects would likely occur under the Tongass Selected Areas Alternative. The most extensive unavoidable social and economic effect would occur under the Tongass Not Exempt Alternative. Continued development in inventoried roadless areas under the Tongass Exempt Deferred and the Tongass Selected Areas Alternatives would likely have unavoidable adverse effects to many of inventoried roadless areas.

Mitigation Options

The programs described in this section are examples of those that could help establish and implement economic mitigation measures. Actual implementation of any economic mitigation measures would dependent on a Forest Service budget request to Congress and subsequent funding in a final appropriation bill. The effects analysis in this chapter is independent of these or any other mitigation measures being implemented. If implemented however, these measures would mitigate some of the economic and social effects described in this chapter.

The analysis contained in this FEIS indicates that prohibitions on road construction, reconstruction, or timber harvest in inventoried roadless areas would have little economic impact to the national economy or to the forest products industry. The Forest Service has determined that 32 national forests have scheduled timber offer volumes of at least 5 MMBF over the next 5 years in inventoried roadless areas. Various combinations of the

prohibitions in these areas could have some adverse economic impacts on communities in or near those forests. USDA Rural Development Program, Rural Business-Cooperative Service, and the Rural Community Assistance Program are available to provide funding to assist communities. Anticipated effects under any alternative would partially be mitigated by these programs.

USDA Rural Development is committed to helping improve the economy and quality of life in rural America. The financial programs support such essential public facilities and services as water and sewer systems, housing, health clinics, emergency service facilities, and electric and telephone service. These programs promote economic development by supporting loans to businesses through banks and community-managed lending pools. Rural Development offers technical assistance and information to help agricultural and other cooperatives get started and improve the effectiveness of their member services. Rural Development also provides technical assistance to help communities undertake community empowerment programs.

The mission of the Rural Business-Cooperative Service is to enhance the quality of life for rural Americans by providing leadership to build competitive businesses including sustainable cooperatives that can prosper in the global marketplace. The Service meets these goals by investing financial resources and providing technical assistance to businesses and cooperatives located in rural communities and establishing strategic alliances and partnerships that leverage public, private, and cooperative resources to create jobs and stimulate rural economic activity.

The Rural Community Assistance Program was originally authorized by the 1990 Farm Bill. This program serves eligible communities with populations of 10,000 or less, and Counties not contained in a Metropolitan Statistical Area that have at least 15% dependency on natural resources and forest products related employment.

One mitigation measure would be to request, and if approved, receive funding for one of these existing programs. Eligible communities impacted because of the preferred alternative described in this FEIS could access the funds. This would be done in much the same way that eligible communities in the Pacific Northwest were able to participate in Rural Community Assistance Program funds set aside for the Northwest during implementation of the Northwest Forest Plan. Such funding would be annually appropriated from Congress, responding to administration requests, and would be included in the Forest Service’s budget.

If funded, and before implementation of the program, the Forest Service would identify cities and Counties in or near the affected national forests that may be eligible for these funds. A procedure would be developed by the Forest Service to permit communities not directly eligible for this program to become eligible if they can demonstrate a particular need based on implementation of the preferred alternative.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.[30]

Implementation of a prohibition on road construction or reconstruction in inventoried roadless areas under Alternative 2, 3, or 4 would not cause an irreversible or irretrievable commitment of resources because a prohibition of activities would prevent any on-the-ground action. If implemented, the proposed prohibition would reduce road-caused irreversible and irretrievable commitments to watersheds, soils, critical habitat, and dispersed recreation activities in inventoried roadless areas on NFS lands compared to the potential roading effects under Alternative 1. Under Alternatives 3 and 4, the additional prohibition on timber harvest would further lower the probability of irreversible or irretrievable commitment of resources when compared to Alternative 1.

Under the Tongass Not Exempt Alternative, prohibitions could be applied to the Tongass and no irreversible or irretrievable commitment of resources would occur. The Tongass Exempt Alternative would allow irreversible and irretrievable commitment of resources to occur at a level similar to that under Alternative 1. The Tongass Deferred Alternative would allow irreversible and irretrievable commitment of resources to occur at a level similar to that under Alternative 1 for the short-term (to 2004). Irreversible and irretrievable commitment of resources would occur under the Tongass Selected Areas Alternative.

Other Required Disclosures

NEPA at 40 CFR §1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements[31] concurrently with and integrated with … other environmental review laws and executive orders.” None of the prohibition alternatives are an action that requires consultation under the Fish and Wildlife Coordination Act because they do not require water to be impounded or diverted, or with the National Historic Preservation Act because there would be no ground disturbing actions. Informal consultation with the U.S. Fish and Wildlife Service and the National Marines Fisheries Service in accordance with the ESA implementing regulations is on going.

Requirements for USDA rulemaking procedures under regulatory laws and Executive Orders, such as the Unfunded Mandates Reform Act, Executive Order 12988, and the

[30]In the DEIS, road effects to inventoried roadless area characteristics were described as irreversible on page 1-10 and 3-11. This has been corrected to irretrievable.

Civil Justice Reform, were discussed in the preamble for the preferred rule published in the Federal Register on May 10, 2000 (65 FR 30276). They will be discussed in the preamble to the final rule.

There are no anticipated effects to any State or County laws because of exceptions for existing rights. Effects to other Federal lands or non-Federal lands are disclosed under each resource section if an effect is anticipated.

CHAPTER 4.
CONSULTATION AND COORDINATION

Public Involvement

The Forest Service has provided notification in the *Federal Register* and opportunity for public comment for promulgation of the Roadless Rule. In addition to Administrative Procedures Act (APA) requirements, the Agency chose to evaluate and disclose the environmental effects of the proposed rulemaking through an EIS prepared in compliance with the National Environmental Policy Act (NEPA). The implementing regulations for NEPA also provide opportunity for public comment after publication of a Notice of Intent in the *Federal Register* and again after publication and distribution of a DEIS. The Agency combined the rulemaking of APA and NEPA processes by publishing the proposed rule at the same time the DEIS was published and distributed.

Public involvement for the Roadless Rule began on October 19, 1999, when the Forest Service published in the *Federal Register* a Notice of Intent to prepare a proposed rule and an environmental impact statement that would provide direction for the future management of inventoried roadless and other unroaded areas. Publication of the Notice of Intent initiated a 60-day scoping period to identify relevant public issues and concerns. The scoping period included more than 180 listening sessions throughout the nation that drew more than 16,000 participants. More than 360,000 public responses were collected through these meetings, and by letter, electronic mail, and telefax. These comments were analyzed to help develop the Roadless Rule and DEIS. (*Roadless Area Conservation Proposed Rule and DEIS, Forest Service, May 2000*).

A website, **(roadless.fs.fed.us)**, was launched in November 1999 to share information about the proposal. The website included a copy of the Notice of Intent, a set of preliminary questions and answers about the proposal, copies of news releases, public meeting schedules, and contact numbers for information from specific regional offices and national forests. Later, the website information was expanded to display profiles of representative inventoried roadless areas from around the country, a full set of State and national forest maps of inventoried roadless areas, a summary of the public comments received during scoping, specialist reports, other supporting information used in developing the DEIS, and direct links to news articles, other pertinent Forest Service and USDA sites, and other sites discussing the Roadless Rule.

To further broaden involvement, members of the National Roadless Team and regional coordinators provided information to a wide array of interest groups including: wildlife, hunting, fishing, travel and tourism, recreation, State and local governments, transportation, professional societies and academic interests, conservation education, racial and cultural minorities, natural resource interests (for example: fire, forestry, mining, ecology, and water), and disability access groups (groups that focus on recreational accessibility of public lands for people with disabilities).

Consultation with American Indian and Alaska Native Tribes began during scoping and continued throughout development of the Roadless Rule. Forest Service line officers made contact with leadership from potentially impacted American Indian or Alaska Native Tribes having proximity to, or interest in, their administrative unit. Most of these contacts were initiated through scoping letters distributed to the tribes, followed by face-to-face meetings between Tribal leadership, members, resource professionals, and other interested parties and Forest Supervisors, District Rangers, and Tribal liaisons. Additional meetings were held during the release of the DEIS to further explain the alternatives analyzed, answer questions, and receive comments from the Tribes.[1]

Throughout development of the roadless environmental analysis, the Agency has responded to continued interest and scrutiny from members of Congress, State governors, and other elected officials. In addition, the Forest Service testified at seven oversight committee hearings, State-level field hearings, and other hearings that dealt indirectly with roadless issues. The Roadless Team conducted regular briefings and updates for key members of Congressional committees and others with interest and oversight for natural resource issues. At the regional and forest level, Forest Service officials met with governors, State agency officials, County officials, and a variety of interest groups to hear their concerns about the proposal and to share information. The Agency estimates that it received more than 11,000 letters addressed to the Chief and his staff asking specific questions about the proposal, including more than 500 letters from members of Congress, other government entities, or letters from citizens relayed through a Congressional office. The Roadless Team has also processed more than 60 requests from citizens for documents and information under the Freedom of Information Act and information requests from congressional oversight committees.

The Roadless Team fielded hundreds of telephone inquiries from national and regional newspaper, radio, and television reporters; concerned Forest Service employees; and a wide variety of public interests. During development of the DEIS, the team briefed Forest Service leaders and employees and developed a network of roadless coordinators at the regional- and national-forest level to provide feedback to the Roadless Team, help improve internal understanding of the proposal, and provide informed contact points for the public.

Some questions and concerns raised by the public and employees during and after scoping focused on a perceived lack of information about what the proposal might affect. Some citizens also expressed a strong need to “speak their mind” about the proposal. Accordingly, public information and involvement for release of the DEIS was designed to provide the maximum information and access in a variety of formats, along with meetings designed to take verbal comments from those who wished to speak.

[1] A separate document entitled “Roadless Area Conservation Rulemaking: Forest Service Consultation With American Indian and Alaska Native Tribes” describes the consultation process in detail and is available upon request.

In early spring, the Agency provided information about how to order copies of the Proposed Rule and DEIS through national and local news media outlets; the project's web site; letters to major libraries, Federal and State resource agencies; congressional, State, and local officials; tribal leaders; and Forest Service employees.

The Roadless Team also conducted several weeks of discussions with a representative internal group of Forest Service field line and staff employees to answer their questions on the proposal and to seek advice on effective information sharing and explanation of the proposal to the broad array of interests across the country. Responding to employee concerns about the proposal, the team also included representatives of the employee union, the National Federation of Forest Employees, on the advisory group. These advisors helped design materials and meeting formats for explaining and commenting on the proposed rule. They also briefed their peers around the country so that Forest Service employees at the local level could answer questions from local citizens about the impacts of the proposal on their interests. The aim was to produce informed and effective public comment on the DEIS.

Release of the DEIS and proposed rule was announced May 9, 2000, initiating a public comment period that ended July 17, 2000. The DEIS and proposed rule, the accompanying maps and database, and the Summary of Public Comment were posted on the web site **(roadless.fs.fed.us)**, where it could be downloaded in whole or in part. The documents were sent to every Forest Service office, key State and local natural resources offices, and public library systems. Citizens who requested copies were provided, at their option, the Summary or the full two-volume set in compact disk or hard copy format. More than 50,000 copies of the Summary and 43,000 copies of the two-volume DEIS were distributed; including 10,500 two-volume sets sent to municipal libraries across the country.

The Roadless Team also staffed an internal hotline and external toll-free telephone line with meeting schedule information, document-ordering information, and voicemail to record public questions, which were answered by a member of the Roadless Team. Over 130 messages were fielded and responded to between May 11 and June 12, the first month after the release of the DEIS; the number of calls dropped off to about six telephone inquiries per week throughout the early part of July.

The Forest Service addressed public requests for information and desires to be heard through a two-step public meeting process. In late May and June, about 230 public information meetings and briefings were held at every regional office and national forest or grassland with roadless acreage. Documents and explanatory materials, questions and answers, a user guide summarizing the proposal and instructions for submitting comments, a PowerPoint summary, posters, and maps, were available at every meeting. Forest Service officials were available to discuss expected effects of the various alternatives on local areas. The material and a full schedule of national meetings were also posted on the **(roadless.fs.fed.us)** web site.

In late June and early July, Forest Service units hosted another set of meetings to hear, and record for the official record, verbal comments from interested citizens. More than 200 meetings were held. Some units held daylong and double sessions to ensure that all who wanted to speak were heard. Additional sessions were scheduled at public request. For example, a meeting was held in Hawaii where there are no National Forest System lands, but where citizens expressed interest in roadless area issues in the continental United States. Court reporters transcribed comments for the official record. Comments were also collected through letters, telefaxes, electronic mail, and reports and videotapes. Opportunity to comment was also available through a link on the **(roadless.fs.fed.us)** web site.

All comments, no matter their origin or format, were sent to the Content Analysis Enterprise Team (CAET) for compilation, coding, and archive purposes. Responses began to arrive as early as May 10, 2000. The final day of comment, July 17, brought the largest number of responses, including several hundred thousand postcards and telefaxes. These comments are summarized in the final CAET report (Content Analysis Enterprise Team 2000b).

More than 23,000 people attended public meetings, and more than 1.2 million chose to respond by postcards, form letters, original letters and notes, testimony at meetings, electronic mail messages, and telefaxes. In terms of volume, the roadless proposal is the largest public involvement project in the history of the Department of Agriculture or the Forest Service.

Preparers and Contributors

Under the overall leadership of the project directors, four primary teams prepared this document. The Public Involvement Team coordinated the scoping effort, other public involvement activities, content analysis of the comments, and responses to correspondence. The Data Team collected and managed the extensive and varied information required for this effort. Using information assembled from the other teams, the EIS and Rule Team developed the proposed rule text and alternatives for the DEIS, conducted necessary analyses, and documented the findings in the FEIS. The Interagency Team served as a steering committee, providing review, edits, advice, and oversight to the project. Their close involvement early and often in the process facilitated and expedited the formal review and clearance process.

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Stuart Kasdin	Office of Management and Budget, Senior Program Examiner
Leigh Linden	Council of Economic Advisors, Economist

Distribution of the Final Environmental Impact Statement

This FEIS has been distributed to individuals who submitted substantive comments on the DEIS and to those who specifically requested a copy of the entire set of documents. Two versions of these documents are available:

- A 43-page summary;
- A 1,766-page, four volume set that also includes a summary, appendices, a set of maps, Agency responses to public comments on the DEIS, and copies of letters from Federal agencies, federally-recognized Tribes, State and local governments, and elected officials.

The above are available in hardcopy, compact disk, and at the Roadless Area Conservation Project Web Site **(roadless.fs.fed.us)**. The final rule and Record of Decision will be published in the *Federal Register* no sooner than 30 days after the Notice of Availability for the FEIS is published in the Federal Register.

In addition, copies of the FEIS have been sent to the following Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views regarding roadless area management.

Advisory Council On Historic Preservation

Agriculture, U.S. Department of
Animal And Plant Health Inspection Service
Policy And Planning Division, Office of Civil Rights
Rural Utilities Service
Natural Resources Conservation Service
National Agricultural Library

Commerce, U.S. Department of (DOC)
National Oceanic And Atmospheric Administration
National Marine Fisheries Service
Habitat Conservationists Division
Northeast Region
Southeast Region
Northwest Region
Protected Species Division, Southwest Region
Protected Resources Management Division, Alaska Region

Council on Environmental Quality

Defense, U.S. Department of

Deputy Assistant Secretary of Defense
U.S. Air Force Environment, Safety, and Occupational Health
Army Corps of Engineers

Mississippi Valley Division	Pacific Ocean Division
North Atlantic Division	South Atlantic Division
Northwestern Division	South Pacific Division
Great Lakes And Ohio Division	Southwestern Division

Office of Chief Of Navy Operations, Environmental Protection Division
Naval Oceanography Division, U.S. Naval Observatory

Energy, U.S. Department of

Office of Environmental Compliance

Environmental Protection Agency

Office of Federal Activities, EIS Filling Section
EIS Review Coordinators:

Region I	Region VI
Region II	Region VII
Region III	Region VIII
Region IV	Region IX
Region V	Region X

Federal Energy Regulatory Commission

Housing & Urban Development, U.S. Department of

Environmental Officers:

Boston, MA	Fort Worth, TX
New York, NY	Kansas City, MO
Philadelphia, PA	Denver, CO
Chicago, IL	Seattle, WA

Interior, U.S. Department of the

Office Of Environmental Policy And Compliance
Bureau Of Land Management

National BLM Office	Montana/Dakota State Office
Alaska State Office	Nevada State Office
Arizona State Office	New Mexico State Office
California State Office	Oregon State Office
Colorado State Office	Utah State Office
Eastern States Office	Wyoming State Office
Idaho State Office	

National Park Service

Alaska Area Region	Northeast Region
Midwest Region	National Capital Region
Intermountain Region	Southeast Region
Pacific West Region	

Interstate Commerce Commission

Northwest Power Planning Council

Ohio River Basins Commission

Susquehanna River Basins Commission

Tennessee Valley Authority

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- Assistant Secretary for Policy, Environmental Division
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  - Eastern Region
  - Great Lakes Region
  - New England Region
  - Northwest Mountain Region
  - Southern Region
  - Southwest Region
  - Western-Pacific Region
  - Alaska Region
  - Central Region

- Federal Highway Administration
  - Regional Administrator
  - Midwestern Region
  - Southern Region
  - Eastern Region
  - Western Region
- Federal Railroad Administration
  - Office of Transportation and Regulatory Affairs
  - Research and Special Program Administration
- U.S. Coast Guard, Environmental Impact Branch

Congressional delegations
State governors
State agencies:
- Lands
- Forestry
- Transportation
- Wildlife management

Federally recognized tribes
County and municipal libraries (approximately 10,500 copies)
Forest Service offices
Individuals that provided substantive comments on the DEIS or specifically requested a copy of the FEIS

A complete list of all recipients of the FEIS is maintained in the project record and is available upon request.

APPENDIX A

Inventoried Roadless Area Acreage Summarized by State, Region, and Forest

State [1]		Categories of NFS Lands					
					Inventoried Roadless Areas allocated to a prescription		
		Total area of National Forest System land [2]	Total area of National Forest System land in Designated Areas [3]	Total area of Inventoried Roadless Areas within National Forest System land [4]	…that does not allow road construction and reconstruction	…that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	…that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Alabama	33,432	665	47	13	13	0	0
Alaska	393,747	22,083	8,605	14,779	8,479	1,638	4,661
Arizona	72,964	11,255	2,105	1,174	415	61	699
Arkansas	34,036	2,586	153	95	22	0	73
California	101,676	20,698	5,674	4,416	1,727	163	2,527
Colorado	66,624	14,509	3,368	4,433	925	11	3,498
Connecticut*	3,548	0	0	0	0	0	0
Delaware**	1,534	0	0	0	0	0	0
District of Columbia**	39	0	0	0	0	0	0
Florida	38,392	1,153	86	50	20	6	25
Georgia	37,745	865	162	63	38	0	25
Hawaii*	4,134	0	0	0	0	0	0
Idaho	53,487	20,458	4,818	9,322	2,285	1,371	5,666
Illinois	36,060	293	34	11	4	0	6
Indiana	23,158	196	13	8	0	0	8
Iowa**	36,017	0	0	0	0	0	0
Kansas	52,660	108	0	0	0	0	0
Kentucky	25,863	800	125	3	0	0	3
Louisiana	31,776	604	16	7	2	0	5
Maine	21,594	53	11	6	1	0	5
Maryland**	7,870	0	0	0	0	0	0
Massachusetts**	5,914	0	0	0	0	0	0
Michigan	37,448	2,858	214	16	0	0	16
Minnesota	54,014	2,838	815	62	0	0	62
Mississippi	30,903	1,159	8	3	0	0	3
Missouri	44,614	1,493	72	25	0	0	25
Montana	94,109	16,893	4,124	6,397	1,729	824	3,844
Nebraska	49,523	352	16	0	0	0	0
Nevada	70,763	5,833	1,173	3,186	18	2	3,166
New Hampshire	5,941	728	103	235	121	0	114
New Jersey**	5,258	0	0	0	0	0	0
New Mexico	77,823	9,327	1,617	1,597	1,101	66	430

State [1]		Categories of NFS Lands					
					Inventoried Roadless Areas allocated to a prescription		
		Total area of National Forest System land [2]	Total area of National Forest System land in Designated Areas [3]	Total area of Inventoried Roadless Areas within National Forest System land [4]	…that does not allow road construction and reconstruction	…that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	…that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
New York	32,056	16	0	0	0	0	0
North Carolina	33,710	1,244	144	172	16	15	142
North Dakota	45,251	1,106	0	266	0	0	266
Ohio	26,451	230	0	0	0	0	0
Oklahoma	44,738	397	94	13	0	0	13
Oregon	62,140	15,658	2,965	1,965	797	0	1,168
Pennsylvania	28,806	513	42	25	24	0	1
Commonwealth of Puerto Rico	2,245	28	2	24	6	10	7
Rhode Island**	788	0	0	0	0	0	0
South Carolina	19,961	613	23	8	3	1	4
South Dakota	49,357	2,012	35	80	0	0	80
Tennessee	26,973	698	130	85	39	0	46
Texas	171,057	755	39	4	0	0	4
Utah	54,339	8,179	894	4,013	446	0	3,567
Vermont	6,154	376	82	25	16	0	10
Virgin Islands*	109	0	0	0	0	0	0
Virginia	27,089	1,660	200	394	273	12	109
Washington	45,208	9,214	3,360	2,015	1,284	15	716
West Virginia	15,508	1,033	138	202	14	0	188
Wisconsin	35,933	1,523	49	69	0	0	69
Wyoming	62,604	9,238	3,364	3,257	154	17	3,085
TOTAL ACRES	2,343,144	192,300	44,919	58,518	19,970	4,212	34,336

* These states have less than 500 acres of National Forest System land area.
** These states have no National Forest System lands

1 Acreages from Government Accounting Office Land Ownership Report to Congressional Requesters, March 1996

2 USDA Forest Service Land Areas Report September 1999, plus an additional 254,000 acres for Land Between the Lakes National Recreation Area and Exxon Valdez Oil Spill Acquisition. Acreages for National Forest System land and do not include private inholdings.

3 Designated areas include national wilderness, national primitive areas, national scenic research areas, national scenic areas, national wild and scenic rivers, national recreation areas, national game refuge & wildlife preserves, national monuments, national volcanic monuments, national historic areas, research natural areas, wilderness study areas, and other Congressionally designated areas. These designated areas include 6,015,000 acres of Inventoried Roadless Areas.

4 Inventoried Roadless Areas are based on forest plans, forest plan revisions in progress where the agency has established an inventory, or other assessments that are completed or adopted by the agency. RARE II information is used if a forest does not have a more recent inventory based on RARE II.

Region	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Region 1*	25,157	5,935	9,005	2,310	1,149	5,546
Region 2*	22,091	5,133	6,183	992	28	5,163
Region 3	20,708	3,722	2,771	1,516	127	1,128
Region 4	31,914	6,787	15,960	2,236	1,047	12,676
Region 5	20,146	5,446	4,200	1,740	164	2,295
Region 6	24,950	6,488	4,002	2,085	15	1,902
Region 8*	13,226	1,232	954	445	44	466
Region 9	12,026	1,570	664	166	0	497
Region 10**	22,083	8,605	14,779	8,479	1,638	4,661
TOTAL ACRES	192,300	44,919	58,518	19,970	4,212	34,336

Region 1

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Beaverhead - Deerlodge	3,364	377	1,831	2	178	1,651
Bitterroot	1,581	862	406	223	76	106
Clearwater	1,810	311	989	243	198	547
Custer	1,187	337	145	42	14	89
Dakota Prairie Grasslands	1,261	0	280	0	0	280
Flathead	2,355	1,122	479	2	93	383
Gallatin	1,807	898	705	552	28	124
Helena	975	117	445	77	34	334
Idaho Panhandle	2,475	51	823	187	138	498
Kootenai	2,279	138	638	265	117	257
Lewis & Clark	1,862	562	1,004	410	56	538
Lolo	2,080	177	758	179	216	363
Nez Perce	2,121	982	502	127	0	375
Other NFS lands*	0	0	0	0	0	0
TOTAL ACRES	25,157	5,935	9,005	2,310	1,149	5,546

Region 2

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Arapaho – Roosevelt	1,587	379	391	167	9	216
Bighorn	1,108	194	621	34	0	587
Black Hills	1,247	35	14	1	0	13
Grand Mesa, Uncompahgre, Gunnison	2,957	632	1,127	89	0	1,038
Medicine Bow – Routt	2,905	354	822	29	0	792
Nebraska NGs	1,064	16	60		0	60
Pike - San Isabel	2,772	427	688	103	2	582
Rio Grande	1,859	442	530	438	0	93
San Juan	1,878	486	604	61	0	543
Shoshone	2,437	1,419	687	30	17	640
White River	2,276	748	640	40	0	600
Other NFS lands*	0	0	0	0	0	0
TOTAL ACRES	22,091	5,133	6,183	992	28	5,163

Region 3

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Apache - Sitgreaves	1,987	204	322	37	0	285
Carson	1,391	131	105	57	44	4
Cibola	1,892	189	246	160	0	86
Coconino	1,848	183	50	0	0	50
Coronado	1,787	401	483	421	61	0
Gila	3,353	852	734	685	0	49
Kaibab	1,559	634	53	0	0	53
Lincoln	1,104	103	179	1	20	158
Prescott	1,239	103	140	0	0	140
Santa Fe	1,570	342	289	154	2	133
Tonto	2,874	580	170	0	0	170
Other NFS lands	103	0	0	0	0	0
TOTAL ACRES	20,708	3,722	2,771	1,516	127	1,128

Region 4

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Ashley	1,382	482	796	249	0	546
Boise	2,288	73	1,109	300	179	630
Bridger - Teton	3,437	1,411	1,431	0	0	1,431
Caribou	1,085	6	750	5	30	714
Dixie	1,889	87	776	3	0	773
Fishlake	1,461	4	717	4	0	713
Humboldt - Toiyabe	6,323	1,380	3,384	0	0	3,384
Manti - La Sal	1,347	49	601	63	0	537
Payette	2,302	783	905	437	206	261
Salmon - Challis	4,308	1,243	2,301	329	199	1,773
Sawtooth	2,090	747	1,228	329	263	635
Targhee	1,820	147	837	388	169	280
Uinta	804	58	528	0	0	528
Wasatch - Cache	1,322	315	598	128	0	471
Other NFS lands	56	0	0	0	0	0
TOTAL ACRES	31,914	6,787	15,960	2,236	1,047	12,676

Region 5

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Angeles	664	99	155	76	0	79
Cleveland	434	77	88	71	0	17
Eldorado	578	104	82	16	13	53
Inyo	1,977	769	837	305	108	424
Klamath	1,726	445	271	180	0	90
Lake Tahoe Basin	181	25	46	41	1	4
Lassen	1,171	99	168	62	20	86
Los Padres	1,763	815	636	172	0	464
Mendocino	888	145	154	66	0	88
Modoc	1,656	71	201	56	0	145
Plumas	1,198	61	65	56	0	9
San Bernardino	663	133	172	53	0	120
Sequoia	1,094	591	346	123	0	223
Shasta - Trinity	2,082	712	323	130	0	194
Sierra	1,336	635	171	86	0	86
Six Rivers	991	398	199	110	0	89
Stanislaus	898	229	139	92	23	24
Tahoe	836	38	147	46	0	101
Other NFS lands	11	0	0	0	0	0
TOTAL ACRES	20,146	5,446	4,200	1,740	164	2,295

Region 6

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Colville	1,103	33	182	4	0	178
Deschutes	1,603	317	136	58	0	79
Fremont	1,202	36	87	25	0	61
Gifford Pinchot	1,400	330	213	151	0	62
Malheur	1,465	91	182	62	0	120
Mt. Baker - Snoqualimie	1,747	887	415	336	0	79
Mt. Hood	1,067	370	118	87	0	31
Ochoco,Crooked River NG	963	46	61	32	0	29
Okanogan	1,702	724	427	276	0	152
Olympic	634	89	86	65	0	21
Rogue River	628	108	82	30	0	51
Siskiyou	1,094	241	287	179	0	108
Siuslaw	633	63	52	34	0	18
Umatilla	1,406	306	282	153	0	129
Umpqua	983	117	110	75	0	35
Wallowa - Whitman	2,394	1,025	515	5	0	510
Wenatchee	2,198	1,175	579	403	15	161
Willamette	1,680	431	158	86	0	72
Winema	1,045	98	32	23	0	8
Other NFS lands	1	0	0	0	0	0
TOTAL ACRES	24,950	6,488	4,002	2,085	15	1,902

Region 8

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Alabama	665	47	13	13	0	0
Caribbean	28	2	24	6	10	7
Chattahoochee - Oconee	866	162	63	38	0	25
Cherokee	635	67	85	39	0	46
Daniel Boone	693	19	3	0	0	3
Florida	1,152	86	50	20	6	25
Francis Marion - Sumpter	613	23	8	3	1	4
George Washington	1,065	42	261	219	12	30
Jefferson	720	160	153	67	0	86
Kisatchie	604	16	7	2	0	5
Land Between the Lakes	170	170	0	0	0	0
Mississippi	1,159	8	3	0	0	3
North Carolina	1,244	144	172	16	15	142
Ouachita	1,776	159	35	0	0	35
Ozark - St. Francis	1,161	88	73	22	0	51
Texas	676	39	4	0	0	4
Other NFS lands*	0	0	0	0	0	0
TOTAL ACRES	13,226	1,232	954	445	44	466

Region 9

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Allegheny	513	42	25	24	0	1
Chequamegon - Nicolet	1,522	49	69	0	0	69
Chippewa	666	2	0	0	0	0
Green Mountain	391	82	25	16	0	10
Hiawatha	895	83	8	0	0	8
Hoosier	196	13	8	0	0	8
Huron - Manistee	974	22	4	0	0	4
Mark Twain	1,493	72	25	0	0	25
Midewin TGP	15	0	0	0	0	0
Monongahela	909	136	181	0	0	181
Ottawa	990	109	4	0	0	4
Shawnee	278	34	11	4	0	6
Superior	2,171	813	62	0	0	62
Wayne	230	0	0	0	0	0
White Mountain	777	114	241	122	0	119
Other NFS lands	6	0	0	0	0	0
TOTAL ACRES	12,026	1,570	664	166		497

Region 10

Forest Name	Total area of National Forest System land [1]	Total area of Designated Areas [2]	Total Inventoried Roadless Area [3]	Inventoried Roadless Areas allocated to a prescription		
				...that does not allow road construction and reconstruction	...that does not allow road construction and reconstruction, and the forest plan recommends as wilderness	...that allows road construction and reconstruction
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)
Chugach	5,492	1,973	5,439	1,058	1,638	2,743
Tongass	16,591	6,632	9,340	7,422	0	1,918
Other NFS lands**	0	0	0	0	0	0
TOTAL ACRES	22,083	8,605	14,779	8,479	1,638	4,661

* This region has less than 500 acres of Land Utilization Projects, Research Experimental Areas and other NFS lands.
** This region has no Land Utilization Projects, Research Experimental Areas or other NFS lands.

1 USDA Forest Service Land Areas Report September 1999, plus an additional 254,000 acres for Land Between the Lakes National Recreation Area and Exxon Valdez Oil Spill Acquisition. Acreages for National Forest System land and do not include private inholdings.

2 Designated areas include national wilderness, national primitive areas, national scenic research areas, national scenic areas, national wild and scenic rivers, national recreation areas, national game refuge and wildlife preserves, national monuments, national volcanic monuments, national historic areas, research natural areas, wilderness study areas and other Congressionally designated areas. These designated areas include 6,015,000 acres of Inventoried Roadless Areas.

3 Inventoried Roadless Areas are based on forest plans, forest plan revisions in progress where the agency has established an inventory, or other assessments that are completed or adopted by the agency. RARE II information is used if a forest does not have a more recent inventory based on RARE II.

State [1]		NFS Lands Potentially Open to Road Construction and Reconstruction				
		Total area of National Forest System land [2]	Total area of National Forest System land in Wilderness	Total area of Inventoried Roadless Areas within National Forest System lands [3]	Total area of National Forest System land that may be open to road construction and reconstruction depending on prescriptions in resource management plans	Percent of National Forest System land that may be open to road construction and reconstruction depending on prescriptions in resource management plans
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(%)
Alabama	33,432	665	42	13	610	91.8
Alaska	393,747	22,083	5,747	14,779	1,557	7.1
Arizona	72,964	11,255	1,328	1,174	8,753	77.8
Arkansas	34,036	2,586	116	95	2,375	91.8
California	101,676	20,698	4,423	4,416	11,859	57.3
Colorado	66,624	14,509	3,136	4,433	6,940	47.8
Connecticut*	3,548	0	0	0	0	0
Delaware**	1,534	0	0	0	0	0
District of Columbia**	39	0	0	0	0	0
Florida	38,392	1,153	75	50	1,027	89.1
Georgia	37,745	865	118	63	683	79.0
Hawaii*	4,134	0	0	0	0	0
Idaho	53,487	20,458	3,965	9,322	7,171	35.1
Illinois	36,060	293	28	11	254	86.8
Indiana	23,158	196	13	8	175	89.3
Iowa**	36,017	0	0	0	0	0
Kansas	52,660	108	0	0	0	0
Kentucky	25,863	800	17	3	780	97.5
Louisiana	31,776	604	9	7	588	97.4
Maine	21,594	53	11	6	36	67.4
Maryland**	7,870	0	0	0	0	0
Massachusetts**	5,914	0	0	0	0	0
Michigan	37,448	2,858	91	16	2,751	96.3
Minnesota	54,014	2,838	810	62	1,965	69.3
Mississippi	30,903	1,159	6	3	1,150	99.2
Missouri	44,614	1,493	64	25	1,403	94.0
Montana	94,109	16,893	3,373	6,397	7,123	42.2
Nebraska	49,523	352	8	0	344	97.8
Nevada	70,763	5,833	790	3,186	1,856	31.8

State [1]		NFS Lands Potentially Open to Road Construction and Reconstruction				
		Total area of National Forest System land [2]	Total area of National Forest System land in Wilderness	Total area of Inventoried Roadless Areas within National Forest System lands [3]	Total area of National Forest System land that may be open to road construction and reconstruction depending on prescriptions in resource management plans	Percent of National Forest System land that may be open to road construction and reconstruction depending on prescriptions in resource management plans
	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(1,000 acres)	(%)
New Hampshire	5,941	728	101	235	393	54.0
New Jersey**	5,258	0	0	0	0	0
New Mexico	77,823	9,327	1,381	1,597	6,349	68.1
New York	32,056	16	0	0	16	100.0
North Carolina	33,710	1,244	103	172	969	77.9
North Dakota	45,251	1,106	0	266	840	75.9
Ohio	26,451	230	0	0	230	100.0
Oklahoma	44,738	397	16	13	368	92.6
Oregon	62,140	15,658	2,059	1,965	11,634	74.3
Pennsylvania	28,806	513	9	25	479	93.4
Puerto Rico	2,245	28	0	24	4	14.7
Rhode Island**	788	0	0	0	0	0
South Carolina	19,961	613	16	8	589	96.1
South Dakota	49,357	2,012	10	80	1,923	95.6
Tennessee	26,973	698	67	85	546	78.3
Texas	171,057	755	39	4	712	94.3
Utah	54,339	8,179	771	4,013	3,394	41.5
Vermont	6,154	376	59	25	292	77.6
Virgin Islands*	109	0	0	0	0	0
Virginia	27,089	1,660	88	394	1,179	71.0
Washington	45,208	9,214	2,605	2,015	4,594	49.9
West Virginia	15,508	1,033	81	202	750	72.6
Wisconsin	35,933	1,523	45	69	1,408	92.5
Wyoming	62,604	9,238	3,069	3,257	2,912	31.5
Total	**2,343,144**	**192,300**	**34,690**	**58,518**	**99,093**	**51.5**

* These states have less than 500 acres of National Forest System land area.
** These states have no National Forest System lands.
[1] Acreages from Government Accounting Office Land Ownership Report to Congressional Requesters, March 1996.
[2] USDA Forest Service Land Areas Report September 1999, plus additional 254,000 acres for Land Between the Lakes National Recreation Area and Exxon Valdez Oil Spill Acquisition. Acreages for National Forest System land and do not include private inholdings.
[3] Inventoried Roadless Areas are based on forest plans, forest plan revisions in progress where the agency has established an inventory, or other assessments that are completed or adopted by the agency. RARE II information is used if a forest does not have a more recent inventory based on RARE II.

APPENDIX B

State-by-State Summaries of Key Information for the Preferred Alternative

State	Region	Total Area of National Forest System Land[a] (thousand acres)	Total Area of Inventoried Roadless Areas within National Forest System Land[b] (thousand acres)	Percent of NFS land that is Inventoried Roadless Area	Estimated Reduction in Annual Harvest from Inventoried Roadless Areas (MMBF)	Percent of Average Annual Historic Harvest (FY 96-99)	Reduction in No. of Jobs Directly Related to Timber Harvest	Potentially Affected Areas
Alabama	R8	665	13	1.9	0	0	0	
Alaska	R10	22,083	14,779	66.9	76.6	61	383	Coffman Cove, Craig, Hoonah, Ketchikan, Klawock, Metlakatla, Petersburg, Thorne Bay, Wrangell,
Arizona	R3	11,255	1,174	10.4	0.1	<1	1	None identified
Arkansas	R8	2,586	95	3.7	2.3	9	17	None identified
California[c]	R4, R5, R6	20,698	4,416	21.3	3.3	<1	24	Burney, Burnt Ranch-Willow Creek, Happy Camp, Hayfork, Weaverville-Douglas City, Weed-Mt. Shasta McCloud, Yreka
Colorado[c]	R2	14,509	4,433	30.6	2.8	6	16	Olathe, CO
Connecticut[d]	R9	0	0	0.0	0	0	0	
Delaware[e]		0	0	0	0	0	0	
District of Columbia[e]		0	0	0	0	0	0	
Florida	R8	1,153	50	4.4	0	0	0	
Georgia	R8	865	63	7.3	0.1	<1	1	None identified.
Hawaii[d]	R5	0	0	0	0	0	0	
Idaho[c]	R1, R4	20,458	9,322	45.6	9.7	4	73	Ashton, Bonner's Ferry, Cambridge, Cascade, Clark Fork, Council, Driggs, Elk City, Emmett, Grangeville, Hope, Horseshoe Bend, Montour, Moyie Springs, New Meadows, Oldtown, Pinehurst, Plummer, Princeton, Priest River, Ovid, Salmon, Sandpoint, St. Anthony, St. Maries, Sweet, Tetonia, Victor, White Bird, Kamiah, Kooskia, Orofino, Pierce, Weippe

State	Region	Total Area of National Forest System Land[a] (thousand acres)	Total Area of Inventoried Roadless Areas within National Forest System Land[b] (thousand acres)	Percent of NFS land that is Inventoried Roadless Area	Estimated Reduction in Annual Harvest from Inventoried Roadless Areas (MMBF)	Percent of Average Annual Historic Harvest (FY 96-99)	Reduction in No. of Jobs Directly Related to Timber Harvest	Potentially Affected Areas
Illinois	R9	293	11	3.6	0	0	0	
Indiana	R9	196	8	4.3	0	0	0	
Iowa[e]		0	0	0	0	0	0	
Kansas	R2	108	0	0	0	0	0	
Kentucky	R8	800	3	0.4	0	0	0	
Louisiana	R8	604	7	1.2	0	0	0	
Maine	R9	53	6	11.3	0	0	0	
Maryland[e]		0	0	0	0	0	0	
Massachusetts[e]		0	0	0	0	0	0	
Michigan	R9	2,858	16	0.6	0	0	0	
Minnesota	R9	2,838	62	2.2	3.3	3	19	Grand Marais, Two Harbors, Isabella, Tofte
Mississippi	R8	1,159	3	0.2	0.3	<1	2	None Identified
Missouri	R9	1,493	25	1.7	0	0	0	
Montana	R1	16,893	6,397	37.9	1.0	<1	9	Townsend, Thompson Falls
Nebraska	R2	352	0	0	0	0	0	
Nevada	R4, R5	5,833	3,186	54.6	0	0	0	
New Hampshire	R9	728	235	32.2	0.2	<1	2	None Identified
New Jersey[e]					0	0	0	
New Mexico	R3	9,327	1,597	17.1	0.2	<1	2	None Identified
New York	R9	16	0	0	0	0	0	
North Carolina	R8	1,244	172	13.9	0.1	<1	1	None Identified
North Dakota	R1	1,106	266	24.1	0	0	0	
Ohio	R9	230	0	0	0	0	0	
Oklahoma	R3, R8	397	13	3.4	0	0	0	

State	Region	Total Area of National Forest System Land[a] (thousand acres)	Total Area of Inventoried Roadless Areas within National Forest System Land[b] (thousand acres)	Percent of NFS land that is Inventoried Roadless Area	Estimated Reduction in Annual Harvest from Inventoried Roadless Areas (MMBF)	Percent of Average Annual Historic Harvest (FY 96-99)	Reduction in No. of Jobs Directly Related to Timber Harvest	Potentially Affected Areas
Oregon	R5, R6	15,658	1,965	12.5	6.4	1	58	Brookings, Elgin, Glendale, Gold Beach, Powers
Pennsylvania	R9	513	25	4.8	0	0	0	
Puerto Rico	R8	28	24	85.3	0	0	0	
Rhode Island[e]		0	0		0	0	0	
South Carolina	R8	613	8	1.2	0	0	0	
South Dakota[c]	R1, R2	2,012	80	4.0	0	0	0	
Tennessee	R8	698	85	12.2	0.1	<1	1	None Identified
Texas	R8	755	4	0.5	0	0	0	
Utah[c]	R4	8,179	4,013	49.1	11.2	18	59	Escalante, Gunnison, LaPointe, Kamas, Heber City, Fairview, Beaver, Bicknell, Lyman, Sigurd, Old La Sal, Panguitch, Vernal, Wellington
Vermont	R9	376	25	6.7	0	0	0	None Identified
Virgin Islands[d]	R8	0	0	0	0	0	0	
Virginia[c]	R8	1,660	394	23.7	0.4	1	3	None Identified
Washington	R1, R6	9,214	2,015	21.9	1.7	1	15	Clarkston, Newport, Omak, Oroville, Pateros, CleElum, Twisp, Winthrop
West Virginia	R8, R9	1,033	202	19.5	2.2	7	8	Marlinton, Richwood, Webster Springs
Wisconsin	R9	1,523	69	4.5	2.3	2	18	None identified
Wyoming[c]	R2, R4	9,238	3,257	35.3	2.9	9	16	Cody, Saratoga, Sheridan
Total		192,300	58,518	31	126.3		730	

[a] USDA Forest Service Land Areas Report September 1999, plus additional 254,000 acres for Land Between the Lakes National Recreation Area and Exxon Valdez Oil Spill Acquisition. Acreages are for National Forest System land and do not include private inholdings.

[b] Inventoried Roadless Areas are based on forest plans, forest plan revisions in progress where the agency has established an inventory, or other assessments that are completed or adopted by the agency. RARE II information is used if a forest does not have a more recent inventory based on RARE II.

[c] Due to national forest boundaries that overlap several States, projected timber harvest volumes and reduction in jobs may contain minor discrepancies.

[d] These States have fewer than 500 acres of National Forest System land.

[e] These States have no National Forest System lands.

APPENDIX C

Summary of Threatened, Endangered, and Proposed Species

List of Threatened, Endangered, and Proposed Species - Proposed (PT or PE), Threatened (T), and Endangered (E), species for the nine Forest Service Regions by species groups, and a determination of which species are likely to be impacted by inventoried roadless area(s). An "**X**" adjacent to a species name indicates that the species has habitat within an inventoried roadless area(s) and/or it may not have habitat within an inventoried roadless area(s), but it is likely to be affected by inventoried roadless area(s). A "Yes" or "Proposed" indicates that the species designated critical habitat is within an inventoried roadless area(s) and/or it may not be within an inventoried roadless area(s), but it is likely to be affected by inventoried roadless area(s). This list is current as of September 1, 2000.

Species likely to have habitat within and/or affected by inventoried roadless area(s)	Species has designated *critical habitat* within and/or affected by inventoried roadless area(s)in one or more Forest Service Regions	Species Scientific Name	Common Name	Species Group	Federal Status	Forest Service Region(s) where species is likely to be impacted by inventoried roadless area(s)
X		*Ambystoma cingulatum*	Flatwoods Salamander	Amphibian	T	8
X		*Ambystoma tigrinum stebbinsi*	Sonoran Tiger Salamander	Amphibian	E	3
		Bufo houstonensis	Houston Toad	Amphibian	E	None
X	**Proposed**	*Bufo microscaphus californicus*	Arroyo Southwestern Toad	Amphibian	E	5
X		*Plethoden nettingi*	Cheat Mountain Salamander	Amphibian	T	9
X	**Proposed**	*Rana aurora draytonii*	California Red-legged Frog	Amphibian	T	5
X		*Rana chiricahuensis*	Chiricahua Leopard Frog	Amphibian	PT	3
X		*Rana mucosa*	Mountain Yellow-legged Frog	Amphibian	PE	5
X		*Accipiter striatus venator*	Puerto Rican Sharp-Shinned Hawk	Bird	E	8
X		*Amazona vittata*	Puerto Rican Parrot	Bird	E	8
X		*Aphelocoma coerulescens*	Florida Scrub Jay	Bird	T	8
X	**Yes**	*Brachyramphus marmoratus marmoratus*	Marbled Murrelet	Bird	T	5, 6
X		*Branta canadensis leucopareia*	Aleutian Canada Goose	Bird	T	5, 6
X		*Buteo platypterus brunnescens*	Puerto Rican Broad-winged Hawk	Bird	E	8
X	**Yes**	*Charadrius alexandrinus nivosus*	Western Snowy Plover	Bird	T	5, 6
X		*Charadrius melodus*	Piping Plover	Bird	T	1, 2, 8, 9
X		*Charadrius montanus*	Mountain Plover	Bird	PT	1, 2, 3, 4
X		*Colinus virginianus ridgwayi*	Masked Bobwhite Quail	Bird	E	3
		Corvus leucognphalus	White-necked Crow	Bird	E	None
		Dendroica kirtlandii	Kirtland's Warbler	Bird	E	None
X	**Yes**	*Empidonax traillii extimus*	Southwestern Willow Flycatcher	Bird	E	2, 3, 4, 5
		Falco femoralis septentrionalis	Northern Aplomado Falcon	Bird	E	None
X	**Yes**	*Glaucidium brasilianum cactorum*	Cactus Ferruginous Pygmy-owl	Bird	E	3
X		*Grus americana*	Whooping Crane	Bird	E	1, 2, 3, 4
		Grus canadensis pulla	Mississippi Sandhill Crane	Bird	E	None

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X		*Gymnogyps californianus*	California Condor	Bird	E	3, 5
X		*Haliaeetus leucocephalus*	Bald Eagle	Bird	T	1, 2, 3, 4, 5, 6, 8, 9
X		*Mycteria americana*	Wood Stork	Bird	E	8
X		*Pelecanus occidentalis*	Brown pelican	Bird	E	3, 5, 6
X		*Picoides borealis*	Red-cockaded Woodpecker	Bird	E	8
X		*Polioptila californica californica*	Coastal California Gnatchatcher	Bird	T	5
		Rallus longirosstris yumanensis	Yuma Clapper Rail	Bird	E	None
X		*Sterna antillarum*	Least Tern	Bird	E	1, 2, 3, 8
		Sterna antillarum browni	California Least Tern	Bird	E	None
X	**Yes**	*Strix occidentalis caurina*	Northern Spotted Owl	Bird	T	5, 6
X	**Proposed**	*Strix occidentalis lucida*	Mexican Spotted Owl	Bird	T	2, 3, 4
X		*Vermivora bachmanii*	Bachman's Warbler	Bird	E	8
		Vireo atricapillus	Black-capped Vireo	Bird	E	None
X		*Vireo bellii pusillus*	Least Bell's Vireo	Bird	E	5
		Acipenser brevirostrum	Shortnose Sturgeon	Fish	E	None
		Acipenser oxyrhyncus desotoi	Gulf Sturgeon	Fish	T	None
		Acipenser transmontanus	White Sturgeon	Fish	E	None
		Amblyopsis rosae	Ozark Cavefish	Fish	T	None
		Catostomus microps	Modoc sucker	Fish	E	None
X		*Catostomus santaannae*	Santa Ana Sucker	Fish	T	5
		Catostomus warnerensis	Warner Sucker	Fish	T	None
X	**Proposed**	*Chamistes brevirostris*	Shortnose sucker	Fish	E	5, 6
		Chasmistes liorus	June Sucker	Fish	E	None
X		*Cyprinella caerulea*	Blue Shiner	Fish	T	8
		Cyprinella formosa	Beautiful Shiner	Fish	T	None
		Cyprinella formosa mearnsi	Yaqui Shiner	Fish	T	None
		Cyprinella monacha	Spotfin Chub	Fish	T	None
		Cyprinodon macularis	Desert Pupfish	Fish	E	None
X	**Proposed**	*Deltistes luxatus*	Lost River Sucker	Fish	E	5

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		Erimystax cahni	Slender Chub	Fish	T	None
		Etheostoma etowahae	Etowah Darter	Fish	E	None
		Etheostoma percnurum	Duskytail Darter	Fish	E	None
		Etheostoma scotti	Cherokee darter	Fish	T	None
		Eucyclogobius newberryi	Tidewater Goby	Fish	E	None
		Gambusia nobilis	Pecos Gambusia	Fish	E	None
X	**Proposed**	*Gasterosteus aculeatus williamsoni*	Unarmored Threespine Stickleback	Fish	E	5
		Gila bicolor mohavensis	Mohave Chub	Fish	E	None
X		*Gila bicolor snyderi*	Owens Tui Chub	Fish	E	5
X		*Gila cypha*	Humpback Chub	Fish	E	2, 3, 4
X	**Yes**	*Gila Ditaenia*	Sonora Chub	Fish	T	3
X		*Gila elegans*	Bonytail Chub	Fish	E	2, 3, 4
		Gila nigrescens	Chihuahua Chub	Fish	T	None
X		*Gila purpurea*	Yaqui Chub	Fish	E	3
		Gila robusta seminuda	Virgin River Chub	Fish	E	None
X		*Hybognathus amarus*	Rio Grande Silveryminnow	Fish	E	3
X		*Hypomesus transpacificus*	Delta Smelt	Fish	T	5
		Ictalurus pricei	Yaqui Catfish	Fish	T	3
X	**Yes**	*Lepidomeda vittata*	Little Colorado Spinedace	Fish	T	3
X	**Yes**	*Meda fulgida*	Spikedace	Fish	T	3
		Notropis albizonatus	Palezone Shiner	Fish	E	None
		Notropis cahabae	Cahaba Shiner	Fish	E	None
		Notropis girardi	Arkansas River Shiner	Fish	T	None
		Notropis mekistocholas	Cape Fear Shiner	Fish	E	None
		Notropis simus pecosensis	Pecos Bluntnose Shiner	Fish	T	None
		Notropis topeka	Topeka Shiner	Fish	E	None
		Noturus baileyi	Smoky Madtom	Fish	E	None
		Noturus flavipinnis	Yellowfin Madtom	Fish	T	None
X		*Oncorhynchus apache*	Apache (Arizona) Trout	Fish	T	3

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Species likely to have habitat within and/or affected by inventoried roadless area(s)	Species has designated *critical habitat* within and/or affected by inventoried roadless area(s)in one or more Forest Service Regions	Species Scientific Name	Common Name	Species Group	Federal Status	Forest Service Region(s) where species is likely to be impacted by inventoried roadless area(s)
X		*Oncorhynchus clarki clarki (Southwestern WA/Columbia River ESU)*	Coastal Cutthroat Trout	Fish	PT	6
X		*Oncorhynchus clarki henshawi*	Lahontan Cutthroat Trout	Fish	T	5
X		*Oncorhynchus clarki seleniris*	Paiute Cutthroat Trout	Fish	T	4, 5
X		*Oncorhynchus clarki stomias*	Greenback Cutthroat Trout	Fish	T	2
X		*Oncorhynchus gilae gilae*	Gila Trout	Fish	E	3
		Oncorhynchus keta (Columbia River ESU)	Chum Salmon	Fish	T	None
X	**Yes**	*Oncorhynchus keta (Hood Canal Summer-run ESU)*	Chum Salmon	Fish	T	6
X	**Yes**	*Oncorhynchus kisutch (OR Coast ESU)*	Coho Salmon	Fish	T	6
X	**Yes**	*Oncorhynchus kisutch (Southern OR/Northern CA Coasts ESU)*	Coho Salmon	Fish	T	5, 6
X		*Oncorhynchus mykiss (CA Central Valley ESU)*	Steelhead	Fish	T	5
X	**Yes**	*Oncorhynchus mykiss (Lower Columbia River ESU)*	Steelhead	Fish	T	6
X	**Yes**	*Oncorhynchus mykiss (Middle Columbia River ESU)*	Steelhead	Fish	T	6
X		*Oncorhynchus mykiss (Northern CA ESU)*	Steelhead	Fish	T	5
X	**Yes**	*Oncorhynchus mykiss (Snake River Basin ESU)*	Steelhead	Fish	T	1, 4, 6
X		*Oncorhynchus mykiss (South-Central CA Coast ESU)*	Steelhead	Fish	T	5
X	**Yes**	*Oncorhynchus mykiss (Southern CA ESU)*	Steelhead	Fish	E	5
X	**Yes**	*Oncorhynchus mykiss (Upper Columbia River ESU)*	Steelhead	Fish	E	6
X	**Yes**	*Oncorhynchus mykiss (Upper Willamette ESU)*	Steelhead	Fish	T	6
		Oncorhynchus mykiss whitei	Little Kern Golden Trout	Fish	T	None
X	**Yes**	*Oncorhynchus nerka (Snake River ESU)*	Sockeye Salmon	Fish	E	1, 4, 6, 10
X	**Proposed**	*Oncorhynchus tshawytscha (CA Coastal ESU)*	Chinook Salmon	Fish	T	5

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X		*Oncorhynchus tshawytscha (Central Valley Spring-run ESU)*	Chinook Salmon	Fish	T	5
X	**Yes**	*Oncorhynchus tshawytscha (Lower Columbia River ESU)*	Chinook Salmon	Fish	T	6
X	**Yes**	*Oncorhynchus tshawytscha (Puget Sound ESU)*	Chinook Salmon	Fish	T	6
X		*Oncorhynchus tshawytscha (Sacramento River Winter-run ESU)*	Chinook Salmon	Fish	E	5
X	**Yes**	*Oncorhynchus tshawytscha (Snake River Fall-run ESU)*	Chinook Salmon	Fish	T	1, 4, 6, 10
X	**Yes**	*Oncorhynchus tshawytscha (Snake River Spring/Summer-run ESU)*	Chinook Salmon	Fish	T	1, 4, 6, 10
X	**Yes**	*Oncorhynchus tshawytscha (Upper Columbia River Spring-run ESU)*	Chinook Salmon	Fish	E	6
X	**Yes**	*Oncorhynchus tshawytscha (Upper Willamette River ESU)*	Chinook Salmon	Fish	T	6
		Oregonichthys crameri	Oregon Chub	Fish	E	None
		Percina antesella	Amber Darter	Fish	E	None
		Percina aurolineata	Goldline Darter	Fish	T	None
		Percina jenkinsi	Conasauga Logperch	Fish	E	None
X		*Percina pantherina*	Leopard Darter	Fish	T	8
		Percina rex	Roanoke Logperch	Fish	E	None
		Percina tanasi	Snail Darter	Fish	T	None
		Phoxinus cumberlandensis	Blackside Dace	Fish	T	None
X		*Plagopterus argentissimus*	Woundfin	Fish	E	3
X		*Poeciliopsis occidentalis*	Gila Topminnow	Fish	E	3
X		*Pogonichthys macrolepidotus*	Sacramento Splittail	Fish	T	5
X		*Ptychocheilus lucius*	Colorado (=squawfish) Pikeminnow	Fish	E	2, 3, 4
X		*Rhinichthys osculus thermalis*	Kendall Warm Springs Dace	Fish	E	4
X		*Salvelinus confluentus*	Bull Trout	Fish	T	1, 4, 6

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X		*Scaphirhynchus albus*	Pallid Sturgeon	Fish	E	2, 8
X	**Yes**	*Tiaroga cobitis*	Loach Minnow	Fish	T	3
X	**Yes**	*Xyrauchen texanus*	Razorback Sucker	Fish	E	2, 3, 4
		Alasmidonta atropurpurea	Cumberland Elktoe	Invertebrate	E	None
		Alasmidonta heterodon	Dwarf Wedge Mussel	Invertebrate	E	None
		Alasmidonta raveneliana	Appalachian Elktoe	Invertebrate	E	None
		Amblema neislerii	Fat Three-Ridge Mussel	Invertebrate	E	None
		Arkansia wheeleri	Ouachita Rock Pocketbook	Invertebrate	E	None
X		*Boloria acrocnema*	Uncompahgre Fritillary Butterfly	Invertebrate	E	2
X		*Branchinecta conservatio*	Conservancy Fairy Shrimp	Invertebrate	E	5
X		*Branchinecta longiantenna*	Longhorn Fairy Shrimp	Invertebrate	E	5
X		*Branchinecta lynchi*	Vernal Pool Fairy Shrimp	Invertebrate	T	5
		Brychius hungerfordi	Hungerford's Crawling Water Beetle	Invertebrate	E	None
X		*Cyprogenia stegaria*	Fanshell	Invertebrate	E	8, 9
X		*Desmocerus californicus dimorphus*	Valley Elderberry Longhorn Beetle	Invertebrate	T	5
		Dromus dromas	Dromedary Pearlymussel	Invertebrate	E	None
		Elliptoideus sloatianus	Purple Bankclimber Mussel	Invertebrate	T	None
		Epioblasma brevidens	Cumberlandian Combshell	Invertebrate	E	None
		Epioblasma capsaeformis	Oyster Mussel	Invertebrate	E	None
X		*Epioblasma florentina curtisii*	Curtis' Pearly Mussel	Invertebrate	E	8
		Epioblasma florentina florentina	Yellow-Blossom Pearlymussel	Invertebrate	E	None
		Epioblasma florentina walkeri	Tan Riffleshell	Invertebrate	E	None
		Epioblasma metastriata	Upland Combshell	Invertebrate	E	None
		Epioblasma obliquata obliquata	Purple Cat's Paw Pearlymussel	Invertebrate	E	None
		Epioblasma othcaloogensis	Southern Acornshell	Invertebrate	E	None
		Epioblasma torulosa gubernaculum	Green-blossom Pearlymussel	Invertebrate	E	None
X		*Epioblasma torulosa rangiana*	Northern Riffleshell	Invertebrate	E	8, 9

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		Epioblasma torulosa torulosa	Tubercled-blossom Pearlymussel	Invertebrate	E	None
		Euphilotes enoptes smithi	Smith's Blue Butterfly	Invertebrate	E	None
X		*Euphydryas editha quino*	Quino Checkerspot Butterfly	Invertebrate	E	5
		Euproserpinus euterpe	Kern Primrose Sphinx Moth	Invertebrate	T	None
		Fusconaia cor (= edgariana)	Shiny Pigtoe	Invertebrate	E	None
		Fusconaia cuneolus	Fine-rayed pigtoe	Invertebrate	E	None
		Hemistena lata	Cracking Pearlymussel	Invertebrate	E	None
X		*Hesperia leonardus montana*	Pawnee Montane Skipper	Invertebrate	T	2
X		*Lampsilis abrupta*	Pink Mucket Pearlymussel	Invertebrate	E	8, 9
		Lampsilis altilis	Fine-lined Pocketbook	Invertebrate	T	None
		Lampsilis perovalis	Orange-Nacre Mucket	Invertebrate	T	None
		Lampsilis powelli	Arkansas Fatmucket	Invertebrate	T	None
		Lasmigona decorata	Carolina Heel Splitter	Invertebrate	E	None
		Lemiox rimosus (= Conradilla caelata)	Birdwing Pearlymussel	Invertebrate	E	None
		Lepidurus packardi	Vernal Pool Tadpole Shrimp	Invertebrate	E	None
		Leptodea leptodon	Scaleshell Mussel	Invertebrate	PE	None
		Lycaeides melissa samuelis	Karner Blue Butterfly	Invertebrate	E	None
		Margaritifera hembeli	Louisiana Pearlshell Mussel	Invertebrate	T	None
		Medionidus acutissimus	Alabama Moccasinshell	Invertebrate	T	None
		Medionidus parvulus	Coosa Moccasinshell	Invertebrate	E	None
X		*Mesodon clarki nantahala*	Noonday Globe	Invertebrate	T	8
		Mesodon magazinensis	Magazine Mountain Shagreen	Invertebrate	T	None
X		*Microhexura montivaga*	Spruce-fir Moss Spider	Invertebrate	E	8
X		*Nicrophorus americanus*	American Burying Beetle	Invertebrate	E	2, 8, 9
		Obovaria retusa	Ring Pink Mussel	Invertebrate	E	None
X		*Pacifastacus fortis*	Shasta Crayfish	Invertebrate	E	5
X		*Pegias fabula*	Little-wing Pearlymussel	Invertebrate	E	8
		Plethobasus cicatricosus	White Wartyback	Invertebrate	E	None

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		Plethobasus cooperianus	Orangefoot Pimpleback	Invertebrate	E	None
X		*Pleurobema clava*	Clubshell	Invertebrate	E	8, 9
X		*Pleurobema collina*	James Spinymussel	Invertebrate	E	8
		Pleurobema decisum	Southern Clubshell	Invertebrate	E	None
		Pleurobema furvum	Dark Clubshell	Invertebrate	E	None
		Pleurobema georgianum	Southern Pigtoe Mussel	Invertebrate	E	None
		Pleurobema perovatum	Ovate clubshell	Invertebrate	E	None
		Pleurobema plenum	Rough Pigtoe	Invertebrate	E	None
		Ptychobranchus greeni	Triangular Kidneyshell	Invertebrate	E	None
		Pyrgulopsis neomexicana	Soccoro Springsnail	Invertebrate	E	None
		Pyrgus ruralis lagunae	Laguna Mountains Skipper	Invertebrate	E	None
		Quadrula cylindrica strigillata	Rough Rabbitsfoot	Invertebrate	E	None
		Quadrula intermedia	Cumberland Monkeyface	Invertebrate	E	None
		Quadrula sparsa	Appalachian Monkeyface	Invertebrate	E	None
		Somatochlora hineana	Hine's Emerald Dragonfly	Invertebrate	E	None
X	**Yes**	*Speyeria zerene hippolyta*	Oregon Silverspot Butterfly	Invertebrate	T	6
X		*Taylorconcha serpenticola*	Bliss Rapids Snail	Invertebrate	T	6
		Thermosphaeroma thermophilus	Soccoro Isopod	Invertebrate	E	None
X		*Tryonia alamosae*	Alamosa Springsnail	Invertebrate	E	3
		Tulotoma magnifica	Tulotoma Snail	Invertebrate	E	None
		Valvata utahensis	Utah Valvata Snail	Invertebrate	E	None
		Villosa perpurpurea	Purple Bean Mussel	Invertebrate	E	None
		Villosa trabalis	Cumberland Bean Pearlymussel	Invertebrate	E	None
		Antilocapra americana sonoriensis	Sonoran Pronghorn	Mammal	E	None
X	**Yes**	*Canis lupus*	Gray Wolf	Mammal	XN	1, 2, 3, 4, 6, 9
X		*Canis rufus*	Red Wolf	Mammal	XN	8
X		*Corynorhinus townsendii ingens*	Ozark Big-eared Bat	Mammal	E	8
X		*Corynorhinus townsendii virginianus*	Virginia Big-eared Bat	Mammal	E	8, 9

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X		*Cynomys parvidens*	Utah Prairie Dog	Mammal	T	4
X		*Dipodomys ingens*	Giant Kangaroo Rat	Mammal	E	5
X		*Dipodomys merriami parvus*	San Bernardino Kangaroo Rat	Mammal	E	5
		Dipodomys nitratoides exilis	Fresno Kangaroo Rat	Mammal	E	None
		Dipodomys nitratoides nitratoides	Tipton Kangaroo Rat	Mammal	E	None
		Dipodomys stephensi	Stephen's Kangaroo Rat	Mammal	E	None
		Enhydra lutris nereis	Southern Sea Otter	Mammal	T	None
X	**Yes**	*Eumetopias jubatus*	Steller's Sea Lion	Mammal	T	5, 10
X		*Glaucomys sabrinus coloratus*	Carolina Northern Flying Squirrel	Mammal	E	8
X		*Glaucomys sabrinus fuscus*	Virginia Northern Flying Squirrel	Mammal	E	8, 9
X		*Herpailurus yagouaroundi tolteca*	Jaguarundi	Mammal	E	3
X		*Leopardus pardalis*	Ocelot	Mammal	E	3
X		*Leptonycteris curasoae yerbabuenae*	Lesser Long-nosed Bat	Mammal	E	3
X		*Leptonycteris nivalis*	Mexican Long-nosed Bat	Mammal	E	3
X		*Lynx canadensis*	Canada Lynx	Mammal	T	1, 2, 4, 6, 9
		Megaptera novaeangliae	Humpback Whale	Mammal	E	None
X		*Microtus mexicanus hualpaiensis*	Hualapai Mexican Vole	Mammal	E	3
X		*Mustela nigripes*	Black-footed Ferret	Mammal	E	1, 2, 3
X		*Myotis grisescens*	Gray Bat	Mammal	E	8, 9
X		*Myotis sodalis*	Indiana Bat	Mammal	E	8, 9
X		*Ovis canadensis*	Bighorn Sheep (Peninsular)	Mammal	E	5
X		*Ovis canadensis californiana*	Sierra Nevada Bighorn Sheep	Mammal	E	5
X		*Panthera onca*	Jaguar	Mammal	E	3
		Puma concolor coryi	Florida Panther	Mammal	E	None
X		*Puma concolor cougar*	Eastern Cougar	Mammal	E	8, 9
X		*Rangifer tarandus caribou*	Woodland Caribou	Mammal	E	1, 6
		Spermophilus brunneus brunneus	Northern Idaho Ground Squirrel	Mammal	T	None
X	**Yes**	*Tamiasciurus hudsonicus grahamensis*	Mount Graham Red Squirrel	Mammal	E	3

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		Trichecus manatus	Florida Manatee	Mammal	E	None
X		*Ursus americanus luteolus*	Louisiana Black Bear	Mammal	T	5
X		*Ursus arctos*	Grizzly Bear	Mammal	T	1, 4, 6
X		*Vulpes macrotis mutica*	San Joaquin Kit Fox	Mammal	E	5
X		*Zapus hudsonius preblei*	Prebles' Meadow Jumping Mouse	Mammal	T	2
		Acanthomintha ilicifolia	San Diego Thorn-mint	Plant	T	None
X		*Aeschynomene virginica*	Sensitive Joint-vetch	Plant	T	8
X		*Agave arizonica*	Arizona Agave	Plant	E	3
		Allium munzii	Munz's Onion	Plant	E	None
		Amphianthus pusillus	Little Amphianthus	Plant	T	None
		Amsonia kearneyana	Kearney's Blue Star	Plant	E	None
		Apios priceana	Price's Potatoe-bean	Plant	T	None
X		*Arabis mcdonaldiana*	McDonald's Rock-cress	Plant	E	5, 6
X		*Arabis serotina*	Shale Barren Rock-cress	Plant	E	8, 9
		Arenaria cumberlandensis	Cumberland Sandwort	Plant	E	None
X		*Arenaria paludicola*	Marsh Sandwort	Plant	E	5
X		*Arenaria ursina*	Bear Valley Sandwort	Plant	T	5
X		*Argemone pleiacantha pinnatisecta*	Sacramento Prickly-poppy	Plant	E	3
X		*Asclepias meadii*	Mead's Milkweed	Plant	T	9
		Asclepias welshii	Welsh's Milkweed	Plant	T	None
X		*Asplenium scolopendrium var. americanum*	Hart's Tongue Fern	Plant	T	9
X		*Astragalus albens*	Cushenbury Milk-vetch	Plant	E	5
		Astragalus applegatei	Applegate's Milk-vetch	Plant	E	None
		Astragalus brauntonii	Braunton's Milk-vetch	Plant	E	None
		Astragalus desereticus	Desert Milkvetch	Plant	T	None
		Astragalus humillimus	Mancos Milk-vetch	Plant	E	None
		Astragalus lentiginosus var. coachellae	Coachella Milk-vetch	Plant	E	None
X	**Yes**	*Astragalus montii*	Heliotrope Milk-vetch	Plant	T	4
		Astragalus tricarinatus	Triplerib Milk-vetch	Plant	E	None

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		Astragulus cremnophylax var. cremnophylax	Sentry Milk-vetch	Plant	E	None
		Baccharis vanessae	Encinitas Baccharis	Plant	T	None
X		*Berberis nevinii*	Nevin's Barberry	Plant	E	5
		Betula uber	Virginia Round-leaf Birch	Plant	T	None
X		*Bonamia grandiflora*	Florida Bonamia	Plant	T	8
X		*Brodiaea filifolia*	Thread-leaved Brodiaea	Plant	T	5
X		*Callicarpa ampla*	Capa Rosa	Plant	E	8
X		*Calyptridium pulchellum*	Mariposa Pussypaws	Plant	T	5
		Carex specuicola	Navaho Sedge	Plant	T	None
X		*Castilleja cinerea*	Ashgray Paintbrush	Plant	T	5
X		*Caulanthus californicus*	California Jewelflower	Plant	E	5
		Ceanothus ophiochilus	Vail Lake Ceanothus	Plant	T	None
		Chlorogalum purpureum var. reductum	Purple Amole	Plant	T	None
		Cirsium loncholepis	La Graciaosa Thistle	Plant	E	None
X		*Cirsium pitcheri*	Pitcher's Thistle	Plant	T	9
X		*Cirsium vinaceum*	Sacramento Mountain Thistle	Plant	T	3
X		*Clarkia springvillensis*	Springville Fairyfan	Plant	T	5
X		*Conradina glabra*	Apalachicola Rosemary	Plant	E	8
		Conradina verticillata	Cumberland Rosemary	Plant	T	None
		Coryphantha (=Escobaria) robbinsorum	Cochise Pincushion Cactus	Plant	T	None
X		*Coryphantha scheeri var. robustispina*	Pima Pineapple Cactus	Plant	E	3
		Coryphantha sneedi var. leei	Lee Pincushion Cactus	Plant	T	None
		Coryphantha sneedi var. sneedi	Sneed Pincushion Cactus	Plant	E	None
		Cycladenia humilis var. jonesii	Jones Cycladenia	Plant	T	None
X		*Dodecahema leptoceras*	Slender-horned Spineflower	Plant	E	5
X		*Dudleya cymosa ssp. ovatifolia*	Santa Monica Mountains Dudleya	Plant	T	5
X		*Echinacea laevigata*	Smooth Purple Coneflower	Plant	E	8

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		Echinocactus horizonthaeonius var. nicholii	Nichol's Turk Head Cactus	Plant	E	None
X		*Echinocereus fendleri var. kuenzleri*	Kuenzler Hedgehog Cactus	Plant	E	3
X		*Echinocereus triglochidiatus var. arizonicus*	Arizona Hedgehog Cactus	Plant	E	3
X		*Eremalche parryi ssp. kernensis*	Kern Mallow	Plant	E	5
X		*Eriastrum densifolium spp. sanctorum*	Giant Woolstar	Plant	E	5
X		*Eriastrum hooveri*	Hoover's Eriastrum	Plant	T	5
X		*Erigeron maguirei*	Maguire Daisy	Plant	T	4
X		*Erigeron parishii*	Parish's Fleabane	Plant	T	5
X		*Erigeron rhizomatus*	Zuni Fleabane	Plant	T	3
		Erigonium gypsophilum	Gypsum Wild Buckwheat	Plant	T	None
X		*Eriogonum kennedyi var. austromontanum*	Southern Mountain Buckwheat	Plant	T	5
X		*Eriogonum longifolium var. gnaphalifolium*	Scrub Buckwheat	Plant	T	8
X		*Eriogonum ovalifolium ssp. vineum*	Cushenbury Buckwheat	Plant	E	5
X		*Eugenia haematocarpa*	Uvillo	Plant	E	8
X		*Eutrema penlandii*	Penland Alpine Fen Mustard	Plant	T	2
		Fremontodendron mexicanum	Mexican Flannelbush	Plant	E	None
X		*Fritillaria gentneri*	Gentner's fritillary	Plant	E	6
X		*Gaura neomexicana coloradoensis*	Colorado Butterfly Plant	Plant	PT	2
X		*Geocarpon minimum*	Geocarpon	Plant	T	8
X		*Geum radiatum*	Spreading Avens	Plant	E	8
X		*Gymnoderma lineare*	Rock Gnome Lichen	Plant	E	8
		Hackelia venusta	Showy Stickweed	Plant	PE	None
X		*Harperocallis flava*	Harper's Beauty	Plant	E	8
		Hedeoma todsenii	Todsen's Pennyroyal	Plant	E	None
X		*Hedyotis purpurea var. montana*	Roan Mountain Bluet	Plant	E	8
		Helenium virginicum	Virginia Sneezeweed	Plant	T	None

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X		*Helianthus eggertii*	Eggert's Sunflower	Plant	T	8
		Helianthus schweinitzii	Schweinitz's Sunflower	Plant	E	None
X		*Helonias bullata*	Swamp Pink	Plant	T	8
		Hexastylis naniflora	Dwarf-flowered Heartleaf	Plant	T	None
X		*Howellia aquatilis*	Water Howellia	Plant	T	1, 6
X		*Hudsonia montana*	Mountain Golden Heather	Plant	T	8
X		*Hymenoxys herbacea*	Lakeside Daisy	Plant	T	9
X		*Ilex sintenisii*	Cuero de Sapo	Plant	E	8
		Iliamna corei	Peter's Mountain-mallow	Plant	E	None
		Ipomopsis sancti spiritus	Holy Ghost Ipomopsis	Plant	E	None
X		*Iris lacustris*	Dwarf Lake Iris	Plant	T	9
		Isoetes louisianensis	Louisiana Quillwort	Plant	E	None
		Isoetes melanospora	Black Spored Quillwort	Plant	E	None
		Isoetes tegetiformans	Mat-forming Quillwort	Plant	E	None
X		*Isotria medeoloides*	Small Whorled Pogonia	Plant	T	8, 9
		Lembertia congdonii	San Joaquin Wooly-Threads	Plant	E	None
X		*Lepanthes eltorensis*	Babyfoot Orchid	Plant	E	8
X		*Lesquerella kingii ssp. bernardina*	San Bernardino Mountains Bladderpod	Plant	E	5
		Lesquerella pallida	White Bladderpod	Plant	E	None
X		*Liatris helleri*	Heller's Blazing Star	Plant	T	8
X		*Lilaeopsis schaffneriana spp. recurva*	Huaachuca Water Umbel	Plant	E	3
X		*Lilium occidental*	Western Lily	Plant	E	6
X		*Lindera melissifolia*	Pondberry	Plant	E	8
X		*Lupinus sulphureus ssp. kincaidii*	Kincaid's Lupine	Plant	PT	6
X		*Lysimachia asperulifolia*	Rough-leaf Loosestrife	Plant	E	8
X		*Macbridea alba*	White Bird-in-a-nest	Plant	T	8
X		*Mirabilis macfarlanei*	Macfarlane's Four-O'Clock	Plant	T	1, 4, 6
		Optunia treleasei	Bakersfield Cactus	Plant	E	None
X		*Orcuttia tenuis*	Slender Orcutt Grass	Plant	T	5

List of Threatened, Endangered, and Proposed Species - Proposed (PT or PE), Threatened (T), and Endangered (E), species for the nine Forest Service Regions by species groups, and a determination of which species are likely to be impacted by inventoried roadless area(s). An "**X**" adjacent to a species name indicates that the species has habitat within an inventoried roadless area(s) and/or it may not have habitat within an inventoried roadless area(s), but it is likely to be affected by inventoried roadless area(s). A "Yes" or "Proposed" indicates that the species designated critical habitat is within an inventoried roadless area(s) and/or it may not be within an inventoried roadless area(s), but it is likely to be affected by inventoried roadless area(s). This list is current as of September 1, 2000.

Species likely to have habitat within and/or affected by inventoried roadless area(s)	Species has designated *critical habitat* within and/or affected by inventoried roadless area(s)in one or more Forest Service Regions	Species Scientific Name	Common Name	Species Group	Federal Status	Forest Service Region(s) where species is likely to be impacted by inventoried roadless area(s)
		Oxypolis canbyi	Canby's Dropwort	Plant	E	None
X		*Oxytheca parishii var. goodmaniana*	Cushenbury Oxytheca	Plant	E	5
X		*Oxytropis campestris var. chartacea*	Fassett's Locoweed	Plant	T	9
		Pediocactus bradyi	Brady Pincushion Cactus	Plant	E	None
X		*Pediocactus despainii*	Winkler Cactus	Plant	T	4
		Pediocactus knowltonii	Knowlton Cactus	Plant	E	None
X		*Penstemon haydenii*	Blowout Penstemon	Plant	E	2
X		*Phacelia argillacea*	Clay Phacelia	Plant	E	4
		Phlox nivalis var. texensis	Texas Trailing Phlox	Plant	E	None
X		*Pinguicula ionantha*	Godfrey's Butterwort	Plant	T	8
		Pityopsis ruthii	Ruth's Golden-aster	Plant	E	None
X		*Platanthera praeclara*	Western Prairie Fringed Orchid	Plant	T	1, 2
X		*Pleodendrum macranthum*	Chupacallos	Plant	E	3
X		*Ploygala lewtonii*	Lewton's Polygala	Plant	E	8
X		*Poa atropurpurea*	San Bernardino Bluegrass	Plant	E	5
X	**Yes**	*Potentilla robbinsiana*	Robbins' Cinquefoil	Plant	E	9
X		*Primula maguirei*	Maguire Primrose	Plant	T	4
		Pseudobahia peirsonii	San Joaquin Adobe Sunburst	Plant	T	None
		Ptilimnium nodosum	Harperella	Plant	E	None
X		*Purshia subintegra*	Arizona Cliffrose	Plant	E	3
		Rhus michauxii	Michaux's Sumac	Plant	E	None
		Ribes echinellum	Miccosukee Gooseberry	Plant	T	None
		Rorippa gambellii	Gambel's Watercress	Plant	E	None
		Sagittaria fasciculata	Bunched Arrowhead	Plant	E	None
X		*Sarracenia oreophila*	Green Pitcher Plant	Plant	E	8
		Sarracenia rubra ssp. jonesii	Mountain Sweet Pitcher Plant	Plant	E	None
X		*Schwalbea americana*	American Chaffseed	Plant	E	8
		Scirpus ancistrochaetus	Northeastern Bulrush	Plant	E	None
X		*Sclerocactus glaucus*	Unita Basin Hookless Cactus	Plant	T	2

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Species likely to have habitat within and/or affected by inventoried roadless area(s)	Species has designated *critical habitat* within and/or affected by inventoried roadless area(s)in one or more Forest Service Regions	Species Scientific Name	Common Name	Species Group	Federal Status	Forest Service Region(s) where species is likely to be impacted by inventoried roadless area(s)
		Sclerocactus mesae verdae	Mesa Verde Cactus	Plant	T	None
X		*Scutellaria floridana*	Florida Skullcap	Plant	T	8
		Scutellaria montana	Large Flowered Skullcap	Plant	E	None
X	Yes	*Senecio franciscanus*	San Francisco Peaks groundsel	Plant	T	3
		Senecio layneae	Layne's Butterweed	Plant	T	None
		Sidalcea nelsoniana	Nelson's Checker Mallow	Plant	T	None
X		*Sidalcea oregana calva*	Wenatchee Checker Mallow	Plant	E	6
X		*Sidalcea pedata*	Bird-footed Checkerbloom	Plant	E	5
X		*Silene spaldingii*	Spalding's Catchfly	Plant	PT	1, 4, 6
		Sisyrinchium dichotomum	White Irisette	Plant	E	None
X		*Solidago albopilosa*	White-Haired Goldenrod	Plant	T	8
X		*Solidago houghtonii*	Houghton's Goldenrod	Plant	T	9
X		*Solidago spithamaea*	Blue Ridge Goldenrod	Plant	T	8
X		*Spiraea virginiana*	Virginia Spiraea	Plant	T	8, 9
		Spiranthes delitescens	Canelo Hills Ladies Tresses	Plant	E	None
X		*Spiranthes diluvialis*	Ute Ladies'-tresses	Plant	T	1, 2, 4, 6
		Spiranthes parksii	Navasota Ladies'-tresses	Plant	E	None
X		*Styrax portoricensis*	Palo de Jazmin	Plant	E	8
X		*Taraxacum californicum*	California Dandelion	Plant	E	5
X		*Ternstroemia luquillensis*	Palo Colorado	Plant	E	8
X		*Ternstroemia subsessilis*	Unknown Common Name	Plant	E	8
X		*Thelypodium stenopetalum*	Slenderpetal Thelypody	Plant	E	5
		Thelypteris pilosa var. alabamensis	Alabama Streak-Sorus Fern	Plant	T	None
X		*Thlaspi californicum*	Kneeland Prairie Pennycress	Plant	PE	5
X		*Townsendia aprica*	Last Chance Townsendia	Plant	T	4
X		*Trifolium stoloniferum*	Running Buffalo Clover	Plant	E	8, 9
		Trillium persistens	Persistent Trillium	Plant	E	None
		Trillium reliquum	Relict Trillium	Plant	E	None
		Tuctoria greenei	Greene's Tuctoria	Plant	E	None

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Species likely to have habitat within and/or affected by inventoried roadless area(s)	Species has designated *critical habitat* within and/or affected by inventoried roadless area(s)in one or more Forest Service Regions	Species Scientific Name	Common Name	Species Group	Federal Status	Forest Service Region(s) where species is likely to be impacted by inventoried roadless area(s)
		Xyris tennesseensis	Tennessee Yellow-eyed Grass	Plant	E	None
		Clemmys muhlenbergii	Bog Turtle	Reptile	T	None
X	**Yes**	*Crotalus willardi obscurus*	New Mexico Ridgenose Rattlesnake	Reptile	T	3
X		*Drymarchon corais couperi*	Eastern Indigo Snake	Reptile	T	8
X		*Epicrates inornatus*	Puerto Rican Boa	Reptile	E	8
		Gambelia silus	Blunt-nosed Leopard Lizard	Reptile	E	None
X	**Yes**	*Gopherus agassizii*	Desert Tortoise (Sonoran pop.)	Reptile	T	3, 4
		Gopherus polyphemus	Gopher Tortoise	Reptile	T	None
		Graptemys flavimaculata	Yellow-blotched Sawback Trutle	Reptile	T	None
X		*Neoseps reynoldsi*	Sand Skink	Reptile	T	8
X		*Nerodia erythrogaster neglecta*	Copperbelly Water Snake	Reptile	T	9
		Sternotherus depressus	Flattened Musk Turtle	Reptile	T	None
		Thamnophis gigas	Giant Garter Snake	Reptile	T	None

APPENDIX D

Civil Rights Impact Analysis
Population Distribution Maps

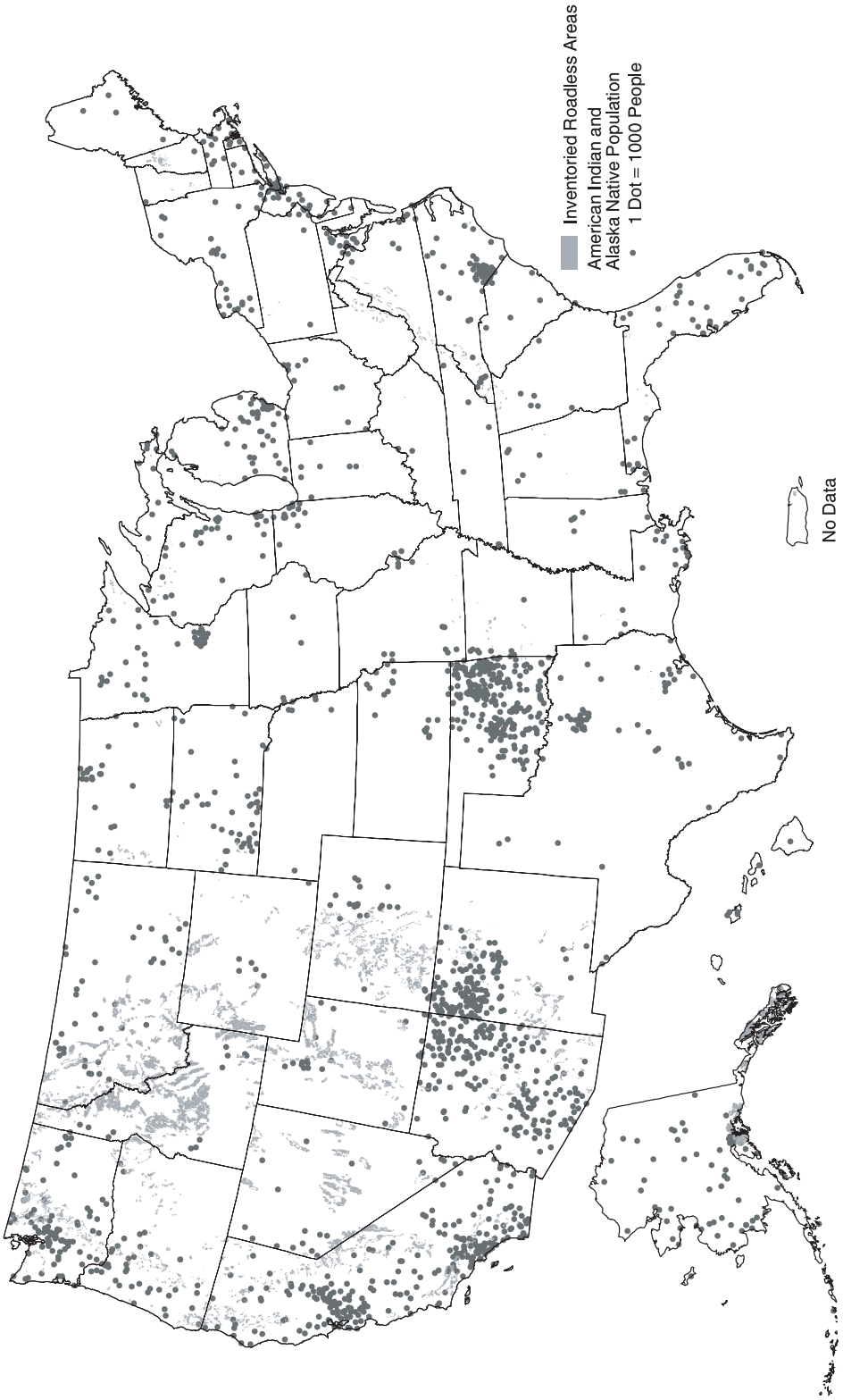

Figure D-1. American Indian population distribution in relation to inventoried roadless areas, 1990. *(Vasievich 2000)*

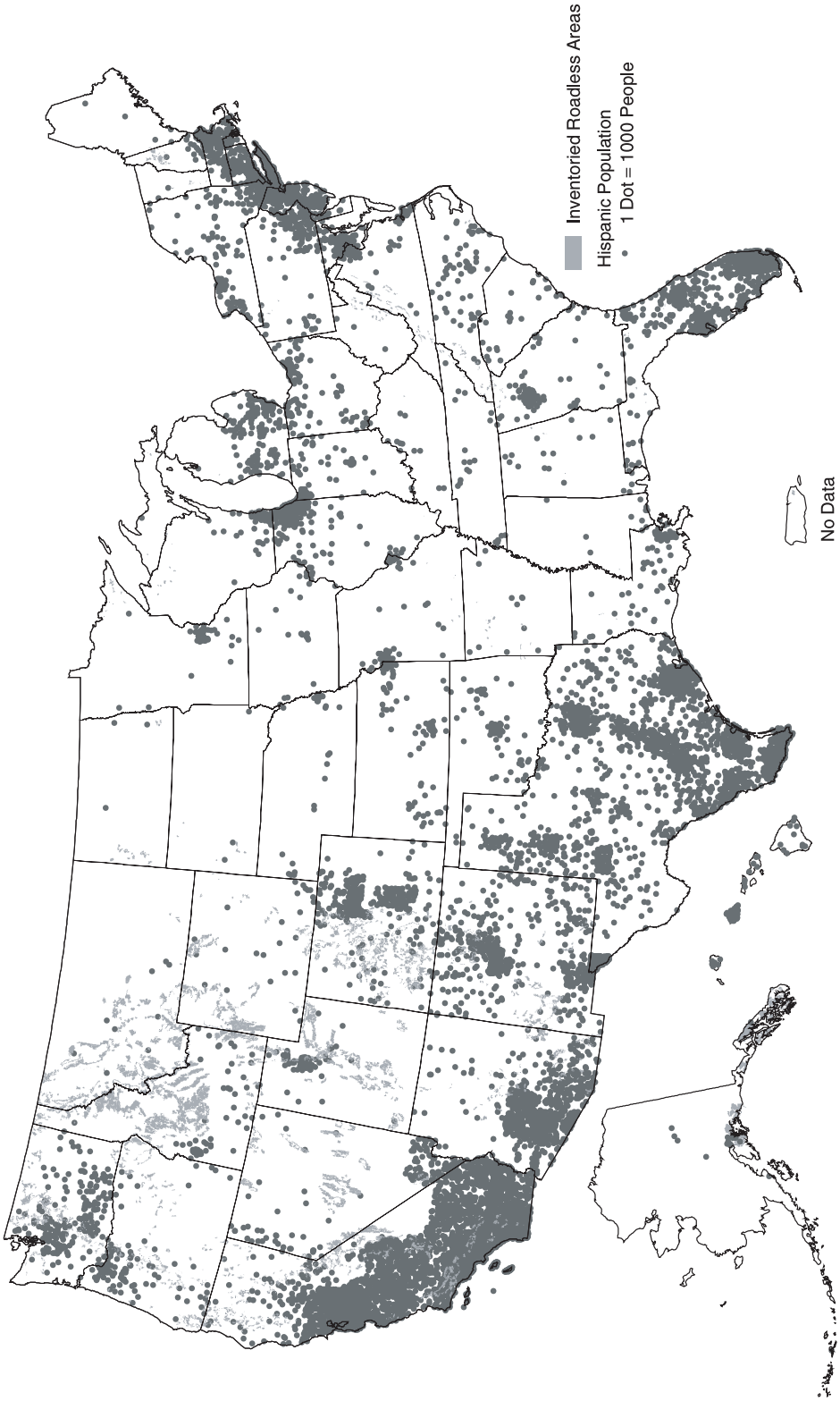

Figure D-2. Hispanic population distribution in relation to inventoried roadless areas, 1990.
(Vasievich 2000)

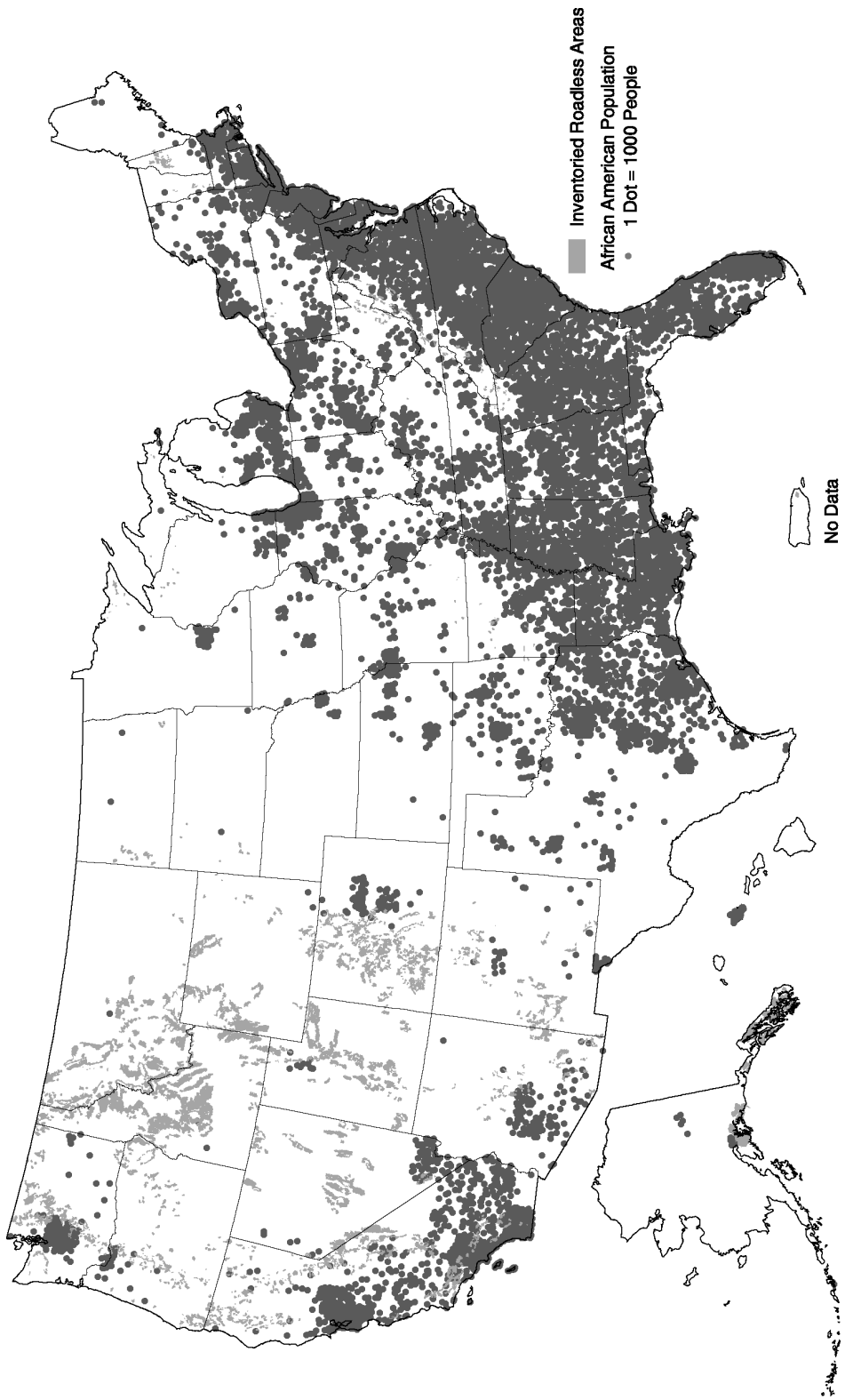

Figure D-3. African American population distribution in relation to inventoried roadless areas, 1990.
(Vasievich 2000)

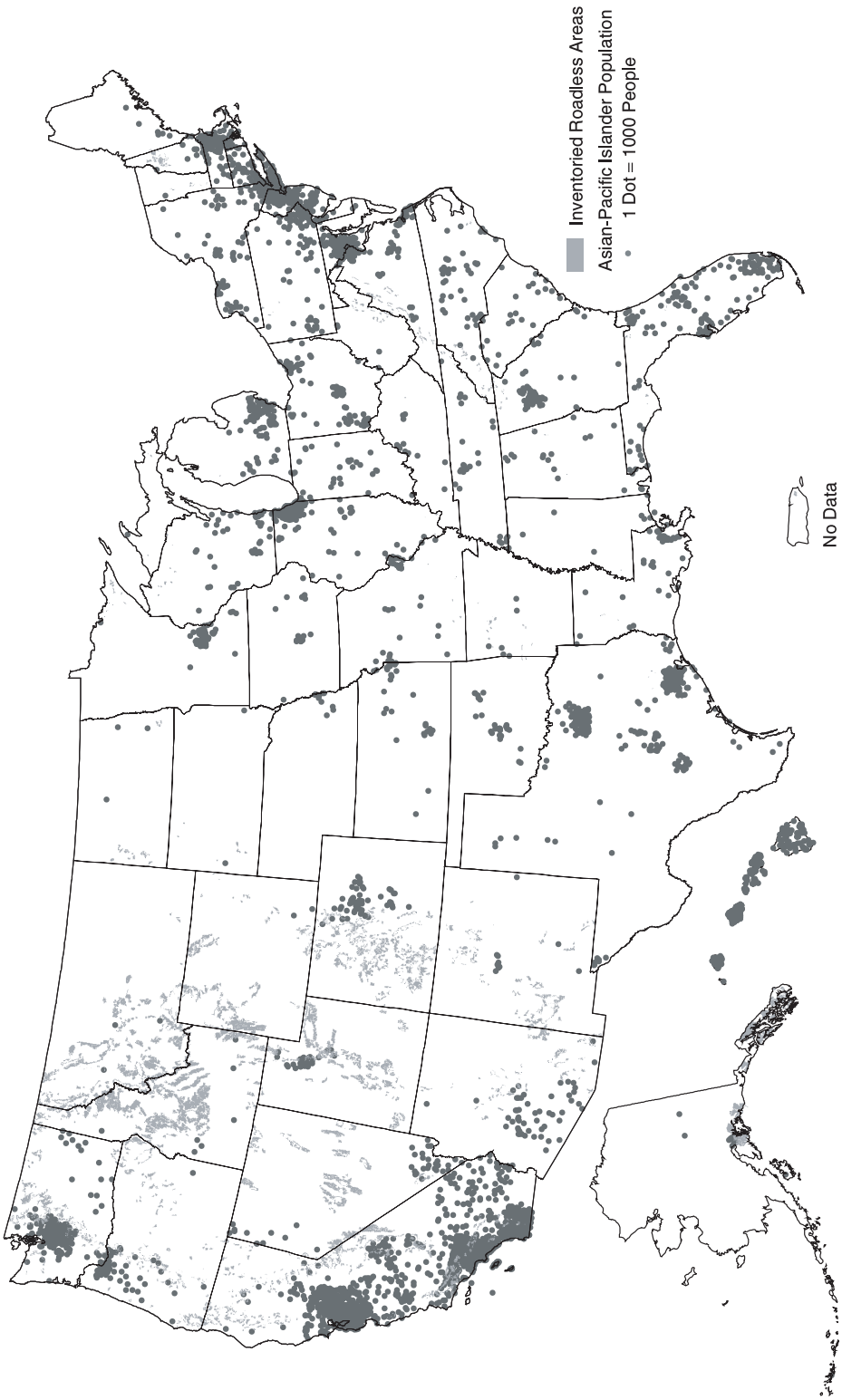

Figure D-4. Asian and Pacific Islander population distribution in relation to inventoried roadless areas, 1990. *(Vasievich 2000)*

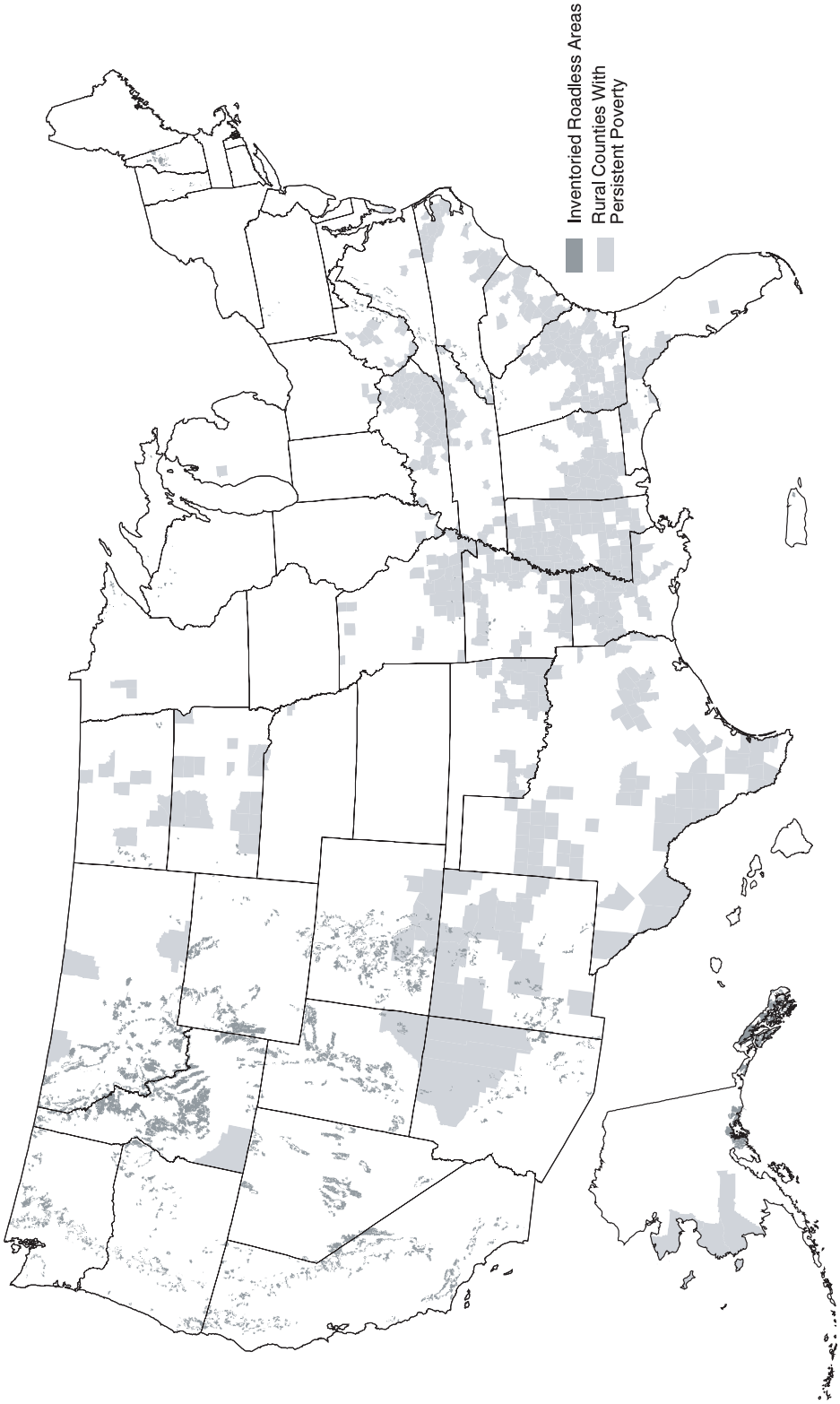

Figure D-5. Rural counties with persistent poverty in relation to inventoried roadless areas, 1990.
(Vasievich 2000)

APPENDIX E

Tongass National Forest Land and Resource Management Plan Prescriptions in Tongass Selected Areas Alternative

Chapter 3
Management Prescriptions[1]

Introduction

Chapters 2, 3 and 4 of the Forest Plan present the direction for managing the Tongass National Forest. The components and priority of this direction are explained in Chapter 1. This chapter includes the complete management prescription for each of the 19 Land Use Designations used in the Forest Plan. The areas allocated to each Land Use Designation are shown on the Forest Plan map (and also the Alternative I I map in the FEIS map packet).

To use this management prescription section, first find the area of the Forest you are interested in on the map. The map legend shows the name and corresponding color of each Land Use Designation. Then locate the management prescription for that designation (they have the same name) in the table of contents of this Plan.

Each management prescription has the following components:

1. Goals, objectives and desired condition.

2. A table which refers, by resource, to the Forest-wide Standards & Guidelines that apply. The Forest-wide Standards & Guidelines are included in Chapter 4. If a reference is not made in this table to a specific Forest-wide Standard & Guideline, then that Standard & Guideline is not applicable.

3. The specific direction, called Land Use Designation Standards & Guidelines. The Land Use Designation Standards & Guidelines are grouped by resource, following the order established for the Forest-wide Standards & Guidelines. Resource codes are the same for both sets of standards and guidelines. Some resources are not included in the Land Use Designation Standards & Guidelines; in that case, resource direction entirely defaults to the table as described above (#2).

Land Use Designation Acreage

The following table shows the number of acres allocated to each of the 19 land use designations (LUDs). However, in some cases, more than one LUD can be applied to the same area (such as a Special Interest Area within Wilderness) therefore, totaling the acres will exceed the total National Forest acreage. For LUDs that allow timber harvest (e.g., Timber production), many of the acres are unsuitable for commercial timber production. Table A-1 in Appendix A shows the actual number of suitable acres on the Forest.

* In this table, the total area within each LUD is included. However, in some cases, more than one Land Use Designation can be applied to the same area (such as a Special Interest Area within Wilderness). Therefore, totaling the acres of the LUDs will exceed the total National Forest acreage. No acreage has been calculated for the Transportation and Utility Systems LUD.
Land Use Designation Allocations,*

[1] This appendix reprints the goals, objectives, desired conditions, standards, and guidelines for the 4 management prescriptions (land use designations) incorporated in Tongass Selected Areas Alternative. Refer to *USDA, Forest Service. 1997c. Land and Resource Management Plan, Tongass National Forest. Alaska Region*, for the entire set of management prescriptions.

Land Use Designation	Acres Allocated
Wilderness	2,622,913
Wilderness National Monument	3,098,820
Nonwilderness National Monument	163,654
Research Natural Area	59,545
Special Interest Area	297,173
Remote Recreation	2,129,169
Enacted Municipal Watershed	45,776
Old-growth Habitat	1,131,059
Semi-remote Recreation	2,941,350
LUD 11	719,000
Wild River	129,650
Scenic River	36,460
Recreational River	36,470
Experimental Forest	17,260
Scenic Viewshed	496,613
Modified Landscape	622,387
Timber production	2,580,821
Minerals	166,215

Special Designations or Classifications

The following listing shows, by name, the areas of the Forest identified as Congressionally designated Wilderness and LUD II's; Wild, Scenic and Recreational Rivers (recommended); Research Natural Areas; Special Interest Areas; and Experimental Forests.

Congressionally designated Wilderness and LUD II's

Wilderness established December 2, 1980 by ANILCA

Kootznoowoo Wilderness (Admiralty Island Nat. Monument)
Coronation Island Wilderness
Endicott River Wilderness
Maurelle Islands Wilderness
Misty Fiords National Monument Wilderness
Petersburg Creek-Duncan Salt Chuck Wilderness
Russell Fiord Wilderness
South Baranof Wilderness
South Prince of Wales Wilderness
Stikine-LeConte Wilderness
Tebenkof Bay Wilderness
Tracy Arm-Fords Terror Wilderness
Warren Island Wilderness
West Chichagof-Yakobi Wilderness

Wilderness established November 28, 1990 by TTRA

Chuck River Wilderness
Karta Wilderness
Kuiu Wilderness
Pleasant-Lemesurier-inian Islands Wilderness
South Etolin Wilderness
Young Lake Addition to Kootznoowoo Wilderness

LUD II's established November 28, 1990 by TTRA

Anan Creek
Berners Bay

Kadashan
Lisianski River/Upper Hoonah Sound
Mt. Calder/Mt. Holbrook
Naha
Nutkwa
Outside Islands
Point Adolphus/Mud Bay
Salmon Bay
Trap Bay
Yakutat Forelands

Wild, Scenic and Recreational Rivers

The following rivers or river segments, as described in Appendix E of the FEIS for Alternative I 1, including the segment classifications, will be recommended to Congress for inclusion in the National Wild and Scenic Rivers System:

Aaron, Oerns and Berg Creeks
Anan Creek
Blind River
Blue River
Chickamin River
Essowah Lakes and Streams
Fall Dog Creek
Farragut River
Gilkey River
Glacial River
Gokachin, Mirror, Fish, and Low Creeks
Harding River
Hasselborg River
Kadake Creek
Kadashan River
Kah Sheets Creek and Lake
Katzehin River
Kegan Lake and Streams
King Salmon River
Kutlaku Creek and Lake
LeConte Glacier
Lisianski River
Niblack Lakes and Streams
Naha River
Orchard Creek and Lake
Petersburg Creek
Salmon Bay Lake and Stream
Santa Anna Creek and Lake Helen
Sarkar Lakes
Thorne River and Hatchery Creek
Virginia Lake and Creek
Wolverine Creek and McDonald Lake

Research Natural Areas

The following will continue to be managed as established Research Natural Areas:

Cape Fanshaw Research Natural Area
Dog Island Research Natural Area
Limestone Inlet Research Natural Area
Old Tom Creek Research Natural Area
Red River Research Natural Area

The existing Pack Creek Research Natural Area is recommended to the Chief, Forest Service for declassification as a Research Natural Area.

The following areas, as described in Appendix D of the FEIS, will be recommended to the Chief, Forest Service for classification as Research Natural Areas, after confirmation in the Establishment Report of the site's suitability for designation:

Kadin Island
Marten River
Rio Roberts
Robinson Lake
Tonalite Creek
Warm Pass
West Gambier Bay

Special Interest Areas

The following areas will continue under a Special Interest Area classification:

Admiralty Lakes Recreation Area
Hubbard Glacier Geological Area
Mendenhall Glacier Recreation Area
New Eddystone Rock Geological Area
Tracy Arm-Fords Terror Scenic Area
Walker Cove-Rudyerd Bay Scenic Area
Ward Lake Recreation Area

The following areas, as described in Appendix F of the FEIS, are classified as Special Interest Areas and designated as named below:

Arena Cove/Cape Felix Geological Area
Bailey Bay Hot Springs Recreation Area
Blind Slough Scenic and Zoological Area
Blue River Lava Flow Geological Area
Clear River Zoological Area
Duke Island Zoological Area
Falls Creek Windthrow Botanical Area
Fish Creek Hot Springs Recreation Area
Karst Areas Geological Area
Keku Islets Geological and Scenic Area
Mount Edgecumbe Geological Area
North Hamilton River Redcedar Cultural and Botanical Area
Patterson Glacier Geological and Botanical Area
Pike Lakes Recreation Area
Soda Springs Geological Area
Ward Lake Recreation Area (expansion)

The Pack Creek Research Natural Area, upon declassification as a Research Natural Area by the Chief, Forest Service, will be designated the Pack Creek Zoological Area.

Experimental Forests

The following will continue to be managed as Experimental Forests:

Maybeso Experimental Forest
Young Bay Experimental Forest

REMOTE RECREATION

Land Use Designation RM

Goals

To provide extensive, unmodified natural settings for primitive types of recreation and tourism.

To provide opportunities for independence, closeness to nature, and self-reliance in environments offering a high degree of challenge and risk.

To minimize the effects of human uses, including subsistence use, so that there is no permanent or long-lasting evidence.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Primitive Recreation Opportunity Spectrum class.

Provide trails and primitive facilities that are in harmony with the natural environment and that promote primitive recreation experiences.

Apply the Retention Visual Quality Objective.

Fish enhancement projects may occur. Design wildlife habitat improvements to emulate natural conditions and appearance.

Desired Condition

Areas in the Remote Recreation Land Use Designation are characterized by extensive, unmodified natural environments. Ecological processes and natural conditions are not noticeably affected by past or current human uses or activities. Users have the opportunity to experience independence, closeness to nature, solitude and remoteness, and may pursue activities requiring self-reliance in an environment that offers a high degree of challenge and risk. Interactions between users are infrequent. Motorized access is limited to traditional means: boats, aircraft and snowmachines. Facilities and structures are minimal, and rustic in appearance.

Apply the following Land Use Designation Standards & Guidelines:

FACILITIES — **Facilities Improvements: FAC2**

A. Design and locate administrative and non-recreation structures to reduce adverse effects on recreation and tourism opportunities.

FIRE — **Fire Suppression: FIRE12**

Suppression Action

A. Suppress wildfires using the suppression option identified in the Southeast Alaska/Prince William Sound Fire Management Plan. An Escaped Fire Situation Analysis (EFSA) of expected fire behavior, time of year, and locations with respect to private land and adjacent Land Use Designations may lead to a lower strategy. If an EFSA discloses no adverse effects and it is more cost-efficient, the lower strategy will be used.

Remote Recreation Land Use Designation Apply the following Forest-wide Standards & Guidelines located in Chapter 4:

Resource	Section	Sub-Sections	Page
Air	AIR	All	4-3
Beach And Estuary Fringe	BEACH1	All	4-4
	BEACH2	I,II(A-G,K,L)	
Facilities	FAC	All	4-6
Fire	FIRE	All	4-7
Fish	FISH	All	4-8
Forest health	HEALTH	All	4-13
Heritage Resources	HER	All	4-14
Karst And Cave Resources	KARST, CAVE	All	4-18
Lands	LAND	All	4-21
Minerals And Geology	MG	All	4-33
Recreation And Tourism	REC	All	4-35
Riparian	RIP1	All	4-53
	RIP2	I-II(A-E,G)	
Rural Community Assistance	RUR	All	4-74
Scenery	VIS1	All	4-75
	VIS11	I,II(A,E)	
	VIS12	I(A,B,D),II	
Soil And Water	S&W1111, 1112,2	All	4-83
	S&W112	I(A:1-4,6-7), II, III	
Subsistence	SUB	All	4-86
Threatened, Endangered, Sensitive	TE&S	All	4-88
Timber	TIM111-1,140	All	4-94
	TIM114	VIII(D)	
Trails	TRAI	All	4-102
Transportation	TRAN	None	4-104
Wetlands	WET	All	4-111
Wildlife	WILD112	I-VIII; IX(A:1-8;11,B); X; XI(A:1); XII,- XIII; XIV; XVI(A:I); XVII	4-112
	WILD22	I(A:I,B)	
	WILD23	All	

FIRE **Fire Suppression: FIRE12** (cont.)

Suppression Action

B. Emphasize suppression tactics which result in the least possible disturbance or evidence of human presence.
   1. Keep use of mechanized equipment to a minimum.
   2. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   3. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as it is safe, but within one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed fire

A. As a general management practice, do not use management-ignited prescribed fire. Should it become necessary to consider the use of management-ignited prescribed fire, FSM 2324 provides direction.
B. As a general management practice, do not use prescribed natural fire. Should it become necessary to consider the use of prescribed natural fire, the Forest Plan must be amended to analyze, justify, and approve prescribed natural fire programs. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH112

Fish Enhancement

A. Evaluate fish habitat improvement during project planning by considering: 1) effects resulting from the introduction of species not indigenous to the watershed; 2) the appropriateness of structures both in type and scale to the Primitive Recreation Opportunity Spectrum (ROS) setting; and 3) the need to provide well-distributed fisheries that support sport and commercial fisheries, subsistence, and community stability.

Fish Habitat Improvement: FISH22

A. Design development to minimize impact on the primitive setting.
B. Construction techniques should be compatible with the primitive recreation setting.
C. Evidence of necessary land-disturbing activities for construction should not be visible to the casual observer after 5 years.

FOREST HEALTH

Forest Health Management: HEALTHI

A. Implement insect and disease management practices to maintain forest health in this and adjacent Land Use Designations.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks annually.

HERITAGE Heritage Resource Activities: HER

Enhancement

A. Heritage Resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Interpretive information concerning Heritage Resources located inside this Land Use Designation should be in the form of exhibits and publications located outside the Land Use Designation.
   2. Heritage Resources are available for scientific studies that are consistent with the primitive settings and activities, and heritage resource management objectives for the specific site.

Inventory/Evatuation

A. Develop priorities and schedule management activities Heritage Resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Identify, classify, and evaluate known Heritage Resources.
   2. Identify heritage properties to be nominated to the National Register of Historic Places.

3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of Heritage Resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: CAVE

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this Land Use Designation.
B. Manage caves as Class I (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards & Guidelines.

LANDS

Special Use Administration (Non-Recreation): LAND122

A. Permit only those new activities which are compatible with the Land Use Designation.
   1. Permit temporary structures and major fisheries improvement projects (such as hatcheries) only if they are widely dispersed.
   2. Permitted activities and structures should not be visually evident from a Visual Priority Route or Use Area (see Appendix F).
B. This Land Use Designation represents a Transportation and Utility System (TUS) "Avoidance Area." Transportation and utility sites and corridors may be located within this Land Use Designation only after an analysis of potential TUS corridors has been completed and no feasible alternatives exist outside this Land Use Designation.

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG12

Forest Lands Open to Mineral entry

A. Forest lands within this Land Use Designation are open to mineral
B. exploration and development. Mineral activities will be compatible with objectives of this Land Use Designation to the extent feasible.
C. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and National Forest Service Minerals Regulations 36 CFR 228.
D. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of operations.

Plan of operations

A. Work with claimants to develop a Plan of operations that adequately mitigates adverse impacts to Land Use Designation objectives. Include mitigation measures that are compatible with the scale of proposed development and commensurate with potential resource impacts.
B. Apply Transportation Forest-wide Standards & Guidelines to the location and construction of mining roads and facilities.
C. Manage mineral exploration and development activities to be compatible with the emphasis of the Remote Recreation Land Use Designation. Apply the following management practices to reduce resource impacts.

1. Manage mineral activities to maintain the present and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible. (Consult ANILCA, Section 505 (a).)
2. Take maximum advantage of topographic and vegetative screening when locating drill rigs and pumps, roads, rock quarries, structures, and marine transfer facilities.
3. Discourage use of motorized surface vehicles, except as provided in ANILCA, Section 1110(b), which assures adequate and feasible access for economic and other purposes.
4. Locate material sites and marine transfer facilities outside this Land Use Designation if reasonable alternatives exist.
5. Ensure that vegetation removed from the project area is hauled away, buried, burned, or scattered.
6. Minimize the scale of spoil/disposal areas to the surrounding landscape as seen from sensitive view points.
7. Approve use of colors that simulate those found in the characteristic landscape. Avoid use of reflective materials in project facilities.
8. Approve reclamation plans in which minerals activities leave a natural-appearing condition.
9. Ensure that landform modifications simulate naturally-occurring forms.
10. Ensure that disturbed areas are revegetated in accordance with project plans.

RECREATION AND TOURISM

Recreation Use Administration: REC122

Recreation Management and Operations

A. Manage for Frimitive recreation settings, recognizing other Recreation Opportunity Settings (ROS) may be present due to authorized activities, existing use patterns, and activities in adjacent Land Use Designations. Strive to minimize these changes from the Primitive ROS objective.
B. Manage recreation and tourism use to meet the levels of social encounters, on-site development, and visitor impacts indicated by the ROS charts in the Recreation and Tourism Forest-wide & Guidelines.

Recreation Special Uses

A. Major developments are generally not consistent with the objectives of this Land Use Designation. Development proposals require scrutiny of the magnitude and scope for Land Use Designation conformance. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.
B. Minor developments may be compatible with the Land Use Designation objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.

SCENERY

Scenery Operations: VIS1

A. Provide a visual condition in which activities are not visually evident to the casual observer.

1. Apply Forest-wide Standards & Guidelines for the Retention Visual Quality Objective.
2. Exceptions for small areas of non-conforming developments, such as recreation sites, may be considered on a case-by-case basis (see the Recreation and Tourism Standards & Guidelines in this prescription).

SOIL AND WATER

Watershed Resource Improvements: S&W2

A. Watersheds will be managed in a natural condition.
B. Use indigenous plants and materials to protect or improve the quality and/or quantity of the water resource or to stabilize soils.

TIMBER

Timber Resource Planning: TIM12

A. Forested land is classified as unsuitable for timber production.
B. Taking of personal use wood will be limited to beach logs which can be removed from coastlines without roads or use of vehicles on uplands. The cutting down of trees in navigable rivers (sweepers) and removal of trees from the banks must be compatible with the management direction for fish habitat.

TRANSPORTATION

Transportation Operations: TRAN1

A. New roads are not permitted except to access valid mining claims (or as excepted under Lands).
B. Existing roads in this Land Use Designation are closed to motorized uses subject to ANILCA provisions.
C. Use of snowmachines, motorboats, and aircraft is permitted.

WILDLIFE

Wildlife Habitat Planning: WILD112

A. Wildlife habitats are generally subject to ecological changes only.
B. Indigenous species are maintained.
C. Habitat improvement projects are acceptable if designed to emulate natural conditions and appearance.

OLD-GROWTH HABITAT

Land Use Designation OG

Goals

Maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources.

Manage early seral conifer stands to achieve old-growth forest characteristic structure and composition based upon site capability. Use *old growth definitions as outlined in Ecological Definitions for Old-growth Forest Types in Southeast Alaska (RI 0-TP-28).*

Objectives

Provide old-growth forest habitats, in combination with other Land Use Designations, to maintain viable populations of native and desired non-native fish and wildlife species and subspecies that may be closely associated with old-growth forests.

Contribute to the habitat capability of fish and wildlife resources to support sustainable human subsistence and recreational uses.

Maintain components of flora and fauna biodiversity and ecological processes associated with old- growth forests.

Allow existing natural or previously-harvested early seral conifer stands to evolve naturally to old-growth forest habitats, or apply silvicultural treatments to accelerate forest succession to achieve old-growth forest structural features. Consider practices such as thinning, release and weeding, pruning, and fertilization to promote accelerated development of old-growth characteristics.

To the extent feasible, limit roads, facilities, and permitted uses to those compatible with old-growth forest habitat management objectives.

Desired Condition

All forested areas within this Land Use Designation have attained old-growth forest characteristics. A diversity of old-growth habitat types and associated species and subspecies and ecological processes are represented.

Old-growth Habitat Land Use Designation Apply the following Forest-wide Standards & Guidelines located in Chapter 4:

Resource	Section	Sub-Sections	Page
Air	AIR	All	4-3
Beach And Estuary Fringe	BEACH	All	4-4
Facilities	FAC	All	4-6
Fire	FIRE	All	4-7
Fish	FISH	All	4-8
Forest Health	HEALTH	All	4-13
Heritage Resources	HER	All	4-14
Karst And Cave Resources	KARST,CAVE	All	4-18
Lands	LAND	All	4-21
Minerals And Geology	MG	All	4-33
Recreation And Tourism	REC	All	4-35
Riparian	RIP1	All	4-53
	RIP2	I,II(A-E,G,H)	
Rural Community Assistance	RUR	All	4-74
Scenery	VIS1,12	All	4-75
	VIS11	I,II(A,E)	
Soil And Water	S&W1111, 1112,2	All	4-83
	S&W112	I(A:1-4,6-7),II,III	
Subsistence	SUB	All	4-86
Threatened, Endangered, Sensitive	TE&S	All	4-88
Timber	TIM111,111-1,130,140	All	4-94
	TIM114	VIII	
Trails	TRAI	All	4-102
Transportation	TRAN	All	4-104
Wetlands	WET	All	4-111
Wildlife	WILD112	I-VIII; IX(A: 1 -8,11, B); X-XVIII	4-112
	WILD 22,23	All	

Apply the following Land Use Designation Standards & Guidelines:

FACILITIES

Facilities Improvements: FAC2

A. Allow administrative and recreational facilities when compatible with Land Use Designation objectives.

FIRE

Fire Suppression: FIRE12

Suppression Action

A. Suppress wildfires using the suppression option identified in the Southeast Alaska/Prince William Sound Fire Management Plan. An Escaped Fire Situation Analysis (EFSA) of expected fire behavior, time of year, and locations with respect to private land and adjacent land use areas, may lead to a lower strategy. If an EFSA discloses no adverse effects and it is more cost-efficient, the lower strategy will be used.
B. Suppression tactics are limited only by the standards for this Land Use Designation, such as soil and watershed concerns.

Fuel Improvements: FIRE2

Prescribed fire

A. Allow management-ignited prescribed fire where its use maintains old- growth characteristics.
B. Do not use prescribed natural fire.

FISH

Fish Habitat Planning: FISHI 12

A. Emphasize the protection and restoration of fish habitat, fish production and aquatic biodiversity. Enhancement projects that may change the natural distribution of fish species within a watershed are consistent with Land Use Designation objectives.

FOREST HEALTH

Forest Health: HEALTHI

A. Insect and disease management measures consistent with this Land Use Designation may be implemented to protect the old-growth forest component and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HER

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
    1. Identify, classify, and evaluate known Heritage Resources.
    2. Identify heritage properties to be nominated to the National Register of Historic Places.
    3. Identify heritage properties that require stabilization or other protective measures.
    4. Identify opportunities for interpretation of Heritage Resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: CAVE

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this Land Use Designation.

LANDS

Special Use Administration (Non-Recreation): LAND122

A. Permit only improvements (such as tent platforms, fish weirs, minor waterlines, minor powerlines, etc.) which are compatible with Land Use Designation objectives.
B. This Land Use Designation represents a Transportation and Utility Systems (TUS) "Avoidance Area." Transportation and utility sites or corridors may be located within this Land Use Designation only after an analysis of potential TUS corridor opportunities has been completed and no feasible alternatives exist outside this Land Use Designation.

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG12

Forest Lands Open to Mineral entry

A. Forest lands within this Land Use Designation are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and National Forest Service Mining Regulations 36 CFR 228.
C. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of operations.

Plan of operations

A. Work with claimants to develop a Plan of operations that minimizes, monitors, and mitigates adverse impacts to Land Use Designation objectives. Monitoring plans should specifically assess impacts to threatened, endangered or sensitive species or other significant fish and wildlife resources. Include mitigation measures that are compatible with the scale of proposed development and commensurate with potential resource impacts.
B. Apply Transportation Forest-wide Standards & Guidelines to the location and construction of mining roads and facilities.
C. Manage mineral exploration and development activities to be compatible with Land Use Designation objectives. Apply the following management practices to avoid or reduce impacts.
1. Manage mineral activities to maintain the present habitat capability and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible. (Consult ANILCA, Section 505 (a).)
2. Take advantage of topographic and vegetative screening when locating drill rigs and pumps, roads, rock quarries, structures, and marine transfer facilities.
3. Locate material sites and marine transfer facilities outside this Land Use Designation if reasonable alternatives exist.
4. Minimize the scale of spoil/disposal areas in relation to the surrounding landscape as seen from sensitive viewpoints to leave a naturally-appearing condition.
5. Ensure that disturbed areas are revegetated in accordance with project plans, emphasizing the use of native vegetation and local genetic plant stocks.
6. Apply timing restrictions to minerals activities as needed to prevent or minimize disturbance to fish and wildlife during critical life stages (e.g., spawning, molting, nesting, or brood-rearing).

RECREATION AND TOURISM

Recreation Use Administration: REC122

Recreation Management and Operations

A. Manage recreation and tourism use to meet Land Use Designation objectives for fish and wildlife resources and habitat.
   1. Design and locate recreation-related structures to be compatible with habitat needs of old-growth associated species.
   2. Manage Off-Highway Vehicle use to prevent degradation of habitat or adverse disturbance to fish and wildlife populations.

B. Generally provide for semi-primitive ROS settings, recognizing that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent Land Use Designations.

Recreation Special Uses

A. Minor recreation and tourism developments may be compatible with the Land Use Designation objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.

SCENERY

Scenery Operations: VIS1

A. Apply Forest-wide Standards & Guidelines for the Retention Visual Quality Objective. Design activities to not be visually evident to the casual observer.

B. Exceptions for small areas of non-conforming developments, such as recreational developments, transportation developments, Log Transfer Facilities, and mining development, may be considered on a case-by-case basis. Use designs and materials that are compatible with forms, colors, and textures found in the characteristic landscape.

SOIL AND WATER

Watershed Resource Improvements: S&W2

A. Undertake watershed improvements only where deteriorated soil and hydrologic conditions create a threat to the goals and objectives for which the old-growth habitat is managed. Rehabilitation or stabilization projects will seek to enable the area to retain its natural appearance.

TIMBER

Timber Resource Planning: TIM112

A. Forest land is classified as unsuitable for timber production.

B. Beach log salvage is compatible with this Land Use Designation.

C. Personal use wood harvest is allowed within locally determined areas if determined to be consistent with Land Use Designation objectives. Salvage of bridge stringer logs is permitted.

Timber Sale Preparation: TIM114

A. Salvage of dead or down material is permitted, but is limited to roadside windfall and hazard trees immediately adjacent to existing permanent roads and catastrophic windthrow events or large insect or disease outbreaks (generally,exceeding 100 acres). Limited standing undamaged timber(up to 20% of total salvage) may be removed only for safety reasons or for feasibility of salvage operations. Salvage sales must be

compatible with Land Use Designation objectives as determined through the environmental analysis process. Stands once salvaged will be managed to achieve old- growth habitat characteristics. During the environmental analysis, consider the scale of the affected area salvaged. If reserve design criteria are no longer met, adjust reserve locations to better meet reserve size, spacing and composition criteria if lands are available (see Wildiife Planning, section B below, and Appendix K).

TRANSPORTATION

Transportation Operations: TRANI

A. New road construction is generally inconsistent with Old-growth Habitat Land Use Designation objectives, but new roads may be constructed if no feasible alternative is available.
   1. Perform integrated logging system and transportation analysis (including Access and Travel management planning) to determine if other feasible routes avoiding this Land Use Designation exist during the project environmental analysis process. If no feasible alternative routes exist, locate, design, and construct roads in a manner which minimizes adverse impact to fish and wildlife resources to the extent feasible, and will be compatible with Land Use Designation objectives. Keep clearing widths to the minimum feasible. Consider enforcement costs of road closures in the integrated logging system and transportation analysis.
   2. If reserve design criteria are no longer met, adjust reserve locations to meet reserve size, spacing and composition criteria if lands are available (see Wildlife Planning, section B below, and Appendix K).
   3. For timber salvage, use logging systems that do not require additional permanent road construction.
B. Manage existing roads to meet Land Use Designation objectives.
   1. In Old-growth Habitat Land Use Designations with existing roads, develop or update Road management objectives to meet Land Use Designation objectives (see Wildlife (brown bear and wolf) and Transportation Forest-wide Standards & Guidelines). Use of existing roads may continue pending the development or update of Road management objectives (see Appendix L).
   2. Road management objectives may include temporary or permanent road closures and may be specific to individual road specification types (e.g., keep mainlines open, close arterial and spur).
   3. Road maintenance and reconstruction may be permitted if consistent with road management objectives.
C. Sites for Log Transfer Facilities may be considered in this Land Use Designation. If no other feasible alternative sites exist, locate, design, construct, and manage these facilities in a manner which will be compatible with Land Use Designation objectives.

WILDLIFE

Wildlife Habitat Planning: WILD122

A. Maintain contiguous blocks of old-growth forest habitat in a forest-wide system of old-growth reserves to support viable
B. A system of large, medium and small old-growth habitat reserves has been identified and mapped in the forest plan as part of a forest-wide old-growth habitat reserve strategy. The mapped

large and medium reserves generally achieve reserve strategy objectives, and few major modifications are anticipated. The small mapped reserves have received differing levels of ground-truthing and integration of site-specific information in their design. During project. level environmental analysis, for projects areas that include or are adjacent to mapped old-growth habitat reserves, the size, spacing and habitat composition of mapped reserves may be further evaluated. (See Appendix K for mapping criteria.)

1. Adjust reserves not meeting the minimum criteria to meet or exceed the minimum criteria.
2. Reserve location, composition, and size may otherwise also be adjusted. Alternative reserves must provide comparable achievement of the Old- growth Habitat Land Use Designation Goals and Objectives. Determination as to comparability must consider the criteria listed in Appendix K.
3. Adjustments to individual reserves described in 1. and 2. above are not expected to require a significant plan amendment. Adjustments Forest- wide shall be monitored yearly to assess whether a significant plan amendment is warranted on the basis of cumulative changes.

C. Allow previously harvested or natural early seral stands to develop into old- growth habitats, or provide young-growth management to accelerate attainment of old-growth characteristics. (See WILD22, below).

Wildlife Habitat Restoration: WILD22

A. Manage early seral forest stands for purposes of wildlife habitat development. Allow techniques such as thinning, pruning, and planting to accelerate development of advanced seral stand structure including maintenance of shrub and forb understory.

SEMI-REMOTE RECREATION

Land Use Designation SM

Goals

To provide predominantly natural or natural-appearing settings for semi-primitive types of recreation and tourism and for occasional enclaves of concentrated recreation and tourism facilities.

To provide opportunities for a moderate degree of independence, closeness to nature, and self-reliance in environments requiring challenging motorized or non-motorized forms of transportation.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Semi-primitive Recreation Opportunity Spectrum classes. Enclaves of concentrated recreation and tourism developments within the Land Use Designation or management activities in adjacent Land Use Designations may cause the ROS setting to become Rural.

Determine on a case-by-case basis whether roads, trails, and other areas should be closed to motorized recreation activities. If so, incorporate into Off-Highway Vehicle (OHV) plans. If not, the use of boats, aircraft, and snowmachines for traditional activities is allowed.

Permit small-scale, rustic recreation and tourism facilities, and occasional enclaves of concentrated recreation and tourism facilities.

Apply the Partial retention Visual Quality Objective to any developments, facilities, or structures.

Fish enhancement and wildlife habitat improvement may occur.

Desired Condition

Areas in the Serni-remote Recreation Land Use Designation are characterized by generally unmodified natural environments. Ecological processes and natural conditions are only minimally affected by past or current human uses or activities. Users have the opportunity to experience a moderate degree of independence, closeness to nature, solitude and remoteness, with some areas offering motorized opportunities and others non-motorized opportunities (except for the traditional uses of boats, aircraft, and snowmachines). Interactions between users are infrequent. Facilities and structures may be minimal or occasionally may be larger in scale, but will be rustic in appearance, or in harmony with the natural setting.

Semi-remote Recreation Land Use Designation Apply the following Forest-wide Standards & Guidelines located in Chapter 4:

Resource	Section	Sub-Sections	Page
Air	AIR	All	4-3
Beach And Estuary Fringe	BEACH1	All	4-4
	BEACH2	I,II(A-G,K,L)	
Facilities	FAC	All	4-6
Fire	FIRE	All	4-7
Fish	FISH	All	4-8
Forest Health	HEALTH	All	4-13
Heritage Resources	HER	All	4-14
Karst And Cave Resources	KARST,CAVE	All	4-18
Lands	LAND	All	4-21
Minerals And Geology	MG	All	4-33
Recreation And Tourism	REC	All	4-35
Riparian	RIP	All	4-53
	RIP2	I,II(A-E,G,H)	
Rural Community Assistance	RUR	All	4-74
Scenery	VIS1,12	All	4-75
	VIS11	I,II(A-B,E)	
Soil And Water	S&W1111, 1112,2	All	4-83
	S&W112	I(A:1-4,6-7),II,III	
Subsistence	SUB	All	4-86
Threatened, Endangered, Sensitive	TE&S	All	4-88
Timber	TIM111,111-1,130,140	All	4-94
	TIM114	VIII	
Trails	TRAI	All	4-102
Transportation	TRAN111, 122, 212, 22, 23	All	4-104
	TRAN214	I(A,B,D-F);II-IV	
Wetlands	WET	All	4-111
Wildlife	WILD112	I-VIII; IX(A: 1 -8,11,B); X-XV	4-112
	WILD 22	I(A:1;B)	
	WILD 23	All	

Apply the following Land Use Designation Standards & Guidelines-.

FACILITIES

Facilities Improvements: FAC2

A. Design and locate administrative and non-recreation structures to reduce adverse effects on recreation and tourism opportunities.

FIRE

Fire Suppression: FIRE12

Suppression Action

A. Suppress wildfires using the suppression option identified in the Southeast Alaska/Prince William Sound Fire Management Plan. An Escaped Fire Situation Analysis (EFSA) of expected fire behavior, time of year, and locations with respect to private land and adjacent Land Use Designations, may lead to a lower strategy. If an EFSA discloses no adverse effects and it is more cost-efficient, the lower strategy will be used.
B. Emphasize suppression tactics which result in the least possible disturbance or evidence of human presence.
   1. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   2. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as it is safe, but within one year after the fire occurs.
   3. Mechanized fireline construction will avoid important wildlife habitat areas such as meadows, bogs, and riparian areas.

Fuel Improvements: FIRE2

Prescribed fire

A. Management ignitions, although they are not presently used in this Land Use Designation, may be used as an acceptable means of fuels management and wildlife habitat improvement so long as its use is compatible with Land Use Designation objectives.
B. As a general management practice, do not use prescribed natural fire. Should it become necessary to consider the use of prescribed natural fire, the Forest Plan must be amended to analyze, justify, and approve prescribed natural fire programs. (Consult FSM 5142.)

FOREST HEALTH

Forest Health Management: HEALTHI

A. Insect and disease management measures consistent with Land Use Designation objectives may be implemented to protect recreation and tourism opportunities, and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HER

Enhancement

A. Heritage Resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Provide interpretive information concerning Heritage Resources located within this Land Use Designation to

users in the form of exhibits and publications located outside of this Land Use Designation.
2. Heritage Resources are available for scientific studies that are consistent with the semi-primitive settings and activities, and heritage resource management objectives for the specific site.

InventorylEvaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known Heritage Resources.
   2. Identify heritage properties to be nominated to the National Register of Historic Places.
   3. Identify heritage properties that require stabilization or other protective measures.
   4. Identify opportunities for interpretation of Heritage Resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: CAVE

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this Land Use Designation.

LANDS

Special Use Administration (Non-Recreation): LAND122

A. Permit only facilities and uses consistent with Semi-remote Recreation Land Use Designation objectives.
B. This Land Use Designation represents a Transportation and Utility System (TUS) "Window" and provides opportunities for the future designation and location of Transportation and Utility sites.

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral entry

A. Forest lands within this Land Use Designation are open to mineral exploration and development.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and National Forest Service Mining Regulations 36 CFR 228. B.
C. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of operations.

Plan of operations

A. Encourage use of state-of-the-art techniques for developing minerals to reduce impacts to the extent feasible.
B. Apply appropriate Transportation Forest-wide Standards & Guidelines to the location and construction of mining roads and facilities.
C. Manage mineral exploration and development activities to be compatible with the emphasis of this Land Use Designation. Apply the following management practices to reduce resource impacts.
   1. Manage mineral activities to maintain the present and continued productivity of anadromous fish and other foodfish

habitat to the maximum extent feasible. (Consult ANILCA, Sec. 505 (a).)

2. When locating drill rigs and pumps, roads, rock quarries, structures, and marine transfer facilities, take maximum advantage of topographic and vegetative screening.
3. Ensure that vegetation removed from the project area is hauled away, buried, burned, or scattered when such vegetation is located adjacent to Visual Priority Travel Routes and Use Areas.
4. Minimize the scale of spoil/disposal areas in relation to the surrounding landscape as seen from Visual Friority Travel Routes and Use Areas.
5. Approve use of colors that simulate those found in the characteristic landscape. Avoid the use of reflective materials in project facilities.
6. Approve reclamation plans in which minerals activities leave a natural-appearing condition.
7. Ensure that landform modifications simulate naturally-occurring forms.
8. Ensure that disturbed areas are revegetated in accordance with project plans.

RECREATION AND TOURISM

Recreation Use Administration: REC122

Recreation Management and Operations

A. Generally, manage for Semi-primitive Recreation Opportunity Spectrum (ROS) settings. Enclaves of concentrated recreation and tourism developments within the Land Use Designation or management activities in adjacent Land Use Designations may cause the ROS setting to become Roaded Natural, Roaded Modified, or Rural.
B. Determine on a case-by-case basis whether roads, trails, and other areas should be closed to motorized recreation activities; incorporate determinations in Off-Highway Vehicle (OHV) Plans.
   1. Manage roads for Traffic Service Level D except when level C roads provide access to or through the Land Use Designation. Occasional enclaves of concentrated recreation and tourism developments could warrant higher service levels in those areas.
C. Where roads, trails, and other areas are closed to motorized recreation activities or vehicles, provide Semi-primitive Non-motorized recreation opportunities.
   1. Permit use of snowmachines, motorboats, and aircraft for traditional activities.
D. Permit small scale, rustic recreation and tourism facilities such as recreation cabins, shelters, docks, and enclaves of concentrated recreation and tourism development.
   1. During all construction activity:
      - Minimize site modification.
      - Minimize vegetation clearing adjacent to the site.
      - Use colors found in the natural environment.

Recreation Special Uses

A. Designation. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.

SCENERY

Scenery Operations: VIS1

A. Design resource activities to remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color or texture common to the landscape. New form, line, color, or texture will be subordinate to the characteristic landscape.
   1. Apply Forest-wide Standards & Guidelines for the Partial retention Visual Quality Objective.
   2. There may be cases where facilities associated with a concentrated recreation or tourism development may not feasibly meet the Partial retention objective. After analysis of the proposal and public involvement, the NEPA decision document for this project should determine the specific Visual Quality Objective for the development. The environmental analysis shall also prescribe design guidelines necessary to meet this visual objective. During the project's design phase, the Forest Service shall be closely involved in the review of design work as it evolves.
   3. Design visitor facilities to blend, to the extent feasible, with the natural setting.

B. Rehabilitation techniques may be used to restore disturbed landscapes to be compatible with the semi-primitive setting.

TIMBER

Timber Resource Planning: TIM112

A. Forested land is classified as unsuitable for timber production.

B. The following types of uses may be authorized when they meet Land Use Designation objectives.
   1. Removal or use of trees for improvement of recreation and tourism opportunities, such as clearing for vistas, campsites, or trails.
   2. Removal, or use of trees cut as a part of some other authorized use within this Land Use Designation. For example, clearing for a fish ladder or road.
   3. Trees may be cut for use in construction and maintenance of authorized structures when it is not feasible to obtain the necessary material from outside this Land Use Designation.

C. Personal use wood harvest from beach log salvage is fully compatible with this,Land Use Designation. Personal use wood cutting is allowed based on local determination.

Timber Sale Preparation: TIM114

A. Salvage will be limited to dead and/or down material resulting from events such as windthrow and insect or disease mortality. Limited standing green timber may be harvested during salvage operations for safety and operational considerations.

TRANSPORTATION

Transportation Operations: TRAN1

A. Where Semi-primitive Motorized recreation opportunities are emphasized, existing low standard roads are generally managed for use by high clearance or Off-Highway Vehicles, snowmobiles or motorcycles subject to an approved Off-Highway Vehicle Management Plan. Generally, new roads are not constructed in this area, except to link existing roads or provide access to adjacent Land Use Designations.
   1. Limit the design standards of Forest Development Roads to those commensurate with the intended use.
   2. Maintain as necessary to provide passage of planned traffic.

3. Locate and design new roads to consider semi-primitive recreation opportunities in this Land Use Designation.

B. Where Semi-primitive Non-motorized recreation opportunities are emphasized, provide foot or cross-country ski trails. Roads and trails may be closed or seasonally restricted. Close or obliterate existing roads except for transportation system links.

LAND USE DESIGNATION II

Land Use Designation L2

Introduction

Twelve areas were permanently allocated to L2 special management in the Tongass Timber Reform Act. These areas are: Yakutat Forelands, Berners Say, Anan Creek, Kadashan, Lisianski River/Upper Hoonah Sound, Mt. Calder/Mt., Holbrook, Nutkwa, Outside Islands, Trap Bay, Point Adolphus/Mud Say, Naha, and Salmon Say. Specific management criteria for Land Use Designation 11 areas are defined in the Tongass Land Management Plan, completed March 1979, and amended Winter 1985-1986 (pp. 8-9).

Goals

To manage the 12 areas designated in perpetuity as Land Use Designation 11 (LUD 11) by the Tongass Timber Reform Act according to the direction for LUD 11 areas in the 1979 Tongass Land Management Plan, as amended.

To manage these areas in a roadiess state to retain their wildland character.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated by the Primitive and Semi-primitive Recreation Opportunity Spectrum classes. Apply the LUD 11 direction from the 1979 Tongass Land Management Plan which is summarized as follows:

- prohibit commercial timber harvest. Permit salvage logging only to prevent significant damage to other resources. Allow personal use of wood for cabin logs, fuelwood, float logs, trolling poles, etc.
- permit water and power developments if designed to be compatible with the primitive characteristics of the area
- permit roads only for access to authorized uses, for transportation needs identified by the state or for vital linkages (See the Standards & Guidelines in this prescription)
- allow mineral development
- permit boats, aircraft, and snowmachines, unless such uses become excessive
- permit fish and wildlife habitat improvements. Design structures to minimize the effects to recreation resources
- permit primitive recreational facilities
- major concentrated recreational facilities will generally be excluded

Salvage logging, personal use of wood, water and power development, fish and wildlife habitat improvement, and research facilities will be designed to be compatible with the primitive characteristics of the area.

Desired Condition

Areas in this Land Use Designation are characterized by extensive, generally unmodified natural environments, and retain their wildiand character. Ecological processes and natural

conditions are only minimally affected by past or current human uses or activities. Users have the opportunity to experience a high-to-moderate degree of independence, closeness to nature, solitude and remoteness and may pursue activities requiring self-reliance, challenge, and risk. Interactions between users are infrequent. Recreational facilities and structures are primitive.

Land Use Designation II
Apply the following Forest-wide Standards & Guidelines located in Chapter 4:

Resource	Section	Sub-Sections	Page
Air	AIR	All	4-3
Beach And Estuary Fringe	BEACH1	All	4-4
	BEACH2	I,II(A-G,K,L)	
Facilities	FAC	All	4-6
Fire	FIRE	All	4-7
Fish	FISH	All	4-8
Forest Health	HEALTH	All	4-13
Heritage Resources	HER	All	4-14
Karst And Cave Resources	KARST,CAVE	All	4-18
Lands	LAND	All	4-21
Minerals And Geology	MG	All	4-33
Recreation And Tourism	REC	All	4-35
Riparian	RIP1	All	4-53
	RIP2	I,II(A-E,G,H)	
Rural Community Assistance	RUR	All	4-74
Scenery	VIS1,12	All	4-75
	VIS11	I,II(A-B,E)	
Soil And Water	S&W1111, 1112,2	All	4-83
	S&W112	I(A:1-4,6-7),II,III	
Subsistence	SUB	All	4-86
Threatened, Endangered, Sensitive	TE&S	All	4-88
Timber	TIM111,111-1,130,140	All	4-94
	TIM114	VIII	
Trails	TRAI	All	4-102
Transportation	TRAN111, 122, 212, 22, 23	All	4-104
	TRAN214	I(A,B,D-F);II-V	
Wetlands	WET	All	4-111
Wildlife	WILD112	I-VIII; IX(A: 1 -8,11,B); X-XVIII	4-112
	WILD 22	I(A:1;B)	
	WILD 23	All	

Apply the following Land Use Designation Standards & Guidelines:

FACILITIES **Administrative Facilities: FAC2**

A. Permanent administrative facilities may be constructed in a manner which blends with the natural character of the area.

FIRE **Fire Suppression: FIRE12**

Suppression Action

A. Suppress wildfires using the suppression option identified in the Southeast Alaska/Prince William Sound Fire Management Plan.

An Escaped Fire Situation Analysis (EFSA) of expected fire behavior, time of year, and locations with respect to private land and adjacent land use areas, may lead to a lower strategy. If an EFSA discloses no adverse effects and it is more cost-efficient, the lower strategy will be used.

B. Emphasize suppression tactics which result in the least possible disturbance or evidence of human presence.
   1. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   2. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as it is safe, and no longer than one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed fire

A. Allow management-ignited prescribed fire for fuels management, insect and disease protection, and wildlife habitat improvement.
B. As a general management practice, do not use prescribed natural fire, although natural ignitions may be used to perpetuate natural ecological processes. Should it become necessary to consider the use of prescribed natural fire, the Forest Plan must be amended to analyze, justify, and approve prescribed natural fire programs. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH112

Fish Enhancement

A. Improvements such as fishways, fish hatcheries, or aquaculture sites may be built. Appropriate landscape management techniques will be applied in the design and construction of such improvements to reduce impacts on recreational resources and scenery.

FOREST HEALTH

Forest Health Management: HEALTHI

A. Insect and disease management measures consistent with this Land Use Designation may be implemented to protect these and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE Heritage Resource Activities: HER

Enhancement

A. Heritage Resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Heritage Resources are available for scientific studies that are consistent with the primitive settings and activities, and heritage resource management objectives for the specific site.

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known Heritage Resources.

2. Identify heritage properties to be nominated to the National Register of Historic Places.
3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of Heritage Resources for public education and enjoyment.

KARST AND CAVES Cave Management Program: CAVE

A. Identify opportunities for interpretation of eaves for public education and enjoyment. Interpretation may occur inside or outside of this Land Use Designation.

LANDS Special Use Administration (Non-Recreation): LAND122

A. Water and power developments are permitted if they can be designed to retain the overall primitive characteristics of the allocated area.
B. Except as authorized by the Tongass Timber Reform Act (TTRA), permit only those activities which are consistent with the wildiand character of the area.
C. This Land Use Designation represents a Transportation and Utility System (TUS) "Avoidance Area." Transportation and utility sites or corridors may be located within this Land Use Designation only after an analysis of potential TUS corridors has been completed and no feasible alternatives exist outside this Land Use Designation.

MINERAL AND GEOLOGY Minerals and Geology Administration: MG12

Forest Lands Open to Mineral entry

A. Forest lands within this Land Use Designation are open to mineral exploration and development.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and National Forest Service Mining Regulations 36 CFR 228.
C. Permit reasonable access to mining exploration and development in accordance with the provisions of an approved Plan of operations.

Plan of operations

A. Encourage use of state-of-the-art techniques for developing minerals to reduce impacts to the extent feasible. Include mitigation measures that are compatible with the scale of proposed development and commensurate with potential resource impacts.
B. Apply appropriate Transportation Forest-wide Standards & Guidelines to the location and construction of mining roads.
C. Manage mineral exploration and development activities to be compatible with the emphasis on maintaining the wildiand character of the LUD 11 Land Use Designation. Apply the following management practices to reduce resource impacts.
    1. Manage mineral activities to maintain the present and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible. (Consult ANILCA, Section 505 (a).)
    2. Manage mineral activities to maintain the present and continued productivity of wildlife habitat to the extent feasible.

3. Take maximum advantage of topographic and vegetative screening when locating drill rigs and pumps, roads, rock quarries, structures, and marine transfer facilities.
4. Discourage use of motorized surface vehicles, except as provided for in ANILCA, Section 1 1 10(b), which assures adequate and feasible access for economic and other purposes.
5. Locate material sites and marine transfer facilities outside this Land Use Designation, if reasonable alternatives exist.
6. Ensure that vegetation removed from the project area is hauled away, buried, burned or scattered when located adjacent to Visual Priority Travel Routes and Use Areas.
7. Minimize the scale of spoil/disposal areas in relation to the surrounding landscape as seen from sensitive viewpoints.
8. Approve use of colors that simulate those found in the characteristic landscape. Avoid use of reflective materials in project facilities.
9. Approve reclamation plans in which minerals activities leave a natural-appearing condition.
10. Ensure that landform modifications simulate naturally-occurring forms.
11. Ensure that disturbed areas are revegetated in accordance with project plans.

RECREATION AND TOURISM

Recreation Use Administration: REC122

Recreation Management and Operations

A. Generally provide for semi-primitive ROS settings, recognizing that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent Land Use Designations.
   1. Primitive recreation facilities, such as recreation cabins, boat docks, moorings and trails may be constructed and maintained.
B. Major concentrated recreation facilities, such as development scale IV and V (those heavily-modified or with a high degree of site modification) will generally be excluded.
C. If a transportation link is constructed through this Land Use Designation, recreation facilities needed to serve the traveling public, to reduce impacts of recreation use to adjacent wildlands, or to provide interpretation, may be constructed in proximity to the transportation link.

Recreation Special Uses

A. Major developments are generally not consistent with the objectives of the Land Use Designation. Development proposals require scrutiny of the magnitude and scope for Land Use Designation conformance. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.
B. Minor developments may be compatible with the Land Use Designation objectives depending on the scope, purpose, and magnitude of the proposal. Each proposal will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards & Guidelines.

SCENERY

Scenery Operations: VIS1

A. Landscapes are managed to retain a natural-appearing visual condition, where activities are not visually evident to the casual observer.
   1. Apply Forest-wide Standards & Guidelines for the Retention Visual Quality Objective.
   2. Some authorized activities and improvements may not meet the Retention Visual Quality Objective, based on project analysis. However, seek to mitigate visual impacts through location, siting, design, material, and coloring of structures.

TIMBER

Timber Resource Planning:- TIM112

A. Forested land is classified as unsuitable for timber production. Commercial timber harvesting is not permitted.
B. Timber can be salvaged only to prevent significant damage to other resources. Examples are removal of windfall in an important fish stream or control of epidemic insect infestations.
C. Personal use of wood is allowed for cabin logs, fuel wood, float logs, trolling poles, and other similar uses.

TRANSPORTATION

Transportation Operations: TRAN1

A. Existing roads are generally closed to highway vehicular use. Any proposed roads will use the following guidelines.
   1. Allow vital Forest transportation system linkages including roads and transfer facilities. Vital Forest transportation system linkages refer to necessary additions to the permanent road network. Such linkages may be built through LUD 11 areas when either: 1) no other feasible routes exist to access adjacent Land Use Designations, or 2) when it can be demonstrated that the routing through the LUD 11 area is clearly environmentally preferable and site-specific mitigation measures can be designed to minimize the impact of the road on the surrounding LUD 11 area. A clear need to build such linkages must be demonstrated through a comparative analysis of feasible transportation alternatives through the NERA process and must be approved by the Forest Supervisor, in consultation with the other Tongass Forest Supervisors.
   2. Roads, other than vital transportation linkages, will not be built except to serve authorized activities such as mining, power and water developments, aquaculture developments, or transportation needs determined by the State of Alaska (also the Transportation and Utility Systems Land Use Designation).

WILDLIFE

Wildlife Habitat Planning: WILD112

A. Wildlife habitats will generally evolve in natural successional stages. Habitat improvement is permitted.

GLOSSARY[1]

Active management – Management approach in which humans actively manipulate ecosystems through timber harvesting and thinning to improve forest health and to reduce fire hazard.

Allowable sale quantity (ASQ) – The quantity of timber that may be sold from an area covered by a land management plan during a period specified by the plan, usually expressed as the average annual allowable sale quantity.

Ambient population density – The population distribution based on the likely location of people over a 24-hour period for typical days, weeks, and seasons. Rather than describing population as a static reference point, ambient population attempts to capture the location of people as they move in and out of areas. For example, during the day, it is expected that more people would be away from their homes at other locations; in the evening, the opposite would be expected. Ambient population density provides models for such changes.

Arterial roads – Classified roads that provide service to large land areas; arterial roads are usually developed and operated for long-term land and resource management purposes and constant service.

Backcountry – A generic term that refers to areas that are relatively unmodified and usually accessible only by foot, horse, watercraft, or Off Highway Vehicle (OHV).

Basal area – The cross-sectional area of all stems of a species or all stems in a stand measured at breast height (4.5 ft. or 1.37 m. above the ground) and expressed per unit area of land (e.g., 25 sq. ft. per acre).

Best management practices (BMPs) – A practice or usually a combination of practices that are determined by a State or a designated planning agency to be the most effective and practicable means (including technological, economic, and institutional considerations) of controlling point and nonpoint source pollutants at levels compatible with environmental quality goals.

Biological diversity (biodiversity) – The variety and abundance of species, their genetic composition, their communities, and the ecosystems and landscapes of which they are a part. As used in this document, biodiversity refers to native biological diversity; therefore, increases in species diversity resulting from the introduction of nonnative species would not constitute an increase in biodiversity.

Biological stronghold – An area that supports all major life-history forms of a species that were historically found within that area, with stable or increasing population numbers at levels not substantially diminished from their historical size or density.

Cable logging – The transport of logs from the stump to a landing and stationary yarder using winch-driven cables to which the logs are attached.

Carrying capacity – A measure used to signify the optimum use that the area can accommodate without having unacceptable degradation of resources or undesirable social interaction, in accordance with specified standards usually found in the land and resource management plan.

Class I air quality areas – National Forest System Wilderness areas, national parks, or national wildlife refuges greater than 5,000 acres in size, designated prior to the establishment of the Clean Air Act Amendments of 1977. Class I areas can also include lands designated by Tribes or States. These areas serve as benchmarks for monitoring changes in air quality over adjacent lands.

[1] Source documents for these definitions include – proposed Road Policy, proposed Planning Regulations, Interim Roads Rule Environmental Assessment, and Recreation Opportunity Spectrum Planning Guide.

Classified roads – Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access, such as State roads, County roads, privately owned roads, National Forest System roads, and roads authorized by the Forest Service that are intended for long-term use.

Clearcutting – Cutting essentially all trees in a given area, which produces a fully exposed microclimate for the development of a new age class. Regeneration can be from natural seeding, direct seeding, planted seedlings, or advance reproduction. See even-aged management.

Cohesive strategy – A Forest Service strategic document, formally titled *Protecting People and Sustaining Resources in Fire-adapted Ecosystems: A Cohesive Strategy*, that outlines how fire managers throughout the National Forest System are to prioritize their fire hazard reduction efforts. This strategy concentrates on short fire return interval forests (Fire Regimes 1 and 2).

Collector roads – Classified roads serving smaller land areas than arterial roads; collector roads collect traffic from local roads and usually connect to forest arterial roads or State and County highways. They are operated for either constant or intermittent service depending on land use and resource management objectives.

Commercial timber harvest – The removal of merchantable trees, portions of trees, and timber products from the National Forest System lands.

Commodity-purpose timber sale (**commodity purpose timber harvest**) – A component of the Forest Service timber sale program that includes timber sales made primarily to supply timber in response to society's demand for wood.

Community – (a) A group of species of plants and/or animals living and interacting at a particular time and place. (b) A group of people residing in the same place and under the same government; spatially defined places such as towns.

Composition – The numbers and kinds of plants and animals in an area.

Condition Class 1–Low risk from uncharacteristic wildfire effects – Fire regimes within this class are within the historical range of variability for fire frequency and intensity.

Condition Class 2–Moderate risk from uncharacteristic wildfire effects – Fire regimes are beginning to be altered since one or more wildfires have been suppressed allowing for forests to become noticeably denser especially with younger sapling trees.

Condition Class 3–High risk from uncharacteristic wildfire effects – The fire regimes in this condition class are significantly altered, having missed many natural fires. Forests that were once open and park-like are now densely stocked.

Connectivity – The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of fragmentation.

Contiguous – Used in a geographic sense, the term applies to situations where areas of land physically touch and share substantial common boundaries or have a common border of considerable length. The term is not intended to include 'point-to-point' touching or 'cornering', or instances where only small portions of land areas touch. It is not intended to encompass or encourage creative mapping exercises that result in irregular shapes, such as narrow corridors and 'gerrymandered' roadless areas.

Coppice method – Regeneration method in which all trees in the previous stand are cut, and the majority of regeneration is from sprouts and root suckers.

Criteria air pollutants – A group of common air pollutants (such as carbon monoxide, particulate matter, or ozone) regulated by the Environmental Protection Agency (EPA) on the basis of criteria (information on health and/or environmental effects of pollution). Criteria air pollutants are widely distributed across the country.

Crown fire – A fire burning into and through the crowns of a forest or shrubland.

Decommissioning – Demolition, dismantling, removal, obliteration, or disposal of a deteriorated or otherwise unneeded asset or component, including necessary cleanup work. This action eliminates the deferred maintenance needs for the fixed asset. Portions of an asset or component may remain if they do not cause problems or require maintenance.

Developed recreation – Activities that are consistent with the settings and experiences identified with the Roaded Natural (RN), Rural (R), and Urban (U) classes of the Recreation Opportunity Spectrum. These activities are usually associated with an area that has been improved or developed for recreation, such as campgrounds and picnic areas, scenic overlooks and interpretive sites, or visitor centers and resorts.

Dispersed recreation – Activities usually associated with backcountry and trails and are consistent with the settings and experiences identified with Primitive (P), Semi-Primitive Non-Motorized (SPNM), and Semi-Primitive Motorized (SPM) classes of the Recreation Opportunity Spectrum. Examples of these activities include hiking, snowmobiling, mountain biking, wilderness use, backpacking, horseback riding, and OHV use.

Disturbance – A natural or human event that causes a change in the existing condition of an ecological system.

Domestic water sources – Watersheds containing National Forest System lands that provide surface waters to facilities that treat and distribute water for domestic purposes. These purposes include normal household uses such as drinking, food preparation, bathing, washing clothes and dishes, watering lawns and gardens, and similar uses.

Dynamic equilibrium – A natural state of stream stability when channel features persist over time within a range of conditions. Dynamic equilibrium uses a series of self-correcting mechanisms that allow the ecosystem to control external stresses or disturbances, thereby maintaining a self-sustaining condition. For example, a stream is able to consistently transport its sediment load, both in size and type, associated with local deposition and scour.

Ecological sustainability – The maintenance or restoration of the composition, structure, and processes of ecosystems over time and space. This includes the diversity of plant and animal communities, and the productive capacity of ecological systems and species diversity, ecosystem diversity, disturbance processes, soil productivity, water quality and quantity, and air quality.

Ecosystem – An arrangement of organisms defined by the interactions and processes that occur between them. Ecosystems are often defined by their composition, function, and structure.

Ecosystem health – The degree to which ecological factors and their interactions are reasonably complete and functioning for continued resilience, productivity, and renewal of the ecosystem.

Edge effect – The influence of two communities on populations in their adjoining boundary zone or ecotone, affecting the composition and density of the populations in these bordering areas.

Endangered species – A plant or animal species listed under the Endangered Species act that is in danger of extinction throughout all or a significant portion of its range.

Endemic species – Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality. Endemism is the occurrence of endemic species in an area.

Essentially roaded – Areas of National Forest System land where classified and temporary roads now exist.

Essentially unroaded – A combination National Forest System Wilderness and inventoried roadless areas.

Exception – A specific circumstance where prohibited activity would be allowed within an inventoried roadless area that is otherwise subject to the prohibitions in the alternatives.

Exemption – A geographic area that is not subject to the prohibitions in the alternatives.

Existing mineral lease – A mineral lease that has been issued by the Department of the Interior and has not expired, terminated, or been relinquished**.**

Even-aged (silvicultural) management – The methods used to regenerate and maintain a stand with a single age class.

Fine fuels – Small needles, sticks, branches of trees (generally less than 3 inches in diameter).

Fire-adapted ecosystem – An arrangement of populations that have made long-term genetic changes in response to the presence of fire in the environment.

Fire frequency – How often fires occur within a given time period in a specified area.

Fire hazard – The overall potential for wildfire in a vegetated ecosystem, often expressed as a condition of fuels on the ground and the probability of ignition. To reduce the fire hazard in an area, managers must deal primarily with the fine fuels on the surface of the forest floor and with the smaller diameter trees growing in the understory of a forest that provide a ladder to the larger, dominant overstory trees.

Fire intensity – The rate at which fuel is consumed and heat is generated.

Fire-intolerant – Vegetation with characteristics that make it more susceptible to damage from fire, such as thin bark, shallow root systems, or a low-branching habit.

Fire regime – The fire pattern across the landscape, characterized by occurrence, interval, and relative intensity. Fire regimes result from a unique combination of climate and vegetation and exist on a continuum from short-interval, low-intensity fires to long-interval, high-intensity fires.

Fire return interval – The average number of years between successive fires in a designated area.

Fire severity – Denotes the scale at which vegetation and a site are altered or disrupted by fire, from low to high. It is a combination of the degree of fire effects on vegetation and on soil properties.

Fire suppression – The practice of controlling forest and rangeland fires in a safe, economical, and expedient fashion while meeting the natural resource objectives outlined in each national forest's or grassland's land management plan.

Fire-tolerant – Vegetation with characteristics that increase its resistance to fire, such as thick bark and high-branching habits.

Forest health – The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that make up the forest, and the appearance of the forest at a point which influences the perception and interpretation of forest health.

Forest road or trail – Any road or trail wholly or partly within, or adjacent to, and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources.

Forward – To haul a log from stump to collection point by a forwarder.

Forwarder – A self-propelled machine, usually self-loading, that transports logs by carrying them completely off the ground.

Fragmentation (habitat) – The break-up of a large land area (such as a forest) into smaller patches isolated by areas converted to a different land type. The opposite of connectivity.

Fuel management – The practice of evaluating, planning, and executing the treatment of wildland fuel to control flammability and reduce the resistance to control.

Fuels – Living and dead parts of trees and shrubs, organic material and surface material that can readily burn in a wildfire.

Fuels treatment – The rearrangement or disposal of fuels to reduce fire hazard or to accomplish other resource management objectives.

Gateway communities – Communities that are economically and socially interdependent on the associated public lands. Proximity to these lands contributes to the quality of life and sense of place for residents and visitors.

Ground-based logging – The dragging or carrying of trees or logs for the stump to the landing using various types of self-propelled machines (e.g., tractors, skidders, forwarders).

Group selection – An uneven-aged cutting method in which small groups of trees, usually no more than two acres in size, are removed to meet a predetermined goal of size distribution and tree species in the remaining stand.

Historic range of variability – The fluctuations of composition, structure, and function within stable ecosystems over time.

IMPLAN (Impact Analysis for Planning) – The input-output model used by the USDA Forest Service to estimate economic effects by tracing the interrelationships between producers and consumers in an economy as measured by jobs and income

Inholding – A parcel of land in other ownership (State, private, other Federal agency) surrounded by National Forest System land.

Initial attack – This term applies to an aggressive suppression action consistent with firefighter and public safety and with protecting various resource values.

Inventoried roadless area – Undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or forest planning. These areas are identified in a set of inventoried roadless area maps, contained in *Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2,* dated November 2000, which are held at the National headquarters office of the Forest Service.

Land use allocation – Site-specific management direction applied to National Forest System lands.

Landscape – An area of interacting and interconnected patterns of habitats (ecosystems) that are repeated because of the geology, landform, soil, climate, biota, and human influences throughout the area. A landscape is composed of watersheds and smaller ecosystems.

Landscape characteristics – The distribution and representation of ecoregions and elevational classes; the size of relatively large and intact habitat areas, and their adjacency to protected habitats; the effects of lands with protected or conservation status on landscape fragmentation; and the relationship between landscape and disturbance patterns.

Local roads – Classified roads that connect terminal activities (e.g., trail head, log landing, camping site) to collector and arterial roads. They are constructed to meet the access requirements of a specific resource activity rather than for travel efficiency. When not in use for the activity for which they were constructed, local roads may be used for other purposes. They are often closed to restrict motor use. The construction standards for these roads are determined by the requirements necessary for the specific resource activity.

Major watershed (sub-basins) – Fourth-level Hydrologic Unit Codes (HUCs), as defined by the U. S. Geologic Survey. Formerly known as 'cataloging units'.

Manageable size – Geographic areas that the local official determines are of a shape and position within the landscape for reasonable achievement of the long-term conservation of roadless characteristics. For example, many long narrow strips or 'stringers' between two highly developed areas would usually not be considered manageable.

Management direction – A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management prescription – Management practices and intensity (frequency and duration) selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.

Map unit – The individual parcels defined in the geographic information system (GIS) database. For reporting purposes, forests often group several map units into a single named inventoried roadless area.

Mechanical pre-treatment – Preparing a forest or shrubland for prescribed burning by using machinery such as bulldozers and rubber tire skidders to create a fuel bed where a prescribed fire can be ignited without undue risk of the fire escaping or killing the dominant trees on the site.

Mechanical transport – Any device for moving people or material in or over land, water, or air, having moving parts, that provides a mechanical advantage to the user, and that is powered by a living or nonliving power source. This includes, but is not limited to, sailboats, hang gliders, parachutes, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It also does not include skis, snowshoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts.

Median – A value in an ordered set of quantities below and above which falls an equal number of quantities.

Mineral reserve – An estimate within specified accuracy limits of the valuable metal or mineral content of known deposits that may be produced under current economic conditions and with present technology.

Mineral resource – A concentration of naturally occurring solid, liquid, or gaseous material in or on the earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

Motorized equipment – Machines that use a motor, engine, or other nonliving power sources. This includes, but is not limited to, chain saws, aircraft, snowmobiles, generators, motorboats, and motor vehicles. It does not include small battery or gas powered hand carried devices such as shavers, wristwatches, flashlights, cameras, stoves, or other similar small equipment.

Mosaic – A pattern of vegetation in which two or more kinds of communities are interspersed in patches, such as clumps of shrubs with grassland between.

National Forest System road – A classified forest road under the jurisdiction of the Forest Service. The term 'National Forest System road' is synonymous with the term 'Forest development road', as used in 23 U.S.C. 205.

Natural amenities – Attributes that enhance a location as a place to live which are physical as opposed to social or economic.

Non-attainment areas – Geographic areas in which the level of a *criteria air pollutant* is higher than the level allowed by the federal standards. A single geographic area may have acceptable levels of one criterion air pollutant but unacceptable levels of one or more other criteria air pollutants; thus, an area can be both attainment and non-attainment at the same time.

Nonnative invasive species – Plant species that are introduced into an area in which they did not evolve, and in which they usually have few or no natural enemies to limit their reproduction and spread. These species can cause environmental harm by significantly changing ecosystem composition, structure, or processes, and can cause economic harm or harm to human health.

Noxious weeds – Plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. These species are generally aggressive, difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and are nonnative, new, or uncommon to the United States.

Old-growth forest – *Old single story forest* – single canopy layer consisting of large or old trees. Understory trees are often absent, or present in randomly spaced patches. It generally consists of widely spaced, shade-intolerant species, such as ponderosa pine and western larch, and high frequency fire regimes. *Old multi-story forest* - a forest stand with moderate to high canopy closure—a multi-leveled and multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous large snags; and heavy accumulations of wood, including large logs on the ground.

Partial cutting – Removal of part of a stand of trees for purposes other than regenerating a new age class. Partial cutting is not a regeneration method.

Passive (natural) management – Management approach in which human intervention in an ecosystem is minimal, with natural processes such as fire and insect and disease infestations allowed to play out their 'natural' role. For fire management, this would mean allowing some lightning fires to burn or allowing only prescribed fires with burning prescriptions that mimicked the natural fire regime in size, intensity, and frequency.

Pre-commercial thinning – The removal of trees not for immediate financial return but to reduce stocking,to concentrate growth on the more desirable trees, or to accomplish some other resource objective such as fuel reduction.

Prescribed burning – The fire management technique of purposely igniting a fire in a vegetated ecosystem to restore forest health and to reduce fire hazard.

Prescription – A written statement defining goals and objectives and the actions or treatments needed to attain the goals and objectives. Prescriptions are written for discrete portions of National Forest System lands. A prescription can be resource specific (such as for prescribed fire or silviculture) or, in the case of management prescriptions, broad to attain multiple use goals and objectives.

Primitive (P) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area that is essentially an unmodified natural environment of large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.

Proposed Species – Any species that is proposed by the Fish and Wildlife Service or the National Marine Fisheries Service to be listed as threatened or endangered under the Endangered Species Act.

Public road – Any road or street under the jurisdiction of and maintained by a public authority and open to public travel.

RARE II roadless area (**Roadless Area Review and Evaluation**) – Roadless areas on National Forest System lands that were inventoried by the Forest Service in 1979.

Refugia – Areas that have not been exposed to great environmental changes and disturbances undergone by the region as a whole. In this FEIS, refugia include inventoried roadless areas that are relatively free from human-caused disruptions and disturbances when compared to roaded areas; refugia provide conditions suitable for survival of species that may be declining elsewhere.

Regeneration method – A cutting procedure that results in a new age class of trees. Methods include clearcutting, seed tree, shelterwood, selection, and coppice.

Replacement value – For subsistence, the amount of money that would have to be spent to buy food substitutes.

Resistance to control – The difficulty of suppressing a wildland fire primarily determined by the fire's rate of spread (how fast it moves) and its intensity (how hot it will get).

Responsible line officer – A Forest Service employee with authority to select or carry out a specific planning action.

Responsible official – The Forest Service line officer with the authority and responsibility to make decisions regarding the protection and management of inventoried roadless areas and other unroaded areas pursuant to [Subpart B-Protection of Roadless Areas].

Risk from uncharacteristic wildfire effects – The risk that once a fire starts and gets large it will damage the ecosystem or human communities.

Road – A motor vehicle travelway over 50 inches wide, except those designated and managed as a trail. A road may be classified, unclassified, or temporary.

Road analysis – An integrated ecological, social, and economic science-based approach to transportation planning that addresses existing and future road management options.

Road-based recreation – Activities that are normally associated with classified roads and are consistent with the settings and experiences identified with Semi-Primitive Motorized (SPM), Roaded Natural (RN), Rural (R), and Urban (U) classes of the Recreation Opportunity Spectrum. Examples of these activities include car camping and picnicking, gathering berries and firewood, driving for pleasure, wildlife viewing, and OHV use.

Road construction – Activities that result in the addition of road miles to the forest transportation system.

Road maintenance – The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective.

Road obliteration – A form of road decommissioning that re-contours and restores natural slopes.

Road reconstruction – Activities that result in road realignment or road improvement, as defined below:

- **Road improvement** – Activities that result in an increase of an existing road's traffic service level, expand its capacity, or change its original design function.

- **Road realignment** – Activities that result in a new location for an existing road or portions of an existing road, including treatment of the old roadway.

Roaded Natural (RN) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area that has predominantly natural-appearing environments with moderate evidences of the sights and sounds of humans. Such evidences are usually in harmony with the natural environment. Interaction between users may be low to moderate, but evidence of other users is prevalent. Resource modification and practices are evident but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and facilities design.

Roadless areas – For the purposes of this EIS, a generic term that includes inventoried roadless area and unroaded areas.

Roadless characteristics – Roadless area characteristics include the following:

- Soil, water, and air
- Sources of public drinking water
- Diversity of plant and animal communities
- Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land
- Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of recreation opportunites
- Reference landscapes
- Landscape character and scenic integrity
- Traditional cultural properties and sacred sites
- Other locally identified unique characteristics

Rural (R) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area with a substantially modified natural environment. Sights and sounds of humans are readily evident, and the interaction between users is moderate to high. A considerable number of facilities are designed for use by large numbers of people. Facilities for intensified motorized use and parking are available.

Salvage – An intermediate cutting made to remove trees that are dead or in imminent danger of being killed by injurious agents.

Sanitation – An intermediate cutting made to remove dead, damaged or susceptible trees to prevent the spread of pests or pathogens.

Scenarios – Predictions of future events and outcomes based on techniques of decision science. Scenarios are often expressed as 'risk profiles'—charts or tables that display the probability of an outcome occurring and its consequences.

Scheduled timber harvest – The quantity of timber planned for sale during a specified time period from the area of suitable land covered by a land management plan. Scheduled timber harvest accomplishes the allowable sale quantity.

Sediment (sedimentation) – Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice, or air; may be moved and deposited away from their original position and eventually will settle to the bottom.

Seed tree cutting – The cutting of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class in a fully exposed microenvironment. Seed trees may or may not be removed after regeneration becomes established.

Selective cutting – A cutting method that removes only a portion of trees in a stand.

Semi-Primitive Motorized (SPM) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area that has a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Semi-Primitive Non-Motorized (SPNM) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area that has a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but they are subtle. Motorized use is not permitted.

Sense of place – The aesthetic, nostalgic, or spiritual effects of physical locations on humans based on personal, use-oriented or attachment-oriented relationships between individuals and those locations. The meaning, values, and feelings that people associate with physical locations because of their experiences there.

Sensitive species – Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or by significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Service contract – A contract normally used by the government to carry out land management activities such as tree planting, site stabilization, thinning of forest stands where the trees to be cut have no commercial value, and similar activities.

Shelterwood cutting – The removal of most trees, leaving those needed for sufficient shade to produce a new age class in a moderated microenvironment. Removal of the shelter trees may or may not occur after regeneration becomes established.

Single-tree selection – Individual trees of all size classes are removed, as uniformly as possible, throughout the stand to promote the growth of remaining trees and to provide space for regeneration.

Skid road (skid trail) – An access cut through the woods for skidding.

Skidder – A self-propelled machine (cable, clam-bunk, or grapple) used for dragging trees or logs.

Species richness – A measure of biological diversity referring to the number of species in an area.

Stand – A distinguishable, contiguous group of similar plants or trees that are uniform in age-class distribution, composition, and structure, and are growing on a site of uniform quality.

Stewardship – Administration of land and associated resources in a manner that enables them to be passed on to future generations in a healthy condition.

Stewardship-purpose timber sales or harvest – A component of the Forest Service timber sale program that includes timber sales made primarily to help achieve desired ecological conditions or to attain some non-timber resource objective requiring manipulation of the existing vegetation.

Structure – The sizes, shapes, and/or ages of the plants and animals in an area.

Subsistence – The customary and traditional uses of wild renewable resources for personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for making and selling handicraft articles out of the nonedible byproducts of fish and wildlife resources; for barter or sharing for personal or family consumption; and for customary trade.

Succession – A predictable process of changes in structure and composition of plant and animal communities over time. Conditions of the prior plant communities or successional stage create conditions that are favorable for the establishment of the next stage. The different stages of succession are often referred to as seral stages.

Temporary roads – Roads authorized by contract, permit, lease, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management.

Thinning – (a) The cutting down and/or removing of trees from a forest to lessen the chance of a ground fire becoming a crown fire; a method of preparing an area so that a prescribed fire can be more easily controlled. Thinning influences the available amount of fuel and fuel arrangement, and it can indirectly affect fuel moisture content and surface wind speeds. (b) A culture treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.

Threatened species – Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and which the appropriate Secretary has designated as a threatened species.

Timberland (commercial forest land) – Land suitable for producing timber crops and not withdrawn from timber production by statute or administrative regulation. The typical minimum level of productivity is 20 cubic feet per acre per year.

Timber harvest – The volume of trees with commercial value that are cut and removed from the forest. Most of this volume was sold in prior fiscal years, as the contract life of most timber sales is 2 to 3 years. Volume harvest in a given year can be more or less than volume offered or volume sold, depending on market conditions (which can cause purchasers to adjust their harvest schedule), volume of timber sold in the previous few years, and other unforeseen situations such as severe fire seasons that limit operating time because of fire danger.

Timber offered – The volume of timber advertised for sale. The volume offered depends on forest estimates of capability (with allowable sale quantity as a ceiling), budget constraints, and success in completing stages of the timber sale preparation process.

Timber sale – A contractual process of selling timber to a purchaser and implementing a series of harvesting requirements for how, when, and what type of trees will be removed.

Timber sold – The timber volume sold and under contract with a purchaser. Volume sold in a given year is usually less than volume offered because some sales offered receive no bids and are not sold.

Total Maximum Daily Load (TMDL) – A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Trail – A pathway for travel by foot, stock, or trail vehicles.

Uncharacteristic wildfire (wildland fire) effects – An increase in wildfire size, severity, and resistance to control, and the associated impacts to people and property.

Unclassified roads – Roads on National Forest System lands that are not needed for, and not managed as part of, the forest transportation system, such as unplanned roads, abondoned travelways, off-road vehicle tracks which have not been designated and managed as a trail, and those roads no longer under permit or authorization.

Uneven-aged (silvicultural) management – Methods used to regenerate and maintain a multi-aged structure by removing some trees in all size classes, either singly, in small groups, or in strips.

Unroaded area – Any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap with inventoried roadless areas.

Unscheduled timber harvest – Any harvest of timber that was not included in the calculation of the allowable sale quantity.

Urban (U) – A definition used in the Recreation Opportunity Spectrum (ROS) to characterize a substantially urbanized environment, although the background may have natural appearing elements. Affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor vehicle use and parking are available. Regimentation and controls are obvious and numerous.

Urban area – As defined by the Census Bureau for the 1990 census, an area comprising all territory, population, and housing units in urbanized areas, or places of 2,500 or more persons outside of urbanized areas. An urbanized area comprises one or more places ('central place') and the adjacent densely settled surrounding territory ('urban fringe') that together have a minimum of 50,000 persons.

Viability – The ability of a population of a plant or animal species to persist for some specified time into the future. Viable populations are populations that are regarded as having the estimated numbers and distribution of reproductive individuals to ensure that its continued existence is well distributed in a given area.

Volume sold – The amount of timber actually purchased, which is usually less than offered volume because some sales are judged as economically marginal by prospective purchasers, and they receive no bids.

Volume harvested – The actual volume removed from the forest in a given year, which may be higher or lower than volume sold depending on market conditions. Most harvest volume was actually sold 1 to 3 years earlier.

Wilderness – A designated area defined in the Wilderness Act of 1964 in the following way: A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which – (a) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (b) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (c) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (d) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Wildfire – An unwanted wildland fire.

Wildland – Land other than that dedicated for other uses such as agriculture, urban, mining, or parks.

Wildland fire – A lightning- or human-caused fire that is either being suppressed or, if lightning-caused, allowed to burn (see Wildland Fire Used for Resource Benefit). Often used synonymously with 'wildfire' or 'forest fire'.

Wildland fire use – The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas.

Wildland Fire Used for Resource Benefit (WFURB) – A lightning-caused wildland fire that is allowed to burn because it meets the resource objectives outlined in the Land Management Plan and the site-specific prescriptive elements outlined in a Fire Management Plan.

Wildland-urban interface – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Because of their location, these structures are extremely vulnerable to fire should an ignition occur in the surrounding area.

Yarder – A machine for cable logging consisting of a system of power-operated winches and a tower used to haul logs from a stump to a landing.

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INDEX

A

Abandoned and inactive mines 3-264
Access 3-39
African Americans 3-275, 3-359, 3-362, 3-365
  recreation 3-362
Agency cost..... 3-267, 3-365, 3-366
Air quality resources 1-11, 3-64
  class I areas 3-64
Alaska National Interest Lands Conservation Act of 1980 (ANILCA)..... 3-251, 3-252, 3-255
Allowable Sale Quantity (ASQ)..... 3-198
Alternative
  comparison of key characteristics and effects by prohibition alternative..... 2-23
  comparison of key characteristics and effects by Tongass National Forest alternative 2-23
Alternatives
  considered but eliminated 2-15
    durations for applying prohibitions....2-20–2-21
    exemptions..... 2-21
      activity..... 2-22
      geographic area 2-21
      Tongass 2-22
    geographical definitions of roadless areas .. 2-20
    land use designations 2-16
      designate all inventoried roadless areas as national monuments 2-17
      designate all inventoried roadless areas as primative, semi-primitive, limited roading, fire access only, or research natural areas 2-16
      make all inventoried roadless areas fully available for development 2-17
      recommend all inventoried roadless areas for wilderness or other special designations 2-17
    processes other than rulemaking..... 2-15
      enactment of legislation..... 2-16
      executive order 2-15
      forest planning process 2-16
    sets of prohibitions applicable to inventoried roadless areas
      mineral withdrawal..... 2-19
      prohibit more activities than road construction, reconstruction, and timber harvesting..... 2-19
      restore roaded portions of inventoried roadless areas 2-19
  considered in detail 2-3–2-4
  prohibition alternatives effects on
    abandoned and inactive mines 3-264
    agency cost 3-365–3-366, 3-365–3-366
    air quality resources..... 3-64
    aquatic animal habitat and species..... 3-162
    channel morphology 3-54–3-56
    civil rights and environmental justice ..3-359–3-365
    construction and decommissioning of roads ...3-21–3-39
    developed and road-based recreation activities 3-219–3-225
    dispersed recration activites 3-211–3-219
    ecoregion protection..... 3-128–3-134
    elevation distribution 3-143–3-145
    energy and non-energy minerals ... 3-311–3-327
    fire effects on watersheds..... 3-76–3-78
    fire suppression 3-99–3-118
    forest-dependent communities 3-329–3-354
    fragmentation and connectivity of habitat.....3-134–3-138
    geological and paleontological resources 3-265–3-267
    heritage resources..... 3-235–3-240
    insects and disease 3-120–3-125
    leasable mineral resources 3-257–3-262
    livestock grazing 3-290–3-293
    local involvement..... 3-354–3-355
    non-recreation special uses 3-252, 3-253, 3-255
    non-timber forest products 3-293–3-298
    special uses-developed and road based 3-219–3-225
    special uses-dispersed recreation .. 3-225–3-230
    research,monitoring and reference landscapes 3-193–3-195
    road construction
      social and economic impacts ... 3-327–3-329
    salable minerals..... 3-262–3-264
    scenic quality 3-230–3-234
    size consideration..... 3-138–3-143
    soil loss, sedimentation and site productivity..3-56–3-59
    terrestrial and aquatic plant species..... 3-175–3-181
    terrestrial animal habitat..... 3-146–3-162
    threatened, endangered, proposed, and sensitive species 3-181–3-193
    timber harvest 3-195–3-210
    water quality and drinking water source areas 3-49–3-54
    water quantity and timing 3-46–3-49
    wilderness 3-240–3-245
Ambient population densities 3-89
American Indian and Alaska Natives 3-356–3-374
Americans with Disabilities Act (ADA).....3-363
Animal habitat and species
  aquatic 3-162–3-175
  terrestrial 3-146–3-162
Antiquities Act 2-17
Archaeological Resources Protection Act of 1979 3-235
Asian Americans 3-294, 3-362, 3-365
Atmospheric emissions
  from road construction and use 3-64

B

Biological diversity (biodiversity)1-3, 1-4, 3-13, 3-43–3-44, 3-125–3-138, 3-158, 3-191–3-192, 3-398
relationship to size of protected area 3-138
United States as a global center for freshwater.....3-163
Boundary management and landownership adjustments.....3-250
Budget constraints 1-15
Bureau of Economic Analysis 3-338
Burned Area Emergency Rehabilitation .. 3-118–3-120

C

CAET.....*See* Content Analysis Enterprise Team
Capital Improvement 3-22, 3-23, 3-33, 3-37, 3-397
Cartographic adjustments 2-23
Ceded lands 2-18
Channel morphology .. 3-44, 3-54–3-56, 3-73, 3-74, 3-165, 3-169, 3-170, 3-184
Civil rights and environmental justice 3-267, 3-359–3-365
Clark-McNary Act of 1924.....3-21
Clean Air Act..... 3-64, 3-65
Clean Water Act (CWA) 2-4, 2-13
Clean Water Action Plan 3-26, 3-372, 3-402
Clearcutting 3-135, 3-136, 3-137
decrease in.....3-200
Compelling need.....1-20, 3-395, 3-401
Condition classes 3-82–3-92
class 1 .....3-83, 3-85-3-88
class 2 .....3-83, 3-86–3-89
class 3 3-85–3-88-
Connectivity 1-11
defined.....3-134
Content Analysis Enterprise Team (CAET)1-7, 1-8, 2-1, 2-21
Council on Environmental Quality (CEQ)3-354, 3-395
Cumulative effects.....*See* Indirect and cumulative
other ongoing rulemaking and policy.....3-394

D

Decommissioning 1-19, 2-18, 2-19
Demographic trends.....3-7
Design function.....2-6, 2-7, 2-8, 3-31
Dispersed activities..... 3-226, 3-246

E

Ecological
factors.....3-42
integrity 3-242, 3-287, 3-292
sustainability.....3-208, 3-269, 3-371
values 3-17, 3-241, 3-268
Economic transition..... 2-9, 2-14
Ecoregions 3-125–3-134, 3-192, 3-394
United States 3-130
Ecosystem assessments 1-19
Ecosystem health 1-20, 3-86, 3-88
potential risk from fire 3-83, 3-86, 3-88
Elected official 1-12, 1-21
Elevation distribution.....3-143–3-145
Endangered Species Act (ESA).. 2-8, 3-5, 3-29, 3-163, 3-308, 3-405
Endemic 3-120, 3-128, 3-144, 3-175
insect and disease rate..... 3-120
plant species.....3-128, 3-175
species and risk of extinction..... 3-175
Energy and non-energy minerals..3-267, 3-311–3-327, 3-316
Environmental Protection Agency 3-45, 3-46, 3-50, 3-53, 3-69, 3-269, 3-398
Erosion
of historic or cultural sites..... 3-236
surface.....3-46, 3-56, 3-77
Essentially roaded 3-100
Essentially roadless 3-101
Evapotranspiration 3-48, 3-55
Exceptions..... 1-9
Executive Order 11593 3-235
Executive Order 12580 3-264
Executive Order 12898 3-359
Executive Order 13007 3-235
Executive Order 13112 .....3-179, 3-180
Exemptions 1-9
Experimental Forest 3-151, 3-194

F

Federal Aid Highway project . 2-9, 2-14, 2-22, 3-70, 3-190
FEIS organization 1-21
Financial assistance.....2-9, 2-14
Fire.....3-78–3-120
effects on heritage resources..... 3-238
historical regime 3-43, 3-194
line construction..... 2-7
return interval 3-81
suppression 3-99–3-118
Fish and Wildlife Coordination Act..... 3-409
Forest fuels.....3-124, 3-159, 3-200
Forest health.....3-74–3-125
Forest System lands
location 3-2
Forest-dependent communities 3-267, 3-329–3-354
economic diversity.....3-330–3-332
economic effects 3-338
population and community resiliency 3-330–3-332, 3-340
potentially affected communities.....3-333, 3-335
timber dependency..... 3-329
Fragmentation . 1-11, 1-14–1-16, 2-16, 2-19, 3-134–3-138
edge effects 3-134
impact from management activities 3-136
Fuel
fine fuel..... 3-78
Fuel management ..1-12, 3-78–3-99, 3-85, 3-90–98, 3-113, 3-117, 3-147, 3-189, 3-366

primary objectives 3-78
Fuel treatment 2-7, 2-8
mechanical 2-7

G

General Mining Law of 1872 ..... 3-256, 3-317
Geological and paleontological resources 3-255, 3-265
Global climate change 3-65–3-69
Government Performance and Results Act . 1-20, 3-37, 3-403
Grazing 3-290–3-293, 3-357, 3-358, 3-367
Grizzly Bear Recovery Areas 3-43, 3-139, 3-141, 3-142, 3-143
need for roadless areas 3-140–3-141

H

Heritage resources 3-235–3-240
definition 3-235
Hispanics 3-295, 3-359, 3-360–3-362, 3-365
land grants 3-361
livestock grazing on NFS lands 3-360
recreation 3-360
subsistence harvest 3-361
Human uses .. 3-70, 3-152, 3-161, 3-189, 3-243–3-244, 3-383, 3-392
Hunting and fishing 3-283–3-290
commercial 3-286–3-287
in Alaska 3-376–3-377
recreational 3-284
subsistence 3-285, 3-377

I

Impact Analysis for Planning (IMPLAN) 3-300, 3-313, 3-314, 3-332
Indirect and cumulative effects on
biodiversity 3-191
fire suppression 3-116
fuel management 3-113
heritage resources 3-239
insects and disease 3-124
minerals and geology 3-266
National Forest System roads 3-34
non-recreation special uses 3-254
recreation 3-223
recreation special-uses 3-230
scenic quality 3-233
social and economic factors 3-369
special designated areas 3-250
timber harvest 3-207
Tongass National Forest 3-391
water, soil, and air resources 3-71
wilderness 3-243
Inland Fish Strategy 3-163
Insects and disease 3-120–3-125
Interim Roads Rule 1-5–1-6, 1-11, 2-20–2-21, 3-28, 3-337, 3-400
Interior Columbia Basin Ecosystem Management Project 3-116, 3-124, 3-209, 3-372, 3-405
Interior Columbia River Basin
community resiliency 3-330
Invasive exotic (non-native) species ... 3-162, 3-176, 3-175–3-181
as a result of timber harvest and road construction 1-4
unpalatable to livestock 3-292
Inventoried roadless areas
definition 2-1
Eastern United States 1-3
Western United States 1-2
Irreversible and Irretrievable 3-409

L

Landscape character 3-7, 3-126, 3-191, 3-219, 3-227, 3-231, 3-232, 3-233
Landscape character goals 3-231
definition 3-231
Landslides 3-59–3-64
Leasable minerals 3-34, 3-257–3-262, 3-262, 3-266, 3-319, 3-324, 3-352, 3-368
definition 3-257
Legal authorities 1-9
Litigation 1-5, 1-15, 3-204–3-208, 3-366
Livestock grazing 1-10, 3-267, 3-291, 3-361, 3-365–3-369, 3-371
Local involvement .. 1-9, 1-12, 3-267, 3-354–3-355, 3-372
Local road 1-20, 3-327
Locatable minerals 3-256–3-257, 3-317, 3-319, 3-324
definition 3-256
Loggers/Mill workers 3-299, 3-309, 3-310

M

Management
Active 3-19–3-20
Passive 3-19–3-20
Management direction 3-2, 3-163
Management prescription 1-10, 2-6, 2-11
Memorandum to the Secretary of Agriculture 1-6
Mineral leasing activities 1-11, 2-9, 2-22, 3-368, 3-391
Mineral withdrawal/mining operations ... 2-18, 2-19, 3-22, 3-71, 3-257, 3-325, 3-326
Minerals and geology 3-255–3-267
Mining 2-2, 2-19
Mitigation .....
option 3-407–3-409
Mitigation effects on
biodiversity 3-189
heritage resources 3-239
minerals and geology 3-266
National Forest System Roads 3-33
on-recreation special uses 3-254
recreation 3-222
recreation special uses 3-230
scenic quality 3-233

social and economic 3-367–3-369
special designated areas.....3-250
Tongass National Forest.....3-390
water, soil and air resouces.....3-70
wilderness.....3-242
Motorized equipment.....2-2, 3-213, 3-216
Mountain bikes 3-5, 3-211
Multiple-Use Sustained-Yield Act of 1960.....1-18
Municipal watershed.....
.....2-21, 3-80, 3-99, 3-113, 3-114, 3-209, 3-403

N

National Ambient Air Quality Standards.....3-65
National Environmental Policy Act (NEPA) .. 2-2, 2-6, 2-15, 3-29, 3-156, 3-184, 3-204, 3-205, 3-226, 3-228, 3-235, 3-241, 3-256, 3-354, 3-355, 3-406, 3-409
National Forest Fund 3-301
National Forest Management Act of 1976 (NFMA)..1-6, 1-18, 2-12, 2-17, 3-64, 3-379
National Forest System Land and Resource Management Planning Rule.....1-6
National Highway System 2-9
National Historic Preservation Act .. 3-7, 3-235, 3-362, 3-409
National Marine Fisheries Service.....2-4, 2-8, 3-38, 3-164, 3-171, 3-182
National Monuments . 2-16, 2-17, 3-245–3-247, 3-375
National Register of Historic Places 3-235, 3-236
National Wilderness Preservation System (NWPS)1-5, 2-17, 3-224, 3-234, 3-240–3-246, 3-277, 3-397
Native American Graves Protection and Repartriation Act.....3-235
Natural amenities.....3-12
Natural Resource Agenda .....
..... 3-37, 3-198, 3-365, 3-371, 3-397, 3-404
Neotropical migratory bird species
effect of fragmentation on 3-146
Non-native species.....3-119
Nonpoint source pollution 3-269
Non-timber forest products.. 3-7, 3-15, 3-40, 3-267, 3-293–3-298, 3-362–3-367
Northwest Forest Plan. 1-11, 3-26, 3-38, 3-198, 3-372, 3-408
Notice of Availability (NOA) 1-17, 2-15
Notice of Intent (NOI) .. 2-1–2-4, 2-15, 3-39, 3-268, 3-280, 3-286–3-296, 3-354, 3-358
Noxious weeds..... 1-12, 3-177, 3-404

O

Off highway vehicles 1-9, 2-19, 3-41, 3-211, 3-218–3-226, 3-279, 3-280, 3-292, 3-363
used by persons with disabilities 3-363
used for ranch chores.....3-292
used to gather non-timber forest products 3-297
Oil Pollution Act.....2-4, 2-13, 3-31, 3-265
Old-Growth..... 2-10, 2-12
Outfitters and guides.... 3-225–3-227, 3-249, 3-281, 3-376
growing demand 3-230
Pacific Northwest Forest Plan..... 2-21
see also Northwest Forest Plan
Payments in lieu of tax (PILT)..... 3-319
Payments to states (PTS)..... 3-354
Personal-use timber harvest 2-7
Persons with disabilities... 1-10, 3-42, 3-213, 3-363, 3-364
Plant species.... 1-4, 3-5, 3-43, 3-128, 3-151, 3-170–3-181, 3-190, 3-292–3-298, 3-396
Pollutants . 3-49, 3-50, 3-65, 3-72, 3-73, 3-169, 3-265, 3-266, 3-270
air 3-72
as a result of forestry operations 3-270
as a result of road construction and use . 3-49, 3-65, 3-169
effects on karst or cave systems..... 3-265
total maxiumum daily load (TDML) 3-50
Preferred alternative....2-2, 2-13, 2-15, 2-23, 3-230, 3-235, 3-405, 3-408, 3-409
Prescribed fire 3-115
President Clinton..... 1-4, 1-6, 3-113, 3-357, 3-402
Priority watersheds. 3-113, 3-163, 3-164, 3-395, 3-402
Procedures..... 1-6
Prohibitions..... 1-6, 3-33, 3-381, 3-386, 3-404
definition..... 2-1
Property boundaries 2-7, 2-8
Proposed action... 2-3, 2-8, 2-16–2-21, 3-31, 3-208, 3-241, 3-357
Public comment
issues raised
environmental effects 1-11
exemptions and exceptions..... 1-11
forest-dependent communities..... 1-13
identification of other unroaded areas 1-10
local involvement 1-12
public access..... 1-9
Public health and safety ..1-11, 2-4–2-8, 2-13, 2-22, 3-22, 3-31, 3-42, 3-70, 3-102, 3-189, 3-283
Public meetings..... 1-7
Public review of the DEIS.....1-7–1-10

R

Range of alternatives.1-9, 1-16, 1-21, 2-2, 2-16, 3-338
Real estate management.....3-250–3-255
Real estate value 3-7, 3-231

Reasonably foreseeable.... 3-35, 3-71, 3-124, 3-191, 3-192, 3-208, 3-254, 3-263, 3-391, 3-392, 3-394, 3-395
Reconstruction 1-5–1-19, 2-2–2-22
See also Roads
Record of Decision..... 1-17
Record of Decision for the Tongass Land and Resource Management Plan (TLMP).
Record of Decision 2-11
Recreation .....
1-4, 1-8, 1-9, 1-10, 1-15, 1-16, 1-17, 2-6, 2-7, 2-8, 2-10, 2-12, 2-16, 2-18
developed and road-based recreation.. 3-219–3-225

dispersed 3-41, 3-211–3-219
facilities 1-8, 1-16
opportunities in roadless areas 1-4
special uses 3-225–3-230
developed and road-based recreation...3-219–3-225
dispersed recreation 3-225–3-230
Recreation Opportunity Spectrum (ROS) 3-210
on the Tongass 3-376
Urban (U).....
3-11, 3-15, 3-89–3-112, 3-113, 3-210–3-228, 3-276
primitive (P). 2-16, 3-5, 3-41, 3-210, 3-211–3-224, 3-241–3-249, 3-272, 3-274, 3-376
semi-primitive motorized (SPM) .. 3-210–3-230, 3-384, 2-10–2-12, 3-386–3-391
semi-primitive non-motorized (SPNM) 3-211–3-225
Remote Recreation ..2-12, 3-386, 3-387, 3-389, 3-390, 3-391
Research Natural Areas..... 2-16, 3-194, 3-245, 3-246
Responsible official... 1-17, 1-20, 2-3, 2-4, 2-8, 2-9, 2-11, 2-12, 2-13, 2-14, 3-38, 3-39, 3-187, 3-196
Retirement destination 3-342, 3-343, 3-344
Right-of-way ...2-18, 3-33, 3-251, 3-252, 3-395, 3-409
Road analysis process 3-31
Road safety improvement projects 2-9, 2-14
Roaded Natural (RN) ...3-210, 3-211, 3-213, 3-214, 3-215, 3-216, 3-219, 3-220, 3-221, 3-222, 3-249
Roadless areas
overview 3-1
RARE I and RARE II 1-5, 3-3, 3-30, 3-258, 3-370, 3-397
Roadless characteristics 1-15–1-16, 1-20, 2-3, 2-11
diversity 3-5
drinking water 3-5
habitat 3-5
recreation 3-5
research 3-7
sacred sites 3-7
scenic integrity 3-7
soil, water, air 3-3
unique characteristics..... 3-7
Roads .....
2-18-2-21, 3-21–3-54, 3-92–3-93, 3-116, 3-122, 3-135, 3-150–3-155, 3-165–3-171, 3-176–3-178, 3-183, 3-200, 3-219, 3-224, 3-233–3-237, 3-244, 3-253, 3-259, 3-266, 3-275, 3-288–3-296, 3-327, 3-358, 3-367–3-372, 3-394–3-395, 3-401–3-404
adverse impacts to aquatic systems..... 3-165
avenues for invasion by invasive plant species 3-176, 3-177
best management practices 3-29
classified
definition 3-24
construction 3-21–3-39, 3-327–3-329
cost 3-327
employment 3-327–3-329
creation of edge effect..... 3-149
decommissioning 1-19, 2-18, 2-19
definititon..... 3-24
effects on water quality 3-169
maintenance backlog..... 1-5
maintenance budget 3-22, 3-36
obliteration 2-18
realignment.....3-31, 3-70, 3-152, 3-189
reconstruction..... 3-21–3-39
temporary 1-19
definition.....3-24
unclassified
definition.....3-24
Roads Policy1-6, 1-18–1-20, 2-19–2-21, 3-28, 3-29, 3-31, 3-35–3-37, 3-39, 3-224, 3-233, 3-244, 3-259, 3-370–3-372, 3-394, 3-395, 3-401–3-404
Rulemaking 1-18, 2-15, 3-28, 3-356, 3-394
Rural Business-Cooperative Service 3-408
Rural Community Assistance Program (RCAP)..3-408
Rural Development.....3-408

S

Salable minerals 3-262–3-264, 3-263, 3-264, 3-313, 3-317, 3-319, 3-324
definiton 3-263
Scenic integrity..... 3-7, 3-219, 3-227, 3-231, 3-232, 3-233, 3-234, 3-281
defined.....3-231
Scenic quality 3-13, 3-38, 3-207, 3-230–3-234, 3-231, 3-232, 3-233, 3-234, 3-268, 3-270, 3-272, 3-273, 3-281, 3-282, 3-392
Scope of the proposal 1-9
Scoping. 1-9, 1-15, 2-15, 2-20, 3-33, 3-103, 3-215, 3-267, 3-286, 3-354, 3-358
Sediment.3-45, 3-49–3-59, 3-73, 3-74, 3-78, 3-119, 3-162–3-169, 3-184, 3-265, 3-270
Sense of place... 3-218, 3-226, 3-231, 3-232, 3-270, 3-362
Sierra Nevada Ecosystem Project.. 3-75, 3-150, 3-162, 3-170, 3-178
Size considerations 3-138–3-143
Ski area developments. 3-221, 3-225, 3-228, 3-229, 3-230, 3-249, 3-279, 3-283
Skid road 3-45, 3-57
Snowmobiles 3-211, 3-216, 3-224
Social and economic factors 3-267–3-374, 3-360
Soil loss, sedimentation and site productivity.. 3-44, 3-56–3-59
areas of greatest concern 3-57
Southeast Alaska1-17, 3-2, 3-59, 3-278, 3-286, 3-374–3-399
Southern Appalachian Assessment..... 3-153, 3-156, 3-160, 3-161
Special designated areas .. 2-23, 3-40, 3-129, 3-131, 3-245–3-250, 3-246, 3-247, 3-248, 3-249, 3-250, 3-358, 3-375
Special use permits ... 3-24, 3-28, 3-33, 3-40, 3-225, 3-226–3-229, 3-246, 3-249, 3-279, 3-281, 3-377
Special uses-non recreation 3-252, 3-253, 3-255
Stewardship ...2-5, 2-7, 2-13, 2-20, 3-19, 3-171, 3-238
Stewardship purpose timber harvest..... 2-7, 3-202

T

Terrestrial and aquatic plant species 3-175–3-181
The Nature Conservancy 3-163
Threatened and endangered (T&E) species 3-44, 3-80, 3-113, 3-114, 3-181–3-182, 3-403
Timber harvest .1-16, 2-2, 2-7, 3-195–3-210, 3-298–3-311
effects on bears.....3-160
adverse effects to aquatic systems 3-166
allowable sale quantity (ASQ).....3-198
effects on fisher, marten, and lynx populations 3-146
effects on water quality 3-169
effects on watersheds..... 3-53, 3-54
in the Tongass.....3-204
insect and disease 3-124
landslides.....3-59
loss of connectivity (fragmentation).....3-135
restrictions.....2-6
suitable lands.....3-196
TEP species habitat management objectives ..3-159
trends in consumption 3-196
Timber Sale Program Information Reporting System..... 3-159, 3-201
Tongass National Forest
Alternatives 3-374–3-395
economic impact 3-384
Tongass deferred 2-10, 2-11, 3-385
Tongass exempt..... 2-10–2-11, 3-380–3-385
Tongass not exempt..... 2-10, 380-383
Tongass selected areas 2-10–2-12, 3-386–3-390
comparison to continental U.S.....3-375
ecological factors.....3-374
social and economic factors.....3-379
timber market demand.....3-379
Tongass National Forest Land and Resource Management Plan.....1-17, 3-376, 3-391
Tongass Timber Reform Act (TTRA) 1-17, 2-12, 3-379
Tourism 3-278
Traffic-service level.....2-6, 2-7, 2-8
Trails
construction 2-7

U

Unavoidable adverse effects 3-407
Unroaded area 3-5, 3-151, 3-216
Unroaded portion of an inventoried roadless area... 2-5

V

Variability, historic range of 3-42

W

Water development 1-16, 3-155, 3-292
Water quality and drinking water sources....3-49–3-54
Water quantity and timing.....3-46–3-49
Watershed 1-1, 1-12, 1-20, 3-94, 3-169, 3-269
Web page
roadless.fs.fed.us.....1-7, 3-175
Weeks Act of 1911..... 3-21
Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats..... 3-79
Wheelchairs
motorized (COBRAS)..... 3-363
Wilderness .. 1-5, 1-10, 2-16, 2-17, 2-21, 3-240–3-245
Wilderness Act of 1964.....2-17, 3-397
Wildfire.....3-86, 3-88
Wildland fire ..3-79, 3-83, 3-103, 3-113–3-125, 3-210, 3-238
Wildland-urban interface .3-80–3-81, 3-114–3-115, 3-403

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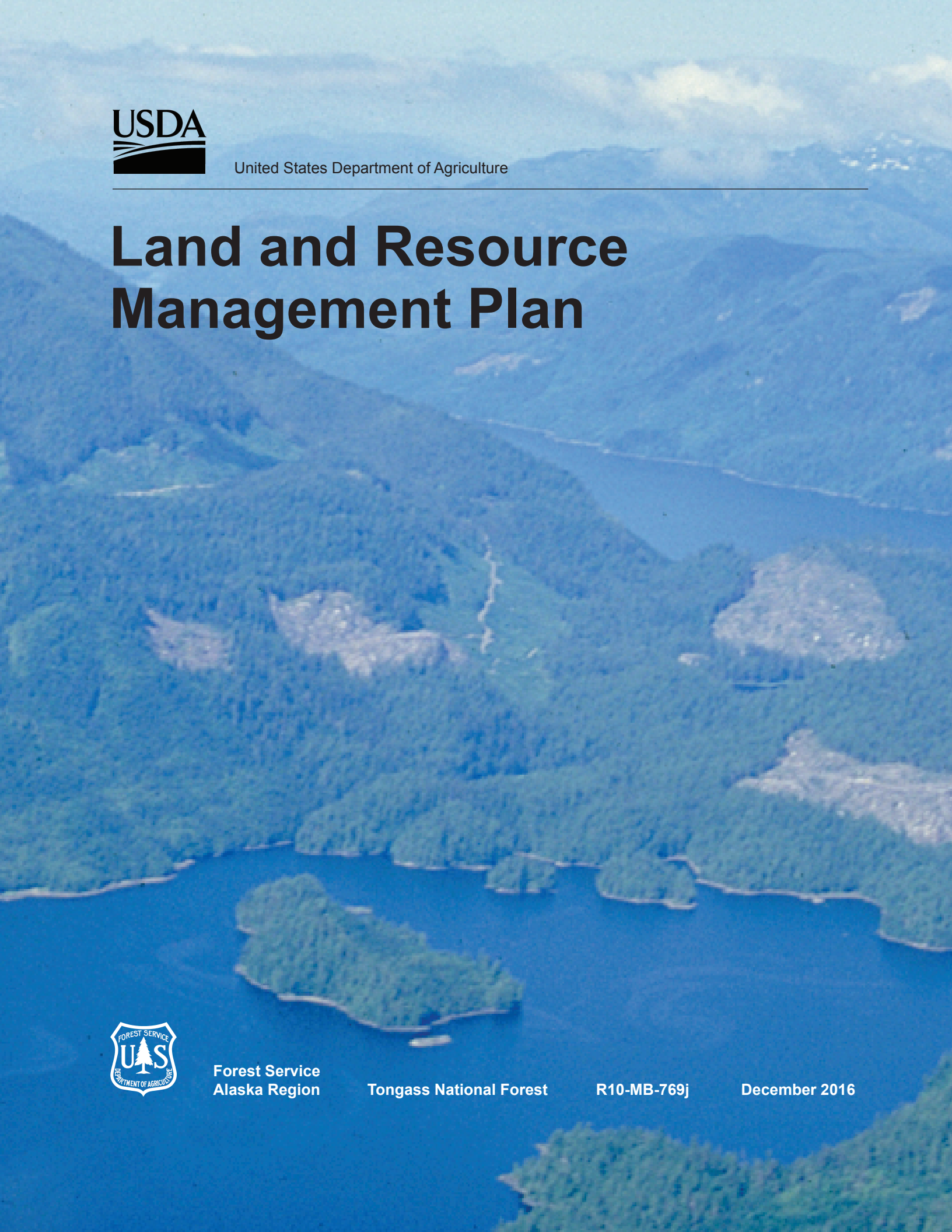

Forest Service
Alaska Region

Tongass National Forest

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CONTENTS

CHAPTER 1 INTRODUCTION **1-1**
Purpose 1-1
Relationship to Other Documents 1-1
Plan Organization 1-2
Forest Plan Management Direction 1-3
Forest Desired Conditions and Forest-wide Goals and Objectives 1-4
Management Prescriptions 1-4
Priority of Direction 1-5
Forest Location and Description 1-5

CHAPTER 2 GOALS AND OBJECTIVES **2-1**
Introduction 2-1
Forest Desired Conditions 2-1
Ecosystem Services 2-2
Forest-wide Multiple-use Goals and Objectives 2-2

CHAPTER 3 MANAGEMENT PRESCRIPTIONS **3-1**
Introduction 3-1
Land Use Designation Acreage 3-2
WILDERNESS and NATIONAL MONUMENT WILDERNESS 3-4
NONWILDERNESS NATIONAL MONUMENTS 3-24
RESEARCH NATURAL AREA 3-33
SPECIAL INTEREST AREA 3-39
REMOTE RECREATION 3-45
MUNICIPAL WATERSHED 3-51
OLD-GROWTH HABITAT 3-58
SEMI-REMOTE RECREATION 3-64
LAND USE DESIGNATION II 3-70
WILD RIVER 3-76
SCENIC RIVER 3-83
RECREATIONAL RIVER 3-90
EXPERIMENTAL FOREST 3-97
SCENIC VIEWSHED 3-103
MODIFIED LANDSCAPE 3-111
TIMBER PRODUCTION 3-118
MINERALS 3-125

CHAPTER 4 FOREST-WIDE STANDARDS AND GUIDELINES **4-1**
Introduction 4-1
AIR 4-3
BEACH and ESTUARY FRINGE 4-4
FACILITIES 4-6
FIRE 4-7
FISH 4-9
FOREST HEALTH 4-15
HERITAGE RESOURCES and SACRED SITES 4-16

Contents

INVASIVE SPECIES 4-22
KARST and CAVE RESOURCES 4-23
LANDS 4-26
MINERALS and GEOLOGY 4-36
PLANTS 4-39
RECREATION and TOURISM 4-41
RIPARIAN 4-48
RURAL COMMUNITY ASSISTANCE 4-53
SCENERY 4-54
SOIL and WATER 4-61
SUBSISTENCE 4-65
TIMBER 4-67
TRAILS 4-73
TRANSPORTATION 4-76
WETLANDS 4-84
WILDLIFE 4-85

CHAPTER 5 PLAN CONTENT DEVELOPED UNDER THE 2012 PLANNING RULE 5-1
Introduction 5-1
Plan Components 5-1
Management Approaches 5-2
Young Growth Direction 5-2
Renewable Energy Direction 5-9
Transportation Systems Corridors Direction 5-10
Forest-wide Plan Components 5-13

CHAPTER 6 IMPLEMENTATION 6-1
Introduction 6-1
Project Consistency Requirements 6-2
Resolving Inconsistencies 6-2
Plan Amendments 6-2

CHAPTER 7 GLOSSARY 7-1

APPENDIX A IDENTIFICATION OF LANDS SUITABLE FOR TIMBER PRODUCTION AND LIMITATIONS ON TIMBER HARVEST
APPENDIX B FINAL TONGASS ADVISORY COMMITTEE RECOMMENDATIONS
APPENDIX C WATERSHED ANALYSIS
APPENDIX D RIPARIAN MANAGEMENT AREA STANDARDS AND GUIDELINES
APPENDIX E COMMUNICATIONS SITES
APPENDIX F VISUAL PRIORITY ROUTES AND USE AREAS
APPENDIX G LOG TRANSFER FACILITY GUIDELINES
APPENDIX H KARST AND CAVE RESOURCES

APPENDIX I **ROS CLASS STANDARDS AND GUIDELINES**

APPENDIX J **SPECIAL LAND DESIGNATIONS OR CLASSIFICATIONS**

APPENDIX K **OLD-GROWTH HABITAT RESERVE MODIFICATION PROCEDURES**

FIGURES

Figure 1-1 Tongass National Forest Vicinity Map 1-7

Contents

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CHAPTER 1
INTRODUCTION

CONTENTS

Purpose 1-1
Relationship to Other Documents 1-1
Plan Organization 1-2
Forest Plan Management Direction 1-3
Forest Desired Conditions and Forest-wide Goals and Objectives 1-4
Management Prescriptions 1-4
Priority of Direction 1-5
Forest Location and Description 1-5

Chapter 1

Introduction

Purpose

This Land and Resource Management Plan (Forest Plan) guides all natural resource management activities and establishes management direction for the Tongass National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for different kinds of resource management.

This Forest Plan embodies the provisions of the National Forest Management Act, the implementing regulations, and other guiding documents. The Forest-wide desired conditions and multiple-use goals and objectives (Chapter 2), Land Use Designation Standards and Guidelines (Chapter 3), Forest-wide Standards and Guidelines (Chapter 4), and Plan Content[1] Developed Under the 2012 Planning Rule (Chapter 5) constitute a statement of the Forest Plan's management direction. However, the projected outputs and rates of implementation are dependent on the annual budget process and other factors.

The Secretary of Agriculture's Memorandum 1044-009, entitled *Addressing Sustainable Forestry in Southeast Alaska* (issued July 2, 2013), and the 5-Year Forest Plan Review (completed in September 2013) indicated that conditions on the land and demands of the public require the Tongass to modify the 2008 Forest Plan. In the Memorandum, the Secretary of Agriculture, Thomas Vilsack, asked the Forest Service to "Strongly consider whether to pursue an amendment to the Tongass Forest Plan. Such an amendment would evaluate which lands will be available for timber harvest, especially young growth timber stands, which lands should be excluded, and additional opportunities to promote and speed transition to young growth management..." and to "…continue to seek input from and work with stakeholders in the region towards this transition." The Tongass Advisory Committee (TAC) was established under the Federal Advisory Committee Act and was approved by the Secretary to "…provide advice to the Forest Service on how to expedite the transition to young growth management." The 5-Year Forest Plan Review highlighted a need to make the development of renewable energy resources more permissible. In response to the Secretary's Memorandum, this Forest Plan has been amended to reflect the recommendations of the TAC.

Relationship to Other Documents

This Forest Plan amends the 2008 Tongass Land and Resource Management Plan (2008 Forest Plan), and incorporates changes made since 2008. It entirely replaces the 2008 Forest Plan, as of the effective date of the Record of Decision (ROD). Proposed changes to the 2008 Forest Plan have been developed under the National Forest System land management planning rule (36 Code of Federal Regulations [CFR] 219), hereafter referred to as the 2012 Planning Rule.

This Forest Plan sets forth in detail the direction for managing the land and resources of the Tongass National Forest. It is a result of extensive programmatic National Environmental Policy Act (NEPA) review, which is

[1] A broad term that refers to written material in a plan, including plan components, and other content in the plan. (See 36 CFR 219.7 (f).) Other content in the plan can be explanatory material that may be useful to Forest Service employees when designing projects and activities under the plan components, such as management approaches.

addressed in the accompanying Tongass Land and Resource Management Plan Final Environmental Impact Statement (FEIS). The FEIS discusses the planning process and the analysis procedures used to amend the 2008 Forest Plan, describes and analyzes five alternatives in detail, including a Proposed Action and No Action Alternative, and discusses how the issues identified during the scoping process helped shape the action alternatives.

Specific activities and projects will be planned and implemented to carry out the direction in this Forest Plan. Environmental analyses will be performed on most of these projects and activities prior to implementation, and as appropriate will tier to and incorporate by reference analysis in the Final Environmental Impact Statement (FEIS).

Plan Organization

All future plans and activities will be based on this Forest Plan. Most existing resource management plans for the Tongass National Forest are already a part of, and consistent with this Forest Plan. Travel Management Plans and other site-specific plans will be used to designate roads, trails, and areas for off-highway vehicles in accordance with the final rule for Travel Management; Designated Routes and Areas for Motor Vehicle Use published in the Federal Register (FR) on November 9, 2005 (70 Federal Register [FR] 68264).

What is Forest planning? Let us compare it to land use zoning for a community. In a community certain areas are zoned for commercial use (stores), industrial use (factories) or residential use (homes) so that for the most part uses are separate from one another. Each of these zones identifies the kinds of uses that may occur there with uses in each zone being reasonably uniform, and other uses not being appropriate. The rationale behind community zoning is that it promotes the good of the entire community in accordance with a comprehensive plan.

In Forest planning, we call the zoning process *allocation* or *land allocation.* Defined areas of the Forest are allocated (zoned) to *Land Use Designations* (LUDs) for different uses or activities. All areas of the Forest (plan area) are allocated to LUDs as part of the Forest planning process. Some LUD allocations are for congressionally designated areas, such as Wilderness, and these areas must be managed in accordance with LUD direction that was developed from the congressional legislation that designated the area. Other LUD allocations are for development of resources, such as timber production, and these areas are managed in accordance with LUD direction that is developed to allow roads to be built and commercial timber to be harvested while protecting resources.

The description of the uses and activities to which a LUD may be managed and the activities that may occur there is called a *management prescription*. Each management prescription gives general direction on what may occur within the area allocated to the corresponding LUD, the standards for accomplishing each activity, and the guidelines on how to go about accomplishing the standards. These are called the *Land Use Designation Standards and Guidelines*. Some of these standards and guidelines may be common to many areas of the Forest. These are called *Forest-wide Standards and Guidelines*. Additionally, each management prescription includes *Plan Content Developed Under the 2012 Planning Rule,* including Plan Components[2] and management approaches that

[2] The parts of a land management plan that guide future project and activity decision-making. Specific plan components may apply to the entire plan area or to specific LUDs. For the purpose of this Plan, Plan Components refers to the desired conditions, objectives, suitability of lands, goals, standards and guidelines developed under the 2012 Planning Rule. See Forest Plan Chapter 5 for more details.

may apply to the entire plan area (that is, Forest-wide) or to specific LUDs. Together, these elements of a management prescription provide direction on what types of uses or activities may be authorized within the LUD.

The locations of LUD boundaries, as indicated on the December 2016 Record of Decision LUD map (LUD map) are approximate due to the scale of the map and the programmatic nature of the allocations. Some boundary adjustments may be necessary when specific projects are implemented under the Forest Plan. These adjustments will typically be made through project-specific plan amendments (see Chapter 6).

This Forest Plan is organized into several chapters. Following this introduction, Chapter 1 explains the elements of Forest Plan management direction found in Chapters 2, 3, 4, and 5 of the Forest Plan, summarizes the priority amongst this direction, and provides a brief description of the Tongass National Forest.

Chapter 6 explains Forest Plan implementation including project consistency requirements, and the process for plan amendments. Chapter 7 is a glossary.

The **plan monitoring program** was modified on May 9, 2016, to meet the requirements of the 2012 Planning Rule (36 CFR 219.12(c)). The plan monitoring program is now a separate document made available online (http://www.fs.usda.gov/goto/R10/Tongass/Monitoring) and is being implemented as part of this Forest Plan. Monitoring serves a key role in adaptive management and provides the opportunity for facilitated learning to gage progress toward desired conditions and objectives of the plan as well as measuring effectiveness of the plan components (Forest Service Handbook [FSH] 1909.12, zero code, sec. 06). The plan monitoring program will be part of the Forest Plan, and will be provided under a separate cover. Modifying a plan's monitoring program does not require any other change to the plan; that is, a plan need not be amended nor revised simply to facilitate monitoring pursuant to the 2012 Planning Rule (FSH 1909.12, Chapter 30, sec. 32.3). One purpose of monitoring and evaluation is to ensure that management direction is being carried out, and that the outputs and schedules are being achieved. If monitoring shows continued conflicts or problems in implementing the management direction, a Forest Plan amendment may be necessary (see Chapter 6).

A discussion of how the Forest Plan amendment process addressed the significant issues, and the management concerns, is included in Chapter 1 of the FEIS, and compared by alternative in Table 2-18 in Chapter 2 of the FEIS. There are 11 appendices including Identification of Lands as Not Suitable and Suitable for Timber Production (Appendix A) and the final Tongass Advisory Committee Recommendations (Appendix B) that were used in the development of the Preferred Alternative (see Alternative 5 in Chapter 2 in the EIS) and represented in this Forest Plan.

Forest Plan Management Direction

Chapters 2, 3, 4, and 5 of the Forest Plan present the direction for managing the Tongass National Forest. The management direction conforms to applicable laws, regulations, and policies. Together, these elements of Forest direction, along with the LUD map, establish a framework that identifies the location, design, and scheduling of all Forest management uses and activities. Within the management framework, project-level planning is undertaken to develop proposed projects under this Plan. The direction in Chapter 5 was developed under the 2012 Planning Rule and is separated from the 1982 Planning Rule direction in Chapters 2, 3, and 4 because the project-to-plan consistency requirements imposed by the 2012 Planning Rule apply only to plan components developed under that rule (see Chapter 6, Project Consistency Requirements). The elements of management direction are summarized below.

Forest Desired Conditions and Forest-wide Goals and Objectives

Chapter 2 of the Forest Plan presents the Plan's desired conditions for the Forest and the Forest-wide goals and objectives. Plan direction in Chapter 2 applies to the entire plan area (that is, Forest-wide). *Forest Desired Conditions* are desired landscape attributes that describe the mosaic of land and resource conditions envisioned for the Forest during the life of the Forest Plan (15 years). They are attained through Forest-wide multiple-use goals and objectives, and through the cumulative achievement of the goals, objectives, and desired conditions for each of the 18 LUDs described in Chapter 3. *Forest-wide Goals* are responsive to identified public issues and ecosystem service–related opportunities, and collectively describe the desired conditions sought to be attained during the life of this Plan. They are expressed in broad, general terms, but do not include completion dates. *Forest-wide Objectives* are expected to be achieved during the life of this Plan to help accomplish Forest-wide multiple use goals, and work toward attaining Forest desired conditions.

Chapter 5 also includes Forest-wide plan components (desired conditions, goals, objectives) that apply to the entire plan area.

Management Prescriptions

Chapter 3 includes the complete management prescription for each of the 18 LUDs used in the Forest Plan. Each LUD has a management prescription. Each management prescription includes the following elements: 1) LUD Standards and Guidelines; 2) Forest-wide Standards and Guidelines (Chapter 4); and 3) Plan Content Developed Under the 2012 Planning Rule (Chapter 5). The geographic areas allocated to each LUD are displayed on the LUD map).

Standards and Guidelines Developed under the 1982 Planning Rule Provisions (Chapters 3 and 4)

Chapter 3 includes Standards and Guidelines that are listed by resource and are LUD-specific. Chapter 4 includes Standards and Guidelines listed by resource that apply Forest-wide, and are cross-referenced in tables in Chapter 3.

Standards in Chapters 3 and 4, which can usually be identified by words such as "must" or "will," are mandatory requirements or minimums that must be met. Project-level analysis may determine that additional requirements beyond these minimums are necessary.

Guidelines in Chapters 3 and 4 are not mandatory requirements, but ways of achieving the standards or meeting other needs of the resource.

Plan Content Developed under the 2012 Planning Rule Provisions (Chapter 5)

Chapter 5 includes plan components (desired conditions, objectives, goals, suitability of lands, standards, guidelines) and management approaches that are listed by resource. Plan components and management approaches may apply to the entire plan area (Forest-wide) or to specific LUDs, and are cross-referenced in tables in Chapter 3. Some plan components and management direction provide direction specific to young-growth, renewable energy, and transportation systems corridors that is LUD-specific, while other plan components (Forest-wide plan components and management approaches) provide Forest-wide direction. A management approach is plan content that describes the principal strategies and program priorities the responsible official intends to employ to carry out projects and activities developed under the Plan, and may be useful to Forest

Service employees when designing projects and activities under the plan components.

Under the 2012 Planning Rule, standards and guidelines are both mandatory constraints. A guideline is a constraint on project and activity decision-making that allows for departure from its terms, so long as the purpose of the guideline is met. Projects and activities must be consistent with the applicable plan components.

Priority of Direction

Should conflict or discrepancy between directions occur, the following priority will apply:

1. Higher-level direction (federal law and regulations)
2. Chapter 5 direction (plan components)

   Chapter 5 assumes all laws, regulations, and policy pertaining to management of National Forest resources will be followed. Ground-disturbing projects will use the approved best management practices (BMPs) (National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, FSH 2509.22) to avoid, minimize, or mitigate environmental impacts.
3. Chapter 3 direction (LUD standards and guidelines)
4. Chapter 4 direction (Forest-wide standards and guidelines)

Any summaries of standards and guidelines (such as in the map legends) are not considered direction.

Forest Location and Description

The 16.7 million-acre Tongass National Forest is located in Southeast Alaska, a part of the Alexander Archipelago, and encompasses about 7 percent of Alaska's total land area. The Tongass extends from Dixon Entrance in the south to Yakutat in the North, and is bordered on the east by Canada and on the west by the Gulf of Alaska. It extends approximately 500 miles north to south, and approximately 150 miles east to west at its widest point. Figure 1-1 is a vicinity map of the Tongass.

The Tongass includes a narrow mainland strip of steep, rugged mountains and icefields, and over 1,000 offshore islands. Together, the islands and mainland equal nearly 11,000 miles of meandering shoreline, with numerous bays and coves. A system of seaways separate the many islands and provides a protected waterway called the Inside Passage. Federal lands comprise about 95 percent of Southeast Alaska, with about 80 percent in the Tongass National Forest (and most of the rest in Glacier Bay National Park and Preserve). The remaining land is held in state, Native, and local community private ownerships.

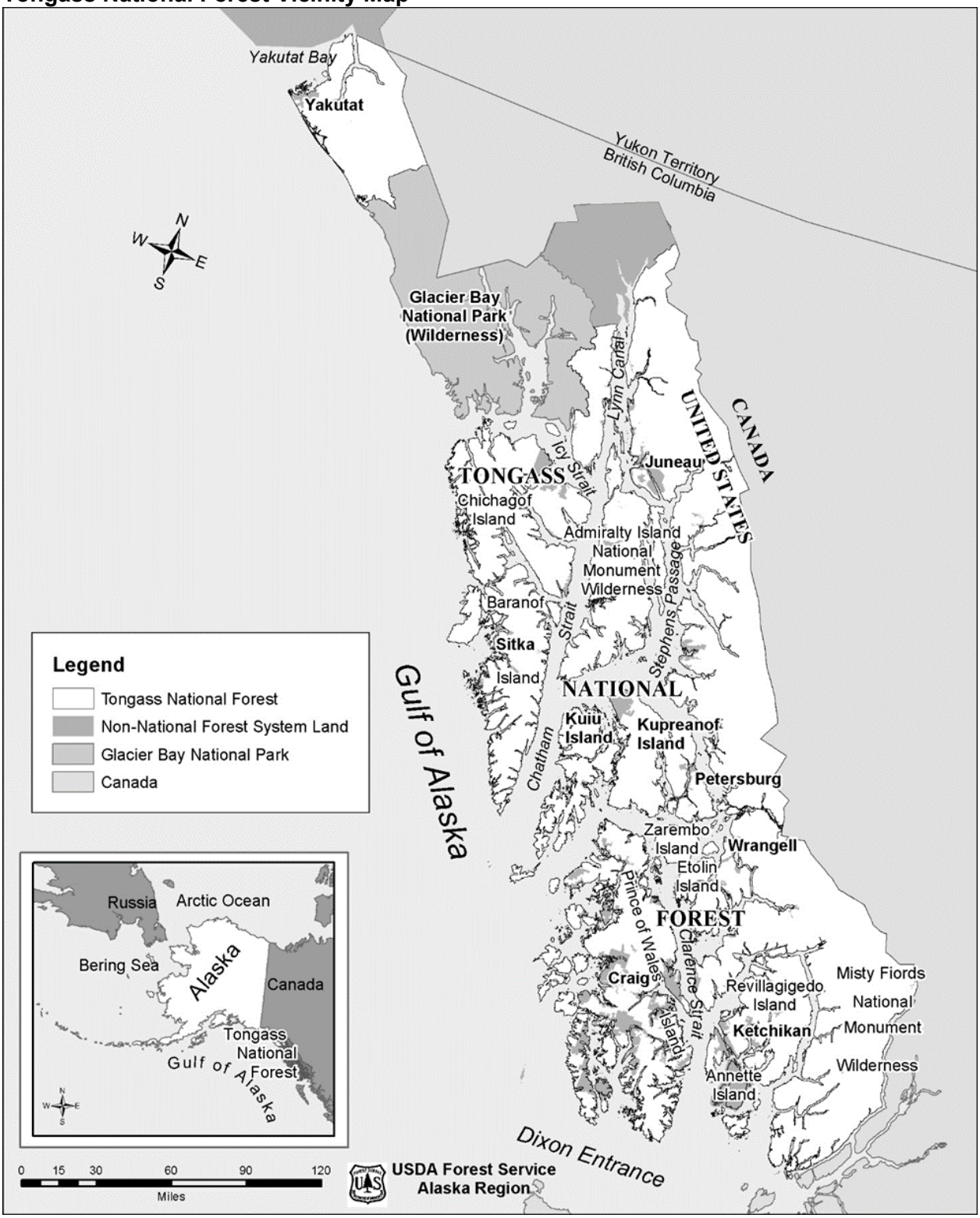
Most of the Tongass is undeveloped. The region is sparsely settled with an estimated 74,280 people living in more than 30 towns and villages located in and around the Forest in 2014 (Alaska DOL 2014a). Only four of Southeast Alaska's communities met the U.S. Census Bureau's definition of urban (population greater than 2,500) in 2014 and only eight had populations greater than 1,000 persons. Most of these communities are surrounded by, or adjacent to, National Forest System land. Just three towns are connected to other parts of the mainland by road: Haines and Skagway to the north and Hyder to the south.

The communities of Southeast Alaska depend on the Tongass National Forest in various ways, including employment in wood products, commercial fishing and

fish processing, recreation, tourism, and mining and mineral development. Many residents also depend on subsistence hunting and fishing to meet their basic needs. In addition, natural amenities, subsistence resources, and recreation activities associated with the Tongass National Forest form an important part of the quality of life for many residents of Southeast Alaska. Management of the Tongass' ecosystem services is, therefore, important for local communities and the overall regional economy. Ecosystem services refer to goods and services vital to human health and livelihood provided by the Forest. A more detailed description of ecosystem services and their role on the Tongass is included in Chapter 2.

There are 10 Ranger Districts, with offices in Yakutat, Juneau, Hoonah, Sitka, Petersburg, Wrangell, Thorne Bay, Craig, and Ketchikan. There are two National Monuments on the Tongass National Forest. The Admiralty Island National Monument is managed through a Monument Ranger co-located at the Juneau Ranger District. The Misty Fjords National Monument is managed by the District Ranger, who also oversees the Ketchikan-Misty Fiords Ranger District.

Figure 1-1
Tongass National Forest Vicinity Map



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CHAPTER 2
GOALS AND OBJECTIVES

CONTENTS

Introduction 2-1
Forest Desired Conditions.....2-1
Ecosystem Services.....2-2
Forest-wide Multiple-use Goals and Objectives.....2-2

Chapter 2

Goals and Objectives

Introduction

Management direction is described under the section titled Forest Plan Management Direction in Chapter 1. Chapter 2 presents the desired conditions for the Forest and the Forest-wide goals and objectives. All applicable elements of management direction presented in Chapters 3, 4, and 5 contribute to the maintenance or attainment of one or more Forest-wide desired conditions, goals, or objectives. The direction in Chapters 3, 4, and 5 does not foreclose the opportunity to maintain or achieve the desired conditions for the Forest and the Forest-wide goals and objectives.

Forest Desired Conditions

Desired landscape attributes describe the mosaic of land and resource conditions envisioned for the Forest in the future. They are attained through Forest-wide multiple-use goals and objectives, and through the cumulative achievement of the goals, objectives, and desired conditions for each of the individual Land Use Designations (LUDs) described in Chapter 3. The Forest's desired landscape attributes are described below.

- The Forest is managed to produce desired resource values, products, services, and conditions in ways that also sustain the diversity and productivity of ecosystems.
- Viable populations of native and desired non-native species and their habitat are maintained and are not threatened by invasive species. Viable populations of sensitive and rare species and their habitats are considered and maintained as to preclude the need for listing species as threatened or endangered. There are no threatened or endangered species on the Forest.
- Fish and wildlife habitat is maintained and improved to ensure sustainable fish and wildlife and their uses.
- A range of recreation opportunities is maintained on the Forest from primitive to more urban settings. Recreation opportunities will allow for a different type of experience in visual quality, access, remoteness, visitor management, on-site recreation development, social encounters, and visitor impacts.
- Opportunities for hunting, trapping, and viewing game species are being provided. World-class wildlife resources such as brown bears and wolves, , are relatively abundant and available for human use and enjoyment in perpetuity.
- Overall aquatic habitat quality is considered good to excellent. Fish thrive in the Forest's lakes and streams due to good water quality and other habitat features, and provide world-class fisheries.
- Rural residents have opportunities to participate in subsistence activities and to harvest subsistence resources in accordance with the direction in the Alaska National Interest Lands Conservation Act of 1980 (ANILCA).
- The outstanding scenery of the Forest is a major attraction for resident and non-resident recreation users. A full range of recreation opportunities is present. Users have the opportunity to experience independence, closeness to nature, solitude, and remoteness.

- Occasional natural catastrophic events occur; however, the properly functioning condition of watersheds and riparian areas, and careful design and location of roads, minimize resource degradation due to such events.
- Areas congressionally designated as Wilderness or LUD II will be managed consistent with their enabling legislation. The desired conditions for Wilderness are as specified in Section 2 of the 1964 Wilderness Act. The desired conditions for LUD II areas are as specified in Section 508 of ANILCA, as amended.
- The Forest is actively engaged in collaborative discussions with interested parties to resolve issues and build partnerships. Data collection, monitoring, and other plan implementation work is coordinated with the State of Alaska, other federal agencies and organizations.
- The Forest is managed to sustain ecosystem services (see next section).

Ecosystem Services

What are ecosystem services? Ecosystem services include the full suite of goods and services that are vital to human health and livelihood provided by ecosystems—in this case, ecosystems on the Tongass National Forest. Ecosystem services based in the Tongass benefit communities from the local to global scale: salmon from waters of Southeast Alaska are a prized food item locally and across the nation; carbon stored in forests can contribute to adding or removing atmospheric carbon dioxide; fiber from trees provides materials for traditional customs; and trees provide timber for homes. Generally, ecosystem services on the Tongass may be divided into four categories:

1. **Provisioning services** provide society with food, fresh water, fuel, and fiber.
2. **Regulating services** refer to processes affecting climate, water, disease regulation, and pollination.
3. **Supporting services** include those processes necessary for proper functioning of other services, such as soil formation and nutrient cycling.
4. **Cultural services** refer to educational, aesthetic, and cultural heritage values as well as recreation and tourism.

These categories provide a framework for establishing monitoring and management operations, and encourage integration across disciplines and agencies to determine the best management decisions while moving toward the desired conditions.

Forest-wide Multiple-use Goals and Objectives

Forest Plan goals are responsive to identified public issues and ecosystem service-related opportunities, and collectively describe the desired conditions sought to be attained in the long run. Goals are expressed in broad, general terms and specify no date by which they are to be accomplished. Complementary goals are listed under the Management Prescriptions in Chapter 3 for each LUD, and as Plan Components in Chapter 5. Taken and considered together, goals represent management from an ecosystem perspective, where ecosystems are considered from the site to the Forest level.

Goals are achieved through the allocations of lands to the set of LUDs, implementation of the Forest Plan management direction specified for the LUDs, and other activities conducted on the Forest. Objectives are expected to be achieved during the life of the Forest Plan (15 years) to help accomplish Plan goals. Additional objectives to help accomplish the goals are included in the Management Prescriptions (Chapter 3) and Plan Components (Chapter 5).

Category	Goal	Objective
Air	Maintain the current air resource condition to protect the Forest's ecosystems from on- and off-Forest air emission sources.	Attain national and state ambient air quality standards Forest-wide.
Biodiversity	Maintain ecosystems capable of supporting the full range of native and desired non-native species and ecological processes. Maintain a mix of representative habitats at different spatial and temporal scales.	Maintain a Forest-wide system of old-growth and other Forest habitats (includes reserves, non-development LUDs, and beach, estuary, and riparian corridors) to sustain old-growth associated species and resources. a) Ensure that the reserve system meets the minimum size, spacing, and composition criteria described in Appendix K. b) Provide sufficient habitat to preclude the need for listing species under the Endangered Species Act, or from becoming listed as Sensitive due to National Forest habitat conditions. c) Manage the Forest in order to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species. d) Develop a baseline estimate of current habitat types, patterns and structural components on the Tongass National Forest. e) Restore watersheds to provide healthy, diverse terrestrial and aquatic habitat.
Fish	Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.	Use baseline fish habitat objectives (identified in Fish Forest-wide Standards and Guidelines) to evaluate the relative health or condition of riparian and aquatic habitat. Design and implement fish habitat improvement projects annually across the Forest.
Heritage Resources	Identify, evaluate, preserve, and protect heritage resources.	Protect heritage resources (as described in the Heritage Resources Forest-wide Standards and Guidelines). Provide public outreach about heritage stewardship.
Karst and Cave Resources	Maintain, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses where appropriate.	Allow for the continuation of natural karst processes. Maintain the productivity of the karst landscape while providing for other land uses, where appropriate. Manage lands in a manner that protects significant caves and their associated resources.
Local and Regional Economies	Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.	Work with local communities to identify rural community assistance opportunities and provide technical assistance in their implementation. Support a wide range of natural resource employment opportunities within Southeast Alaska's communities.

Category	Goal	Objective
Minerals and Geology	Provide for environmentally sound mineral exploration, development, and reclamation in areas open to mineral entry and in areas with valid existing rights that are otherwise closed to mineral entry. Seek withdrawal of specific locations where mineral development may not meet LUD objectives. Maintain inventory of surficial geology, geomorphic features, geologic hazards, and paleontological resources.	Implement the Minerals and Geology Forest-wide Standards and Guidelines.
Plants	Maintain viable plant communities and populations; maintain a mixture of habitats that are capable of supporting the full range of naturally occurring flora, including a variety of vegetation types, botanical life forms, patterns, structural components, and the consideration of rare species.	Prevent species from becoming listed as threatened, endangered, or sensitive.
Recreation and Tourism	Provide a range of recreation opportunities consistent with public demand, emphasizing locally popular recreation places and those important to the tourism industry.	Manage the Forest's recreation settings in accordance with the Recreation Opportunity Spectrum Standards and Guidelines for each LUD. Maintain existing Forest Service system trails to a standard that provides for the health and safety of all users. Construct or reconstruct trails to encourage a healthier lifestyle for the public. Emphasize projects that facilitate community use or community connections. Maintain existing recreation sites and facilities to provide for the health and safety of all users. Construct or reconstruct facilities in locations where the need for the facilities are supported by either known use, partnerships for long-term maintenance, or repeated safety concerns. Remove facilities that are no longer needed or are not affordable.
Renewable Energy	See Chapter 5 Forest-wide goal G-RE-01.	
Research	Continue to seek out and promote research opportunities that are consistent with identified information needs.	Cooperate with the Pacific Northwest Research Station and the State of Alaska in pursuing the high priority information needs.
Sacred Sites	Consult with tribes to protect and maintain sacred sites Forest-wide.	Manage and protect sacred sites as an integral part of the landscape and land management planning (as described in the Heritage Resources and Sacred Sites Forest-wide Standards and Guidelines).
Scenery	Provide Forest visitors with visually appealing scenery, with emphasis on areas seen from the Alaska Marine Highway, tour ship and small boat routes, state highways, major Forest roads, and popular recreation places. Recognize that there will be areas where these landscapes are altered by management activities, particularly young-growth timber harvest, and the activity may visually dominate the characteristic landscape.	Manage the scenery of the Forest in order to achieve the adopted Scenic Integrity Objectives.

Category	Goal	Objective
Soil and Water	Maintain soil productivity Forest-wide and minimize soil erosion resulting from land-disturbing activities.	Meet Alaska Regional soil quality standards.
		Attain State of Alaska water quality standards Forest-wide.
	Minimize sediment transported to streams from land-disturbing activities.	Complete Watershed Restoration Action Plans for priority watersheds.
	Maintain and restore the biological, physical, and chemical integrity of Tongass National Forest waters.	Complete watershed restoration projects as part of an annual program of work.
Subsistence	Provide for the continuation of subsistence uses and resources by rural Alaskan residents.	Evaluate and consider the needs of subsistence users in making project land management decisions.
Timber	Provide for the continuation of timber uses and resources by the timber industry and Alaska residents.	Manage young growth to provide commercial timber products and to maintain or improve habitat for wildlife and fish at the stand or landscape level.
	Manage the timber resource for production of saw timber and other wood products from lands suitable for timber production, on an even-flow, long-term sustained yield basis and in an economically efficient manner.	Pre-commercial thin previously harvested suitable forest land.
		Provide about three years supply of volume under contract to local mills and then establish NEPA-cleared volume to maintain flexibility and stability in the sale program.
		Review the timber sale program and work with the state and other partners to implement changes that will keep an “economic timber” perspective throughout the process and monitor the implementation of these reforms to ensure they are consistently employed across the Forest.
		See Chapter 5 Forest-wide objectives O-TIM-01 and O-TIM-02.
Transportation	Develop and manage transportation systems corridors to support resource management activities; recognize the potential for future development of major transportation systems.	Provide access for Forest users, access to Southeast Alaska communities, and access points to facilitate implementation of the State of Alaska’s Southeast Transportation Plan.
		Design, construct, and maintain roads in support of Forest resource management activities to provide access to forest resources and opportunities. Decommission roads that are no longer needed to meet forest resource objectives.
		See Chapter 5 Forest-wide goal G-TRAN-01.
Wetlands	Minimize the destruction, loss, or degradation of wetlands, and preserve and enhance wetland functions and values.	Avoid alteration of, or new construction on wetlands, wherever there is a practicable, environmentally preferred alternative.
		Implement Best Management Practices and Estuary, Riparian, Soil, and Water Standards and Guidelines specific to wetlands.

Category	Goal	Objective
Wild and Scenic Rivers	Maintain the outstandingly remarkable values and the free flowing conditions of rivers designated or recommended for designation as components of the National Wild and Scenic Rivers System.	Manage the 31 rivers (or segments) recommended for designation as Wild, Scenic, and Recreational, pending designation by Congress, to maintain the eligibility of the total miles of river for the following recommended classifications: Wild 359.5 miles Scenic 87.5 miles Recreational 89.0 miles
Wilderness	Manage designated Wilderness to maintain an enduring wilderness resource while providing for the public purposes of recreational, scenic, scientific, educational, conservation, and historical use, as provided in the Wilderness Act of 1964 and ANILCA.	Provide for public use of the Wilderness in accordance with ANILCA provisions for motorized and non-motorized access and travel, including reasonable traditional subsistence use by rural residents. Facilities are designed primarily to provide resource protection and encourage smaller group size. Facilities and trails tend to allow for challenge and risk instead of convenience. Maintain the wilderness to provide information on natural ecological processes. Preserve biodiversity. Inventory and reduce or eliminate invasive species in Wilderness. Manage Wilderness as a place where self-reliance and primitive skills are needed and can be honed by the general public.
Wildlife	Maintain the abundance and distribution of habitats, especially old-growth forests, to sustain viable populations in the planning area. Maintain habitat capability sufficient to produce wildlife populations that support the use of wildlife resources for sport, subsistence, and recreational activities.	See biodiversity objectives. Design and implement structural and non-structural wildlife habitat improvement projects. Include a young-growth management program to maintain, prolong, and/or improve understory forage production, and to improve habitat distribution, including future old-growth characteristics in young-growth timber stands for wildlife on lands both suitable and not suitable for timber production.

CHAPTER 3
MANAGEMENT PRESCRIPTIONS

CONTENTS

Introduction 3-1
Land Use Designation Acreage 3-2
WILDERNESS and NATIONAL MONUMENT WILDERNESS 3-4
NONWILDERNESS NATIONAL MONUMENTS 3-24
RESEARCH NATURAL AREA 3-33
SPECIAL INTEREST AREA 3-39
REMOTE RECREATION 3-45
MUNICIPAL WATERSHED 3-51
OLD-GROWTH HABITAT 3-58
SEMI-REMOTE RECREATION 3-64
LAND USE DESIGNATION II 3-70
WILD RIVER 3-76
SCENIC RIVER 3-83
RECREATIONAL RIVER 3-90
EXPERIMENTAL FOREST 3-97
SCENIC VIEWSHED 3-103
MODIFIED LANDSCAPE 3-111
TIMBER PRODUCTION 3-118
MINERALS 3-125

Chapter 3

Management Prescriptions

Introduction

Chapters 2, 3, 4, and 5 of the Forest Plan present the direction for managing the Tongass National Forest. Forest Plan management direction and the priority of this direction are explained in Chapter 1. This chapter includes the management prescriptions for the 18 Land Use Designations (LUDs) used in the Forest Plan. The areas allocated to each LUD are shown on the December 2016 Record of Decision LUD map (LUD map). These prescriptions only apply to National Forest System (NFS) lands within the areas allocated to each LUD.

To use this management prescription section, first find the area of the Forest you are interested in on the LUD map. The LUD map legend shows the name and corresponding color of each LUD. Then locate the management prescription for that designation (they have the same name) in the table of contents of this Plan.

Each management prescription in Chapter 3 has the following elements of management direction:

1. Goals, objectives, and desired conditions.
2. A table that cross-references, by resource, the Forest-wide Standards and Guidelines found in Chapter 4 that apply. If a reference is not made in this table to a specific Forest-wide Standard and Guideline, that Standard and Guideline is not applicable.

   Resource codes by section and subsection are provided in Chapter 4. For example, FIRE1 in Chapter 4 refers to direction for fire suppression. Therefore, specific direction for fire suppression in the Wilderness LUD is also labeled FIRE1 in the table. If all Forest-wide Standards and Guidelines for a resource apply, the word “ALL” is included.
3. A table that cross-references, by category, the plan content, found in Chapter 5 that applies. If a reference is not made in the table to a specific Plan Component, that Plan Component is not applicable.

   Plan Components in Chapter 5 may apply forest-wide or to specific LUDs. Resource codes for Plan Components in Chapter 5 are different than those for Forest-wide Standards and Guidelines in Chapter 4. For example, S-YG-BEACH-01 in Chapter 5 refers to a Standard for young-growth management in the beach and estuary fringe. Therefore, this Plan Component applies in the Old-growth Habitat, Scenic Viewshed, Modified Landscape, and Timber Production LUDs only. If all Plan Components for a resource apply to the LUD, the word “ALL” is included. If only some of the Plan Components for a resource apply to the LUD, then they are listed individually, such as Desired Conditions for young growth in the Scenic Viewshed LUD (only DC-YG-01, DC-YG-02, DC-YG-04, and DC-YG-05 apply because DC-YG-03 is specific to the Old-growth Habitat LUD).
4. In addition to the Forest-wide Standards and Guidelines and Plan Components (items 2 and 3 above), LUD-specific Standards and Guidelines and Plan Components are established for each LUD following

the order established for the Forest-wide Standards and Guidelines in Chapter 4.

Land Use Designation Acreage

The following table shows the acres allocated to each LUD. The first column of numbers presents the total number of acres allocated to each LUD; summing these acres will exceed the National Forest acreage because more than one LUD can be applied to the same area. For example, a Special Interest Area can exist within Wilderness. Therefore, the second column of numbers counts each acre of the Tongass only once and associates each acre with only one LUD (see the table footnotes). Table A-1 in Appendix A displays the results of the suitability process, and lists the acreage for each step.

Land Use Designation Allocations

Land Use Designation	Total Acres Allocated to Each LUD[1]	Total Acres Allocated to Each LUD without Overlay[2]
Wilderness LUD Group		
Wilderness	2,641,042	2,641,042
Wilderness National Monument	3,113,807	3,113,807
Nonwilderness National Monument	167,282	167,282
Total for Wilderness LUD Group		**5,922,131**
Natural Setting LUD Group		
LUD II	878,694	878,694
Remote Recreation	3,010,933	3,010,933
Semi-Remote Recreation	2,008,582	2,005,891
Old-Growth Habitat	1,202,450	1,202,450
Municipal Watershed	45,208	45,208
Research Natural Area	71,552	21,682
Special Interest Area	667,487	206,370
Wild River	196,245	60,338
Scenic River	136,207	32,849
Recreational River	64,590	8,943
Total for Natural Setting LUD Group		**7,473,358**
Development LUD Group		
Experimental Forest	36,264	36,264
Scenic Viewshed	308,180	308,180
Modified Landscape	723,883	723,883
Timber Production	2,291,040	2,291,040
Total for Development LUD Group		**3,359,367**
Overlay LUD		
Minerals[2]	249,570	0
TOTAL NATIONAL FOREST SYSTEM LAND		**16,755,685**

[1] This column includes the total acreage allocated to each LUD. However, in some cases, more than one LUD is applied to the same area (such as a Special Interest Area within Wilderness); therefore, totaling the acres of this column exceeds the total National Forest acreage.

[2] This column counts each acre of the Tongass only once. It includes the total areas allocated to each LUD, except for four LUDs that sometimes overlay other LUDs. The Research Natural Area, Special Interest Area, and Wild River LUDs sometimes overlay Wilderness, Wilderness National Monument, or LUD II; when this occurs, the acreage is included under these other LUDs (so as not to double count). Also, the Minerals LUD always functions as an overlay and does not have acreage in this column.

[3] The Minerals LUD is always an overlay LUD. Areas allocated to this LUD are managed according to the underlying LUD until such time that mineral development is approved, if at all.

Appendix J shows, by name, the areas of the Forest identified as Congressionally designated Wilderness and LUD IIs; Wild, Scenic, and Recreational Rivers (recommended); Research Natural Areas; Special Interest Areas; and Experimental Forests.

Map Errata

The Tongass Forest Plan LUDs were developed using small-scale Tongass-wide Forest maps. The level of accuracy of a map at such a scale is approximately ±500 feet. Enlargements of this map were also sometimes used in LUD development, but these maps contained no additional detail or accuracy; they were just larger scale. This approach is appropriate for the development of a Forest Plan map, which is a permissive, zoning map. It is the role of subsequent project planning to resolve, within the overall intent of the Forest Plan mapped LUDs, the actual location of activities on the ground. In some situations, there is a lack of precise map correlation or registration of a LUD boundary between two GIS maps. Most of these variations are minor, and are due to the combining of map covers of varying resolution. This situation results in remnants, or "slivers" of small acreages of land appearing on the maps between mapped polygons. In other situations during project planning LUD boundaries may be indefinite or illogical if located literally on the ground as depicted on the FEIS map. In some instances boundaries may appear to bisect an existing or mapped harvest unit; or, while paralleling an existing or mapped road, boundaries may appear to cross and re-cross the road randomly.

These types of map inconsistencies are clerical errors and can be dealt with as an administrative change in the Forest Plan (36 CFR 219.13(c)).

WILDERNESS AND NATIONAL MONUMENT WILDERNESS

Goals (Wilderness)

Manage all designated Wilderness to maintain the enduring resource of Wilderness as directed by the Wilderness Act of 1964, subject to the special provisions and exceptions in the Alaska National Interest Lands Conservation Act of 1980 (ANILCA); as amended.

Protect and perpetuate natural biophysical and ecological conditions and processes. Ensure Wilderness ecosystems are substantially free from the effects of civilization.

Provide a high degree of remoteness from the sights and sounds of humans, and opportunities for solitude or primitive recreation activities consistent with Wilderness preservation.

Keep Wilderness untrammeled and free from human control or manipulation, including actions taken to manage Wilderness.

Protect the undeveloped character of Wilderness by following legislative guidelines regarding permanent improvements or human occupation, including mechanized transport and motorized equipment.

Goals (National Monument Wilderness)

To manage the Wilderness portions of Admiralty Island and Misty Fiords National Monuments to maintain an enduring Wilderness resource, while providing for public access and uses consistent with the Wilderness Act of 1964, and ANILCA. These units were designated as National Monuments to protect objects of ecological, cultural, geological, historical, prehistorical, and scientific interest.

Objectives (Wilderness)

Apply a multi-disciplinary focus to Wilderness management; consider stewardship of Wilderness in the annual program of work by all resources.

Manage recreation activities so that the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Primitive Recreation Opportunity Spectrum (ROS) Class are emphasized (see Chapter 4, Recreation and Tourism and Appendix I). Areas managed as Semi-Primitive within a Wilderness are an exception and not encouraged.

Provide for public uses of Wilderness as authorized in the Wilderness Act, but subject to ANILCA provisions for motorized and non-motorized access and travel, including reasonable traditional subsistence use by rural residents, and provisions of other applicable Wilderness designation acts.

Maintain trails and primitive facilities that are in harmony with the natural environment and that promote primitive recreation opportunities. Feature facilities designed primarily to provide resource protection and encourage smaller group size, and emphasize challenge and risk instead of convenience.

Maintain the Wilderness capacity to provide information on natural ecological processes.

Preserve and perpetuate biodiversity.

Inventory, reduce, and, when possible, eliminate non-native species in Wilderness.

Manage Wilderness as a place where self-reliance and primitive skills are needed and can be honed.

Objectives (National Monument Wilderness)

Inventory, research, protect, and interpret National Monument resources as directed by Monument designation consistent with Wilderness management practices.

Make resource and research information about the National Monuments available to other forest units where it may be beneficial for management of multiple use lands.

Desired Condition (Wilderness)

All designated Wilderness on the Tongass National Forest is characterized by extensive, unmodified natural environments. Ecological processes and natural conditions are not measurably affected by past or current human uses or activities. Users have the opportunity to experience independence, closeness to nature, solitude and remoteness, and may pursue activities requiring self-reliance, challenge, and risk. Motorized and mechanized use is limited to the minimum needed for the administration of the Wilderness. Allow for access to state and private lands, subsistence uses, and public access and other uses to the extent provided for by ANILCA.

Desired Condition (National Monument Wilderness)

The purposes of National Monument designation are fulfilled by protecting and learning more about the special resources they contain. Appropriate research is encouraged and supported within the constraints of wilderness designation, and contributes to both the purposes of the Wilderness National Monuments and improved management of other forest lands. Appropriate interpretive and educational efforts allow the public to better understand the resources of these special areas and to appreciate how these areas fit into the local, regional, and even global context of geology, ecology, and human history.

The Wilderness portions of Admiralty Island and Misty Fiords National Monuments are characterized by extensive, unmodified natural environments. Ecological processes and natural conditions are not measurably affected by past or current human uses or activities. Users have the opportunity to experience independence, closeness to nature, solitude and remoteness, and may pursue activities requiring self-reliance, challenge, and risk. Motorized and mechanized use is limited to the minimum needed for the administration of Wilderness. Allow for access to state and private lands, subsistence uses, and public access and other uses to the extent provided by ANILCA. If not specifically provided through an ANILCA exception, the resources within a designated Wilderness shall be administered in accordance with the applicable provisions of the Wilderness Act.

Wilderness and National Monument Wilderness Land Use Designations Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1	All
Facilities	FAC	All
Fire	FIRE1	All
Fish	FISH	All
Forest Health	HEALTH1	I (B,C)
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND1, 3, 4, 6	All
	LAND2	I(A:1-10),VII,IX
	LAND5	I(A)
Minerals and Geology	MG1	All
	MG2	I,III,VI,VII,VIII
Plants	PLA1, 2, 3	All
Recreation and Tourism	REC1	All
	REC2	I,II(A),III
	REC3	I,II,III(B),IV-VII
Riparian	RIP1	All
	RIP2	I,II(A-D)
Rural Community Assistance	RUR	All
Scenery	SCENE1	All
	SCENE2	I,II(A,E)
Soil and Water	SW1, 2, 4	All
	SW3	I(A:1-4,B-F),II
Subsistence	SUB	All
Timber	TIM1	All
	TIM6	I(A-C;E)
Trails	TRAI1,2	All
Wetlands	WET	All
Wildlife	WILD1	All
Wildlife	WILD1	I,II,VII,VIII, IX(A,B,C,E), X,XI, XII(A,B),XIII,XIV(A), XV(A),XVI, XVIII(A),XIX(A)
	WILD4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All
Transportation Systems Corridors Direction	All	All
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

AIR

Air Resource Inventory: AIR1

A. Air Quality monitoring will be accomplished in accordance with specific District- or Forest-level plans and strategies.

FACILITIES

Administrative Facilities: FAC1, FAC2, FAC3, and FAC4

A. Construct no new permanent administrative facilities in Wilderness, except as consistent with ANILCA, Sections 1303, 1306, 1310, and 1315, and other applicable Wilderness designation acts.
B. Allow the continued operation and maintenance of permanent administrative facilities for which there is an ongoing need (ANILCA, Section 1306 (b)).
   1. When reconstruction of existing permanent administrative structures is necessary, reconstruct or replace them with structures of compatible design.
   2. During reconstruction and maintenance activities:
      a) Paint or stain structure to blend with the environment;
      b) Keep clearing of vegetation to the minimum feasible; and
      c) Select materials natural in appearance.
C. Allow temporary facilities and crew barges for administration.
   1. Temporary administrative camps used by Wilderness rangers, trail crews, or for other administrative activities should avoid areas used for camping by the general public and should be screened from view.
   2. Temporary administrative camps may remain in place only during periods required for the administrative activity. All equipment and materials will be removed or collapsed and laid flat at the end of the field season or during other extended periods of non-use.
   3. Temporary camps will seek to achieve minimum impact on the land. There will be no permanent foundations or anchors, and only minimal clearing of vegetation at campsites.
   4. Crew barges should be located in unobtrusive locations. They may be periodically moved and relocated to support administrative needs.
D. Allow administrative use of public cabins and shelters in Wilderness. When scheduling, avoid conflict with public use.
E. When necessary, allow radio repeaters to provide essential communications for the health and safety of employees involved in the administration of the area. Allow permanent radio repeaters currently located in Wilderness to remain.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics resulting in the least possible disturbance or evidence of human presence.
   1. Use of mechanized equipment requires approval by the Forest Service officer with delegated authority.
   2. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.

3. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as it is safe, but within one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. As a general management practice, do not use management-ignited prescribed fire. Should it become necessary to consider the use of management-ignited prescribed fire, Forest Service Manual (FSM) 2324 provides direction.

B. As a general management practice, allow natural fires in accordance with fire management plans specific to the area (consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

Planning

A. Plan for fisheries in Wilderness consistent with ANILCA, Section 1315(b), which recognizes the goal of restoring and maintaining fish production in the State of Alaska to optimum sustained yield levels and in a manner that adequately ensures protection, preservation, enhancement, and rehabilitation of the Wilderness resource. Subject to reasonable regulations, permanent improvements and facilities such as fishways, fish weirs, fish ladders, fish hatcheries, spawning channels, stream clearance, egg planting, and other accepted means of maintaining, enhancing, and rehabilitating fish stocks may be permitted. For this purpose, optimum sustained yield levels will be considered synonymous with the long-term harvest goals documented in the State of Alaska Comprehensive Salmon Plans and other state fisheries plans. (Consult R-10 supplements to FSM 2632 and FSM 2320 for further details.)

B. Determine the need for Wilderness aquaculture projects (as described in ANILCA, Section 1315(b)) on a broad basis that includes the potential of private, state, and federal non-wilderness projects.

C. Evaluate fish habitat improvement during project planning by considering: 1) availability of suitable non-wilderness opportunities that should be used first; 2) effects on Wilderness conditions, in general; 3) effects resulting from the introduction of species not indigenous to the watershed; 4) the appropriateness of structures both in type and scale to the desired future condition for the Wilderness and the ROS class setting; and 5) the need to provide well-distributed fisheries that support sport and commercial fisheries, subsistence, and community stability.

D. In planning, stress protection of fish habitat to prevent the need for mitigation.

Fish Habitat Improvement: FISH3

A. Construct facilities in a rustic manner to blend into the natural character of the area and limit facilities to those essential to the project (ANILCA, 1315(b)). Methods for the installation of any feature or facility will apply the minimum requirement concept to management activities that affect the Wilderness resource and character by conducting a minimum requirements analysis (FSM 2322.03).

B. Permit reasonable access, including the temporary use of motorized equipment, subject to reasonable regulation to maintain the Wilderness character, water quality, and fish and wildlife values of the area.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Allow natural occurrences to play their normal role in ecological succession.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible insect and disease outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Enhancement

A. Heritage resources are available for scientific study to the extent that the study is consistent with 1) the preservation of Wilderness; 2) the intent of the Wilderness Act; and 3) heritage resource management objectives.
B. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses, consistent with management of Wilderness.
    1. Provide interpretive information concerning heritage resources to users in the form of exhibits and publications outside of the Wilderness.

Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, and protection within the Wilderness.
    1. Identify heritage properties to be nominated to the National Register of Historic Places.
    2. Identify, classify, and evaluate known heritage resources.
    3. Identify heritage properties that require stabilization or other protective measures.

INVASIVE SPECIES

Invasive Species Monitoring and Treatment: INV2 and INV3

A. Non-native, invasive species monitoring and treatment will be accomplished in accordance with specific District- or Forest-level plans and strategies.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. A cave management plan will be developed prior to the authorization of appropriate, allowed activities inside caves. Activities include agency interpretation, commercial use, or scientific investigation.
B. Manage caves as Class 1 (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards and Guidelines.

LANDS

Special Use Administration (non-recreation): LAND2

A. Authorize only activities that are consistent with the Wilderness Act or specifically allowed by ANILCA, or other applicable Wilderness designation acts, and are otherwise in compliance with management direction of this plan (Consult FSM 2700, FSM 2320, and Regional Supplements).
    1. Analyze proposals on a case-by-case basis.
    2. Authorize only activities consistent with the goals, objectives, and desired conditions for Wilderness.
    3. Integrate special use management with the ROS so that approved uses and activities emphasize the most primitive ROS class setting.

4. Avoid authorizing uses that are not dependent upon Wilderness resources or uses for which reasonable alternative locations exist outside the Wilderness.
5. Use cost-recovery direction to process applications.

B. New special use cabins and related structures may be authorized by the Forest Service officer with delegated authority in accordance with Section 1303(b)(1) of ANILCA under the conditions described below.
   1. The authorization is nontransferable and limited to a 5-year term.
   2. The determination is made that the proposed use, construction, and maintenance of the structure(s) are consistent with the goals, objectives, and desired conditions for Wilderness.
   3. The determination is made that the proposed cabin is either directly related to the administration of the Wilderness or the continuation of an ongoing use otherwise allowed in the Wilderness, where a) the applicant has no reasonable alternative site for constructing a cabin; and b) the cabin is not to be used for private recreational use.
   4. The United States shall retain ownership of the cabin and related structures.
   5. To qualify, an applicant must:
      a) Agree to vacate the structure(s) and remove all personal property upon nonrenewal or revocation of the authorization within a reasonable time period established by the District Ranger or Monument Ranger;
      b) Acknowledge in writing that they have no interest in the real property on which the structure(s) are constructed and that any cabin or related structure constructed under the authority of the special use authorization shall be the property of the United States; and
      c) Submit with their applications a sketch or photograph and a map of the proposed structure(s) showing the specific geographical location.
   6. Special Use Permits will contain the following provision: “Chainsaws, generators or other motorized equipment shall not be used in the permit area unless specifically approved by the Regional Forester.”

C. Cabins and related structures that were in place on December 2, 1980, for which a valid authorization does not exist, may be authorized with a non-transferable renewable 5-year special use authorization for traditional and customary uses if the use is compatible with the Wilderness. No authorizations shall be issued for private recreational use. These authorizations shall be renewed until the death of the last immediate family member using the cabin as a dwelling. Revocation of the authorization must be by the Regional Forester, after notice and hearing establish that continued use is causing, or may cause, significant harm to the Wilderness (ANILCA, 1303(b)).
   1. To qualify for an authorization, the applicant must:
      a) Demonstrate by affidavit, bill of sale, or other documentation, proof of possessory interests or rights of occupancy in the cabin;
      b) Submit a list of all immediate family members;
      c) Submit a sketch or photograph and a map of the cabin and related structures showing its geographic location;
      d) Agree to vacate all structures and remove all personal property within a reasonable time period established by the District Ranger or Monument Ranger; and

e) Acknowledge, in writing, that there is no interest in the real property on which the cabin and structures are located.

2. The use of motorized ground equipment, not designed for personal transport use, is authorized in and about authorized structures and facilities in the authorized area for a period not to exceed the termination or the revocation of the authorization. Authorized ground equipment includes chainsaws, generators, power brushcutters, and other hand-held tools and appliances, but do not include all-terrain vehicles, motorcycles, or other types of off-highway vehicles (OHVs), except snowmachines. Power lawnmowers, rototillers, and other power garden equipment may be used only on existing lawns and gardens that were established prior to the designation of the area as Wilderness.
3. Cabins and associated structures that do not qualify for a special use authorization shall be removed by the owner unless accepted as a donation to the United States. Cabins that remain will be posted as property of the United States. Cabins that may be useful for emergency shelter may be designated by the Forest Service officer with delegated authority as public use cabins or posted for use as emergency public shelters.

D. Renew existing valid special use authorizations for cabins, home sites, or similar structures, which were in effect on December 2, 1980, unless the Forest Service officer with delegated authority finds, following notice to the permittee and after the permittee has had a reasonable opportunity to respond, that the permitted structure constitutes a direct threat or a significant impairment to the Wilderness (ANILCA, Section 1303(d) and Section 101 (b)).

1. Authorizations in effect on December 2, 1980, will be considered for renewal in accordance with provisions of the existing authorization and reasonable regulations that may be prescribed.
2. The structures authorized by these authorizations may be maintained, rehabilitated, modified, replaced, or removed, but not enlarged.
3. All modifications and replacement plans will require form, color, and materials that blend and are compatible with the immediate and surrounding Wilderness landscape.
4. In the case of conflicts that could lead to termination of the special use authorization, the permit holder will be offered reasonable opportunity to correct the conflict.
5. The special use authorization may be transferred at the election or death of the original permit holder. The original permit holder is the one of record on December 2, 1980. This is a transfer of the authorization in effect on December 2, 1980—not the issuance of a new special use authorization. The transfer may be accomplished following the normal procedures except that the special use authorization will be amended to change the name of the permit holder instead of issuing a new authorization.
6. The amendment will also contain the following tenure clauses:
   a) This permit is nontransferable, and a new permit will not be issued to any subsequent owner of the improvements or to any person holding any interest in the improvements.
   b) If the present permittee, herein named, ceases to have personal need for, or to make personal use of, the site for the purpose for which the permit is issued, this permit will terminate and the structures on the area shall be disposed of as provided in the conditions of the permit.

c) No additional improvements shall be constructed without prior written approval by the Forest Service officer with delegated authority.
d) The use of motorized ground equipment, not designed for personal transport use, is authorized in and about authorized structures and facilities on the permitted area for a period not to exceed the termination or the revocation of this authorization. Authorized ground equipment includes chainsaws, generators, power brushcutters, and other hand-held tools and appliances, but do not include all-terrain vehicles, motorcycles, or other types of OHVs, except snowmachines. Power lawnmowers, rototillers, and other power garden equipment may be used only on existing lawns and gardens that were established prior to the designation of the area as Wilderness.

E. Provide for the continuance of existing and future establishment and use of temporary campsites, tent platforms, shelters, and other temporary facilities and equipment directly related to and necessary for the taking of fish and wildlife in accordance with ANILCA (Section 1316). Regulate these temporary facilities as follows:
1. Special use authorizations are limited to a period not to exceed 5 years, but may be renewed.
2. Authorized facilities and/or equipment must be directly and necessarily related to the taking of fish and wildlife. Special use authorizations will only be issued when the following conditions are met:
   a) The facilities are needed as a practical necessity to conduct legal hunting, trapping, and fishing activities that occur either within the Wilderness or in adjacent waters.
   b) The applicant has no feasible alternative location outside the Wilderness.
3. Does not include cabins.
4. Does not include motorized forms of transportation other than snowmachines, motorboats, or fixed-wing airplanes.
5. The specific location of temporary facilities will not cause physical resource damage, and should be located and designed to minimize conflicts with other users.
6. Tent platforms, toilets, or other constructed facilities should be located approximately 0.5 mile, or more, from popular beaches, lakes, recreational boat anchorages (both developed and undeveloped), or other special recreation places. Consider season of use, compatibility of activities, core use areas, the goals, objectives, and desired conditions for the Wilderness, consistency with the ROS setting, and other factors in assessing the 0.5-mile guideline.
7. Temporary camp facilities in Wilderness will include at least the following conditions:
   a) The time of occupancy will be limited to coincide with the hunting or fishing season for the species for which the temporary facility is being used.
   b) At the end of the specified occupancy, tents will be taken down and tent platforms laid flat. Unnecessary equipment will be removed from the site.
   c) Temporary structures will be built with materials that blend with and are visually compatible with the surrounding landscape.

d) Temporary facilities will be screened from the water, and located so that they are unobtrusive as seen from trails and areas of public use.

8. The Forest Service officer with delegated authority may determine, after adequate public notice, that the establishment and use of new facilities or equipment would constitute a significant expansion of existing facilities or uses that would be detrimental to the purposes for which the Wilderness was established, including its wilderness character. Upon such determination, the Forest Service officer with delegated authority may deny the use or establishment of new facilities and equipment in accordance with ANILCA, Section 1316 (b).

F. Allow reasonable access to, and operation and maintenance of existing air and water navigation aids, communication sites, and related facilities, as well as existing facilities for national defense purposes, weather, climate, and fisheries research and monitoring. Allow the continuation of necessary motorized access at existing sites (ANILCA, Section 1310(a)). New facilities proposed for these activities and purposes, except communications sites, shall be permitted: 1) following consultation between the head of the federal agency undertaking the establishment, operation, or maintenance, and the Forest Service officer with delegated authority; and 2) in accordance with such terms and conditions as may be mutually agreed upon in order to minimize the adverse effects of such activities on the Wilderness resources (ANILCA, Section 1310).

1. Perform environmental analysis to evaluate the effects of such proposals on Wilderness resources and to provide the basis for determining the necessary terms and conditions under which the use will be permitted.
2. Mechanized transport and motorized equipment may be authorized where no other feasible alternative exists.
3. Forest Service officer(s) with delegated authority will consult with the permittees and jointly develop an operating plan, documenting procedures that will minimize impacts on the Wilderness resources without unreasonably limiting the operation and maintenance of the proposed facilities.

G. The resorts discussed below were under permit prior to the establishment of the Monument Wildernesses. They will be administered in accordance with ANILCA provisions as follows:

1. Thayer Lake Lodge. Section(see ANILCA, Sections 503(j) of ANILCA provides that the Special Use Permit for Thayer Lake Lodge shall be renewed, as necessary, for the longest of either: 1) 15 years after December 2, 1980; or 2) the lifetime of the permittee, as designated in such permit as of January 1, 1979, or the surviving spouse or child of such permittee, whoever lives longer, so long as the management of the lodge remains consistent with the purposes of the Admiralty Island National Monument.
2. Humpback Lake Chalet. The resort Special Use Permit in existence on December 2, 1980, authorized one rental cabin and appurtenant structures on Humpback Lake within Misty Fiords National Monument Wilderness. The continuation of this use is authorized by ANILCA, Section 1307(a). The existing improvements may be maintained, rehabilitated, modified, replaced, or removed, but not enlarged. New cabin construction will not be allowed. Approval of exterior color schemes, materials, and designs shall use criteria that keep the improvements unobtrusive and compatible with the surroundings. The Special Use Permit may be revised as

appropriate, but the permittee must remain Sportsman Paradise Tours, the permittee on December 2, 1980. The use shall continue to be permitted so long as it remains a public recreation rental cabin, provides adequate public service, does not significantly threaten any resource, and other terms and conditions of the permit are met.)).

H. Allow reasonable access to, operation, and maintenance of existing air and water navigation aids, communication sites, and related facilities, as well as existing facilities for national defense purposes, weather, climate, and fisheries research and monitoring. Allow the continuation of necessary motorized access at existing sites (ANILCA, Section 1310(a)). New facilities proposed for these activities and purposes, except communications sites, shall be permitted 1) following consultation between the head of the federal agency undertaking the establishment, operation, or maintenance, and the Forest Service officer with delegated authority; and 2) in accordance with such terms and conditions as may be mutually agreed upon in order to minimize the adverse effects of such activities on the National Monument Wilderness resources.
   1. Conduct environmental analysis to evaluate the effects of such proposals on Monument Wilderness resources and to provide the basis for determining the necessary terms and conditions under which the use will be permitted.
   2. Mechanized transport and motorized equipment may be authorized where no other feasible alternative exists.
   3. Forest Service officers with delegated authority will consult with the permit holder and jointly develop Operating Plans, documenting procedures that will minimize impacts on the Monument Wilderness resources without unreasonably limiting the operation and maintenance of the proposed facilities.

I. Transportation and utility systems may be located in the Wilderness (see ANILCA Title XI). ANILCA (Section 506) includes specific exceptions for Admiralty Island National Monument Wilderness regarding the right to develop hydroelectric resources and public access and use.

J. Onshore facilities such as waterlines, storage areas, and shoreties for mariculture shall not be authorized in Wilderness.

Landline Location and Maintenance: LAND4

A. Provide adequate marking for the public and Forest Service employees to distinguish land ownership.
   1. Survey, mark, and post property lines of inholdings and adjacent private lands. Give highest priority to those landlines that are adjacent to private lands where activities or occupancies are likely to encroach into the Wilderness. The next priority is adjacent to trails, canoe routes, and other Wilderness transportation corridors or areas of frequent human use.

B. Provide adequate marking of Wilderness boundaries to prevent encroachment of non-compatible activities from adjacent public lands.

C. Determine survey, marking, and posting priorities by the degree to which adjacent land management is compatible with the adjacent Wilderness.

Land Ownership Adjustments: LAND6

A. Acquire private inholdings as opportunities arise.
   1. Acquisition of private inholdings within the Wilderness is a continuing high priority.
   2. As opportunities arise, acquire private inholdings through donation, exchange, or purchase.

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG1 and MG2

Forest Lands Withdrawn from Mineral Entry

A. Forest lands within Wilderness are withdrawn from mineral entry subject to valid existing rights.
B. Claimants with valid claims located within the Wilderness retain valid existing rights if such rights were established prior to the date that Wilderness lands were withdrawn from mineral entry.
C. Permit reasonable access to mining claims in accordance with the provisions of approved Plan of Operations (ANILCA, Section 1110(b)).
D. Section 1010 of ANILCA provides for the assessment of oil, gas, and other mineral potential on all public lands in Alaska. Core and test drilling for geologic information purposes, but excluding exploratory oil and gas test wells, may be authorized within Wilderness. Air access shall be permitted for such assessment activities. Sections 503, 504, and 505 of ANILCA provide specific direction for minerals management in the National Monument.
E. Encourage use of state-of-the-art techniques for developing mineral resources to reduce impacts to Wilderness values to the extent feasible. Include mitigation measures that are compatible with the proposed development and commensurate with potential resource impacts.
F. The use of motorized equipment may be authorized. Apply appropriate Transportation Forest-wide Standards and Guidelines to the location and construction of mining roads (ANILCA, Section 1110 (b)).

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. To the degree consistent with the Wilderness designation, provide a spectrum of wildland recreation opportunities that reflects the inherent ecological, cultural, historical, prehistorical, scientific, and sociological conditions found within the Wilderness.
B. Emphasize the management of the Primitive ROS setting that acknowledges existing opportunities, while recognizing exceptions due to ANILCA or other authorizations and development activities outside of Wilderness. Provide for the appropriate activities throughout the Wilderness. Protect the integrity of the Wilderness character through integrated project planning and implementation.
    1. Manage for the adopted ROS class where established through Wilderness plans. If adopted ROS classes do not exist for the specific Wilderness, emphasize management for the Primitive ROS class, unless activities and practices allowed by ANILCA are authorized by the Forest Service officer with delegated authority and cause change in the ROS setting(s). Seek to minimize the changes through project design and mitigation. Commercial services may be performed within the Wilderness to the extent necessary for activities that are proper for realizing the recreational or other Wilderness purposes of the area.
    2. Seek to minimize changes to the setting through project design and mitigation. Maintain the capability of the Wilderness to emphasize quality primitive recreation on a sustained basis.
C. Manage recreation activities to meet appropriate levels of social encounters, on-site development, methods of access, and visitor impacts indicated for either the adopted ROS class or emphasizing the more

Primitive ROS class (see “B” above). (Consult national and regional handbooks.)

1. Group size is limited to no more than 12 persons for commercial or general public use of a Wilderness unless otherwise approved by the appropriate line officer. Exceptions may be approved by the District Ranger or Monument Ranger in response to unusual circumstances. Recurring exceptions should be justified in local area analyses or decision documents. Exceptions for general public use authorized by the Forest Plan include:
   a) The Stikine River Valley and tidal estuary below 100 feet elevation, not including Shakes Valley upstream from the outlet of Shakes Lake.
2. Length of stay at any one location is limited to 14 days with the exception of uses approved through a special use authorization.
3. At no time will caches or storage of equipment be allowed unless approved by the line officer with the delegated authority by a special use authorization.
4. Management restrictions on visitor behavior will be primarily for resource protection and to minimize conflicts.
5. Work to preserve outstanding opportunities for solitude or a primitive, unconfined type of recreation experience. Use will not be encouraged into more pristine areas as a means of resolving conflicts in areas of concentrated use.
6. Do not authorize commercial services in Wilderness with more than two groups of 12 people from a single vessel or other means of transport or access. These groups will be required to disperse out of sight and sound from each other when using National Forest System lands to minimize impacts to a specific site or other groups who may want to use an area.
7. Encounters should be less than three groups per day to maintain the more primitive experience.

D. Where applicable, provide for general public use of the Wilderness in accordance with ANILCA provisions for the use of snowmachines (during periods of adequate snow cover), motorboats, fixed-wing airplanes, and nonmotorized surface transportation methods for traditional activities that are legal and for travel to and from villages and home sites (ANILCA, Section 1110). Designation of motorized routes for OHVs in Wilderness areas is not allowed except for instances where documented local traditional use for subsistence activities has occurred prior to ANILCA (1980), or the area is designated as a Wilderness.

1. Traditional activities include, but are not limited to, recreation activities such as sport fishing, sport hunting, boating, sightseeing, and hiking.
2. Legal traditional activities shall be allowed to continue where such use has previously occurred. No proof of pre-existing use will be required in order to use a snowmachine, motorboat, or fixed-wing airplane. No permits will be required for the general public to use these specific types of motorized transport or any nonmotorized surface transportation methods for traditional activities that are legal, unless an area is specifically closed to public use. Such use is subject to reasonable regulation by the Forest Service officer with delegated authority to protect Wilderness resources and other values from damage.
3. Restrictions or closures of specific areas within the Wilderness to transportation methods listed in "D" above, may be invoked by the Forest Service officer with the delegated authority following adequate

public notice and public hearing, and the determination that such use would be detrimental to Wilderness resources and values. Closure of broad areas is not contemplated.

4. Fixed-wing airplanes will be allowed to land on all suitable lakes, beaches, and icefields without authorization unless the activity (i.e., commercial use) requires a special use authorization.
5. The landing of helicopters for access by the general public is prohibited.

E. Maintain existing public use cabins and shelters at present or improved condition. Consider additional public use cabins and/or shelters only when needed for health and safety purposes (ANILCA, Section 1315(d)).
   1. Base new cabin or shelter locations on an analysis of public health and safety needs. The analysis shall include at least the following factors:
      a) Difficulty of access, particularly in regard to timely pick-up of users by floatplane or boat, or for emergency situations;
      b) Presence of natural hazards including weather, brown bears, and dangerous tide and currents;
      c) History of fatalities and life-threatening incidents in the area; and
      d) Natural attractions that entice people to use a particular area.
   2. Design of new or replacement cabins or shelters will use drawings approved for use in Wilderness.
   3. Appurtenant structures to the cabin or shelter will be limited to a toilet, a woodshed, and minimum structures necessary for resource protection and accessibility.
   4. All structures shall be built of materials that blend with, and are compatible with, the foreground and middleground landscape surrounding the site.
   5. Decisions to construct new cabins or relocate or move existing cabins must be supported by an environmental analysis.
   6. The Forest Supervisor will inform Congress regarding any proposed public use cabin or shelter removal or additions (ANILCA, Section 1315(d)).
   7. Report Wilderness managed to standard through INFRA each year.

F. All users will be encouraged to follow “Leave No Trace” practices. With the help of user groups, develop ways to distribute information for "Leave No Trace" practices.

G. Maintain the recreation campsite inventories to help determine changes to Wilderness character and to meet minimum stewardship levels as provided through national direction.

Outfitter/Guide Operations

A. Special Use Authorizations permitting individuals or organizations to provide visitor services in Wilderness may be issued if there is demonstrated need for the service(s) and they are deemed appropriate for the area proposed. District Rangers and Monument Rangers will maintain a record of currently active authorizations.
   1. In selecting persons to provide new visitor services, except for guided hunting and sport fishing, preference shall be given to: 1) the Native corporation most directly affected by the establishment of the subject Wilderness, and 2) local residents defined by the Secretary of Agriculture (ANILCA, Section 1307).consult ANILCA, Section 1307.
   2. Outfitter and guide permit holders may be authorized the use of assigned temporary campsites for specific dates within a use

season. Assigned campsites shall not include structures such as tent platforms or equipment caches (except as in 3. below).

3. Outfitter and guide services for the taking of fish and wildlife may be allowed certain temporary camp facilities by ANILCA, Section 1316 (see Lands section).
4. Authorize a party size of no more than 12 persons for any one site or activity. District Rangers or Monument Rangers may approve exceptions to this party size limitation in response to extremely unusual circumstances. Recurring exceptions should be justified in local area analyses or decision documents.
5. Outfitter and guide operating plans for Wilderness direct permit holders to model appropriate Wilderness practices and incorporate appreciation for Wilderness values in their interaction with clients and others.

Recreation Special Uses

A. Major and minor developments other than those specifically provided for in ANILCA or other applicable Wilderness designation acts are illegal or not consistent with agency policy and regulations. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Design activities to not be visually evident to the casual observer.
   1. Apply Forest-wide Standards and Guidelines for the Very High or High Scenic Integrity Objective. This objective defines the maximum limit of allowable change to the visual character of the area. Less visible evidence of activities, such as those compatible with the Very High Scenic Integrity Objective, is preferred.
   2. Design allowed structures, campsites, and constructed trails to meet the Moderate Scenic Integrity Objective.

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements only where deteriorated soil and hydrologic conditions caused by humans or their influences create a threat or loss of Wilderness values, or where such conditions could cause serious depreciation of important environmental qualities outside of the Wilderness. For exceptions, see the Fish section.
B. Whenever possible, use indigenous plant species and materials in implementing watershed improvements.

SUBSISTENCE

Subsistence: SUB

A. Rural residents engaged in subsistence uses shall have reasonable access to subsistence resources. Appropriate use of snowmachines, motorboats, and other means of surface transportation traditionally employed for such purposes by local residents shall be permitted, subject to reasonable regulation to protect Wilderness resource values (ANILCA Section 811). The use of other mechanical/motorized equipment, such as chainsaws, is allowed by special use authorization only.

TIMBER

Timber Resource Planning: TIM4

A. Forested land in the Wilderness is classified as not suitable for timber production and withdrawn from the timber base.

B. The following types of public uses may be authorized if done in a manner that minimizes impacts on the Wilderness (the use of mechanical/motorized equipment, such as chainsaws, is allowed by special use authorization only):
   1. Commercial beach log salvage on Wilderness coastlines may be authorized in accordance with ANILCA, Section 1315(f). Require that the recovery of logs above mean high tide be conducted from the water without roads or use of vehicles on uplands. Beach log salvage is defined as the recovery of logs that have been lost in transit and washed up on beaches.
   2. Traditional personal use wood harvesting activities, primarily: a) beach logs on coastlines that can be removed without roads or use of vehicles on uplands, and b) firewood, subject to reasonable regulations to protect Wilderness resources and values. The cutting of down trees in navigable rivers (sweepers) and removal of trees from the banks is incompatible with Wilderness objectives (the main channel of the Stikine River, which is a treaty river, is an exception). Cutting of green trees (except for emergency cutting of trolling poles) will be by permit only. (Consult ANILCA, Section 1315(f) and 36 CFR 223.10.)
   3. Removal or use of trees cut as part of some other authorized administrative use within the Wilderness (e.g., clearing for a fish ladder).
   4. Trees may be cut for use in construction and maintenance of authorized structures when it is not feasible to obtain the necessary material from outside the Wilderness.

TRAILS

Trail Activities: TRAI1

A. Provide for a diversity of outdoor recreation trail and waterway opportunities that emphasizes the Primitive ROS class, or are the minimum standard necessary to protect Wilderness values and resources. Emphasize nonmotorized and nonmechanized participation in activities such as hiking, mountaineering, spelunking, cross-country skiing, canoeing, and kayaking.
B. Emphasize primitive recreation opportunities that are in harmony with the natural environment and consistent with the intent and purposes of the Wilderness Act and ANILCA or other applicable Wilderness designation acts.
C. Consider trail systems that:
   1. Reconstruct and maintain trails so that they appear to be part of the Wilderness environment;
   2. Create connected, multi-day trip opportunities for both land trails and water trails;
   3. Situate trailheads and access points away from concentrated use areas;
   4. Loop trail systems in connection with public use cabins;
   5. Primarily use signs for resource protection, as necessary;
   6. Install signs identifying the area as Wilderness, only as necessary, at trail junctions or trailheads; and
   7. Provide Wilderness boundary signs, where necessary, at entries to inform users of the change in management or conditions.

Trail Administration: TRAI2

A. Trails and associated waterways leading to and within Wilderness and National Monument Wilderness often become the principal management

tools for achieving management objectives. Construct and maintain trails, bridges, and signs, so they:

1. Contribute to Wilderness management goals and objectives;
2. Emphasize the Primitive ROS setting;
3. Appear to be part of the Wilderness environment and not an intrusion upon it (Consult the Forest Service Trails Management Handbook and the Alaska Region Trails Construction and Maintenance Guide); and
4. Provide protection to resources (e.g., streambanks, soils, etc.).

TRANSPORTATION **Transportation Operations: TRAN**

A. New roads, new motorized trails, and new airstrips are not permitted in the Wilderness, except where authorized by ANILCA and to access surrounded state and private land and valid mining claims subject to stipulations to protect Wilderness resources and values. Any transportation development in association with minerals operations will be in accordance with an approved Plan of Operations, and subsequent annual work plans.

B. Any existing roads in the Wilderness are closed to motorized uses unless authorized under ANILCA or other applicable Wilderness designation acts.

C. Allow use of snowmachines (during periods of adequate snow cover), motorboats, fixed-wing airplanes, and non-motorized methods of surface transportation for legal traditional activities and transportation to and from villages and homesites, subject to reasonable regulation. (Consult ANILCA, Section 1110(a), and Wilderness and Recreation and Tourism Sections.)

D. Provide reasonable access to owners of land, including subsurface rights to land, valid mining claims, or other valid occupancies that are effectively surrounded by Wilderness.
   1. The routes and types of access shall be practical in an economic sense, but do not necessarily have to be the most economically feasible alternative.
   2. District Rangers or Monument Rangers will work with the landowner, or their authorized representative, to work out solutions that will meet the intent of ANILCA (Sections 1110(b) and 1323), while minimizing adverse impacts on Wilderness resources and values.

WILDERNESS **Wilderness Resource Administration: WILDER**

Wilderness Resource Management

A. Manage all designated Wilderness and National Monument Wilderness to maintain an enduring Wilderness resource as provided by the Wilderness Act of 1964, while providing for public access and uses specifically allowed by ANILCA (P.L. 96-487) or other applicable Wilderness designation acts. Consult Alaska Region Supplement to FSM 2320, as amended. Activities and practices authorized by ANILCA will be regulated or restricted in accordance with the special provisions of ANILCA.
   1. Per ANILCA (Section 506 (a)), any right or interest in land granted or reserved in paragraph (3)(A, B, and C) shall not be subject to the provisions of the Wilderness Act.

B. Identify inventory needs for all Wilderness and National Monument Wilderness to meet minimum stewardship levels per the Wilderness Act

of 1964. Accomplish baseline inventory needs commensurate with other forest inventory efforts.

C. Use available opportunities to encourage and enlist public and private sector interest groups to work together in meeting Wilderness management objectives. Emphasize programs that help in educating the public in the appropriate conduct of activities and uses within Wildernesses (e.g., "Leave No Trace").

D. To the extent feasible, minimize the impacts of administrative activities on the Wilderness resources and visitors. Administrative activities include authorized use and Wilderness resource-related work being done by other agencies and cooperators. In developing project plans, follow FMS 2300, R10 ID 2300-2006-1, FMS 2322.03 or most current version, and the guidelines described below.

1. Encourage permit holders and cooperators to minimize the use of mechanized vehicles and equipment to make their presence in the Wilderness as unobtrusive as possible even though authorized.
2. The use of mechanized transport and motorized equipment by the Forest Service and other federal, state, and local agencies for the administration of the Wilderness should be carefully considered to determine if it is necessary. Mechanized transport and motorized equipment use is subject to the following conditions:
   a) Aircraft
      - Fixed-wing airplanes may land on all suitable lakes, rivers, beaches, and icefields.
      - The administrative use of helicopters may be allowed on a case-by-case basis after evaluation of the need and full consideration of all alternative options for access. Approval by the Forest Service officer with delegated authority is required for administrative use.
      - Established air routes will be used to the extent feasible.
      - Low flights and continuous circling should be avoided.
      - Work logistics will be planned to minimize the number of aircraft flights over the Wilderness and landings within a specific area.
   b) Motorboats on Rivers
      - Motorboats may be used on rivers for all administrative purposes under the same conditions that public use is allowed.
   c) Motorboats on freshwater lakes
      - Outboard motors of 10 horsepower or less may be used for administering the Wilderness, gathering firewood for public use cabins, and transporting crews and equipment on lakes. Exceptions for a larger motor may be allowed when use is approved by the District Ranger or Monument Ranger (Consult FSM 2322.03).
   d) Chainsaws and Power Brushers
      - Use of chainsaws and power brushers is allowed for trail and cabin maintenance and firewood cutting when specially authorized in writing by the Forest Service officer with delegated authority (consult FSM 2322.03).
      - Use of chainsaws and power brushers is allowed for trail construction and reconstruction projects when specifically authorized in writing by the Forest Service officer with delegated authority (consult FSM 2322.03).
   e) Generators and Other Motorized Tools

- Generators and other motorized tools may be used for construction/reconstruction projects only when use has been specifically authorized in writing by the Forest Service officer with delegated authority. They may not be used for typical maintenance work or in field camps, except where specifically authorized by the Forest Service officer with delegated authority.

f) Snowmachines
- Snowmachines may be used to administer Wilderness under the same snow conditions that public use is allowed.

g) Exceptions
- Aircraft and mechanized equipment may be authorized by the Forest Service officer with delegated authority as needed for search and rescue purposes and law enforcement.
- The temporary use of motorized equipment may be allowed for fisheries research, management, rehabilitation, and enhancement activities, when such use is authorized in the project environmental assessment or Decision Notice approved by the Forest Service officer with delegated authority.
- The use of chainsaws and power winches is allowed for clearing of navigational hazards along the Stikine River. All other administrative activities must be completed using primitive nonmotorized/nonmechanized methods when specifically authorized by the Forest Service officer with delegated authority (consult FSM 2322.03).

Wilderness Planning

A. Protect and perpetuate Wilderness character. Using the following four qualities, evaluate whether or not Wilderness character is degrading, stable, or improving over time:
   1. Untrammeled,
   2. Natural,
   3. Undeveloped, and
   4. Outstanding opportunities for solitude or primitive and unconfined recreation.

B. A minimum requirements analysis will be used for all management proposals and activities (consult FSM 2320).

C. All mechanized transportation or motorized equipment is reported annually by all other agencies if authorized using minimum requirements analysis.

D. Update individual Wilderness plans if inconsistent with this Plan.

E. Wilderness plans may be developed or updated for an individual Wilderness in response to issues and concerns. All Wilderness plans for individual areas will be consistent with the Wilderness Act, ANILCA, other applicable Wilderness designation acts, and the Forest Plan.

F. ROS classes may be adopted through Wilderness planning.

G. As needed and consistent with direction in this Forest Plan, update Wilderness Implementation Schedules and any other area plans, analyses, or decision documents applicable to a Wilderness.

H. Establish subunit management zones within the Wilderness to deal with unique situations, or to integrate local issues and concerns with management activities, where necessary, to better accomplish Wilderness objectives.

1. The boundaries of subunits should generally be located on identifiable topographic features and/or coincide with existing ROS classification areas.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Wildlife management activities will be consistent with Wilderness objectives, and will protect and maintain natural processes and Wilderness values.
B. Address issues regarding management, introduction, and re-introduction of wildlife species consistent with national and regional policy.

Wildlife Habitat Improvement: WILD2

A. Conduct wildlife habitat improvement projects only when the principal objective is to protect or restore the Wilderness resource, or to assist in the recovery of a federally listed threatened or endangered species.

NONWILDERNESS NATIONAL MONUMENTS

Both National Monuments contain Congressionally designated Wilderness and Nonwilderness National Forest System lands. Management direction for Wilderness portions is provided in the Wilderness and National Monuments Wilderness LUDs section.

Goals

To manage Admiralty Island and Misty Fiords National Monuments for public access and uses consistent with the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) and their respective Presidential Proclamations of 1978, which designated these units as National Monuments because of their superlative combination of significant scientific and historical features.

> Admiralty Island, exclusive of the Mansfield Peninsula, was designated as a National Monument for the scientific purpose of preserving intact a unique coastal island ecosystem. The goal of preservation was to ensure continued opportunities for study of Admiralty Island's ecology and its notable cultural, historical, and wildlife resources, within its relatively unspoiled natural ecosystem. Protection and study of Tlingit cultural resources, other historical resources, brown bear and bald eagle populations are specifically directed.
>
> Misty Fiords was designated as a National Monument to serve the scientific purposes of preserving a unique ecosystem and the remarkable geologic and biological objects and features it contains. The goal of preservation was to ensure continued opportunities for study of Misty Fiord's geology and ecology, including the complete range of coastal to interior climates and ecosystems. Protection and study of the geology, plant and animal succession, historical resources, and fish and wildlife resources are specifically directed.

To facilitate the development of significant mineral resources located within portions of Admiralty Island and Misty Fiords National Monuments, as specified by ANILCA.

To protect objects of ecological, cultural, geological, historical, pre-historical, and scientific interest, as specified by ANILCA, and the Plan of Operations, as well as minimize effects on non-mineral resources to the extent feasible. In the long term, when mining is completed, to reclaim areas disturbed by mining to a near-natural condition.

To limit mining activities to claims with valid existing rights, and to the land area actually needed to carry out mining operations.

Objectives

Inventory, research, protect, and interpret National Monument resources as directed by National Monument designations.

Make resource and research information about the National Monuments available to other Forest units where it may be beneficial for management of multiple use lands.

Ensure that the Plan of Operations for each mineral development specify the activities to be conducted, the location and timing of those activities, and how the environment and resources in each area will be protected through compliance with federal and state requirements.

In areas affected by mining, manage activities to maintain the productivity of anadromous fish and other foodfish habitat to the maximum extent feasible. Stress protection of fish habitat to prevent the need for mitigation.

In areas affected by mining, manage public recreation use as directed in the Plan of Operations. Outside these areas, manage recreation use and activities to meet the appropriate levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the adopted or existing Recreation Opportunity Spectrum (ROS), as appropriate.

Locate and manage trails to direct the public away from mining operations.

Develop reclamation plans prior to project initiation. Include, as needed, rehabilitation of fish and wildlife habitats, soil resources, and the scenery.

Desired Condition

The purposes of National Monument designation are fulfilled by protecting and learning more about the special resources they contain. Appropriate research is encouraged and supported and contributes to both the purposes of the National Monuments Wilderness and improved management of other Forest lands. Appropriate interpretive and educational efforts allow the public to better understand the resources of these special areas and appreciate how these areas fit into the local, regional, and even global context of geology, ecology, and human history.

During mining operations, mining activities are localized and limited to the area necessary for their efficient and orderly development. Off-site effects to National Monument resources are minimal, and most Monument users are not aware of, or affected by, the mines. After the completion of mining, reclamation of the affected areas is done to minimize the evidence of past mining and, to the maximum extent feasible, seek to return the area to generally natural conditions. Ultimately, the entire Nonwilderness National Monument provides the same natural settings and recreation experiences as the adjacent National Monument Wilderness areas.

Nonwilderness National Monuments Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1	All
	BEACH2	I (A:1-3,8)
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH1	I(B;C)
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG1	All
	MG2	I,III-VIII
Plants	PLA	All
Recreation and Tourism	REC1, 3	All
	REC2	I,II(A),III
Riparian	RIP1	All
	RIP2	I,II(A-F)
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW1, 2, 4	All
	SW3	I(A:1-4;6-7,B-F),II
Subsistence	SUB	All
Timber	TIM1,2	All
	TIM4	VII(D)
	TIM6	I(A-C;E)
Trails	TRAI1,2	All
Transportation	TRAN1, 2, 3, 6	All
	TRAN4	II-IV
Wetlands	WET	All
Wildlife	WILD1	All
	WILD2	All
	WILD4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All
Transportation Systems Corridors Direction	All	All
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow structures needed and authorized for the extraction of mineral deposits, specially authorized activities, and for the protection of National Monument values.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics resulting in the least possible disturbance or evidence of human presence.
   1. Use of mechanized equipment will require approval by the Forest Service officer with delegated authority.
   2. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   3. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as it is safe, but within one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. As a general management practice, do not use management-ignited prescribed fire. Should it become necessary to consider the use of management-ignited prescribed fire, consult Forest Service Manual (FSM) 2324.
B. Outside the active mining area, use prescribed fire only to perpetuate natural ecological processes. As a general management practice, do not use prescribed natural fire (consult FSM 5142).

FISH

Fish Habitat Planning: FISH2

Planning and Mitigation

A. In areas affected by mining, manage activities to maintain the present and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible (consult ANILCA, Section 505 (a).)
B. Stress protection of fish habitat to prevent the need for mitigation. Mitigation, rehabilitation, and monitoring of mining impacts to fish habitat or populations shall be identified in appropriate environmental documents, Plan of Operations, and updates and amendments to each. Stocking of sport fish will generally be employed only to re-establish indigenous stock depleted by human influences. Stocking of indigenous species in currently barren waters may be considered, where appropriate, to the purposes of National Monument management.
C. Mining impacts to fish habitat shall be mitigated by the mining operator (consult ANILCA, Section 505 (b) for Quartz Hill).

Planning Fish Enhancement

A. Provide for fisheries habitat enhancement subject to the goal of restoring and maintaining fish production in the State of Alaska. (Consult ANILCA, Sections 507 and 1315(b) and the Regional Comprehensive Salmon Plans.) Consider the suitability of fish habitat enhancement, during project planning, by evaluating: 1) availability of suitable non-Monument, Non-wilderness opportunities; 2) effects on Monument conditions in general; 3) effects on Monument ecosystems and desired solitude level due to an enhanced fishery resulting in increased recreation use; 4) effects on ecosystems due to the introduction of species not indigenous to the watershed; and 5) the appropriateness of structures both in type and scale to the ROS setting.

Fish Habitat Improvement: FISH3

A. Use construction techniques that are consistent with Monument management.
   1. Construct only those facilities essential to operations and in a rustic manner to blend into the natural character of the area (consult ANILCA, Section 1315 (b)).
   2. Land-disturbing activities necessary for construction will be temporary.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Allow natural occurrences to play their normal role in ecological succession.
B. Scientific study of natural populations is encouraged using research methods appropriate for the National Monument setting and goals.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Activities that have the potential to affect heritage resources shall be in compliance with the National Historic Preservation Act, Section 106, 110.
B. Inventory heritage resources in valid, existing mineral claims prior to the approval of a Plan of Operations for mineral activities.
C. Inventory and evaluation may be done at the operator's discretion and cost, provided that the inventory and evaluation is accomplished under the supervision of a qualified heritage resource specialist and authorized by a special use authorization.
D. Include, as part of the Plan of Operations, specific protective and/or mitigation measures to be taken by the operator who is responsible for the cost of any such protective or mitigation measures.

Enhancement

A. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Provide for the scientific study and interpretation of heritage resources to visitors.

INVASIVE SPECIES

Invasive Species Monitoring and Treatment: INV2 and INV3

A. Non-native, invasive species monitoring and treatment will be accomplished in accordance with specific District- or Forest-level plans and strategies.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this LUD.
B. Manage caves as Class 1 (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards and Guidelines.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize special uses to facilitate mineral-related activities. Authorize other uses if they do not substantially conflict with mineral-related activities.
   1. Authorizations must be compatible with the purposes for which the area was established, subject to exceptions provided by ANILCA.

Landline Location and Maintenance: LAND4

A. Provide adequate marking for the public and Forest Service employees to distinguish land ownership and land classification.
   1. Survey, mark, and post property lines to Wilderness or National Monument standards along trails, canoe routes, and other transportation corridors or areas of frequent human use.
   2. Determine survey, marking, and posting priorities by the degree to which the adjacent LUD is compatible with the National Monument management objectives.

Land Ownership Adjustments: LAND6

A. Allow and assist in the process for valid mining claims embracing locatable commodities to go to patent, subject to the requirements of ANILCA.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG1 and MG2

Lands Withdrawn from Mineral Entry

A. National Forest System lands within this LUD are withdrawn from additional mineral entry (ANILCA, Section 503).
B. Claimants with valid claims located in areas withdrawn from mineral entry retain valid existing rights if such rights are established prior to the date the area was withdrawn from mineral entry.
C. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of Operations.
D. The Plan of Operations for mining projects describes the activities that will be conducted, the location and timing of those activities, and how the environment and resources in each area will be protected through compliance with federal and state requirements. (Consult ANILCA, Sections 503 and 504.)
E. Issue leases and other necessary associated permits in accordance with ANILCA, Sections 503 and 504.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. To the degree consistent with the overall purposes of National Monument management, provide a spectrum of wildland recreation opportunities that reflect the existing ecological, historical, and sociological conditions found within the Monument.
B. Continue to manage for the established ROS opportunities and appropriate activities throughout the LUD unless specifically closed to public use. Protect the integrity of National Monument resources through

integrated project planning and implementation within the National Monument.

1. Manage for the existing recreation settings and opportunities unless scheduled activities and practices cause a change in the ROS setting(s). Manage recreation use in a manner that is compatible with the long-term objectives of the Monument.
2. In locations where scheduled activities change the recreation setting(s), manage the new setting(s) in accordance with the appropriate ROS guidelines. Maintain the capability of the National Monument to provide appropriate quality recreation opportunities on a sustained basis.

C. Manage and regulate public recreation use within this LUD area in accordance with direction contained in the Plan of Operations for the respective mining operations. Outside the area covered by the Plan of Operations, manage recreation use and activities to meet the appropriate levels of social encounters, on-site development, methods of access, and visitor impacts indicated for the established ROS settings.

D. Consider additional public use cabins and/or shelters when needed to meet recreation demand within the National Monument.

E. With the help of user groups, develop "no trace" camping and use programs to encourage the dispersal and use of durable campsites. Where dispersal is not feasible, develop designated campsites and encourage their use.

F. Designation of motorized routes for off-highway vehicles (OHVs) in Nonwilderness National Monument LUDs is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route is compatible with Monument management objectives.

Establishment of Subunit Management Zones

A. Where necessary, to better accomplish Nonwilderness National Monument management objectives, establish special management zones within the Monument to deal with unique situations, or to integrate local issues and concerns with management activities.
   1. The boundaries of subunits should generally be located on identifiable topographic features and/or coincide with an established ROS area.

Recreation Special Uses

A. Major developments are generally not consistent with the objectives of this LUD. Development proposals require scrutiny for the magnitude and scope of conformance. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

B. Minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Manage the visual resource to be compatible with Nonwilderness Monument objectives.
   1. Adopted Scenic Integrity Objectives will range from High in those portions of the Monument without access, to Very Low in those portions developed in connection with mineral activities.
      Site-specific Scenic Integrity Objective and rehabilitation objectives

will be identified in specific Plan of Operations for mineral operations.

SUBSISTENCE

Subsistence: SUB

A. Assess the effect of continued existing subsistence uses on the long-term condition and natural succession of National Monument ecosystems.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production and withdrawn from the timber base. Any timber removal associated with mineral access and facility development will not count toward the Projected Timber Sale Quantity (PTSQ).
B. Commercial beach log salvage on coastlines may be authorized in accordance with ANILCA, Section 1315(f). Require that the recovery of logs above mean high tide be conducted from the water without roads or use of vehicles on uplands. Beach log salvage is defined as the recovery of logs that have been lost in transit and washed up on beaches.
C. Allow the following traditional personal use wood harvesting activities: 1) primarily beach logs on coastlines that can be removed without roads or use of vehicles on uplands, and 2) firewood in National Monuments, subject to reasonable regulations to protect Monument resources. The cutting of down trees in navigable rivers (sweepers) and removal of trees from the banks is discouraged. Cutting of green trees (except for emergency cutting of trolling poles) will be by permit only. (Consult ANILCA Section 1315(f) and 36 CFR 223.10.)

Timber Resource Improvements: TIM2

A. Rehabilitation, including reforestation, will be a function of mineral development and not a timber management objective.

TRAILS

Trail Administration: TRAI2

A. During the period of mining development and operation, plan and locate trails within this LUD to direct the public away from mining operations. Construct and maintain trails and related facilities so that they contribute to desired conditions and appear to be an appropriate part of the Monument environment and not an intrusion upon it. (Consult the Forest Service Trails Management Handbook.)

TRANSPORTATION

Transportation Operations: TRAN

A. New roads are not permitted, except: 1) to access valid mining claims and state or private lands not otherwise reasonably accessible; and 2) for transportation and utility systems in accordance with ANILCA, Title XI.
B. Further development of transportation systems in association with minerals extraction will be in accordance with an approved Plan of Operations and subsequent annual work plans.
C. Roads in this LUD are generally closed to public use.
D. Use of snowmachines, motorboats, aircraft, and non-motorized methods of surface transportation are permitted.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Mitigation, rehabilitation, and monitoring of mining impacts to wildlife habitats or populations shall be identified in environmental documents, Plan of Operations, and updates and amendments to each.
B. Address issues regarding management, introduction, and re-introduction of wildlife species consistent with national and regional policy.

Wildlife Habitat Improvement: WILD2

A. Wildlife habitat improvements must have as their principal objective the protection or restoration of the National Monument resources.
B. Scientific study of indigenous species and their habitats is encouraged with emphasis on identifying their roles in ecosystem dynamics and impacts of human uses.

RESEARCH NATURAL AREA

Goals

To preserve areas of ecological importance in their natural condition for the purposes of research, monitoring, education, and/or to maintain natural diversity.

To allow natural physical and biological processes to prevail without human intervention.

Objectives

Provide opportunities for baseline monitoring of ecological processes and non-manipulative research and observation.

Maintain the natural, undisturbed character of each area by:

- Permitting no permanent facilities, and no roads or trails except for research purposes or as otherwise provided by law;
- Recommending withdrawal of the area from mineral entry when necessary, subject to valid existing rights;
- Limiting recreation uses to those that do not affect or alter natural biological processes; and
- Allowing vegetative manipulation, fish enhancements, wildlife improvements, and/or soil and water improvements only if they will provide a closer approximation of natural conditions than would be possible otherwise.

Desired Condition

All Research Natural Areas (RNAs) on the Tongass National Forest are characterized by essentially unmodified environments in which natural ecological processes prevail. They remain undisturbed by human uses or activities, and provide quality opportunities for non-manipulative scientific research, observation, and study. The RNA network is representative of the predominant vegetation types, wildlife habitats, and aquatic communities of the Tongass. The "National Hierarchical Framework of Ecological Units" is used to identify sites to be represented in the RNA network. RNAs are used as monitoring reference areas to evaluate other lands where management activities are undertaken to assess the effectiveness of various standards, guidelines, and mitigation measures in reducing or preventing adverse environmental effects.

Research Natural Areas Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	None
Facilities	FAC	None
Fire	FIRE1	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC1	All
	KC2	All
Lands	LAND2	VII
	LAND4	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC1	All
	REC2	I(A)
	REC3	I,II,III(B),VI,VII
Riparian	RIP1	All
	RIP2	I,II(A-D)
Rural Community Assistance	RUR	All
Scenery	SCENE1	All
	SCENE2	I,II(A,E)
	SCENE3	All
Soil and Water	SW1, 2	All
	SW3	I(A:1-4,B-F)
Subsistence	SUB	All
Timber	TIM1	All
	TIM6	I(A-C;E)
Wetlands	WET	II
Wildlife	WILD1	I, II, V, VII,VIII, IX(A,C,E); X;XI; XII(A,B); XIII; XIV(A); XV; XVI;XVIII(A); XIX
	WILD4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-01
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. No buildings are allowed. (Consult Forest Service Manual [FSM] 4063 for authorizing temporary physical improvements, which requires approval by the Pacific Northwest Research Station Director.)

FIRE

Fire Suppression: FIRE1

Suppression Action

A. As a general guide, extinguish human-ignited fires that endanger Research Natural Areas as quickly as possible, using means that will cause minimal damage to the area. Naturally ignited fires are generally not suppressed unless they pose a threat to adjacent lands, life and property.

Fuel Improvements: FIRE2

Prescribed Fire

A. Use prescribed fire, including those ignited by management as well as natural ignitions, only if the land manager is certain that it will provide a closer approximation of natural vegetation than would be possible otherwise. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

A. Allow enhancement of fish habitat only if it will provide a closer approximation of natural conditions than would be possible otherwise.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Implement insect and disease management measures only if the Regional Forester and Pacific Northwest Research Station Director deem such action necessary to protect the features for which the RNA was established or proposed, or to protect adjacent resources. More specifically, 1) if endemic, consider no management; 2) if exotic, consider control; 3) if past insect and disease management activities (e.g., insect and disease and/or fire suppression) have exacerbated the threat to the RNA, consider control; and 4) if insects and disease in the RNA threaten adjacent lands, consider control.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

A. Locate, evaluate, and protect significant heritage resources. Interpretation may be provided when it can be done while maintaining unmodified natural conditions and processes.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this LUD.

B. Manage caves as Class 1 (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards and Guidelines.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Except as otherwise provided by law, allow only activities that will preserve the RNA in an unmodified condition, or activities that serve research purposes. (Consult FSM 2700 and 4063.)
   1. Coordinate all special use proposals with the Pacific Northwest Research Station Director, to ensure compatibility with research objectives.
   2. Do not authorize activities that modify natural ecological processes.
   3. Do not permit roads, fences, or signs in an RNA, unless they contribute to the management objectives or the protection of the area.
   4. Do not authorize new buildings, and remove existing unauthorized buildings when feasible.
   5. Consider authorizing temporary facilities, such as tent platforms, when directly and necessarily related to the taking of fish and wildlife, when approved by the Pacific Northwest Research Station Director in consultation with the Forest Supervisor. (See the Lands Forest-wide Standards and Guidelines for additional information.)
   6. Only the Pacific Northwest Research Station Director, after consultation with the Forest Supervisor, can approve plans for temporary water and atmospheric gauging stations and instrument shelters. Ensure that such plans contain provisions for tenure of the facility, actions to be taken, time limits for completion of actions, and identification of parties responsible for returning disturbed areas to a natural condition.
   7. Encourage the use of RNAs by scientists and educators. Refer research applicants to the Pacific Northwest Research Station Director, who will approve study plans in consultation with the Forest Supervisor. Upon approval of the study plan, the District Ranger authorizes access to the area.
   8. Do not allow road or trail development or special uses of a permanent nature, except for research and education purposes, unless otherwise provided by law.

Landline Location and Maintenance: LAND4

A. Ensure that the boundaries of RNAs are clearly identifiable in the field and in administrative records.

Land Ownership Adjustments: LAND6

A. Acquire private inholdings as opportunities arise.

LAW ENFORCEMENT

Law Enforcement Activities: LAW

A. Where a special closure is necessary to protect an RNA, recommend a closure order under provisions of 36 CFR 261.50. Ensure that such orders incorporate the special closure provisions of 36 CFR 261.53. (Consult FSM 4060.)

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG1 and MG2

Mineral Withdrawals

A. Designated RNAs may be withdrawn from mineral entry, subject to valid existing rights.
B. Permit reasonable access to mining claims with valid existing rights in accordance with the provisions of an approved Plan of Operations.

C. Mineral leasing and material sales are allowable in areas open to mineral entry at the discretion of the authorized officer and in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Provide only those specific types and intensities of recreation activities and opportunities that can be accommodated without endangering or altering the natural biological processes occurring within the RNA.
B. Issue appropriate orders regulating public use within the area that are necessary to ensure non-degradation of the natural environments for which the RNA was established or proposed.
C. Designation of motorized routes for off-highway vehicles in RNAs is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route can be accommodated without endangering or altering the natural biological processes occurring within the RNA.

Recreation Special Uses

A. Neither major nor minor developments are allowed because they are incompatible with the objectives of this LUD. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Allow the visual character of the area to evolve naturally.
   1. Apply Forest-wide Standards and Guidelines for the High Scenic Integrity Objective.

SOIL AND WATER

Watershed Resource Improvement: SW4

A. Soil and water resources evolve under natural conditions. Allow improvement of soil and water resources only if it will provide a closer approximation of natural conditions than would be possible otherwise.

SUBSISTENCE

Subsistence: SUB

A. Seek to provide customary and traditional subsistence opportunities consistent with the Alaska National Interest Lands Conservation Act of 1980.

TIMBER

Timber Resource Planning: TIM4

A. Forested lands are classified as not suitable for timber production.
B. Vegetation is allowed to evolve in natural undisturbed conditions. Non-native plants are removed if feasible. Avoid RNAs when other feasible locations for personal use wood cutting are available. If personal (free) use timber harvest is allowed, personal permit requirements must satisfy LUD objectives (refer to Chapter 4, Personal Use Program, Section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are unsuitable for timber harvest to ensure that the LUD objectives are fulfilled. Christmas tree cutting is incompatible with LUD objectives.
C. Administrative use of timber is generally incompatible.

TRAILS

Trail Activities: TRAI1

A. Locating trails in this LUD is not allowed unless they contribute to the objectives or the protection of the area, unless otherwise provided by law.

TRANSPORTATION

Transportation Operations

A. Unless otherwise provided by law, do not locate roads in this LUD unless they contribute to the objectives or protection of the area.

WILDLIFE

Wildlife Habitat Improvement: WILD2

A. Wildlife habitats evolve in natural conditions and non-native plants and animals are removed where possible. Allow wildlife habitat enhancement only if it provides a closer approximation of natural conditions.

SPECIAL INTEREST AREA

Goals

To provide for the inventory, maintenance, interpretation, and protection of the existing characteristics and attributes of areas with unique cultural, geological, botanical, zoological, recreational, scenic, or other special features.

Objectives

Provide opportunities for public study, use, and enjoyment of unique natural areas that are suitable to, and do not compromise, the characteristics of each area.

Allow only facilities and recreation developments that contribute to the interpretation of natural features or provide for compatible public uses, and that blend with the natural setting.

Provide for existing Recreation Opportunity Spectrum (ROS) opportunities and activities, unless public use is specifically restricted for the protection of other resources.

Consider withdrawing each area from mineral entry, subject to valid existing rights, on a case-by-case basis, if mineral development would not be consistent with protecting the unique features of the area.

Apply the High Scenic Integrity Objective except around developed interpretive facilities, and other developments or structures.

Allow fish, wildlife, and/or soil and water improvements if they are compatible with the purposes for which each Special Interest Area was established.

Develop management plans for those Special Interest Areas needing specific direction for achieving these goals and objectives.

Desired Condition

All Special Interest Areas on the Tongass National Forest are characterized by generally unmodified environments in which unique natural features are preserved. They remain largely undisturbed by human uses or activities, except for localized interpretive purposes and, in some cases, recreation developments, and provide quality opportunities for public study, use, and enjoyment. Each is an example of one or more cultural, geological, botanical, zoological, paleontological, or other special features unique within the Tongass.

- Cultural areas possess prehistoric/historic sites, buildings, or artifacts of National Register of Historic Places Significance or having special cultural associations with Native Americans.
- Scenic areas are comprised of landscapes of outstanding beauty or natural characteristics, such as glaciers, alpine, and areas of diverse vegetative patterns/coverage. These are areas that could be viewed for a long duration from specific vantage points, such as developed recreation sites, trails, anchorages, travel routes, and communities.
- Geological areas have unique geologic features of the earth's development, including caves, volcanic features, stratigraphic and structural features, and fossilized specimens of plants and animals.
- Botanical areas contain specimens or groups of plants, plant groups, and plant communities that are significant because of form, color, occurrence, habitat location, life history, arrangement, ecology, environment, rarity, and/or other features.
- Zoological areas contain unique or significant animals, animal groups, or animal communities, habitat, location, life history, ecology, environment, rarity, or other features.

Special Interest Area Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1 BEACH2	All I(A:1-6,10,11)
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP1 RIP2	All I,II(A-D,F)
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW1, 2, 4 SW3	All I(A:1-4,6-7,B-F),II,III
Subsistence	SUB	All
Timber	TIM1,7 TIM4 TIM6	All VII I(A-C;E),III
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 5, 6 TRAN4	All I-IV
Wetlands	WET	All
Wildlife	WILD1, 3, 4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-01
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow administrative, interpretive and information sites as needed to accomplish Special Interest Area objectives.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression action that minimizes fire suppression cost and resource damage. The action must meet the Special Interest Area objectives.
B. Suppression tactics will be compatible with Special Interest Area objectives.

Fuel Improvements: FIRE2

Prescribed Fire

A. Use management-ignited prescribed fire if it is compatible with the Special Interest Area objectives.
B. As a general management practice, do not use prescribed natural fire (consult FSM 5142).

FISH

Fish Habitat Planning: FISH2

A. Provide for public interpretation of fish habitats, habitat enhancement projects, and associated special fisheries conditions in appropriate Special Interest Areas.
B. Allow fish enhancement projects if they are compatible with Special Interest Area objectives.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Implement insect and disease management measures, consistent with Special Interest Area objectives, to protect the area's special features and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Identify significant heritage properties that include archaeological, historical, religious, or areas that contain specific Forest resources of heritage value used for Native art and craft forms.

Evaluation and Protection

A. Heritage resource properties that are classified as Special Interest Areas under 36 CFR 294 shall be evaluated for the National Register of Historic Places and as possible National Historic Landmarks as established in 36 CFR 63.
    1. Establish the exterior boundary of heritage resource properties on the ground if determined necessary to protect the site.
    2. Protect heritage resource properties from degradation from effects of management activities occurring within adjacent LUDs.

3. Manage for the availability and use of forest products for traditional Native heritage activities, while maintaining the physical and scientific integrity of the heritage resource properties.
4. Provide interpretive devices to explain special features and protective regulations.
5. Provide for interpretive activities that enhance the recreation experience, while protecting the unique values for which the heritage resource property was designated.
6. Prevent the use of heritage resource property when national policy or sensitivity of unique values requires closure.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Issue only those special use authorizations that will perpetuate the unique values that led to the designation or proposal to designate the Special Interest Area.
   1. Issue authorizations that will aid in the maintenance, improvement, and protection of the existing characteristics and attributes of the Special Interest Area.
   2. Analyze each proposal on a case-by-case basis, using an interdisciplinary process.

Land Ownership Adjustments: LAND6

A. Acquire private inholdings as opportunities arise.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations of Special Interest Areas, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Withdrawn from Mineral Entry

A. Consider recommending that Special Interest Areas be withdrawn from mineral entry, subject to valid existing rights, when mining would not be compatible with the area's objectives.
B. Permit reasonable access to mining claims with valid existing rights in accordance with the provisions of an approved Plan of Operations.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Regulate use based on studies reflecting the effect of recreation and tourism activities on the unique features for which the Special Interest Area is established. Studies need only be done where a conflict may exist.
   1. Consider providing interpretation of the unique characteristics of the Special Interest Area.
   2. If studies indicate human use adversely affects the special features, regulate use to eliminate the adverse effects or reduce use to acceptable levels.

3. Design and locate recreation-related structures to be compatible with characteristics of the area. Regulate user-created structures to avoid degradation of the unique character of the area (consult FSH 2309.23).
4. Restrict public motorized travel to designated travel routes except for powerboats operating on open water channels. Designation of motorized routes for off-highway vehicles in Special Interest Areas is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route is compatible with the characteristics of the area.

B. Before project planning, manage according to the existing ROS class. Adopt ROS classes through project planning; manage according to the adopted ROS class.

Recreation Special Uses

A. Major and minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Manage areas for their scenic integrity, with most areas in a naturally appearing condition.
   1. Apply Forest-wide Standards and Guidelines for the High Scenic Integrity Objective, except in the portions with developed recreation or interpretive facilities (such as Mendenhall Glacier, Ward Lake, and Blind Slough).
   2. In those portions with developed recreation or interpretive facilities (such as Mendenhall Glacier, Ward Lake, and Blind Slough), apply the Scenic Integrity Objective of Low in the foreground and Moderate in the middleground and background.
   3. Design visitor facilities to blend, to the extent feasible, with the natural setting.

TIMBER

Timber Resource Planning: TIM4

A. Special Interest Areas are classified as not suitable for timber production.
B. Limited salvage of windthrown timber shall be allowed along existing roads within Geologic Special Interest Areas, as long as karst and cave resource values are not compromised. Many Geologic Special Interest Areas contain areas of past harvest. Opportunities for management of the young-growth stands in these areas should be considered when karst and cave resource values are not compromised.
C. Avoid Special Interest Areas when other feasible locations for personal use wood and Christmas tree cutting are available. If personal (free) use timber harvest is allowed, personal use permit requirements must satisfy the Special Interest Area's objectives (refer to Chapter 4, Personal Use Program, Section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are not suitable for timber harvest to ensure that the LUD objectives are fulfilled.
D. Allow administrative use of timber if it is compatible with the objectives of the Special Use Area.

TRANSPORTATION

Transportation Operations: TRAN

A. Provide and manage a transportation system compatible with, or which will improve the interpretation of, the unique values of the Special Interest Area. (See exceptions under the Lands and Minerals and Geology sections of this prescription.)

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Provide for public interpretation of wildlife habitats and associated special wildlife conditions in appropriate Special Interest Areas.

Wildlife Habitat Improvement: WILD2

A. Allow wildlife improvement projects where they are compatible with the purposes for which the Special Interest Area was established. Prioritize treatment needs and scheduling.

REMOTE RECREATION

Goals

To provide extensive, unmodified natural settings for primitive types of recreation and tourism.

To provide opportunities for independence, closeness to nature, and self-reliance in environments offering a high degree of challenge and risk.

To minimize the effects of human uses, including subsistence use, so that there is no permanent or long-lasting evidence.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Primitive Recreation Opportunity Spectrum (ROS) class.

Provide trails and primitive facilities that are in harmony with the natural environment and promote primitive recreation experiences.

Apply the High Scenic Integrity Objective.

Fish enhancement projects may occur. Design wildlife habitat improvements to emulate natural conditions and appearance.

Desired Condition

Areas in the Remote Recreation LUD are characterized by extensive, unmodified natural environments. Ecological processes and natural conditions are not noticeably affected by past or current human uses or activities. Users have the opportunity to experience independence, closeness to nature, solitude and remoteness, and may pursue activities requiring self-reliance in an environment that offers a high degree of challenge and risk. Interactions between users are infrequent. Motorized access is limited to traditional means: boats, aircraft, and snowmachines. Facilities and structures are minimal and rustic in appearance.

Remote Recreation Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1 BEACH2	All I(A:1-6, 10,11)
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP1 RIP2	All I-II(A-D,F)
Rural Community Assistance	RUR	All
Scenery	SCENE1 SCENE2 SCENE3	All I,II(A,E) I(A,B)
Soil and Water	SW1, 2, 4 SW3	All I(A:1-4,6-7),II,III
Subsistence	SUB	All
Timber	TIM1,7 TIM4 TIM6	All VII I(A-C;E),III
Trails	TRAI	All
Wetlands	WET	All
Wildlife	WILD1 WILD2 WILD3,4	I-III;VII,VIII,IX(A,C,E); X;XI;XII(A,B); XIII;XIV(A);XV;XVI; XVIII(A);XIX I(A,B,C,D) All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-01
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Design and locate administrative and non-recreation structures to reduce adverse effects on recreation and tourism opportunities.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics that result in the least possible disturbance or evidence of human presence.
   1. Keep use of mechanized equipment to a minimum.
   2. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   3. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as part of rehabilitation, but within one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. As a general management practice, do not use management-ignited prescribed fire. Should it become necessary to consider the use of management-ignited prescribed fire, Forest Service Manual (FSM) 2324 provides direction.
B. As a general management practice, do not use prescribed natural fire. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

Fish Enhancement

A. Evaluate fish habitat improvement during project planning by considering: 1) effects resulting from the introduction of species not indigenous to the watershed; 2) the appropriateness of structures both in type and scale to the Primitive ROS setting; and 3) the need to provide well-distributed fisheries that support sport and commercial fisheries, subsistence, and community stability.

Fish Habitat Improvement: FISH3

A. Design development to minimize impact on the Primitive ROS setting.
B. Construction techniques should be compatible with the Primitive ROS setting.
C. Evidence of necessary land-disturbing activities for construction should not be visible to the casual observer after five years.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Implement insect and disease management practices to maintain forest health in this and adjacent LUDs.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks annually.

HERITAGE

Heritage Resource Activities: HSS1

Enhancement

A. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Interpretive information concerning heritage resources located inside this LUD should be in the form of exhibits and publications located outside the LUD.
   2. Heritage resources are available for scientific studies that are consistent with the primitive settings and activities, and heritage resource management objectives for the specific site.

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known heritage resources.
   2. Identify heritage properties to be nominated to the National Register of Historic Places.
   3. Identify heritage properties that require stabilization or other protective measures.
   4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this LUD.
B. Manage caves as Class 1 (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards and Guidelines.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those new activities that are compatible with the Remote Recreation objectives.
   1. Permit temporary structures and major fisheries improvement projects (such as hatcheries) only if they are widely dispersed.
   2. Authorized activities and structures should not be visually evident from a Visual Priority Route or Use Area (see Appendix F).

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral exploration and development. Mineral activities will be compatible with objectives of this LUD to the extent feasible.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Minerals Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the

provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Manage for Primitive ROS settings, recognizing other ROS settings may be present due to authorized activities, existing use patterns, and activities in adjacent LUDs. Strive to minimize these changes from the Primitive ROS objective.
B. Manage recreation and tourism use to meet the levels of social encounters, on-site development, and visitor impacts indicated by the ROS charts in the Recreation and Tourism Forest-wide Standards and Guidelines.
C. Designation of motorized routes for off-highway vehicles in Remote Recreation is generally not allowed. There may be limited exceptions where documented local traditional use related to subsistence activities has occurred or when connecting to routes in adjacent LUDs.

Recreation Special Uses

A. Major developments are generally not consistent with the objectives of this LUD. Development proposals require scrutiny of the magnitude and scope for LUD conformance. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.
B. Minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Provide a scenic condition in which activities are not visually evident to the casual observer.
   1. Apply Forest-wide Standards and Guidelines for the High Scenic Integrity Objective.
   2. Exceptions for small areas of non-conforming developments, such as recreation sites, may be considered on a case-by-case basis (see the Recreation and Tourism Forest-wide Standards and Guidelines in this prescription).

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Watersheds will be managed in a natural condition.
B. Use indigenous plants and materials to protect or improve the quality and/or quantity of the water resource or to stabilize soils.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production.
B. Taking of personal use wood will be limited to beach logs that can be removed from coastlines without roads or use of vehicles on uplands. The cutting down of trees in navigable rivers (sweepers) and removal of trees from the banks must be compatible with the management direction for fish habitat.
C. Allow administrative use of timber if LUD objectives are met.

TRANSPORTATION

Transportation Operations: TRAN

A. New roads are not permitted, except to access authorized mineral operations (or as excepted under Lands).
B. Existing roads in this LUD are closed to motorized uses subject to ANILCA provisions.
C. Use of snowmachines, motorboats, and aircraft is permitted.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Wildlife habitats are generally subject to ecological changes only.
B. Indigenous species are maintained.

Wildlife Habitat Improvement: WILD2

A. Habitat improvement projects are acceptable if designed to emulate natural conditions and appearance. Prioritize treatment needs and scheduling.

MUNICIPAL WATERSHED

The emphasis of this LUD is to provide protection of municipal water supplies for the following incorporated cities and boroughs: Ketchikan, Petersburg, Sitka, Juneau, Wrangell, Kake, Klawock, Craig, and Hydaburg. For the Petersburg watershed, consult 36 CFR 251.35. See Forest-wide Soil and Water Standards and Guidelines for state-classified public water supply source watershed protection outside of the Municipal Watershed LUDs.

Goals

To maintain these watersheds as municipal water supply reserves, in a manner that meets provisions of the Safe Drinking Water Act and State of Alaska Drinking Water Regulations and Water Quality Standards, in accordance with Forest Service Manual (FSM) 2542 and 36 CFR 251.9.

Objectives

Limit most management activities to the protection and maintenance of natural resources. Consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

Desired Condition

Lands managed as Municipal Watersheds are generally in a natural condition. Facilities or structures to provide municipal water supplies may be present. Uses or activities that could adversely affect water quality or supply do not occur. These watersheds provide municipal water that meets State of Alaska Drinking Water Regulations and Water Quality Standards.

Municipal Watershed Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1 BEACH2	All All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW1, 2, 4 SW3	All I(A1-4,6-7),II
Subsistence	SUB	All
Timber	TIM1 TIM4 TIM6	All VII(A,C) I(A-C,E),III
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 4, 5, 6,	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-01
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Construct no Forest Service administrative facilities. Facilities such as dams, reservoirs, and pipelines are consistent with municipal watershed objectives.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics that result in the least possible disturbance or evidence of human presence.
   1. Use of mechanized equipment should be kept to a minimum.
   2. Rehabilitation of all suppression lines and other evidence of human presence will occur as part of rehabilitation, no more than one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. As appropriate, normally use management-ignited prescribed fire rather than mechanical treatment to reduce the fire hazard from timber salvage. Management-ignited prescribed fire may also be used to maintain or improve watershed characteristics as long as there is no adverse impact to water quality.
B. As a general management practice, do not use prescribed natural fire. (Consult FSM 5142).

FISH

Fish Habitat Planning: FISH2

A. Plan the construction and maintenance of fish improvement projects only if they are compatible with the municipal watershed objectives.
   1. Restrict fish habitat improvements that result in reduced water quality for a municipality using the water from the affected stream.
   2. When planning fish habitat improvement projects, consider the effects of anticipated municipal water withdrawals.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Maintain or improve forest health. Implement insect and disease management measures to protect the watershed and adjacent resources.
B. Timber may be salvaged at the request of municipality.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known heritage resources.
   2. Identify heritage properties to be nominated to the National Register of Historic Places.

3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of heritage resources for public education and enjoyment. Interpretation will generally occur outside the municipal watershed.

KARST AND CAVES

Cave Management Program: KC2

A. Caves may be made available for general public recreation and education uses, only when compatible with watershed objectives and in consultation with the municipality.
B. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Manage special uses in accordance with the legislation establishing the watershed (if any) and to safeguard the quality and quantity of municipal water supplies. Limit special uses to those that support development activities. Coordinate all proposals with affected municipalities and obtain written concurrence before issuing special-use authorizations. (Consult 36 CFR 251.9, 36 CFR 251.35, and FSM 2700.)
   1. Analyze special-use proposals on a case-by-case basis, using an interdisciplinary process, to determine probable effects.
   2. Do not permit any activities that would lead to violation of State of Alaska Drinking Water Regulations.
   3. Terminate or bring into conformance, existing uses that are causing violation of State of Alaska Drinking Water Regulations or degradation of water quality.
B. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

Land Ownership Adjustments: LAND6

A. Protect municipal interests in land adjustment decisions. Unless otherwise prohibited by law, encourage actions that result in the affected municipality owning the land.
   1. Dispose of lands only when allowed to by applicable legislation.
   2. When disposal is contemplated, involve the affected municipality early in the process.
   3. Encourage state land selections under the Statehood Act for subsequent transfer to the municipal governing body.
   4. If legislation allows, consider exchange of these lands with the affected municipality.
   5. Do not acquire National Forest System lands for municipal watershed purposes.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Interpret geologic, paleontologic, and historic mining for municipal watersheds, where appropriate.
B. Maintain inventory of surficial geology, geomorphic features, geologic hazards, and paleontological resources. Maintain reports of municipal watershed assessments.

Minerals and Geology Administration: MG2

Mineral Withdrawals

A. Municipal watersheds may be withdrawn from mineral entry on a case-by-case basis after consultation with the municipality, subject to valid existing rights.
B. Assure claimants with valid and existing rights are allowed ingress and egress granted under the General Mining Law of 1872, the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Minerals Regulations under 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.
D. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operation

A. Provide only for those activities and recreation use levels that can be accommodated without detriment to water quality and flow.
B. Issue appropriate orders for regulating public use within the watershed, in cooperation with the municipality.
C. Designation of motorized routes for off-highway vehicles in Municipal Watersheds is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route does not degrade water quality or flow.
D. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

Recreation Special Uses

A. Major and minor developments are generally not consistent with objectives for this LUD. Proposals for development will require scrutiny of the magnitude and scope of the project to see if they meet LUD objectives. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.
B. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

SCENERY

Scenery Operations: SCENE1

A. Considerations for the scenery resource will be secondary to the objectives of the municipal watershed. Scenic quality conditions are the result of the municipality's watershed management objectives.
    1. Design management activities within the watershed to minimize scenery impacts as seen from Visual Priority Travel Routes and Use Areas (see Appendix F).

SOIL AND WATER

Watershed Resource Planning: SW3

A. Maintain water quality consistent with Alaska Water Quality Standards (18 AAC 70) and protect source watersheds consistent with the federal

Safe Drinking Water Act and the Alaska Drinking Water Regulations (18 AAC 80)

B. Do not authorize activities that create or maintain a condition that has a significant potential to cause or allow the pollution or contamination of a public water system.

C. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution. Refer to FSM 2542 and 36 CFR 251.9 for guidance. Refer to 18 AAC 80.620(c)(3) for systems that seek to avoid filtration.

D. Develop site-specific Best Management Practices (BMPs) for any authorized activity. Consider at a minimum BMPs that limit ground disturbance, restrict public access (in consultation with municipality), and restrict hazardous materials and hazardous waste.

Watershed Resource Improvement: SW4

A. Soil and water protective measures are applied to protect the watersheds and water resources for municipal water use. Soil and water improvement will occur on all disturbances that threaten the watershed values.

B. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

SUBSISTENCE

Subsistence: SUB

A. Allow subsistence activities in accordance with the federal, state, municipal, and other local laws.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production.

B. No timber harvest is scheduled. Salvage may be considered on a case-by-case basis in consultation with the municipality.

C. Avoid Municipal Watersheds when other feasible locations for personal use wood and Christmas tree cutting are available. If personal (free) use timber harvest is allowed, personal permit requirements must satisfy the Municipal Watershed's objectives (refer to Chapter 4, Personal Use Program, Section TIM6). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are not suitable for timber harvest to ensure that the LUD objectives are fulfilled.

C. Allow administrative use of timber if LUD objectives are met.

TRAILS

Trails: TRAI1

A. Trail systems are limited to those that can be accommodated without detriment to water quality and flow. Trails may be considered on a case-by-case basis in consultation with the municipality. For the Petersburg watershed, consult 36 CFR 251.35.

TRANSPORTATION

Transportation Operations: TRAN

A. Allow roads needed for the routine operation, maintenance, and improvement of the municipal water system and watershed. Allow roads to provide for timber salvage operations if they are permitted by the watershed's establishing legislation (if any) and after consultation with

the affected municipality. If no feasible alternative exists, roads may occur in this area.

1. Conduct a transportation analysis to determine optimum road location and design standards to ensure minimum adverse impacts to the watershed.
2. Coordinate road management with the affected municipality. Manage access in accordance with the legislation establishing the watershed (if any).
3. Road construction may occur if it is consistent with legislation establishing the watershed (if any), and if it can be done without unacceptable degradation of water quality.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Manage wildlife habitats for uses compatible with the watershed management objectives. Prioritize treatment needs and scheduling.

OLD-GROWTH HABITAT

Goals

Maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources.

Manage early seral conifer stands to achieve old-growth forest characteristic structure and composition based upon site capability. Use old growth definitions as outlined in Ecological Definitions for Old-growth Forest Types in Southeast Alaska (R10-TP-28).

Objectives

Provide old-growth forest habitats, in combination with other LUDs, to maintain viable populations of native and desired non-native fish and wildlife species and subspecies that may be closely associated with old-growth forests.

Contribute to the habitat capability of fish and wildlife resources to support sustainable human subsistence and recreational uses.

Maintain components of flora and fauna biodiversity and ecological processes associated with old-growth forests.

Allow existing natural or previously harvested early seral conifer stands to evolve naturally to old-growth forest habitats, or apply silvicultural treatments to accelerate forest succession to achieve old-growth forest structural features. Consider practices such as thinning, release and weeding, pruning, and fertilization to promote accelerated development of old-growth characteristics.

To the extent feasible, limit roads, facilities, and authorized uses to those compatible with old-growth forest habitat management objectives.

Desired Condition

All forested areas within this LUD have attained old-growth forest characteristics. A diversity of old-growth habitat types and associated species and subspecies and ecological processes are represented.

Old-Growth Habitat Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP1	All
	RIP2	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD1	I-III; V-XIX
	WILD2,3,4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	All except DC-YG-05, and S-YG-SCENE-01
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-01
Forest-wide Plan Components	All	All

3 Management Prescriptions

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow administrative and recreational facilities when compatible with LUD objectives.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards for this LUD, such as soil and watershed concerns.

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire only where its use maintains old-growth characteristics.
B. As a general management practice, do not use prescribed natural fire. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

A. Emphasize the protection and restoration of fish habitat, fish production, and aquatic biodiversity. Enhancement projects that may change the natural distribution of fish species within a watershed are consistent with LUD objectives.

FOREST HEALTH

Forest Health: HEALTH1

A. Insect and disease management measures consistent with this LUD may be implemented to protect the old-growth forest component and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
    1. Identify, classify, and evaluate known heritage resources.
    2. Identify heritage properties to be nominated to the National Register of Historic Places.
    3. Identify heritage properties that require stabilization or other protective measures.
    4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Permit only improvements (such as tent platforms, fish weirs, minor waterlines, minor powerlines, etc.) that are compatible with LUD objectives.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Mining Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Mineral Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Manage recreation and tourism use to meet LUD objectives for fish and wildlife resources and habitat.
    1. Design and locate recreation-related structures to be compatible with habitat needs of old-growth associated species.
B. Generally provide for Semi-Primitive ROS settings, recognizing that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent LUDs.
C. Designation of motorized routes for off-highway vehicles is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route does not degrade water quality or flow.

Recreation Special Uses

A. Minor recreation and tourism developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Apply Forest-wide Standards and Guidelines for High Scenic Integrity Objective. Design activities to not be visually evident to the casual observer.
B. Exceptions for small areas of non-conforming developments, such as recreational developments, transportation developments, log transfer facilities, and mining development, may be considered on a case-by-case basis. Use designs and materials that are compatible with forms, colors, and textures found in the characteristic landscape.

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements only where deteriorated soil and hydrologic conditions create a threat to the goals and objectives for which the old-growth habitat is managed. Rehabilitation or stabilization projects will seek to enable the area to retain its natural appearance.

TIMBER

Timber Resource Planning: TIM4

A. Old-growth forest land is classified as not suitable for timber production.
B. Beach log salvage is compatible with this LUD.
C. Avoid Old-growth Habitat areas when other feasible locations for personal use sawtimber, firewood, and Christmas tree cutting are available. If personal (free) use timber harvest is allowed, personal use permit requirements must satisfy LUD objectives (refer to Chapter 4, Personal Use Program, Section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are unsuitable for timber harvest to ensure that the LUD objectives are fulfilled.
D. Harvest of bridge stringer logs is allowed.

Timber Sale Preparation: TIM5

A. Salvage of dead or down material is permitted, but is limited to roadside windfall and hazard trees immediately adjacent to existing permanent roads and catastrophic windthrow events or large insect or disease outbreaks (generally exceeding 100 acres). Limited standing undamaged timber (up to 20 percent of total salvage) may be removed only for safety reasons or for feasibility of salvage operations. Salvage sales must be compatible with LUD objectives as determined through the environmental analysis process. Stands once salvaged will be managed to achieve old-growth habitat characteristics. During the environmental analysis, consider the scale of the affected area salvaged. If reserve design criteria are no longer met, adjust reserve locations to better meet reserve size, spacing, and composition criteria if lands are available (see Wildlife Habitat Planning, section B below, and Appendix K).

TRANSPORTATION

Transportation Operations: TRAN

A. New road construction is generally inconsistent with Old-growth Habitat LUD objectives, but new roads may be constructed if no feasible alternative is available.
   1. Perform integrated logging system and transportation analysis (including Access and Travel management planning) to determine if other feasible routes avoiding this LUD exist during the project environmental analysis process. If no feasible alternative routes exist, locate, design, and construct roads in a manner that minimizes adverse impact to fish and wildlife resources to the extent feasible, and will be compatible with LUD objectives. Keep clearing widths to the minimum feasible. Consider enforcement costs of road closures in the integrated logging system and transportation analysis.
   2. If reserve design criteria are no longer met, adjust reserve locations to meet reserve size, spacing, and composition criteria if lands are available (see Wildlife Habitat Planning, section B below, and Appendix K).
   3. For timber salvage, use logging systems that do not require additional permanent road construction.

B. Manage existing roads to meet LUD objectives.
   1. In Old-growth Habitat LUDs with existing roads, develop or update road management objectives to meet LUD objectives (see Wildlife [brown bear and wolf] and Transportation Forest-wide Standards and Guidelines). Use of existing roads may continue pending the update of the access and travel management plan.
   2. Road management objectives may include temporary or permanent road closures, and may be specific to individual road specification types (e.g., keep mainlines open, close arterial and spur).
   3. Road maintenance and reconstruction may be permitted if consistent with road management objectives.

C. Sites for log transfer facilities are generally not appropriate in this LUD. If no other feasible alternative sites exist, locate, design, construct, and manage these facilities in a manner that will be compatible with LUD objectives. Consider the Log Transfer Facility Guidelines (Appendix G) when making the selection for the facility.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Maintain contiguous blocks of old-growth forest habitat in a forest-wide system of old-growth reserves to support viable and well-distributed populations of old-growth associated species and subspecies.

B. A system of large, medium, and small old-growth habitat reserves has been identified and mapped in the Forest Plan as part of the Old-growth Habitat Conservation Strategy. The mapped large and medium reserves generally achieve reserve strategy objectives, and few major modifications are anticipated. The small mapped reserves have received differing levels of ground-truthing and integration of site-specific information in their design. During project-level environmental analysis, for projects areas that include or are adjacent to mapped old-growth habitat reserves, the size, spacing, and habitat composition of mapped reserves may be further evaluated (consult Appendix K).
   1. Adjust reserves not meeting the minimum criteria to meet or exceed the minimum criteria.
   2. Reserve location, composition, and size may otherwise also be adjusted. Alternative reserves must provide comparable achievement of the Old-growth Habitat LUD goals and objectives. Determination as to comparability must consider the criteria listed in Appendix K.
   3. Adjustments to individual reserves described in 1 and 2 above are not expected to require a significant plan amendment. Adjustments Forest-wide shall be monitored yearly to assess whether a significant plan amendment is warranted on the basis of cumulative changes.

C. Allow previously harvested or natural early seral stands to develop into old-growth, or provide young-growth management to accelerate attainment of old-growth characteristics (see WILD2, below).

Wildlife Habitat Restoration: WILD2

A. Manage early seral forest stands for purposes of wildlife habitat development. Allow techniques such as thinning, pruning, and planting to accelerate development of advanced seral stand structure, including maintenance of shrub and forb understory.

SEMI-REMOTE RECREATION

Goals

To provide predominantly natural or natural-appearing settings for semi-primitive types of recreation and tourism, and occasional enclaves of concentrated recreation and tourism facilities.

To provide opportunities for a moderate degree of independence, closeness to nature, and self-reliance in environments requiring challenging motorized or non-motorized forms of transportation.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Semi-Primitive Recreation Opportunity Spectrum (ROS) classes. Enclaves of concentrated recreation and tourism developments within the LUD or management activities in adjacent LUDs may cause the ROS setting to become Rural.

Determine on a case-by-case basis whether roads, trails, and other areas should be closed to motorized recreation activities. If so, update the Access and Travel Management Plan (ATM). If not, the use of boats, aircraft, and snowmachines for traditional activities is allowed.

Permit small-scale, rustic recreation and tourism facilities, and occasional enclaves of concentrated recreation and tourism facilities.

Apply the Moderate Scenic Integrity Objective to any developments, facilities, or structures.

Fish enhancement and wildlife habitat improvement may occur.

Desired Condition

Areas in the Semi-Remote Recreation LUD are characterized by generally unmodified natural environments. Ecological processes and natural conditions are only minimally affected by past or current human uses or activities. Users have the opportunity to experience a moderate degree of independence, closeness to nature, solitude, and remoteness, with some areas offering motorized opportunities and others non-motorized opportunities (except for the traditional uses of boats, aircraft, and snowmachines). Interactions between users are infrequent. Facilities and structures may be minimal or occasionally may be larger in scale, but will be rustic in appearance, or in harmony with the natural setting.

Semi-Remote Recreation Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1 BEACH2	All I(A:1-6, 10, 11)
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP RIP2	All II(A-D,F)
Rural Community Assistance	RUR	All
Scenery	SCENE1 SCENE2 SCENE3	All I,II(A,E) I(A,B)
Soil and Water	SW1, 2, 4 SW3	All I(A:1-4,6-7),II,III
Subsistence	SUB	All
Timber	TIM1,7 TIM4 TIM6	All VII I(A-C;E),III
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 4, 5, 6	All
Wetlands	WET	All
Wildlife	WILD1 WILD2 WILD3, 4	I-III;VI-XIX I(A,B,C,D) All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

3 Management Prescriptions

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Design and locate administrative and non-recreation structures to reduce adverse effects on recreation and tourism opportunities.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics that result in the least possible disturbance or evidence of human presence.
   1. Suppression tactics will avoid human/bear conflicts and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   2. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as part of rehabilitation activities, but within one year after the fire occurs.
   3. Mechanized fireline construction will avoid important wildlife habitat areas such as meadows, bogs, and riparian areas.

Fuel Improvements: FIRE2

Prescribed Fire

A. Management ignitions may be used as an acceptable means of fuels management and wildlife habitat improvement so long as its use is compatible with LUD objectives.
B. As a general management practice, do not use prescribed natural fire (consult Forest Service Manual [FSM] 5142).

FOREST HEALTH

Forest Health Management: HEALTH1

A. Insect and disease management measures consistent with LUD objectives may be implemented to protect recreation and tourism opportunities, and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Enhancement

A. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Provide interpretive information concerning heritage resources located within this LUD to users in the form of exhibits and publications.
   2. Heritage resources are available for scientific studies that are consistent with the semi-primitive settings and activities, and heritage resource management objectives for the specific site.

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known heritage resources.

2. Identify heritage properties to be nominated to the National Register of Historic Places.
3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize facilities and uses consistent with Semi-Remote Recreation LUD objectives.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral exploration and development.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Minerals Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Generally, manage for Semi-Primitive ROS settings. Enclaves of concentrated recreation and tourism developments within the LUD or management activities in adjacent LUDs may cause the ROS setting to become Roaded Natural, Roaded Modified, or Rural.
B. Designation of motorized routes for OHVs in Semi-Remote Recreation is allowed and will be planned in accordance with 36 CFR 212.
    1. Manage roads for Maintenance Level 2, except when Maintenance Level 3 roads provide access to or through the LUD. Occasional enclaves of concentrated recreation and tourism developments could warrant higher service levels in those areas.
C. Where roads, trails, and other areas are closed to motorized recreation activities or vehicles, provide Semi-Primitive Non-Motorized recreation opportunities.
    1. Permit use of snowmachines, motorboats, and aircraft for traditional activities.

D. Permit small scale, rustic recreation and tourism facilities such as recreation cabins, shelters, docks, and enclaves of concentrated recreation and tourism development.
   1. During all construction activity:
      a. Minimize site modification,
      b. Minimize vegetation clearing adjacent to the site, and
      c. Use colors found in the natural environment.

Recreation Special Uses

A. Major and minor developments are compatible with this LUD. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Design resource activities to remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color, or texture common to the landscape. New form, line, color, or texture will be subordinate to the characteristic landscape.
   1. Apply Forest-wide Standards and Guidelines for the Moderate Scenic Integrity Objective.
   2. There may be cases where facilities associated with a concentrated recreation or tourism development may not feasibly meet the Moderate objective. After analysis of the proposal and public involvement, the NEPA decision document for this project should determine the specific Scenic Integrity Objective for the development. The environmental analysis shall also prescribe design guidelines necessary to meet this scenery objective. During the project's design phase, the Forest Service shall be closely involved in the review of design work as it evolves.
   3. Design visitor facilities to blend, to the extent feasible, with the natural setting.

B. Rehabilitation techniques may be used to restore disturbed landscapes to be compatible with the Semi-Primitive setting.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production.

B. The following types of uses may be authorized when they meet LUD objectives.
   1. Removal or use of trees for improvement of recreation and tourism opportunities, such as clearing for vistas, campsites, or trails.
   2. Removal or use of trees cut as a part of some other authorized use within this LUD (e.g., clearing for a fish ladder or road).
   3. Trees may be cut for use in construction and maintenance of authorized structures when it is not feasible to obtain the necessary material from outside this LUD.

C. Personal use wood harvest from beach log salvage is fully compatible with this LUD. Personal use wood cutting may be allowed based on local determination. If personal (free) use timber harvest is allowed, personal use permit requirements must satisfy the LUD's objectives (refer to Chapter 4, Personal Use Program, Section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are unsuitable for timber harvest to ensure that the LUD objectives are fulfilled.

Timber Sale Preparation: TIM5

A. Salvage will be limited to dead and/or down material resulting from events such as windthrow and insect or disease mortality. Limited standing green timber may be harvested during salvage operations for safety and operational considerations.

TRANSPORTATION

Transportation Operations: TRAN

A. Where Semi-Primitive Motorized recreation opportunities are emphasized, existing low standard roads are generally managed for use by high clearance or OHVs, snowmobiles, or motorcycles subject to an approved Access and Travel Management Plan. Generally, new roads are not constructed in this area, except to link existing roads or provide access to adjacent LUDs.
   1. Limit the design standards of Forest development roads to those commensurate with the intended use.
   2. Maintain, as necessary, to provide passage of planned traffic.
   3. Locate and design new roads to consider Semi-Primitive recreation opportunities in this LUD.

B. Where Semi-Primitive Non-Motorized recreation opportunities are emphasized, provide foot or cross-country ski trails. Roads and trails may be closed or seasonally restricted. Close or obliterate existing roads except for transportation system links.

C. Sites for log transfer facilities may be considered in this LUD. If no other feasible alternative sites exist, locate, design, construct, and manage these facilities in a manner that will be compatible with LUD objectives. Consider the Log Transfer Facility Guidelines (Appendix G) when making the selection for the facility.

LAND USE DESIGNATION II

Goals

To manage the 20 areas (see Appendix J) designated in perpetuity as LUD II according to the direction for LUD II areas in the 1979 Tongass Land Management Plan, as amended.

Manage these areas in a roadless state to retain their wildland character.

Objectives

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated by the Primitive and Semi-Primitive Recreation Opportunity Spectrum (ROS) classes. Apply the LUD II direction from the 1979 Tongass Land Management Plan, which is summarized as follows:

- Prohibit commercial timber harvest. Permit salvage logging only to prevent significant damage to other resources. Allow personal use of wood for cabin logs, fuelwood, float logs, trolling poles, etc.
- Permit water and power developments if designed to be compatible with the primitive characteristics of the area.
- Permit roads only for access to authorized uses, transportation needs identified by the state, or vital linkages.
- Allow mineral development.
- Permit access by boats, aircraft, and snowmachines, unless such uses become excessive.
- Permit fish and wildlife habitat improvements. Design structures to minimize the effects to recreation resources.
- Permit primitive recreational facilities.
- Generally exclude major concentrated recreational facilities.

Salvage logging, personal use of wood, water and power development, fish and wildlife habitat improvement, and research facilities will be designed to be compatible with the primitive characteristics of the area.

Desired Condition

Areas in this LUD are characterized by extensive, generally unmodified natural environments, and retain their wildland character. Ecological processes and natural conditions are only minimally affected by past or current human uses or activities. Users have the opportunity to experience a high-to-moderate degree of independence, closeness to nature, solitude, and remoteness, and may pursue activities requiring self-reliance, challenge, and risk. Interactions between users are infrequent. Recreational facilities and structures are primitive.

Land Use Designation II
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1 BEACH2	All I(A:1-6, 10, 11)
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP1 RIP2	All I,II(A-D,F,G)
Rural Community Assistance	RUR	All
Scenery	SCENE1, 3 SCENE2	All I,II(A,B,E)
Soil and Water	SW1, 2, 4 SW3	All I(A:1-4,6-7),II,III
Subsistence	SUB	All
Timber	TIM1,7 TIM4 TIM6	All VII I(A-C,E)
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 4, 5, 6	All
Wetlands	WET	All
Wildlife	WILD1 WILD2 WILD3,4	I-III,VI-XIX I(A,B,C,D) All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

3 Management Prescriptions

Apply the following LUD Standards and Guidelines:

FACILITIES

Administrative Facilities: FAC2 and FAC3

A. Administrative facilities may be constructed in a manner that blends with the natural character of the area.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics that result in the least possible disturbance or evidence of human presence.
   1. Suppression tactics will minimize human/bear conflicts, and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   2. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as part of rehabilitation activities, and no longer than one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire for fuels management, insect and disease protection, and wildlife habitat improvement.
B. As a general management practice, do not use prescribed natural fire, although natural ignitions may be used to perpetuate natural ecological processes. (Consult Forest Service Manual [FSM] 5142.)

FISH

Fish Habitat Planning: FISH2

Fish Enhancement

A. Improvements such as fishways, fish hatcheries, or aquaculture sites may be built. Appropriate landscape management techniques will be applied in the design and construction of such improvements to reduce impacts on recreational resources and scenery.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Insect and disease management measures consistent with this LUD may be implemented to protect these and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Enhancement

A. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses.
   1. Heritage resources are available for scientific studies that are consistent with the primitive settings and activities, and heritage resource management objectives for the specific site.

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.

1. Identify, classify, and evaluate known heritage resources.
2. Identify heritage properties to be nominated to the National Register of Historic Places.
3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Water and power developments are authorized if they can be designed to retain the overall primitive characteristics of the allocated area.
B. Except as authorized by the TTRA, authorize only those activities that are consistent with the wildland character of the area.

MINERAL AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral exploration and development.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980, and Forest Service Minerals Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with 36 CFR 228 and FSM 2800.
D. Manage mineral exploration and development activities to be compatible with the emphasis on maintaining the wildland character of the LUD II Land Use Designation.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. Generally provide for Semi-Primitive ROS settings, recognizing that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent LUDs.
   1. Primitive recreation facilities, such as recreation cabins, boat docks, moorings, and trails may be constructed and maintained.
B. Major concentrated recreation facilities, such as development scale IV and V (those heavily modified or with a high degree of site modification) will generally be excluded.
C. If a transportation link is constructed through this LUD, recreation facilities needed to serve the traveling public, to reduce impacts of

recreation use to adjacent wildlands, or to provide interpretation, may be constructed in proximity to the transportation link.

D. Designation of motorized routes for off-highway vehicles in LUD II is generally not allowed. There may be limited exceptions where documented local traditional use related to subsistence activities has occurred, or when connecting to routes in adjacent LUDs.

Recreation Special Uses

A. Major developments are generally not consistent with the objectives of the LUD. Development proposals require scrutiny of the magnitude and scope for LUD conformance. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

B. Minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Each proposal will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Landscapes are managed to retain a natural-appearing scenic condition, where activities are not visually evident to the casual observer.
   1. Apply Forest-wide Standards and Guidelines for the High Scenic Integrity Objective.
   2. Some authorized activities and improvements may not meet the High Scenic Integrity Objective, based on project analysis. However, seek to mitigate scenic impacts through location, siting, design, material, and coloring of structures.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production. Commercial timber harvesting is not permitted.

B. Timber can be salvaged only to prevent significant damage to other resources. Examples are removal of windfall in an important fish stream or control of epidemic insect infestations.

C. Personal use of wood is allowed for cabin logs, fuel wood, float logs, trolling poles, and other similar uses.

TRANSPORTATION

Transportation Operations: TRAN

A. Existing roads are generally closed to highway vehicular use. Any proposed roads will use the following guidelines:
   1. Allow Forest transportation system linkages including roads and transfer facilities. Forest transportation system linkages refer to necessary additions to the permanent road network. Such linkages may be built through LUD II areas when either: 1) no other feasible routes exist to access adjacent LUDs, or 2) it can be demonstrated that the routing through the LUD II area is clearly environmentally preferable and site-specific mitigation measures can be designed to minimize the impact of the road on the surrounding LUD II area. A clear need to build such linkages must be demonstrated through a comparative analysis of feasible transportation alternatives through the NEPA process and approved by the Forest Supervisor.
   2. Roads, other than transportation linkages, will not be built except to serve authorized activities such as mining, renewable energy

developments, aquaculture developments, or transportation needs determined by the State of Alaska.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Wildlife habitats will generally evolve in natural successional stages. Habitat improvement is permitted. Prioritize treatment needs and scheduling.

WILD RIVER

Goals

To manage designated river segments according to the Wild and Scenic Rivers Act (Public Law 90-542), National Wild and Scenic Rivers System; Final Revised Guidelines for Eligibility, Classification, and Management of River Areas (Federal Register Volume 47, Number 173, 1982), and direction in Forest Service manuals and handbooks.

To maintain, enhance, and protect the free-flowing character and outstandingly remarkable values of rivers and river segments designated as Wild Rivers and included in the National Wild and Scenic Rivers System.

To maintain Wild Rivers in a natural, free-flowing, unmodified condition, and provide recreation and tourism opportunities affording a high degree of independence, closeness to nature, and self-reliance.

To manage recommended Wild River segments to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them.

Objectives

Manage Wild River segments to maintain an enduring wildland and free-flowing river resource, while providing for access and use consistent with the Wild and Scenic Rivers Act and the Alaska National Interest Lands Conservation Act of 1980 (ANILCA).

Withdraw Wild River segments from mineral entry when designated by Congress, subject to valid existing rights, and classify forested lands as not suitable for timber production.

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Primitive or Semi-Primitive Recreation Opportunity Spectrum (ROS) classes.

Apply the High Scenic Integrity Objective within the river corridor.

Desired Condition

Wild Rivers and river segments are in a natural, free-flowing, and undisturbed condition. Ecological processes and changes predominate. The outstandingly remarkable values for which the river was designated remain outstanding and remarkable. Recreation users have the opportunity for primitive and semi-primitive experiences, solitude, and remoteness in a natural setting. Interactions between users are infrequent, and evidence of human activities is minimal. Facilities and structures are rustic in appearance and promote primitive recreation and tourism experiences.

Wild River Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH1	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH1	I(B,C)
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC1, 3	All
	REC2	I,II(A-C),III
Riparian	RIP1	All
	RIP2	I,II(A-D,F)
Rural Community Assistance	RUR	All
Scenery	SCENE1	All
	SCENE2	I,II(A,E)
	SCENE3	I(A,B)
Soil and Water	SW1, 2, 4	All
	SW3	I(A:1-4,B-F),II
Subsistence	SUB	All
Timber	TIM1, 7	All
	TIM4	VII
	TIM6	I(A,E)
Trails	TRAI1	I(A-E;F:1,3,5,6)
	TRAI2	All
Transportation	TRAN	None
Wetlands	WET	All
Wildlife	WILD1	I-III;VI-VIII; IX(A,C,E);X;XI; XII(A,B);XIII-XIX
	WILD2	I(A,B,C,D)
	WILD4	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All
Transportation Systems Corridors Direction	All	All
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Avoid construction of new administrative facilities unless needed for administration of river resources and users. If needed, facilities will be rustic and kept to a minimum.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Emphasize suppression tactics that result in the least possible disturbance or evidence of human presence.
   1. Use of mechanized equipment will be addressed in the management plan developed for each river.
   2. Suppression tactics will minimize human/bear conflicts, and existing policy will be emphasized to leave no trash or any other kinds of bear attractants in the area.
   3. Rehabilitation of all campsites, suppression lines, and other evidence of human presence will occur as soon as part of rehabilitation activities, but within one year after the fire occurs.

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire that emulates natural ecological processes.
B. As a general management practice, do not allow prescribed natural fire. (Consult FSM 5142.)

FISH

Fish Habitat Planning: FISH2

Fish Enhancement

A. Fish enhancement projects may be allowed after considering the following during project planning:
   1. The primitive character of the area can be maintained. Realize that an enhanced fishery could result in increased recreation and tourism use.
   2. Effects on Wild River ecosystems due to the introduction of species not indigenous to the watershed.
   3. If a naturally appearing free-flowing condition can be maintained.
   4. Effects on the outstandingly remarkable values for which the river was designated.
   5. The appropriateness of structures both in type and scale to the primitive and natural character of the area.
   6. Ability to meet a High Scenic Integrity Objective.

Fish Habitat Improvement: FISH3

A. Use construction techniques that are consistent with the ROS setting.
   1. Land-disturbing activities necessary for construction will be temporary.
   2. Design development to minimize impact on the primitive character of the corridor.
B. Permanent stream obstructions are not permitted.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Implement insect and disease management measures consistent with this LUD to protect the character and values of Wild Rivers.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Enhancement

A. Heritage resources are available for scientific study to the extent that the study is consistent with the intent of the Wild and Scenic Rivers Act.
B. Heritage resources are available for recreational, scenic, scientific, educational, conservation, and historic uses, consistent with Wild River management.
   1. Generally, provide interpretive information concerning heritage resources to users in the form of exhibits and publications outside the Wild River corridor.

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
   1. Identify, classify, and evaluate known heritage resources.
   2. Identify heritage properties to be nominated to the National Register of Historic Places.
   3. Identify heritage properties that require stabilization or other protective measures.
   4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation will generally occur outside this LUD.
B. Manage caves as Class 1 (Sensitive) or Class 3 (Undeveloped) as described in the Karst and Cave Resources Forest-wide Standards and Guidelines.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those uses consistent with management objectives. (Consult the Land Management Planning Handbook 1909.12, Chapter 80.)
   1. Do not authorize water supply dams or major diversions.
   2. Do not authorize development of hydroelectric power facilities for 1) projects exempted from licensing by the Federal Energy Regulatory Commission (FERC), or 2) projects on rivers designated through Sections 2, 3, and 5(a) of the Wild and Scenic Rivers Act. The Forest Service will recommend to FERC that a project on a river found eligible and suitable for inclusion in the Wild and Scenic Rivers System should not be licensed because it is inconsistent with the purposes for which the National Forest was created or acquired and, if necessary, impose conditions on any license issued for a project on that river that fully protect its outstandingly remarkable characteristics and free-flowing nature.

3. Maintain the natural appearance and primitive character of the river area. Do not authorize flood control dams, levees, or similar structures in the channel or river corridor.
4. Do not authorize new structures that would have a direct adverse effect on river values.
5. Transportation and utility systems will be considered in accordance with ANILCA, Title XI.
6. Allow motorized access in accordance with ANILCA Sections 811 and 1110(b).

Land Ownership Administration: LAND6

A. Acquire private inholdings in the river corridor as opportunities arise.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Resource Administration: MG2

Wild Rivers

A. When designated by Congress, Forest lands within 0.25 mile of the river are withdrawn from mineral entry subject to valid existing rights.
B. Permit reasonable access to valid existing claims in accordance with the provisions of an approved Plan of Operations.
C. Encourage use of state-of-the-art techniques for developing mineral resources to reduce impacts to Wild Rivers to the extent feasible. Include mitigation measures that are compatible with the scale of proposed development and commensurate with potential resource impacts.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Management and Operations

A. To the degree consistent with the overall purposes of designation, provide primitive wildland recreation opportunities that reflect the ecological, historical, and sociological conditions found within the river corridor and adjacent lands.
B. Manage for Primitive and Semi-Primitive ROS settings and activities that emphasize existing opportunities. Protect the integrity of river resources through integrated project planning and implementation.
    1. Manage for the existing or less developed recreation settings and opportunities unless activities and practices authorized by the Forest Service officer with delegated authority causes change in the ROS setting(s). Seek to minimize the changes through project design and mitigation. Manage recreation and tourism use in a manner that is compatible with the long-term objectives of the LUD.
C. Manage recreation and tourism use and activities to meet the appropriate levels of social encounters, on-site development, methods of access, and visitor impacts indicated for the ROS settings. (Consult the ROS Forest Service Handbook and the Recreation and Tourism Forest-wide Standards and Guidelines.)
D. Minor, rustic, recreation and tourism facilities, including public recreation cabins, floatplane and boat docks, trails, and trail bridges may be constructed in the river corridor.

E. Designation of motorized routes for off-highway vehicles in Wild Rivers is generally not allowed. Designation may only occur where documented local traditional use has occurred and the route is compatible with a Primitive or Semi-Primitive ROS setting.

Wild River Management

A. Manage Wild River segments to maintain an enduring wildland and free-flowing river resource, while providing access and use consistent with the purposes of the Wild and Scenic Rivers Act, as amended, and ANILCA (Public Law 96-487). Traditional activities and practices authorized by ANILCA will be regulated or restricted only where it is determined that the effects of continued or expanded use is likely to cause one or more of the following:
   1. The degradation of the long-term successional changes in wildland and water ecosystems. Adequate determination of the cumulative effects of activities and equipment use must be demonstrated as well as site-specific or singular effects.
   2. It is detrimental to the natural dynamics of the composition or structure of wildland and water ecosystems.
   3. It is detrimental to identified objects of heritage, historic, prehistoric, and scientific interest.
   4. It is detrimental to the ROS setting conditions or where the cumulative effects of various activities are likely to become detrimental to those settings.
   5. A specific use is not in accordance with applicable law.

B. Encourage and enlist public and private sector interest groups to work together in meeting Wild River management objectives. Emphasize programs that help to educate the public in the appropriate conduct of activities and uses within Wild River corridors.

Recreation Special Uses

A. Major developments are not consistent with agency policy and regulations. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

B. Minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Landscapes are managed to retain a natural-appearing scenic condition, where activities are not visually evident to the casual observer.
   1. Apply the Forest-wide Standards and Guidelines for the High Scenic Integrity Objective to all areas within the river corridor. The area adjacent to the corridor is managed according to the guidelines of the adjacent LUD.
   2. Low scenic-impact recreation and tourism facilities, cabins, infrequent fish or wildlife management activities, and other authorized structures that are compatible with the primitive character of the corridor may be acceptable and should be considered on a case-by-case basis. (Also see the Recreation and Tourism Standards and Guidelines in this prescription.)

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements within 0.25 mile each side of the river only where deteriorated soil or hydrologic conditions create a threat to the values for which the river is managed. Use, whenever possible, indigenous plant species and materials in implementing land treatment measures to protect or improve the quality and/or quantity of the water resource or when stabilizing or improving the productivity of the soil resource. (Consult FSM 2350 and 2520).

B. Maintain water quality and flow to protect the river's outstandingly remarkable values.

SUBSISTENCE

Subsistence: SUB

A. Allow subsistence activities in Wild River corridors, subject to reasonable regulations to protect Wild River resources.

TIMBER

Timber Resource Planning: TIM4

A. Forested land is classified as not suitable for timber production.

B. Silvicultural treatments are limited to control of insect and disease.

C. Salvage harvest of dead or down material may occur. Removal of naturally occurring dead trees in and along the river shoreline, including sweepers extending into the river from the bank should consider the protection of the outstandingly remarkable values and fish habitat in accordance with agreements with the state.

D. Taking of personal use wood is limited to beach logs on the portion of the river influenced by tidal action. Only beach logs that can be removed without roads or use of vehicles on uplands may be taken.

TRANSPORTATION

Transportation Operations: TRAN

A. Permit no new roads, except to access valid mining claims or as transportation and utility systems in accordance with ANILCA Title XI.

B. Close roads in this LUD to motorized vehicle use.

C. Allow continued existing use of snowmachines and aircraft; however, restrictions may be imposed on a case-by-case basis to protect outstandingly remarkable river values.

WILDLIFE

Wildlife Habitat Improvement: WILD2

A. Allow wildlife habitat improvements where their principal objective is the protection or restoration of Wild River resources, and enhancement of outstandingly remarkable values.

SCENIC RIVER

Goals

To manage designated river segments according to the Wild and Scenic Rivers Act (Public Law 90-542), National Wild and Scenic Rivers System; Final Revised Guidelines for Eligibility, Classification, and Management of River Areas (Federal Register Volume 47, Number 173, 1982), and direction in Forest Service manuals and handbooks.

To maintain, enhance, and protect the free-flowing character and outstandingly remarkable values of rivers and river segments designated as Scenic Rivers and included in the National Wild and Scenic Rivers System.

To maintain Scenic Rivers in a natural or naturally appearing, free-flowing condition, and provide recreation and tourism opportunities meeting these expectations.

To manage recommended Scenic River segments to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them.

Objectives

Manage Scenic River segments to maintain an enduring wildland and free-flowing river resource, while providing access and use consistent with the Wild and Scenic Rivers Act and the Alaska National Interest Lands Conservation Act (ANILCA).

Permit timber harvest on lands suitable for timber production if adjacent lands are being managed for that purpose, in accordance with the standards and guidelines for the stated Scenic Integrity Objectives.

Manage recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the desired Recreation Opportunity Spectrum (ROS) class (generally Semi-Primitive).

Permit roads to provide access to, and occasionally cross, the river. Roads, except for short segments, are not visually evident to river users.

Apply the High Scenic Integrity Objective to foreground areas as seen from the river, roads, and trails, and Moderate for all other seen areas within the river corridor.

Desired Condition

Scenic Rivers and river segments are in a generally unmodified, free-flowing condition. Ecological processes and changes may be somewhat affected by human uses. The outstandingly remarkable values for which the river was designated remain outstanding and remarkable. Recreation and tourism users have the opportunity for experiences ranging from Primitive to Roaded Natural in a natural-appearing setting. Resource activities within the river corridor are not visually evident to the casual observer. Interactions between users are moderate. Facilities and structures are rustic in appearance, and promote semi-primitive recreation experiences and/or public safety. A yield of timber may be produced that contributes to the Forest-wide PTSQ.

Scenic River Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 4, 5, 6	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All
Transportation Systems Corridors Direction	All	All
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Administrative and authorized non-recreation facilities should not be evident as viewed from the river and its banks.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards and guidelines for this LUD (e.g., the soil, water, and scenery resources).

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire that meets the High Scenic Integrity Objective and meets all soil and water quality standards.

1. Treat all activity fuels to meet the High Scenic Integrity Objective within one year following timber harvest.

B. As a general management practice, do not allow prescribed natural fire. (Consult Forest Service Manual [FSM] 5142.)

FISH

Fish Habitat Planning: FISH2

A. Provide for public interpretation of fish habitats, habitat enhancement projects, and special fisheries conditions in appropriate Scenic Rivers.

B. Evaluate fish habitat improvement during project planning by considering:

1. Effects on the free flow of water.
2. Effects on the outstandingly remarkable values for which the river was designated.
3. Stream obstructions are discouraged.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Maintain or improve forest health through insect and disease management practices.

1. Allow sanitation and salvage of infested timber to protect the character and the outstandingly remarkable values of the Scenic River.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.

1. Identify, classify, and evaluate known heritage resources.
2. Identify heritage properties to be nominated to the National Register of Historic Places.
3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those uses consistent with river management objectives.

1. Do not authorize water supply dams or major diversions.
2. Do not authorize development of hydroelectric power facilities for: 1) projects exempted from licensing by the Federal Energy Regulatory Commission (FERC) or 2) projects on rivers designated through Sections 2, 3, and 5(a) of the Wild and Scenic Rivers Act. The Forest Service will recommend to FERC that a project on a river found eligible and suitable for inclusion in the Wild and Scenic Rivers System should not be licensed because it is inconsistent with

the purposes for which the National Forest was created or acquired and, if necessary, impose conditions on any license issued for a project on that river that fully protect its outstandingly remarkable characteristics and free-flowing nature.

3. Do not authorize flood control dams and levees.
4. Roads may occasionally bridge river areas. Permit short stretches of conspicuous or longer stretches of inconspicuous and well-screened, roads or railroads, on a case-by-case basis, depending upon intended use.
5. Do not authorize new structures that would have a direct adverse effect on river values.
6. Allow transportation and utility systems in accordance with ANILCA, Title XI.
7. Allow motorized access in accordance with ANILCA, Sections 811 and 1110(b).

Land Ownership Administration: LAND6

A. Acquire private inholdings as opportunities arise.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Resource Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and Forest Service Minerals Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites, as well as authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Continue to provide the spectrum of outdoor recreation opportunities in accordance with the existing capabilities of this LUD as indicated by the ROS inventory.
    1. Manage for the existing recreation settings and opportunities until scheduled activities and practices cause a change in the ROS setting(s). Manage recreation use in a manner that is compatible with the long-term objectives of this LUD.
    2. In locations where scheduled activities change the recreation setting(s), manage the new setting(s) in accordance with the appropriate ROS guidelines. Maintain the capability of this LUD to provide appropriate quality recreation opportunities on a sustained basis.
    3. Provide recreation facilities consistent with the ROS setting. Where possible, major facilities should be screened from the river. On-site interpretation may be provided.
    4. Manage use and activities for the safety and convenience of the user, and protection and interpretation of the river resources.

Experiences may include those requiring moderate isolation to those influenced by humans in a modified setting. Recreation facilities may include campgrounds, picnic areas, lodges, resorts, and interpretive sites and similar facilities.

B. Designation of motorized routes for off-highway vehicles in Scenic Rivers is allowed and will be planned in accordance with 36 CFR 212.

Recreation Special Uses

A. Major developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

B. Minor developments are fully compatible with this LUD; applicants are encouraged to examine these areas first. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Maintain or improve the scenic character of river segments that qualified the river as a Scenic River, particularly where scenic quality is an outstandingly remarkable value. In foreground settings, design management activities to not be visually evident to the casual observer. Management activities should be visually subordinate to the characteristic landscape in the middleground distance zone. In all settings, activities should utilize existing form, line, color, and texture found in the characteristic landscape.

   1. Apply to the river corridor the High Scenic Integrity Objective for lands in the foreground distance zone and the Moderate Scenic Integrity Objective for lands in the middleground and background distance zone, as seen from the river and other Visual Priority Travel Routes and Use Areas (see Appendix F). In areas not seen from the river or Visual Priority Travel Routes and Use Areas, apply the Low Scenic Integrity Objective. However, if scenery is listed as one of the outstandingly remarkable values, apply the Moderate Scenic Integrity Objective. These objectives define the maximum limit of allowable change to the scenic character of the area; less visible evidence of activities is acceptable. Note that these standards and guidelines only apply to lands within the Scenic River LUD. The area adjacent to this LUD is managed according to the guidelines of the adjacent LUD.
   2. Exceptions to the Scenic Integrity Objective for small areas of non-conforming developments, such as recreation sites, transportation developments, and mining development, may be considered on a case-by-case basis. Use designs and materials that are compatible with forms, colors, and textures found in the characteristic landscape.

B. Locate and design recreation facilities and other authorized activities within the river corridor in a manner most compatible with the High Scenic Integrity Objective. Recreation facilities visible from the river generally are limited to those providing access to water-based recreation opportunities, such as fishing access points, trails, and boat launch facilities. Other recreation facilities, such as cabins, are generally screened from view from the river.

C. The following guidelines provide direction for timber harvest activities to meet Scenic Integrity Objectives and Visual Absorption Capability (VAC) settings. These conditions are approximate estimates for planning

purposes and should be referred to as guidelines during project analysis. Ground conditions may indicate a need to be more restrictive or relaxed in scheduling harvest to meet the intent of the Scenic Integrity Objective.

1. High - Timber harvest activities are not evident to the casual Forest visitor.
2. Moderate - Although timber harvest activities are evident, they must remain subordinate to the characteristic landscape.
3. Low - Timber harvest activities may dominate the characteristic landscape, yet will be designed to borrow from form and line found in the naturally- occurring landscape.
4. Typical regeneration methods and approximate unit sizes for landscapes of different visual absorption capabilities for the Scenic Integrity Objectives adopted in this LUD are described below.

e) Scenic Integrity Objective High:

- Low VAC: Single tree or group selection (openings less than 2 acres)
- Intermediate VAC: Single tree or clearcut (openings approximately 5 to 15 acres)
- High VAC: Clearcut (openings approximately 15 to 30 acres)

f) Scenic Integrity Objective Moderate:

- Low VAC: Group selection or clearcut (openings approximately 2 to 10 acres)
- Intermediate VAC: Clearcut (openings approximately 10 to 40 acres)
- High VAC: Clearcut (openings approximately 40 to 60 acres)

g) Scenic Integrity Objective Low:

- Low VAC: Clearcut (openings approximately 15 to 40 acres)
- Intermediate VAC: Clearcut (openings approximately 40 to 60 acres)
- High VAC: Clearcut (openings approximately 60 to 100 acres)

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements within the river corridor only where deteriorated soil or hydrologic conditions create a threat to the values for which the river is managed. Use, whenever possible, indigenous plant species and materials in implementing land treatment measures to protect or improve the quality and/or quantity of the water resource, or when stabilizing or improving the productivity of the soil resource. (Consult FSM 2350 and 2520.)

SUBSISTENCE

Subsistence: SUB

A. Allow subsistence activities in the Scenic River LUD, subject to reasonable regulations to protect Scenic River resources.

TIMBER

Timber Resource Planning: TIM4

A. Lands suitable for old-growth timber production are available for harvest if the adjacent LUD allows timber harvest.
B. Personal use sawtimber, firewood, and Christmas tree harvesting is compatible with this LUD provided that management objectives are met.

Discourage cutting within 100 feet each side of the river (also see the Riparian Forest-wide Standards and Guidelines). The cutting of down trees in navigable rivers (sweepers) must be compatible with the management direction for fish habitat and protect the outstandingly remarkable characteristics of the river.

C. Scenic rivers contribute to the old-growth conservation strategy. If project-level planning considers timber harvest within these areas, ensure that sufficient old growth will still be maintained to meet the size, spacing, composition, and connectivity requirements of the old-growth strategy specified in the Forest Plan.

D. Project analysis, development of environmental documents, and design for timber activities will enhance or maintain the outstandingly remarkable values within the river corridor.

Timber Sale Preparation: TIM5

A. Timber harvest activities may include all applicable silvicultural systems. Project analysis will recognize the effects of color, tone, texture, line, slope, size, and edge on the Scenic River.

B. Salvage harvest of dead or down material may occur. Removal of naturally occurring dead trees in and along the river shoreline, including "sweepers" extending into the river from the bank, should consider the protection of outstandingly remarkable values and fish habitat.

TRANSPORTATION

Transportation Operations: TRAN

A. Develop and manage the transportation system in a manner compatible with Scenic River classification.
   1. Allow the construction of Forest Development Roads that may provide access to the river. Roads may occasionally bridge the river.
   2. Locate and design roads that, except for short segments or at bridge crossings, are not evident to the casual observer traveling on the river. Do not allow long stretches of conspicuous and well-traveled roads parallel the riverbank.
   3. Limit the design standards of Forest Development Roads to those necessary to accommodate single use or a controlled mix of traffic (i.e., Traffic Service Level C or D). Occasional roads will be at a higher service level, but that will be an exception.
   4. Consider the recreation emphasis of this LUD during development of road management objectives.

WILDLIFE

Wildlife Habitat Improvement: WILD2

A. Allow wildlife habitat improvement where the principal objective is the protection or restoration of river resources, and the enhancement of outstandingly remarkable values.

RECREATIONAL RIVER

Goals

To manage designated river segments according to the Wild and Scenic Rivers Act (Public Law 90-542), National Wild and Scenic Rivers System; Final Revised Guidelines for Eligibility, Classification, and Management of River Areas (Federal Register Volume 47, Number 173, 1982), and direction in Forest Service manuals and handbooks.

To maintain, improve, and protect the essentially free-flowing character and outstandingly remarkable values of rivers and river segments designated as Recreational Rivers and included in the National Wild and Scenic Rivers System.

To provide recreation opportunities in a pleasing, though modified, generally free-flowing river setting, while allowing timber harvest, transportation, and other developments.

To manage recommended Recreational River segments to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them.

Objectives

Manage Recreational River segments to maintain a free-flowing river resource, while providing for access and use consistent with the Wild and Scenic Rivers Act and the Alaska National Interest Lands Conservation Act of 1980 (ANILCA).

Permit timber harvest on lands suitable for timber production if adjacent lands are being managed for that purpose, in accordance with the standards and guidelines for the stated Scenic Integrity Objectives.

Manage recreation use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the desired Recreation Opportunity Spectrum (ROS) class (generally Roaded Natural).

Allow roads to access, parallel, or cross the river. In general, design access roads to accommodate passenger cars, and open them to public use.

Apply the Moderate Scenic Integrity Objective to foreground areas within the corridor seen from the river, roads, and recreation facilities, and Low to all other seen areas within the river corridor.

Desired Condition

Recreational Rivers and river segments are in a generally unmodified to modified, essentially free-flowing condition. Ecological processes and changes may be affected by human uses. The outstandingly remarkable values for which the river was designated remain outstanding and remarkable. Recreation users have the opportunity for a variety and range of experiences in a modified but pleasing setting. Resource activities and developments may be present within the river corridor, and may dominate some areas. A variety of scenic conditions occur. Interactions between users may be moderate to high. A yield of timber may be produced, which contributes to Forest-wide PTSQ.

Recreational River Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN1, 2, 3, 4, 5, 6	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All
Transportation Systems Corridors Direction	All	All
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow the location of administrative facilities and public information centers in the river corridor if they do not have adverse effects on the values this LUD is intended to protect.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards and guidelines for this LUD (e.g., soil, water, and scenery resources).

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire that meets the Moderate Scenic Integrity Objective as well as all soil and water quality standards.

1. Treat all activity fuels to meet the Moderate Scenic Integrity Objective within one year following timber harvest.

B. As a general management practice, do not allow prescribed natural fire. (Consult Forest Service Manual [FSM] 5142.)

FISH

Fish Habitat Planning: FISH2

A. Provide for public interpretation of fish habitats, habitat enhancement projects, and associated special fisheries conditions in appropriate Recreational Rivers.

B. Evaluate fish habitat improvement during project planning by considering:

1. Effects on the free flow of water.
2. Effects on the outstandingly remarkable values for which the river was designated.
3. Stream obstructions will be discouraged.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Maintain or improve forest health through insect and disease management practices. Implement these practices in compliance with recreation objectives.

1. Encourage hazard tree management in developed areas.
2. Permit salvage and sanitation of infested timber.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, interpretation, and allocation.

1. Identify, classify, and evaluate known heritage resources.
2. Identify heritage properties to be nominated to the National Register of Historic Places.
3. Identify heritage properties that require stabilization or other protective measures.
4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those uses consistent with river management objectives.

1. Allow existing low dams, diversion works, rip rap, and other minor similar instream structures to remain. Generally, prohibit new structures of this nature.
2. Authorize no development of hydroelectric power facilities for: 1) projects exempted from licensing by the Federal Energy Regulatory Commission (FERC), or 2) projects on rivers designated through

sections 2, 3, and 5(a) of the Wild and Scenic Rivers Act. The Forest Service will recommend to FERC that a project on a river found eligible and suitable for inclusion in the Wild and Scenic Rivers System should not be licensed because it is inconsistent with the purposes for which the National Forest was created or acquired and, if necessary, impose conditions on any license issued for a project on that river that fully protect its outstandingly remarkable characteristics and free-flowing nature.

3. Permit maintenance of existing flood control structures. Do not authorize new ones.
4. Consider authorizing construction of roads, trails, or railroads on a case-by-case basis. They may be authorized on one, or both, river banks and there may be several bridge crossings and numerous river access points. Permit new structures as necessary and appropriate.
5. Transportation and utility systems will be allowed in accordance with ANILCA, Title XI.
6. Allow motorized access in accordance with ANILCA, Sections 811 and 1110(b).

Land Ownership Administration: LAND6

A. Acquire private inholdings as opportunities arise.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and Forest Service Minerals Regulations 36 CFR 228.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Continue to provide the spectrum of outdoor recreation opportunities in accordance with the existing capabilities of this LUD as indicated by the ROS inventory.
   1. Manage for the existing recreation settings and opportunities until scheduled activities and practices cause a change in the ROS setting(s). Manage recreation use in a manner that is compatible with the long-term objectives of this LUD.
   2. In locations where scheduled activities change the recreation setting(s), manage the new setting(s) in accordance with the appropriate ROS guidelines. Maintain the capability of this LUD to provide appropriate quality recreation opportunities on a sustained basis.

3. Provide recreation facilities consistent with the ROS setting. Where possible, major facilities should be screened from the river. On-site interpretation may be provided.
4. Manage use and activities for the safety and convenience of the user, and protection and interpretation of the river resources. Experiences may include those requiring moderate isolation to those influenced by humans in a modified setting. Recreation facilities may include campgrounds, picnic areas, lodges, resorts, and interpretive sites and similar facilities.

B. Motorized routes for off-highway vehicles in Recreation River LUDs may be allowed and will be planned in accordance with 36 CFR 212.

Recreation Special Uses

A. Major and minor developments are compatible with this LUD; applicants are encouraged to examine these areas first. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. In foreground settings, design management activities to be subordinate to the characteristic landscape. Management activities may dominate areas seen in the middleground distance. In all settings, activities should utilize existing form, line, color, and texture found in the characteristic landscape.
   1. Apply the Moderate Scenic Integrity Objective in the foreground distance zone and the Low Scenic Integrity Objective in the middleground and background distance zones, as seen from Visual Priority Travel Routes and Use Areas (see Appendix F). In areas not seen from the river or Visual Priority Travel Routes and Use Areas, apply the Very Low Scenic Integrity Objective. However, if scenery is listed as one of the outstandingly remarkable values, apply the Moderate Scenic Integrity Objective in the middleground, background, and unseen areas. These objectives define the maximum limit of allowable change to scenic character of the area; less visible evidence of activities is acceptable. Note that these standards and guidelines apply only to the lands within the Recreational River LUD. The area adjacent to this LUD is managed according to the guidelines of the adjacent LUD.
   2. Exceptions for small areas of non-conforming developments, such as recreation sites, transportation developments, log transfer facilities, and mining development, may be considered on a case-by-case basis. Use designs and materials that are compatible with forms, colors, and textures found in the characteristic landscape.

B. The following guidelines provide direction for timber harvest activities to meet Scenic Integrity Objectives and Visual Absorption Capability (VAC) settings. These estimates are appropriate for planning purposes and should be referred to as guidelines. Ground conditions may indicate a need to be more restrictive or relaxed in scheduling harvest to meet the intent of the Scenic Integrity Objective.
   1. <u>Moderate</u> - Although timber harvest activities are evident, they must remain subordinate to the characteristic landscape.
   2. <u>Low</u> - Timber harvest activities may dominate the characteristic landscape, yet will be designed to borrow from form and line found in the naturally- occurring landscape.

3. Very Low - Timber harvest activities may visually dominate the original characteristic landscape. This Scenic Integrity Objective should be met within 1 year in the foreground distance zone and within 5 years in the middle and background distances.
4. Typical regeneration methods and approximate unit sizes for landscapes of different visual absorption capabilities for the Scenic Integrity Objectives adopted in this LUD are described below.
   a) Scenic Integrity Objective. Moderate:
   - Low VAC: Group selection or clearcut (openings approximately 2 to 10 acres)
   - Intermediate VAC: Clearcut (openings approximately 10 to 40 acres)
   - High VAC: Clearcut (openings approximately 40 to 60 acres)

   b) Scenic Integrity Objective Low:
   - Low VAC: Clearcut (openings approximately 15 to 40 acres)
   - Intermediate VAC: Clearcut (openings approximately 40 to 60 acres)
   - High VAC: Clearcut (openings approximately 60 to 100 acres)

   c) Scenic Integrity Objective Very Low:
   - Low VAC: Clearcut (openings approximately 50 to 75 acres)
   - Intermediate VAC: Clearcut (openings approximately 80 to 100 acres)
   - High VAC: Clearcut (openings approximately 80 to 100 acres)

SOIL AND WATER

Watershed Resource Improvements: SW4

A. Undertake watershed improvements within the river corridor where deteriorated soil or hydrologic conditions exist. Use, whenever possible, indigenous plant species and materials in implementing land treatment measures to protect or improve the quality and/or quantity of the water resource, or when stabilizing or improving the productivity of the soil resource. (Consult FSM 2350 and 2520.)
B. Carry out land use activities to maintain water quality.

TIMBER

Timber Resource Planning: TIM4

A. Lands suitable for old-growth timber production are available for harvest if the adjacent LUD allows timber harvest. Silvicultural treatment is integrated with site and area development to provide healthy tree stands, vegetative diversity, and forage production for indigenous wildlife populations. Insect and disease control, and landscaping are performed to maintain the aesthetic value of both existing recreation and potential recreation sites.
B. Personal use sawtimber, firewood, and Christmas tree harvesting is compatible with this LUD provided that LUD objectives are met, consistent with the level of use allowed by the ROS. Discourage cutting within 100 feet each side of the river (also see the Riparian Forest-wide Standards and Guidelines). The cutting of down trees in navigable rivers (sweepers) must be compatible with the management direction for fish habitat and the protection of the outstandingly remarkable characteristics of the river.

C. Recreational rivers contribute to the old-growth conservation strategy. If project-level planning considers timber harvest within these areas, ensure that sufficient old growth will still be maintained to meet the size, spacing, composition, and connectivity requirements of the old-growth strategy specified in the Forest Plan.
D. Project design, analysis, and development of environmental documents for timber activities will emphasize enhancement or maintenance of the outstandingly remarkable river values.
E. Administrative use of timber is allowable or allowed for structures within the LUD and for other uses outside the LUD if compatible with LUD objectives.

Timber Sale Preparation: TIM5

A. Timber harvest activities may include all applicable silvicultural systems. Project analysis will recognize the effects of color, tone, texture, line, slope, size, and edge on the scenic viewshed.
B. Salvage harvest of dead or down material may occur. Removal of dead trees in and along the river shoreline, including sweepers extending into the river from the bank, should consider the protection of the outstandingly remarkable values and fish habitat.

TRANSPORTATION

Transportation Operations: TRAN

A. Develop and manage the transportation system in a manner compatible with Recreational River classification.
   1. Allow the construction of Forest Development Roads. The river may be readily accessible by road. Roads may parallel the river bank and be conspicuous in places when viewed from the river.
   2. If accessible for public use, design roads to accommodate passenger cars and open them to public use (consistent with road management objectives), although traffic controls may be used during periods of high use (i.e., design to Traffic Service Level C or above).

EXPERIMENTAL FOREST

Goals

To provide for long-term opportunities for forest research and demonstration essential to managing forest resources.

Objectives

The Director of the Pacific Northwest Research Station will prepare a development plan for each experimental forest in consultation with the Forest Supervisor designed to achieve the desired research objectives. Experimental forests are jointly administered by the Pacific Northwest Research Station and the Ranger District in which it is located.

Allow timber harvest, as specified in the development plan, for research and demonstration purposes. Timber harvest is not counted towards the Projected Timber Sale Quantity (PTSQ), and forest lands are classified as not suitable for timber production.

Roads and trails will generally complement research and interpretation. Allow facilities necessary for ongoing research, as specified in the experimental forest's development plan.

Allow fish enhancement or wildlife improvement projects for research purposes, or if they are compatible with the establishment objectives of the experimental forest.

Desired Condition

Each experimental forest is managed for the purposes for which it was established. Ongoing research provides useful needed information for forest management. Non-research types of activities and uses may be compatible with, and do not interfere with, research or demonstration objectives. Opportunities for public use of roads may be present.

Experimental Forest Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM2,7 TIM6	All I(A-D)
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

BEACH AND ESTUARY FRINGE

Beach and Estuary Fringe: BEACH2

A. Management activities, more intensive than those allowed in the Beach and Estuary Fringe Forest-wide Standards and Guidelines, may be allowed to assess their impacts on beach and estuary fringe resources. Prior to these activities, appropriate NEPA analysis and decision by the Forest Service officer with delegated authority will occur.

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Allow facilities necessary for ongoing research and its interpretation, as specified in the individual experimental forest's development plan.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression action that minimizes fire suppression cost and resource damage. The action must meet the objectives of the experimental forest's development plan.
B. Suppression tactics will be compatible with the Experimental Forest's objectives.

Fuel Improvements: FIRE2

Prescribed Fire

A. Allow management-ignited prescribed fire if it is compatible with the experimental forest's objectives.
B. As a general management practice, do not use prescribed natural fire, although it may be needed to perpetuate natural ecological processes. Should it become necessary to consider the use of prescribed natural fire, the Forest Plan must be amended to analyze, justify, and approve prescribed natural fire programs. (Consult Forest Service Manual 5142).

FISH

Fish Habitat Planning: FISH2

A. Fish habitat may be managed differently (e.g., using more intensive timber harvest techniques) than identified in the Riparian Forest-wide Standards and Guidelines to help meet the experimental forest's research objectives. In some cases, Forest-wide direction listed under FISH2 may not apply.
B. Fish enhancement projects may occur if they are compatible with the experimental forest's establishment objectives. Fish habitat manipulation may also occur to provide research into the costs, benefits, and effects of such manipulations with appropriate NEPA analysis and decision by the Forest Service officer with delegated authority.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Coordinate insect and disease management activities with the Pacific Northwest Research Station and with the Experimental Forest's Development Plan.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory/Evaluation

A. Develop priorities and schedule management activities to implement heritage resource inventory, evaluation, protection, and interpretation.
    1. Identify, classify, and evaluate known heritage resources.
    2. Identify heritage properties to be nominated to the National Register of Historic Places.
    3. Identify heritage properties that require stabilization or other protective measures.
    4. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Issue only those special use authorizations consistent with the experimental forest's research objectives.
   1. Coordinate all proposed new uses with the Pacific Northwest Research Station Director to ensure compatibility with research objectives.

Land Ownership Adjustments: LAND6

A. Acquire private inholdings as opportunities arise.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Depending on the research objectives, portions or all of the Experimental Forest may be withdrawn from mineral entry.
B. Claimants with claims located within this LUD retain valid existing rights if such rights were established prior to the date the experimental forest was withdrawn.
C. Permit reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Continue to provide the spectrum of outdoor recreation opportunities in accordance with the existing capabilities of this LUD.
   1. Manage for the existing recreation uses, settings, and opportunities that can be accommodated without adverse effect on research objectives, until scheduled activities and practices cause a change in the ROS setting(s).
   2. In locations where scheduled activities change the recreation setting(s), manage the new setting(s) in accordance with the appropriate ROS guidelines.
   3. Manage public use within the experimental forest to protect ongoing research activities.
B. Motorized routes may be allowed for off-highway vehicles in Experimental Forests and will be planned in accordance with 36 CFR 212.

Recreation Special Uses

A. Major and minor developments are generally not consistent with the objectives of the LUD. Development proposals require scrutiny of the magnitude and scope for LUD conformance.

SCENERY

Scenery Operations: SCENE1

A. In the Development Plan, identify the Scenic Integrity Objectives that may range from High to Very Low and will depend on the research objectives of the experimental forest. Emphasis on scenic quality should be given for areas seen from Visual Priority Travel Routes and Use Areas (see Appendix F).

RIPARIAN

Riparian Habitat Planning: RIP1 and RIP2

A. Riparian habitat may be managed differently (e.g., using more intensive timber harvest techniques) than identified in Riparian Forest-wide Standards and Guidelines to help meet the experimental forest's research objectives. In some cases, Forest-wide direction listed under RIP may not apply with appropriate NEPA analysis conducted by the Pacific Northwest Research Station for decision by the Forest Service officer with delegated authority.

SOIL AND WATER

Watershed Resource Planning: SW3

A. Soil and water resources may be temporarily altered by experimental activities to assess the impacts of such activities upon soil productivity, water quality and quantity, and fish populations and habitat with appropriate NEPA analysis conducted by the Pacific Northwest Research Station for decision by the Forest Service officer with delegated authority.

Watershed Resource Improvement: SW4

A. Soil and water treatment measures may occur if they are compatible with experimental forest's establishment objectives. Different treatments may occur to provide information on benefits, costs, and effects of such treatments.

SUBSISTENCE

Subsistence: SUB

A. Allow subsistence activities.

THREATENED ENDANGERED, and SENSITIVE

Threatened, Endangered and Sensitive: TES

Sensitive Species

A. Sensitive species habitats may be manipulated with planned research activities to assess the impacts of forest management activities/programs upon sensitive species habitats and populations with NEPA analysis and decision by the Forest Service officer with delegated authority.

TIMBER

Timber Resource Planning: TIM4

A. Forest lands are classified as not suitable for timber production. Timber harvested for experimental and demonstration purposes will not count toward the Projected Timber Sale Quantity (PTSQ). Timber activities, including harvest and cultural treatment, will only take place for demonstration and research purposes as specified in the Experimental Forest Development Plan.

B. Personal use and Christmas tree cutting activities are limited to be consistent with the provisions of the experimental forest's development plan.
C. Administrative use of timber is allowed for structures needed to meet LUD objectives for research and interpretation projects.

TRANSPORTATION

Transportation Operations: TRAN

A. Provide and manage the transportation system as needed to accomplish the experimental forest objectives.
B. Roads and trails may be developed to facilitate and interpret the ongoing research.
C. Roads may be constructed through the experimental forest to access other LUDs, unless the roads would interfere with research objectives.
D. During design, construction, operation, and maintenance of roads, apply standards and guidelines and Best Management Practices, as appropriate.

WETLANDS

Wetlands: WET

A. Wetlands may be managed differently than identified in the Wetlands and Riparian Forest-wide Standards and Guidelines to help meet the experimental forest's research objectives with appropriate NEPA analysis and decision by the Forest Service officer with delegated authority. The appropriate permits will be acquired when needed.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Wildlife habitat management and research will be identified in the Experimental Forest's Development Plan.
B. Wildlife habitats may be treated to assess the impact of vegetation management upon wildlife populations. Use the Tongass Young-Growth Management Strategy to help prioritize treatment needs and scheduling (consult Tongass Young-growth Management Strategy).

SCENIC VIEWSHED

Goals

To provide a sustained yield of timber and a mix of resource activities while minimizing the visibility of developments as seen from Visual Priority Travel Routes and Use Areas.

To recognize the scenic values of suitable forest lands viewed from selected popular roads, trails, water travel routes, recreation sites, bays, and anchorages, and to modify timber harvest practices accordingly.

To seek to provide a supply of timber from the Tongass National Forest that meets the annual and planning-cycle market demand, consistent with the standards and guidelines for this LUD.

Objectives

Within this LUD, apply the Scenic Integrity Objective of High in the foreground distance zone and Moderate in the middleground and background distance zones, as seen from the Visual Priority Travel Routes and Use Areas (see Appendix F). Apply the Very Low Scenic Integrity Objective to all other areas.

Forest lands are suitable for timber production. Use appropriate silvicultural systems consistent with the adopted Scenic Integrity Objectives. Other timber management considerations include:

- Seek to reduce clearcutting when other methods will meet land management objectives;
- Identify opportunities for diversifying the wood products industry (e.g., special forest products and value-added local production);
- Use forest health management to protect resource values;
- Improve timber growth and productivity on commercial forest lands;
- Plan, inventory, prepare, offer, sell, and administer timber sales and permits to ensure the orderly development of timber production; and
- Emphasize the overall reduction of costs, increase of revenues, and improvement of public service within the timber program.

Perform viewshed analysis in conjunction with project development to provide direction for retaining or creating a scenically attractive landscape over time, and for rehabilitation of areas overly modified in the past.

Provide a spectrum of recreation and tourism opportunities consistent with the capabilities of this LUD. Semi-primitive to roaded experiences may be offered.

Design roads and trails to be compatible with the characteristic landscape.

Extend rotations, as necessary, to meet the Scenic Integrity Objectives.

Desired Condition

In areas managed under the Scenic Viewshed LUD, forest visitors, recreationists, and others using identified popular travel routes and use areas will view a natural-appearing landscape (refer to Appendix F). Management activities in the foreground will not be evident to the casual observer. Activities in the middleground and background will be subordinate to the characteristic landscape. Areas topographically screened from Visual Priority Travel Routes and Use Areas may be heavily modified. Within these viewsheds, even-aged timber harvest units are typically small and affect only a small percentage of the seen area. At any given point in time, roads, facilities, and other structures

are either not visually evident or are subordinate to the landscape. A variety of successional stages providing wildlife habitat occur, although late successional stages predominate. Recreation and tourism opportunities in a range of settings are available. In the areas managed for High or Moderate Scenic Integrity Objectives, timber yields will generally be obtained through the use of small openings or uneven-aged systems. A yield of timber is produced, which contributes to Projected Timber Sale Quantity (PTSQ).

Scenic Viewshed Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	WILD	None
	All Remaining	All except DC-YG-03
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

Apply the following LUD and Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Meet the Scenic Integrity Objectives for this LUD when siting and constructing facilities for administrative use.
   1. High: Structures and activities should not be visually evident to the casual observer from sensitive viewpoints.
   2. Moderate: Structures and activities should be subordinate to the landscape character of the area.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards for the LUD (e.g., soil, water quality, and scenery).

Fuel Improvements: FIRE2

Prescribed Fire

A. Management-ignited prescribed fire must meet the Very High Scenic Integrity Objective and meet all soil and water quality standards.
   1. Treat all activity fuels to meet the Very High Scenic Integrity Objective within one year following timber harvest.
B. Do not use prescribed natural fire.

FISH

Fish Habitat Improvements: FISH3

A. Meet the Scenic Integrity Objectives in the design and construction of fish habitat improvements and aquaculture facilities.
   1. Construct facilities from materials which blend with, and are compatible with, the immediately surrounding landscape.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Design Timber Stand Improvement, sanitation, salvage, and insect and disease management activities to be consistent with scenery and forest health objectives.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Provide heritage resource assistance to all development proposals. Coordination includes participation and support for environmental analysis, inventory, evaluation, assessment, monitoring, and protection of heritage resources during activities.
   1. Heritage resource inventory will be accomplished during project planning. State Historic Preservation Office concurrence and Forest Supervisor approval is required prior to implementation.
   2. Heritage resource specialists shall provide input on known or predicted heritage resource site density in proposed project areas and make recommendations to manage heritage resources.

3. Should any heritage resources be discovered during project activity, all work within the vicinity of the discovery shall cease until a heritage resource specialist is able to evaluate the situation and resumption of activity is approved by the Forest Supervisor.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize improvements only when Scenic Integrity Objectives can be achieved.
   1. Authorize only structures that will not be evident to casual observers when viewed in the foreground distance from Visual Priority Travel Routes and Use Areas. In the middle to background distance, design structures to be subordinate to the characteristic landscape.
   2. Specify that materials and fabrication techniques for all new facilities be compatible with form, color, and texture found in the immediate surrounding landscape.

Landline Location and Maintenance: LAND4

A. Provide adequate landline marking for Forest Service contractors.
   1. Prior to Forest Service management activities, survey, mark, and post the boundary of National Forest System lands to Forest Service Standards, where there is a risk of trespass.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Require a scenic assessment and scenery resource assistance with site planning and design of minerals activities.
B. Prepare geologic, paleontologic, and historic mining interpretations, where appropriate.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA, and Forest Service Minerals Regulations 36 CFR 228.
C. Allow reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.
D. Manage mineral activities to be compatible with the emphasis of this LUD. Apply the following management practices to meet Visual Quality Objectives:
   1. Recognize the effects of color, tone, form, texture, line, size, and edge on the scenic viewshed.
   2. Locate material disposal sites and marine transfer facilities outside this LUD if reasonable alternatives exist.

3. Take maximum advantage of topographic and vegetative screening when locating drill rigs and pumps, roads, rock quarries, structures, and marine transfer facilities.
4. Ensure that vegetation removed from the project area is hauled away, buried, burned, or scattered when such vegetation is located adjacent to sensitive viewpoints.
5. Minimize the scale of spoil/disposal areas in relation to the surrounding landscape as seen from sensitive viewpoints.
6. Approve use of colors that simulate those found in the characteristic landscape. Avoid use of reflective materials in project facilities.
7. Ensure that landform modifications simulate naturally occurring forms.
8. Ensure that disturbed areas are revegetated in accordance with project plans.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Provide a spectrum of recreation and tourism opportunities consistent with the objectives of this LUD.
   1. Where possible, management activities should avoid change to inventoried recreation places unless analysis indicates a need to provide a different recreation opportunity.
   2. In locations where approved activities occur, the recreation setting may change to the Semi-Primitive Motorized, Roaded Natural, and Roaded Modified ROS classes.
   3. Seek to maintain recreation opportunities along existing trail corridors by minimizing road crossings and clearing directly adjacent to the trail.
   4. Seek to minimize impacts to areas directly adjacent to developed recreation and tourism facilities (e.g., cabins and campgrounds) through scheduling and location of timber harvest activities.

B. In those areas identified as inventoried recreation places, seek to maintain the existing ROS setting. When scheduled activities nearby may result in a change in the ROS setting, minimize the impacts so they maintain a Roaded Natural, or more natural setting.

C. Motorized routes for off-highway vehicles in Scenic Viewshed may be allowed and will be planned in accordance with 36 CFR 212.

Recreation Special Uses

A. Major and minor developments are compatible with this LUD; applicants are encouraged to examine these areas first. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Manage areas to maintain scenic quality as seen from Visual Priority Travel Routes and Use Areas.
   1. Apply the High Scenic Integrity Objective for lands in the foreground distance zone and the Moderate Scenic Integrity Objective for lands in the middleground and background distance zones, as seen from Visual Priority Travel Routes and Use Areas (see Appendix F). In areas of this allocation not seen from the Visual Priority Travel Routes and Use Areas, apply the Very Low Scenic Integrity Objective. These objectives define the maximum limit of allowable

change to the scenic character of the area; less visible evidence of activities is acceptable.

2. Exceptions for small areas of non-conforming developments, such as recreation sites, transportation developments, log transfer facilities and mining development, may be considered on a case-by-case basis.
3. Perform viewshed analysis in conjunction with project development to provide guidance for retaining or creating a visually attractive landscape over time.

B. The following guidelines provide direction for old-growth timber harvest activities to meet Scenic Integrity Objectives and Visual Absorption Capability (VAC) settings.
   1. High - Timber harvest activities are not evident to the casual Forest visitor.
   2. Moderate - Although timber harvest activities are evident, they must remain subordinate to the characteristic landscape.
   3. Very Low - Timber harvest activities may dominate the area.

C. The following guidelines provide specific scenery mitigation measures appropriate to old-growth timber management.
   1. The ability to attain the adopted Scenic Integrity Objective is dependent on many variables. Visual Absorption Capability (VAC) is an estimate of the relative ability of a landscape to absorb management activities. VAC ratings of High, Intermediate, and Low were derived from the Revision Database for analysis purposes. A Low VAC setting generally has steep slopes, with little landscape variety, while a High VAC setting is relatively flat and/or has a high degree of variety in the landscape.
   2. The unit sizes listed below provide guidance to the project Interdisciplinary Team. Each landscape setting is different, and should be evaluated on a case-by-case basis. There may be instances where the scenery objective can be attained while the unit size is greater than the guideline, and there also may be instances where the unit size must be smaller to meet the intent of the Scenic Integrity Objective.
   3. Typical regeneration methods and approximate unit sizes for landscapes of different visual absorption capabilities for the Scenic Integrity Objectives adopted in this LUD are described below.
      a) Scenic Integrity Objective High:
      - Low VAC: Single tree or group selection (less than 2 acres)
      - Intermediate VAC: Single tree or clearcut (openings approximately 5 to 15 acres)
      - High VAC: Clearcut (openings approximately 15 to 30 acres)

      b) Scenic Integrity Objective Moderate:
      - Low VAC: Group selection or clearcut (openings approximately 2 to 10 acres)
      - Intermediate VAC: Clearcut (openings approximately 10 to 40 acres)
      - High VAC: Clearcut (openings approximately 40 to 60 acres)

      c) Scenic Integrity Objective Very Low:
      - Low VAC: Clearcut (openings approximately 50 to 75 acres)
      - Intermediate VAC: Clearcut (openings approximately 80 to 100 acres)

- High VAC: Clearcut (openings approximately 80 to 100 acres)

SOIL AND WATER

Watershed Resource Planning: SW3

A. Delineate the location of high hazard soils, riparian, and other sensitive areas on project maps to insure their recognition, proper consideration, and protection on the sale area.
B. Manage state classified public water supply source watersheds for multiple use, while providing water suitable for human consumption in compliance with the Safe Drinking Water Act, State of Alaska Drinking Water Regulations, and Water Quality Standards. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.
C. Apply Best Management Practices (BMPs) to all land-disturbing activities as a process to protect the beneficial uses of water from non-point sources of pollution (consult National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, FSH 2509.22). Also consult Forest Service Manual (FSM) 2530, Transportation Forest-wide Standards and Guidelines, U.S. Army Corps of Engineers Regulations (33 CFR 323.4) and the Clean Water Act.

Watershed Resource Improvements: SW4

A. Accomplish soil and water improvement projects on non-designated domestic water use watersheds to prevent degradation of water quality below the State of Alaska's Water Quality Standard for domestic use.

TIMBER

Timber Resource Planning: TIM4

A. Forest lands are suitable for timber production and are included in the Projected Timber Sale Quantity (PTSQ) calculation.
B. Scenery objectives will be emphasized in the analysis, in the development of environmental documents, and in the design and implementation of silvicultural activities.

Timber Sale Preparation: TIM5

A. Timber harvest activities may include all applicable silvicultural systems. Project analysis will recognize the effects of color, tone, form, texture, line, slope, size, and edge on the scenic viewshed.
B. Tree limbs, root wads, and tree stumps may require secondary treatment to meet the High and Moderate Scenic Integrity Objective. For timber sales and road construction contracts, use appropriate clauses that address these concerns.
C. Seek to minimize impacts to areas directly adjacent to developed recreation facilities (e.g., cabins and campgrounds) through scheduling and location of harvest activities.

Other Forest Products: TIM7

A Personal use sawtimber, firewood, and Christmas tree cutting activities are compatible with this LUD provided that LUD objectives are met.

TRANSPORTATION

Transportation Operations: TRAN

A. Develop and manage cost-effective transportation systems that integrate resource requirements consistent with LUD direction.
   1. To meet the Scenic Integrity Objectives, give special consideration to minimizing apparent landform modification (as seen from sensitive travel routes) during road and log transfer facility location, design, and construction.
   2. Perform integrated logging system and transportation system analysis to determine the least cost facility (considering cost of construction, maintenance, and hauling) and design standards necessary to meet LUD objectives.
   3. Give special emphasis to maintaining fish and wildlife habitat values, especially during road location and development of road management objectives.
      a) If the need to restrict access is identified during project interdisciplinary review, roads may be closed, either seasonally or year-long. (Consult Transportation Forest-wide Standards and Guidelines.)
   4. Provide recreational access, where appropriate.
   5. Seek to avoid road crossings on existing trails unless the road provides improved access to the trail or locating roads parallel to trails. Should no other feasible alternative exist, minimize site disturbance visible from the trail. Locate rock source developments away from trails to the extent possible, while meeting the objectives of this LUD.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Use existing inventories and evaluate the need for further project-specific inventories of wildlife habitat conditions during project analysis.
   1. Select Management Indicator Species (MIS) appropriate to the project area for project analysis.
B. Coordinate all activities with consideration for the needs of wildlife, within the overall objectives of this LUD.
   1. Use the habitat needs of MIS to evaluate opportunities for, and consequences on, wildlife.
   2. In project planning, consider opportunities to allow for the elevational migration of wildlife.
   3. Consider silvicultural techniques that establish and prolong understory forb and shrub production in important habitat areas. Such techniques can include prescribed burning, precommercial thinning, canopy gaps, and uneven-aged management. Use the Tongass Young-Growth Strategy to help prioritize treatment needs and scheduling (consult Tongass Young-growth Management Strategy).
C. Coordinate road management with the needs of wildlife.

Wildlife Habitat Improvement: WILD2

A. Design and implement wildlife habitat improvement projects to meet the Scenic Integrity Objectives.

MODIFIED LANDSCAPE

Goals

To provide a sustained yield of timber and a mix of resource activities while minimizing the visibility of developments in the foreground distance zone.

To recognize the scenic values of forest lands viewed from identified popular roads, trails, marine travel routes, recreation sites, bays, and anchorages, and to modify timber harvest practices accordingly.

To maintain and promote wood production from suitable forest lands, providing a continuous supply of wood products to meet society's needs.

To seek to provide a supply of timber from the Tongass National Forest that meets the annual and planning-cycle market demand, consistent with the standards and guidelines for this LUD.

Objectives

Within this LUD, apply the Scenic Integrity Objective of Moderate in the foreground distance zone and Low in the middleground and background distance zones, as seen from the Visual Priority Travel Routes and Use Areas (see Appendix F). Apply the Very Low Scenic Integrity Objective to all other areas.

Forest lands are suitable for timber production. Use silvicultural systems consistent with the adopted Scenic Integrity Objectives. Other timber management considerations include:

- Seek to reduce clearcutting when other methods will meet land management objectives;
- Identify opportunities for diversifying the wood products industry (e.g., special forest products and value-added local production);
- Use forest health management to protect resource values;
- Improve timber growth and productivity on commercial forest lands;
- Plan, inventory, prepare, offer, sell, and administer timber sales and permits to ensure the orderly development of timber production;
- Emphasize the overall reduction of costs, increase of revenues, and improvement of public service within the timber program.

Provide a spectrum of recreation and tourism opportunities consistent with the capabilities of this LUD. Semi-Primitive Non-Motorized to Roaded experiences may be offered. Avoid changing Semi-Primitive Non-Motorized settings to Roaded when feasible.

Design roads and associated rock quarries to meet the applicable Scenic Integrity Objective.

Desired Condition

In areas managed under the Modified Landscape LUD, forest visitors, recreationists, and others using popular Travel Routes and Use Areas will view a somewhat modified landscape (refer to Appendix F). Management activities in the visual foreground will be subordinate to the characteristic landscape, but may dominate the landscape in the middle and backgrounds. Within the foreground, timber harvest units are typically small and affect only a small percentage of the seen area at any one point in time. Roads, facilities, and other structures are also subordinate to the foreground landscape. Recreation opportunities associated with natural-appearing to modified settings are available. A variety of successional stages provide a range of wildlife habitat conditions. Timber is produced, which contributes to Projected Timber Sale Quantity (PTSQ).

Modified Landscape Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	WILD	None
	All Remaining	All except DC-YG-03
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Locate and construct facilities for administrative use that meet the Scenic Integrity Objective.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards and guidelines for this LUD (e.g., soil, water quality, and scenic quality).

Fuel Improvements: FIRE2

Prescribed Fire

A. Management-ignited prescribed fire must meet the Moderate Scenic Integrity Objective and meet all soil and water quality standards and guidelines.
   1. Treat all activity fuels to meet the Moderate Scenic Integrity Objective within one year following timber harvest.

B. Do not use prescribed natural fire.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Forest insect and disease management activities emphasize forest health through achieving beneficial populations of insects and diseases.
   1. Encourage Timber Stand Improvement, sanitation, and salvage.
   2. Manipulate insects and diseases to desirable levels by evaluating chemical, cultural, mechanical, biological, or "no action" alternatives.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Provide heritage resource assistance to all developmental proposals. Coordination includes participation and support for environmental analysis, inventory, evaluation, assessment, monitoring, and protection of heritage resources during activities.
   1. Heritage resource inventory will be accomplished during project planning. State Historic Preservation Office concurrence and Forest Supervisor approval is required prior to implementation.
   2. Heritage resource specialists shall provide input on known or predicted heritage resource site density in proposed project areas and make recommendations to manage heritage resources.
   3. Should any heritage resources be discovered during project activity, all work within the vicinity of the discovery shall cease until a heritage resource specialist is able to evaluate the situation and resumption of activity is approved by the Forest Supervisor.

B. Identify opportunities for interpretation of heritage resources for public education and enjoyment.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those development activities compatible with LUD objectives. Avoid issuing, or limit the duration of, authorizations for uses that require natural surroundings.
   1. Only authorize activities that can be designed to meet the Scenic Integrity Objectives for this LUD.

Landline Location and Maintenance: LAND4

A. Provide adequate landline marking for Forest Service contractors.

1. Prior to Forest Service management activities, survey, mark, and post the boundary of National Forest System lands, to Forest Service Standards, where there is a risk of trespass.

MINERALS AND GEOLOGY

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Minerals Regulations 36 CFR 228.
C. Allow reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Provide a spectrum of outdoor recreation and tourism opportunities consistent with the objectives of the LUD.
   1. Manage for the existing recreation settings and opportunities until approved activities and practices change the ROS setting(s). Manage recreation and tourism use in a manner that is compatible with the timber harvest objectives.
   2. In locations where approved activities change the recreation setting(s), manage the new setting(s) with the appropriate ROS guidelines (generally Roaded Modified).
   3. Seek to maintain the recreation opportunity along existing trail corridors by minimizing road crossings and clearing directly adjacent to the trail.
   4. Seek to minimize impacts to areas directly adjacent to developed recreation and tourism facilities (e.g., as cabins and campgrounds) through scheduling and location of project activities.
B. In those areas inventoried as recreation places, seek to maintain the existing ROS setting. When approved activities nearby may result in a change to the ROS setting, minimize the impacts so they maintain a Roaded Natural or more natural ROS setting.

Recreation Special Uses

A. Major and minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. In foreground settings, design management activities to be subordinate to the characteristic landscape. Management activities may dominate areas seen in the middleground and background distance. In all settings, activities should utilize existing form, line, color, and texture found in the characteristic landscape.
   1. Apply the Moderate Scenic Integrity Objective in the foreground distance zone and the Low Scenic Integrity Objective in the middleground and background distance zones, as seen from Visual Priority Travel Routes and Use Areas (see Appendix F). In areas of this allocation not seen from the Visual Priority Travel Routes and

Use Areas, apply the Very Low Scenic Integrity Objective. These objectives define the maximum limit of allowable change to scenic character of the area; less visible evidence of activities is acceptable.

2. Exceptions for limited areas of non-conforming developments, such as recreation sites, transportation developments, log transfer facilities, and mining development, may be considered on a case-by-case basis.

B. The following guidelines provide direction for old-growth timber harvest activities to meet Scenic Integrity Objectives and Visual Absorption Capability (VAC) settings. The guidelines define the maximum allowable disturbance for timber harvest. Ground conditions may indicate a need to be more or less restrictive in scheduling harvest to meet the intent of the Scenic Integrity Objective.

1. Moderate - Although timber harvest activities are evident, they must remain subordinate to the characteristic landscape.
2. Low - Timber harvest activities may dominate the characteristic landscape, yet will be designed to borrow from form and line found in the naturally- occurring landscape.
3. Very Low - Timber harvest activities may visually dominate the original characteristic landscape. This Scenic Integrity Objective should be met within one year in the foreground distance zone and within five years in the middle and background distance zones.

C. The following guidelines provide specific scenery mitigation measures for old-growth timber management.

1. The ability to attain the adopted Scenic Integrity Objective is dependent on many variables. Visual Absorption Capacity (VAC) is an estimate of the relative ability of a landscape to absorb management activities. A Low VAC setting generally has steep slopes, with little landscape variety, while a High VAC setting is relatively flat and/or has a high degree of variety in the landscape.
2. The unit sizes listed below provide guidance to the project Interdisciplinary Team. Each landscape setting is different and should be evaluated on a case-by-case basis. There may be instances where the scenery objective can be attained while the unit size is greater than the guideline. There also may be instances where the unit must be smaller to meet the intent of the Scenic Integrity Objective.
3. Typical regeneration methods and approximate unit sizes for landscapes of different visual absorption capabilities for the Scenic Integrity Objectives adopted in this LUD are described below.

a) Scenic Integrity Objective Moderate:

- Low VAC: Group selection or clearcut (openings approximately 2 to 10 acres)
- Intermediate VAC: Clearcut (openings approximately 10 to 40 acres)
- High VAC: Clearcut (openings approximately 40 to 60 acres)

b) Scenic Integrity Objective Low:

- Low VAC: Clearcut (openings approximately 15 to 40 acres)
- Intermediate VAC: Clearcut (openings approximately 40 to 60 acres)
- High VAC: Clearcut (openings approximately 60 to 100 acres)

c) Scenic Integrity Objective Very Low:

- Low VAC: Clearcut (openings approximately 50 to 75 acres)
- Intermediate VAC: Clearcut (openings approximately 80 to 100 acres)
- High VAC: Clearcut (openings approximately 80 to 100 acres)

SOIL AND WATER

Watershed Resource Planning: SW3

A. Delineate the location of high hazard soils, riparian, and other sensitive areas on project maps to ensure their recognition, proper consideration, and protection on the sale area.

B. Manage state classified public water supply source watersheds for multiple use, while providing water suitable for human consumption in compliance with the Safe Drinking Water Act, State of Alaska Drinking Water Regulations, and Water Quality Standards. Conduct watershed analysis (Appendix C) and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.

C. Apply Best Management Practices (BMPs) to all land-disturbing activities as a process to protect the beneficial uses of water from non-point sources of pollution (consult National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, FSH 2509.22). Also consult Forest Service Manual (FSM) 2530, Transportation Forest-wide Standards and Guidelines, U.S. Army Corps of Engineers Regulations (33 CFR 323.4), and the Clean Water Act.

Watershed Resource Improvements: SW4

A. Accomplish soil and water improvement projects to prevent degradation of water quality.

TIMBER

Timber Resource Planning: TIM4

A. Forest lands are suitable for timber production and are included in the Projected Timber Sale Quantity (PTSQ) calculation.

B. Personal use wood cutting activities are compatible with this LUD, provided that management objectives are met.

Timber Sale Preparation: TIM5

A. Timber harvest activities may include all applicable silvicultural systems. Recognize the effects of color, tone, texture, line, slope, size, and edge on the characteristic landscape.

B. Tree limbs, root wads, and tree stumps may require secondary treatment to meet the Moderate Scenic Integrity Objective in the foreground distance. For timber sales and road construction contracts, use clauses that address these concerns. Brush disposal funds may be appropriate to use in these settings.

C. Seek to provide for a reasonable assurance of windfirm boundaries. To design for windfirmness, consider conditions such as soils, local wind patterns, tree height and size, and other site-specific factors.

Timber Stand Improvement: TIM10

A. Timber Stand Improvement activities that meet the scenery and timber objectives of the LUD may be used.

B. Continue evaluation of commercial thinning opportunities in young-growth stands on the Forest for enhancing timber growth and development, while improving the scenery quality and habitat conditions for wildlife. Evaluation will be provided as part of the Tongass Young-Growth Strategy development.

TRANSPORTATION

Transportation Operations: TRAN

A. Develop and manage cost-effective transportation systems that integrate resource requirements consistent with LUD direction.
   1. To meet the Scenic Integrity Objectives, give special consideration to minimizing apparent landform modification (as seen from sensitive travel routes) during road and log transfer facility location, design, and construction.
   2. Perform integrated logging system and transportation system analysis to determine the least-cost facility (considering cost of construction, maintenance, and hauling) and design standards necessary to meet LUD objectives.
   3. Give special emphasis to maintaining fish and wildlife habitat values, especially during road location and development of road management objectives.
      a) If the need to restrict access is identified during project interdisciplinary review, roads may be closed, either seasonally or year-long. (Consult Transportation Forest-wide Standards and Guidelines.)
   4. Provide recreation access, where appropriate.
   5. Seek to avoid road crossings on existing trails or locating roads parallel to trails. Should no other feasible alternative exist, minimize site disturbance visible from the trail. Locate rock source developments away from trails to the extent possible, while meeting the objectives of this LUD.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Use existing inventories and evaluate the need for further project-specific inventories of wildlife habitat conditions during project analysis.
   1. Select Management Indicator Species (MIS) appropriate to the project area for project analysis (see Wildlife Forest-wide Standards and Guidelines).
B. Consider wildlife habitat needs during project planning and implementation. Use the Tongass Young-Growth Strategy to help prioritize treatment needs and scheduling (consult Tongass Young-growth Management Strategy).
   1. Use the habitat needs of MIS to evaluate opportunities for, and consequences on, wildlife.
   2. In project planning, consider opportunities to allow for the elevational migration of wildlife.
C. Coordinate road management with the needs of wildlife.

TIMBER PRODUCTION

Goals

To maintain and promote wood production from forest lands that are suitable for timber production, providing a continuous supply of wood to meet society's needs.

To manage these lands for sustained long-term timber yields.

To seek to provide a supply of timber from the Tongass National Forest that meets the annual and planning-cycle market demand, consistent with the standards and guidelines for this LUD.

Objectives

Within this LUD, apply the Scenic Integrity Objectives of Low in the foreground distance zone, as seen from Visual Priority Travel Routes and Use Areas (see Appendix F). Apply the Very Low Scenic Integrity Objective to all other areas.

Locate and design timber harvest activities primarily to meet timber objectives. Forest lands are suitable for timber production; appropriate silvicultural systems may be used. Other timber management objectives include:

- Seek to reduce clearcutting when other cutting methods will meet land management objectives;
- Identify opportunities for diversifying the wood products industry (e.g., special forest products, and value-added local production);
- Use forest health management to protect resource values;
- Improve timber growth and productivity on commercial forest lands;
- Plan, inventory, prepare, offer, sell and administer timber sales and permits to ensure the orderly development of timber production;
- Emphasize the overall reduction of costs, increase of revenues, and improvement of public service within the timber program.

Provide a spectrum of recreation and tourism opportunities consistent with the capabilities of this LUD. Manage recreation and tourism use to be compatible with timber production objectives. Manage changed recreation settings in accordance with the appropriate Recreation Opportunity Spectrum (ROS) class.

On forest lands that are suitable for timber production plan a transportation network of roads and helicopter access that will eventually access most of the standard logging or helicopter yarding systems facilitating the transition to young-growth management.

Desired Condition

Suitable forest lands are managed for the production of sawtimber and other wood products on an even-flow, long-term sustained yield basis; the timber yield produced contributes to Projected Timber Sale Quantity (PTSQ). An extensive road system provides access for timber management activities, recreation uses, hunting and fishing, and other public and administrative uses; some roads may be closed, either seasonally or year-long, to address resource concerns. Management activities will generally dominate most seen areas. Tree stands are healthy and with a mix of age classes from young stands to trees of harvestable age, often in 40- to 100-acre stands. Recreation opportunities, associated with roaded settings from Semi-Primitive to Roaded Modified, are available. A variety of wildlife habitats, predominantly in the early and middle successional stages, are present.

Timber production Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM	All
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	WILD	None
	All Remaining	All except DC-YG-03
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

Apply the following LUD and Standards and Guidelines:

FACILITIES

Facilities Improvements: FAC2 and FAC3

A. Administrative facilities are constructed to be compatible with this LUD objective.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards and guidelines for the LUD (e.g., soil and water).

Fuel Improvements: FIRE2

Prescribed Fire

A. Management-ignited prescribed fire may be used for fuels management, insect and disease protection, silvicultural site preparation, and wildlife habitat improvement.
B. Do not use prescribed natural fire.

FOREST HEALTH

Forest Health Management: HEALTH1

A. Forest insect and disease management activities emphasize forest health through manipulating insects and diseases to desirable levels.
   1. Encourage Timber Stand Improvement, sanitation, and salvage.
   2. Evaluate chemical, cultural, mechanical, biological, and "no action" to manipulate insects and diseases to desirable levels.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Provide heritage resource assistance to all development proposals. Coordination includes participation and support for environmental analysis, inventory, evaluation, assessment, monitoring, and protection of heritage resources during activities.
   1. Heritage resource inventory will be accomplished during project planning. State Historic Preservation Office concurrence and Forest Supervisor approval is required prior to implementation.
   2. Heritage resource specialists shall provide input on known or predicted heritage resource site density in proposed project areas and make recommendations to manage heritage resources.
   3. Should any heritage resources be discovered during project activity, all work within the vicinity of the discovery shall cease until a heritage resource specialist is able to evaluate the situation and resumption of activity is approved by the Forest Supervisor.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Authorize only those uses that are compatible with LUD objectives. Avoid issuing, or limit the duration of, authorizations for uses that require natural surroundings.

Landline Location and Maintenance: LAND4

A. Provide adequate landline marking for Forest Service contractors.
   1. Prior to Forest Service management activities, survey, mark, and post the boundary of National Forest System lands, to Forest Service Standards, where there is a risk of trespass.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Coordinate the location of timber and mining transportation systems when feasible.
B. Coordinate with claimant to ensure the location of timber sale units and roads across mining claims do not interfere with mining activities, markers, and improvements.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and Forest Service Minerals Regulations 36 CFR 228.
C. Allow reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the provisions of an approved Plan of Operations in accordance with Forest Service Minerals Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Provide a spectrum of outdoor recreation and tourism opportunities consistent with the objectives of this LUD.
    1. Manage for the existing recreation settings and opportunities until approved activities change the ROS setting(s). Manage recreation and tourism use in a manner that is compatible with the timber harvest objectives.
    2. In locations where approved activities change the recreation setting(s), manage the new setting(s) with the appropriate ROS guidelines (generally Roaded Modified).
    3. Seek to maintain the recreation opportunity along existing trail corridors by minimizing road crossings and clearing directly adjacent to the trail.
    4. Seek to minimize impacts to inventoried recreation places and developed recreation and tourism facilities (such as cabins and campgrounds) through scheduling and location of project activities.

Recreation Special Uses

A. Major and minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis. Refer to the Recreation and Tourism Forest-wide Standards and Guidelines.

SCENERY

Scenery Operations: SCENE1

A. Timber management activities may dominate the scenic character of the landscape.
    1. Apply Forest-wide Standards and Guidelines for the Low Scenic Integrity Objective in the foreground distance zone of Visual Priority Travel Routes and Use Areas (see Appendix F) and the Very Low Scenic Integrity Objective for all other areas. This objective defines the maximum limit of allowable change to the scenic character of the area; less visible evidence of activities is acceptable.

2. Consider roadside cleanup of construction debris and logging slash as a mitigation measure when recreational use is included as a road management objective for the proposed road.
3. In areas visible from Visual Priority Travel Routes and Use Areas, incorporate landscape design techniques in the planning process to the extent that they are compatible with LUD objectives.

B. The following guidelines provide direction for old-growth timber harvest activities to meet Scenic Integrity Objectives and Visual Absorption Capability (VAC) settings. The guidelines define the maximum allowable disturbance for old-growth timber harvest. Ground conditions may indicate a need to be more or less restrictive in scheduling harvest to meet the intent of the Scenic Integrity Objective.
   1. Low - Timber harvest activities may dominate the characteristic landscape, yet will be designed to borrow from form and line found in the naturally- occurring landscape.
   2. Very Low - Timber harvest activities may dominate the seen area. In planning timber harvest, design activities to resemble natural occurrences as viewed in the background distance zone.

C. The following guidelines provide specific scenery mitigation measures appropriate to old-growth timber management:
   1. The ability to attain the adopted Scenic Integrity Objective is dependent on many variables. Visual Absorption Capacity (VAC) is an estimate of the relative ability of a landscape to absorb management activities. A Low VAC setting generally has steep slopes, with little landscape variety, while a High VAC setting is relatively flat and/or has a high degree of variety in the landscape.
   2. The unit sizes listed below provide guidance to the project Interdisciplinary Team. Each landscape setting is different and should be evaluated on a case-by-case basis. There may be instances where the scenery objective can be attained while the unit size is greater than the guideline. There also may be instances where the unit must be smaller to meet the intent of the Scenic Integrity Objective.
   3. Typical clearcut regeneration methods and approximate unit sizes for landscapes of different visual absorption capabilities for the Scenic Integrity Objectives adopted in this LUD are described below.

      a) Scenic Integrity Objective Low:
      - Low VAC: Clearcut (openings approximately 15 to 40 acres)
      - Intermediate VAC: Clearcut (openings approximately 40 to 60 acres)
      - High VAC: Clearcut (openings approximately 60 to 100 acres)

      b) Scenic Integrity Objective Very Low:
      - Low VAC: Clearcut (openings approximately 50 to 75 acres)
      - Intermediate VAC: Clearcut (openings approximately 80 to 100 acres)
      - High VAC: Clearcut (openings approximately 80 to 150 acres)

SOIL AND WATER

Watershed Resource Planning: SW3

A. Delineate the location of high hazard soils, riparian, and other sensitive areas on project maps to ensure their recognition, proper consideration, and protection on the sale area.
B. Manage state classified public water supply source watersheds for multiple use, while providing water suitable for human consumption in compliance with the Safe Drinking Water Act, State of Alaska Drinking Water Regulations, and Water Quality Standards. Conduct watershed analysis (Appendix C)), and consult with Alaska Department of Environmental Conservation and affected municipalities prior to authorizing activities that are likely to cause pollution.
C. Apply Best Management Practices (BMPs) to all land-disturbing activities as a process to protect the beneficial uses of water from non-point sources of pollution (consult National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, FSH 2509.22). Also consult Forest Service Manual (FSM) 2530, Transportation Forest-wide Standards and Guidelines, U.S. Army Corps of Engineers Regulations (33 CFR 323.4) and the Clean Water Act.

Watershed Resource Improvements: SW4

A. Accomplish soil and water improvement projects on non-designated domestic water use watersheds to prevent degradation of water quality below the State of Alaska's Water Quality Standard for domestic use.

TIMBER

Timber Resource Planning: TIM4

A. Timber management is emphasized. Forest lands are suitable for timber production and are included in the Projected Timber Sale Quantity (PTSQ) calculation.

Timber Sale Preparation: TIM5

A. Locate and design timber harvest activities primarily to meet timber objectives. Include integration of other resources objectives, particularly wildlife and vegetative diversity, if they do not have a significant adverse impact on the timber resource goals. Timber harvest activities may include all silvicultural systems.
B. Consult Timber Forest-wide Standards and Guidelines for maximum sizes of created openings.
C. Seek to provide for a reasonable assurance of windfirm boundaries. To design for windfirmness, consider conditions such as soils, local wind patterns, tree height and size, and other site-specific factors.

Timber Resource Coordination: TIM7

A. Personal use sawtimber and firewood harvesting and Christmas tree cutting activities are consistent with this LUD.
B. Administrative use of timber is consistent with this LUD.

TRANSPORTATION

Transportation Operations: TRAN

A. Develop and manage cost-effective LUD direction.
    1. Perform integrated logging system and transportation system analysis to determine the least-cost facility (considering cost of construction, maintenance, and hauling) and design standards necessary to meet LUD objectives.
    2. If the need to restrict access is identified during project interdisciplinary review, roads may be closed, either seasonally or year-long.

3. Consider future recreational access in location and design of roads.
4. Seek to avoid road crossings on existing trails or locating roads parallel to trails. Should no other feasible alternative exist, minimize site disturbance visible from the trail. Locate rock source developments away from trails to the extent possible, while meeting the objectives of this LUD.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Use existing inventories and evaluate the need for further project-specific inventories of wildlife habitat conditions during project analysis.
   1. Select Management Indicator Species (MIS) appropriate to the project area for project analysis.

B. Consider wildlife habitat needs during project planning and implementation.
   1. Use the habitat needs of MIS to evaluate opportunities for, and consequences on, wildlife. Use the Tongass Young-Growth Strategy to help prioritize treatment needs and scheduling (consult Tongass Young-growth Management Strategy, USDA Forest Service unpublished).

MINERALS

Goals

To encourage the prospecting, exploration, development, mining, and processing of locatable minerals in areas with the highest potential for minerals development.

To ensure minerals are developed in an environmentally sensitive manner and other high-valued resources are considered when minerals developments occur.

Objectives

Apply this management prescription to the project areas of currently approved Minerals Plan of Operations. Use the prescription as criteria in the planning and design of proposed mineral developments and Plan of Operations. During the period before approval of the Plan of Operations, the underlying LUD(s) continue to apply to the project area.

Use the following as guidance for minerals activities:

- Authorize special uses that facilitate such activities;
- Allow reasonable access, consistent with other resource values;
- Apply the Low Scenic Integrity Objective to foreground areas viewed from the Visual Priority Travel Routes and Use Areas (Appendix F); otherwise, the Very Low objective applies; and
- Maintain present and continued soil productivity and water quality to the extent feasible. Apply Best Management Practices (BMPs) and meet State Water Quality Standards.

Use the following as guidance for non-minerals activities:

- Authorize special uses that will not substantially conflict with present or anticipated mineral-related activities;
- Limit new recreation facilities to those compatible with mineral developments; and
- Manage recreation settings and opportunities to be as compatible as possible with the underlying LUD.

Maintain the present and continued productivity of anadromous fish and other foodfish habitat, as well as wildlife habitats, to the maximum extent feasible. Stress the protection of fish and wildlife habitats to prevent or minimize the need for mitigation.

Rehabilitate soil and water resources and fish and wildlife habitats after the completion of mining operations.

After the completion of mining activities and restoration, manage the area according to the underlying LUD.

Desired Condition

During mining operations, mining activities are limited to the area necessary for their efficient, economic, and orderly development. Mining is carried out so that any effects on other resources are minimized to the extent feasible, all minimum legal resource protection requirements are met, and other resource uses and activities in the area do not conflict with mining operations. After the completion of mining, affected areas are reclaimed and, in most cases, the area once again provides the settings and opportunities of the underlying LUD.

Minerals Land Use Designation
Apply the following Forest-wide Standards and Guidelines located in Chapter 4:

Category	Section	Subsections
Air	AIR	All
Beach and Estuary Fringe	BEACH	All
Facilities	FAC	All
Fire	FIRE	All
Fish	FISH	All
Forest Health	HEALTH	All
Heritage Resources/Sacred Sites	HSS	All
Invasive Species	INV	All
Karst and Cave Resources	KC	All
Lands	LAND	All
Minerals and Geology	MG	All
Plants	PLA	All
Recreation and Tourism	REC	All
Riparian	RIP	All
Rural Community Assistance	RUR	All
Scenery	SCENE	All
Soil and Water	SW	All
Subsistence	SUB	All
Timber	TIM1,4,7 TIM6	All I(A-E)
Trails	TRAI	All
Transportation	TRAN	All
Wetlands	WET	All
Wildlife	WILD	All

Apply the following Plan Content located in Chapter 5:

Category	Section	Plan Component
Young-growth Direction	All	None
Renewable Energy Direction	All	All except S-RE-LAND-01 and S-RE-TRAN-01
Transportation Systems Corridors Direction	All	All except S-TSC-LAND-02
Forest-wide Plan Components	All	All

Apply the following LUD Standards and Guidelines:

FACILITIES

Administrative Facilities: FAC2 and FAC3

A. Generally, co-locate administrative facilities with facilities authorized in the Plan of Operations.

FIRE

Fire Suppression: FIRE1

Suppression Action

A. Suppress wildfires using the suppression option identified in the Alaska Interagency Wildland Fire Management Plan.
B. Suppression tactics are limited only by the standards and guidelines for this LUD.

Fuel Improvements: FIRE2

Prescribed Fire

A. Management-ignited prescribed fire may be used for fuels management, insect and disease protection, silvicultural site preparation, and wildlife habitat improvement.
B. Do not use prescribed natural fire.

FISH

Fish Habitat Planning: FISH2

Planning/Mitigation

A. Maintain the present and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible (consult ANILCA, Section 505 (a)).
B. Stress protection of fish habitat to prevent the need for mitigation. Mitigation, rehabilitation, and monitoring of mining impacts to fish habitat or populations shall be identified in environmental documents and the Plan of Operations.
C. Consider the need to maintain instream flows for fish during the development of minerals management activities.

FOREST HEALTH

Forest Health Management: HEALTH1

A. For underlying LUDs that permit timber harvest, emphasize Timber Stand Improvement, sanitation, salvage, and insect and disease management measures consistent with the LUD objectives.
B. For underlying LUDs that do not permit timber harvest, apply insect and disease management measures consistent with the underlying LUD to protect these and adjacent resources.

Forest Insect and Disease Survey and Inventory: HEALTH2

A. Survey and inventory visible outbreaks annually.

HERITAGE

Heritage Resource Activities: HSS1

Inventory

A. Provide heritage resource assistance to all development proposals. Coordination includes participation and support for environmental analysis, inventory, evaluation, assessment, monitoring, and protection of heritage resources during activities.
    1. Heritage resource inventory will be accomplished during project planning. State Historic Preservation Office concurrence and Forest Supervisor approval is required prior to implementation.

2. Heritage resource specialists shall provide input on known or predicted heritage resource site density in proposed project areas and make recommendations to manage heritage resources.
3. Should any heritage resources be discovered during project activity, all work within the vicinity of the discovery shall cease until a heritage resource specialist is able to evaluate the situation and resumption of activity is approved by the Forest Supervisor.

KARST AND CAVES

Cave Management Program: KC2

A. Identify opportunities for interpretation of caves for public education and enjoyment. Interpretation may occur inside or outside of this LUD.

LANDS

Special Use Administration (Non-Recreation): LAND2

A. Generally, authorize special uses to facilitate mineral-related activities.
   1. Evaluate alternative facility designs and locations (including off-site) that consider: 1) amount of land disturbance; 2) effects on other resources; and 3) effects resulting from human use.
B. Generally, authorize non-mineral development related uses if they do not substantially conflict with present or anticipated mineral-related activities or the underlying (initial) LUD.
   1. Use temporary or annual permits that maintain options for future mineral development.

MINERALS AND GEOLOGY

Minerals and Geology Resource Preparation: MG1

Resource Preparation

A. Emphasize minerals management activities. Management should facilitate the prospecting, exploration, development, mining, and processing of mineral resources in areas with the highest potential for development.
B. Prior to the initiation of mineral activities, manage these lands under their underlying LUD in the Forest Plan. With the initiation of mineral activities, apply reasonable regulation of surface occupancy and use to manage the mineral development to be as compatible as possible with the underlying LUD.
C. The minerals land use prescription will apply upon approval of a Plan of Operations. Those portions of the initial LUD not identified for mineral activity in an approved Plan of Operations will continue to be managed under the initial LUD. After mineral operations are completed, lands allocated under the minerals prescription will revert to the initial LUD to the extent possible.

Minerals and Geology Administration: MG2

Forest Lands Open to Mineral Entry

A. Forest lands within this LUD are open to mineral entry.
B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, ANILCA, and Forest Service Minerals Regulations 36 CFR 228.
C. Development of locatable mineral resources takes precedence in this LUD; however, leasable and salable minerals may also be developed at the authorized officer's discretion.
D. Allow reasonable access to mining claims, leases, and material sites and authorization of orderly mineral resource development with the

provisions of an approved Plan of Operations in accordance with National Forest Mining Regulations 36 CFR 228 and FSM 2800.

RECREATION AND TOURISM

Recreation Use Administration: REC3

Recreation Settings

A. Prior to the initiation of mineral development, provide recreation settings and opportunities consistent with the underlying LUD.
   1. For any new investment in recreation facilities, consider the potential effects to those facilities by future minerals development.

B. With the initiation of mineral development, manage the recreation setting in a manner as compatible as feasible with the underlying LUD.
   1. Manage for the existing recreation settings and opportunities until scheduled activities and practices change the ROS settings. Manage recreation use in a manner that is compatible with the mineral objectives.
   2. In locations where scheduled activities change the recreation setting(s), manage the new setting(s) with the appropriate ROS guidelines (generally Roaded Modified).
   3. Seek to maintain the recreation experience along existing trail corridors by locating road crossings and clearing so they are not directly adjacent to the trail when feasible.
   4. Seek to minimize impacts to areas directly adjacent to developed recreation facilities (e.g., cabins and campgrounds).
   5. Consider regulating recreation use and access to mitigate for the minerals development.
   6. Manage public use of mining access roads and development areas to be consistent with the new ROS class, unless recreation analysis indicates a need for a modified ROS class.
   7. Where effects on existing maintained recreation facilities and trails cannot be avoided due to mineral development, analyze alternatives for reasonable substitute facilities.

Recreation Special Uses

A. Major and minor developments may be compatible with the LUD objectives depending on the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis (see Recreation and Tourism Forest-wide Standards and Guidelines).

SCENERY

Scenery Operations: SCENE1

A. Prior to the initiation of mineral development, manage for scenic quality according to the initial LUD.

B. With the initiation of mineral development, apply Forest-wide Standards and Guidelines for Low in the foreground distance, as seen from Visual Priority Travel Routes and Use Areas (see Appendix F) and for the Very Low Scenic Integrity Objective in all other areas. The objective defines the maximum limit of allowable change to the scenic character of the area; less evidence of scenic change is acceptable.
   1. Incorporate landscape design techniques to reduce adverse scenic impact in areas visible from sensitive travel routes.

SOIL AND WATER

Watershed Resource Planning: SW3

A. For use in designing mineral management activities, delineate the location of important soil and water protection areas on project maps to

ensure their recognition, proper consideration, and protection on the project area.

B. Manage watersheds for beneficial uses consistent with State Water Quality Standards. Apply BMPs to control nonpoint sources of water pollution (consult National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, FSH 2509.22).

C. Design mineral management activities to maintain the present and continued productivity of soil and water resources to the extent feasible.

D. Stress protection of soil and water resources to prevent the need for mitigation. Identify mitigation, rehabilitation, and monitoring of mining impacts to soil and water resources in environmental documents and the Plan of Operations.

TIMBER

Timber Resource Planning: TIM4

A. Suitability for timber production is based on the underlying LUD.

B. Personal use wood cutting activities will be based on direction in the underlying LUD until a Plan of Operation is approved. After approval, access for personal use wood and Christmas trees will be subject to provisions compatible with the Plan of Operations.

C. Project analysis, development of environmental documents, and project design will facilitate the probable future mineral development to the maximum extent feasible.

Timber Sale Preparation: TIM5

A. Where possible, coordinate the location and design of timber harvest activities with planned or potential mineral development.

TRANSPORTATION

Transportation Operations: TRAN

A. Authorize reasonable access, consistent with other resource values, to allow for the exploration and development of mineral resources.

B. Any transportation development in association with minerals extraction will be in accordance with an approved Plan of Operations, and subsequent annual work plans.

C. Roads in this LUD may be closed to public use.

D. Apply BMPs in the development and maintenance of transportation facilities.

WILDLIFE

Wildlife Habitat Planning: WILD1

A. Maintain the present and continued productivity of wildlife habitat to the extent feasible while meeting the goals and objectives of this LUD.

B. Address protection of wildlife habitat and the need for mitigation. Identify any need for mitigation, rehabilitation, and monitoring of mining impacts to wildlife habitat or populations in environmental documents and the Plan of Operations.

C. Coordinate road management with the needs of wildlife.

Wildlife Habitat Inventory: WILD5

A. Prior to the development of minerals management activities, establish or use existing baseline wildlife inventories.

CHAPTER 4
STANDARDS AND GUIDELINES

CONTENTS

Introduction....4-1
AIR....4-3
BEACH and ESTUARY FRINGE....4-4
FACILITIES....4-6
FIRE....4-7
FISH....4-9
FOREST HEALTH....4-15
HERITAGE RESOURCES and SACRED SITES....4-16
INVASIVE SPECIES....4-22
KARST and CAVE RESOURCES....4-23
LANDS....4-26
MINERALS and GEOLOGY....4-36
PLANTS....4-39
RECREATION and TOURISM....4-41
RIPARIAN....4-48
RURAL COMMUNITY ASSISTANCE....4-53
SCENERY....4-54
SOIL and WATER....4-61
SUBSISTENCE....4-65
TIMBER....4-67
TRAILS....4-73
TRANSPORTATION....4-76
WETLANDS....4-84
WILDLIFE....4-85

Chapter 4

Forest-wide Standards and Guidelines

Introduction

Chapters 2, 3, 4, and 5 of the Forest Plan present the direction for managing the Tongass National Forest. Management direction and the priority of this direction are explained in Chapter 1. This chapter includes the Forest-wide Standards and Guidelines, which apply to all or most areas of the Forest and provide for the protection and management of forest resources. They are used in conjunction with the additional Land Use Designation (LUD)-specific Standards and Guidelines (Chapter 3) and Plan Components (Chapter 5). Each management prescription (Chapter 3) includes a table indicating which of these Forest-wide Standards and Guidelines apply to that LUD. The Forest-wide Standards and Guidelines are organized by resource or category.

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AIR
Forest-wide Standards and Guidelines

Air Resource Inventory: AIR1

I. Baseline Quality and Values

A. During project planning, assess air quality conditions on National Forest System lands by following direction in Forest Service Manual (FSM) 2580.

B. Establish inventory and monitoring sufficient to follow legislative requirements (Forest and Rangeland Renewable Resources Act of 1974 [16 U.S.C. 1601], as amended by the National Forest Management Act [16 U.S.C. 1602], and Federal Land Policy and Management Act of 1976 [43 U.S.C. 1701 et seq.]), and to meet national policy and direction (Chief's 10-Year Wilderness Stewardship Challenge 2005, National Strategic Plan for Air Resource Management 1994).

C. Coordinate air climate change inventory, monitoring, and modeling efforts with National Park Service programs, Forest Health Monitoring and Forest Inventory and Analysis programs, and other Forest Service regions.

Air Resource Planning: AIR2

I. Objective

A. The objective for the air resource, which is to be managed as a part of the Forest ecosystem, is to maintain or improve National Forest air quality by preventing significant deterioration from Forest activities or other sources (Clean Air Act, as amended [42 U.S.C. 7401 et seq.]).

II. Planning for the Maintenance of Air Quality

A. Plan to maintain current air quality Forest-wide.

1. Manage on-Forest resource activities to control and minimize air pollution impacts and to ensure that predicted emissions from all pollution sources do not exceed Ambient Air Quality Standards specified under the Alaska Administrative Code (AAC), Title 18, Chapter 50.
   a) Obtain burning permits from the Alaska Department of Environmental Conservation (ADEC) for all prescribed fire projects.
2. Require permittees, contractors, and mine operators to apply for applicable state permits and meet state Air Quality Standards when conducting work on the Forest.
3. Cooperate with regulatory authorities to prevent adverse effects of air pollutants and atmospheric deposition on the Forest ecosystems.

Air Coordination: AIR3

I. Coordination with the State of Alaska

A. Cooperate with ADEC to protect the air resource on the National Forest. Join in the assessment of air quality monitoring needs and in the development or revisions of air quality standards and regulations, as needed.

B. Review and comment on both proposed and existing sources of off-Forest pollution that may significantly affect ambient air quality on National Forest System lands.

C. Review the requirements for proposed new emission sources under the Prevention of Significant Deterioration permitting process.

BEACH and ESTUARY FRINGE
Forest-wide Standards and Guidelines

Beach and Estuary Description: BEACH1

I. Objectives and Identification

A. Management objectives of the beach and estuary fringe habitat.
   1. To maintain the ecological integrity of beach and estuary fringe forested habitat to provide sustained natural habitat conditions and requirements for wildlife, plants, fish, recreation, heritage, scenery, wilderness, and other resources.
   2. To provide a relatively continuous forested corridor linking terrestrial landscapes.
   3. To provide a variety of recreation opportunities, typically of a Primitive or Semi-Primitive nature and retain the scenic quality.
   4. To maintain an approximate 1,000-foot-wide beach fringe of mostly unmodified forest to provide important habitats, corridors, and connectivity of habitat for eagles, goshawks, deer, marten, otter, bear, and other wildlife species associated with the maritime-influenced habitat. Old-growth forests are managed for near-natural habitat conditions (including natural disturbances) with little evidence of human-induced influence on the ecosystem.
   5. To maintain an approximate 1,000-foot-wide estuary fringe of mostly undisturbed forest that contributes to maintenance of the ecological integrity of the biologically rich tidal and intertidal estuary zone. Habitats for shorebirds, waterfowl, bald eagles, goshawks and other marine-associated species are emphasized. Old-growth conifer stands, grasslands, wetlands, and other natural habitats associated with estuary areas above the mean high tide line are managed for near-natural habitat conditions with little evidence of human-induced disturbance.

B. Beach fringe identification.
   1. The beach fringe is an area of approximately 1,000 feet slope distance inland from mean high tide around all marine coastline.

C. Estuary fringe identification.
   1. The estuary fringe is an area of approximately 1,000 feet slope distance around all identified estuaries. Estuaries are ecological systems at the mouths of streams where fresh and salt water mix, and where salt marshes and intertidal mudflats are present. The landward extent of an estuary is the limit of salt-tolerant vegetation (not including the tidally influenced stream or river channel incised into the forested uplands), and the seaward extent is a stream's delta at mean low water.

Beach and Estuary Management: BEACH2

I. Management

A. Management is governed by the Land Use Designation (LUD) in which the beach or estuary area is located. Some LUDs (such as Wilderness and some of the Natural Setting LUDs) highly restrict development. Where the LUD allows development (e.g., moderate and intensive Development LUDs), the standards and guidelines discussed below will apply.
   1. Allow facility developments that require in-water access (e.g., docks, floats, or boat ramps).
      a) Locate facilities more than 300 feet from the mouths of intertidal channels of known Class I anadromous fish streams, or tidal or subtidal beds of aquatic vegetation to avoid significant impairment.
      b) Avoid filling of intertidal and subtidal areas to the extent feasible.
   2. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of Operations. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and National Forest Mining Regulations at 36 CFR 228.
      a) Take advantage of topographic and vegetative screening when locating drill rigs, pumps, roads, rock quarries, structures, and marine transfer facilities.
      b) Consider timing restrictions to minerals activities to avoid adverse impacts to fish and wildlife resources during critical periods.

3. Emphasize natural recreation settings and continue to provide the spectrum of outdoor recreation and tourism opportunities.
   a) Where feasible, schedule activities to avoid change to the existing Recreation Opportunity Spectrum (ROS) class in marine recreation settings. Emphasize the more primitive ROS class when activities are considered in the Wilderness or Wilderness Monument LUD.
   b) In locations where scheduled activities change the recreation setting(s), manage the new setting(s) in accordance with the appropriate ROS guidelines with emphasis on marine-related recreation activities.
   c) Design and locate recreation-related structures (e.g., recreation cabins, lodges, and wildlife viewing structures) to be compatible with beach and estuary fringe objectives.
   d) Manage off-highway vehicle (OHV) use as documented in the Travel Management Plan.
   e) Manage recreation and tourism use to maintain fish, wildlife, and rare plant habitats.
4. Allow subsistence and other personal use of timber in accordance with ANILCA, Title VIII, and other standards and guidelines (e.g., the 330-foot buffer around bald eagle nests). Personal use is generally inconsistent with beach and is only allowed when the accessibility of other lands suitable for timber production are not feasible, such as when the eligible permittee lives in an unroaded area with no feasible access to designated "suitable timber" lands suitable for timber production, and when the LUD objectives can be met.” Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are not suitable for timber production to ensure that the LUD objectives are fulfilled.
5. Beach log salvage is permitted.
6. (See Forest-wide plan components in Chapter 5)
7. (See Forest-wide plan components in Chapter 5)
8. Road construction is discouraged in the beach and estuary fringes. Where feasible alternatives are not available, road corridors may be designated.
   a) Provide or maintain recreation or community access where needed as identified through project analysis.
9. Log transfer facilities may be constructed.
   a) Use the Alaska Timber Task Force Siting Guidelines (see Appendix G and the log transfer facility standards and guidelines in the Transportation Forest-wide Standards and Guidelines section).
10. Wildlife habitat restoration of young-growth conifer stands is encouraged to accelerate development of advanced seral stand structure. Treatments may include thinning of young stands, release, pruning, and fertilization.
11. Other authorized activities (e.g., powerlines, fish camps) may be allowed in the beach and estuary fringe where feasible alternative locations are not available.

FACILITIES

Forest-wide Standards and Guidelines

The following Standards and Guidelines apply to recreation and administrative facilities needed to support the management, protection, and use of the National Forests, including buildings, utility systems, dams, and other constructed features.

Facilities Operations: FAC1

I. Administration and Maintenance

A. Assess and document the ability of Forest Service facilities to support planned activities.
B. Assess the historic and cultural values of these facilities.
C. Provide maintenance and safety inspections on major structures on the Forest in compliance with Forest Service Manual (FSM) requirements.
D. Maintain current operation and maintenance plans for Forest Service-owned recreation facilities (Consult FSM 2330.)
E. Maintain facilities to meet codes applicable at the time of construction, unless otherwise required by law.
F. Perform accessibility surveys on all existing facilities. Implement improvements to provide barrier-free, accessible facilities appropriate to the site development and ROS level as funding and opportunity allow (also see Recreation and Tourism Forest-wide Standards and Guidelines).

Facilities Improvement Preparation: FAC2

I. Plan Development

A. Complete site development plans for all facility needs identified in the Forest Plan implementation schedule or the Forest Facility Master Plan. (Consult FSM 7311.)
B. Maintain a description of the desired condition for facilities that reflect needs, future development opportunities, and long-term management in the Forest Facility Master Plan. Document the extent and management of these facilities, including:
   1. Number of buildings by type and age.
   2. Number of dams in federal ownership by classification.
   3. Developed recreation sites, such as National Forest campgrounds, picnic areas, and trailheads with recreation facilities.
   4. Number and types of permitted facilities, including dams, ski areas, fences, buildings, etc.
   5. Number (and/or miles) of systems including sewage, water, electrical, and communication networks needed within recreation and administrative sites.

Facility Construction: FAC3

I. Construction Requirements

A. All remodeling, new construction, or building leasing should be in accordance with an approved site development plan in order to provide safe, functional, aesthetically pleasing, energy efficient, and cost-effective facilities.
B. Ensure consistency with LUD direction.
C. Access for persons with disabilities is required for all new facilities (administrative and recreation).
D. Consult Forest Service Handbook (FSH) 7309.11 for gender-related design standards.
E. Consider additional public use cabins and/or shelters in the Wilderness only when needed for health and safety purposes (Alaska National Interest Lands Conservation Act of 1980, Section 1315(d)).
F. Develop a revegetation plan using approved plant species.

FIRE
Forest-wide Standards and Guidelines

Fire Suppression: FIRE1

I. Protection Options

A. Due to climate conditions, fire suppression is not a common need on the Tongass National Forest. Under typical conditions, the period of time for fire starts and spread is short. All suppression actions will provide for the safety of fire fighters and be applied at a minimum suppression cost, commensurate with the values at risk. Fire suppression shall fall into one of four optional categories: "Critical" (control strategy), "Full" (control strategy), "Modified" (contain strategy), or "Limited" (confine strategy). These options and strategies are further defined and discussed in the Alaska Interagency Wildland Fire Management Plan. Complete a Wildland Fire Situation Analysis (WFSA) for all suppression actions that fail to confine, contain, or control the fire's spread following the first initial attack shift. (Consult Forest Service Manual [FSM] 5132.)

1. Critical Protection Option (control). This option is specifically created to differentiate the protection of human life and inhabited property and improvements from natural resource protection. The designation of a site or area with this option is the discretion of the land manager responsible for the fire protection. Fires occurring in or immediately threatening lands in this designation will receive highest priority for immediate initial attack and continuing aggressive actions dependent upon availability of suppression resources.
2. Full Protection Option (control). Areas assigned this designation will receive aggressive initial attack and aggressive suppression actions consistent with availability of suppression resources until the fire is declared out. This option was designed for the protection of high resource values, cultural sites, historical sites, and those resources that require wildland fire protection, but do not involve protection of human life and habitation.
3. Modified Protection Option (contain). This designation is intended to be the most flexible option available to land managers. The intent of the Modified management option is to provide a higher level of protection when fire danger is high, probability of significant fire growth is high, and probability of containment is low. A lower level of protection is provided when fire danger decreases, potential for fire growth decreases, and the probability of containment increases. The Modified designation provides a management level between Full and Limited. Generally, early in the season fire starts on lands under this designation are treated more aggressively and then after the conversion date, they are treated like Limited designation lands. The conversion date is determined by the Alaska Wildland Fire Coordination Group each fire season. The intent of this designation is to reduce suppression costs and increase resource benefits where possible during the entire fire season. Some portions of the fire may require aggressive action and others may only require a containment action.
4. Limited Protection Option (confine). This category recognizes areas where the cost of suppression may exceed the value of the resources to be protected and the environmental impacts of fire suppression activities may have more negative impacts on the resources than the effects of the fire. Wildland fires occurring within this designation will be allowed to burn under the influence of natural forces within predetermined areas while continuing protection of human life and site-specific values within the management option. Generally, this designation receives the lowest priority for allocations of initial attack resources; however, surveillance may be a high priority. Suppression actions may be initiated to keep a fire within the boundary of the management option.

Fuels Improvements: FIRE2

I. Prescribed Fire

A. The use of prescribed fire as a tool for resource management is often undependable due to shortness of burning opportunities and weather limitations during the burning season. Use

prescribed fire, as appropriate, for silvicultural site preparation, wildlife habitat improvement, invasive plant control, or slash hazard treatment.

1. All prescribed fires must have an approved burn plan signed by the appropriate line officer with a designated burn boss, contingency options, and a process for monitoring and evaluating results. All prescribed fires will have a qualified organizational structure, including personnel, to suit the complexity of burn. (Consult FSM 5140.)
2. For silvicultural site preparation, wildlife habitat improvement, and slash hazard treatment, the District Ranger will ensure appropriate interdisciplinary specialist participation during planning, executing, monitoring, and evaluation phases of prescribed fire use. (Consult FSM 5140, FSH 5709, and FSM 6740.)
3. Because of the absence of fire as a natural disturbance agent in Southeast Alaska, prescribed fire is expected to play little to no role within the Wilderness or Wilderness Monument LUD.

FISH

Forest-wide Standards and Guidelines

Fish Habitat Inventory and Monitoring: FISH1

I. Fish Habitat Inventory

A. Maintain the channel type and stream class (see Glossary) based inventory of all Forest streams.
   1. Maintain and update the stream inventory (and geographic information system [GIS] mapping) during site-specific project planning and analysis.
      a) Consult publication R10-TP-26, A Channel Type Users Guide for the Tongass National Forest, Southeast Alaska (as revised), for descriptions of the channel types.
      b) Consult the Aquatic Habitat Management Handbook FSH 2090.21 for descriptions of Region 10, stream survey methodologies.

B. Maintain the inventory of Forest streams and watersheds for fish enhancement opportunities.

C. Maintain, and further develop as necessary, the fish habitat objectives database used to measure changes in the natural range and frequency of aquatic habitat conditions. (See FISH2,IV(B).)

Fish Habitat Planning: FISH2

I. Fish Habitat and Channel Processes

A. Recognize watershed function and channel processes when planning for the protection, restoration or enhancement of fish habitat. (Consult Riparian Forest-wide Standards and Guidelines RIP2 and Soil and Water Forest-wide Standards and Guidelines SW3.)
   1. Consider the effects of upstream and upslope activities during site-specific planning.
   2. Consider the condition of upstream and upslope areas during site-specific planning.
   3. Consider topics such as erosion processes, watershed hydrology, vegetation, stream channel morphology, water quality, wilderness designation, recommendations for inclusion into the Wild and Scenic River System, species and habitats, and human uses, during analyses.

II. Channel Classification and Process Groups

A. Use channel type inventories to categorize stream reaches into channel process groups. Use channel types and process groups to plan management activities affecting fish and fish habitat along all lakes and streams. Process groups and the channel types included in each process group are shown in Appendix D and publication R10-TP-26, A Channel Type Users Guide for the Tongass National Forest, Southeast Alaska (as revised). These groups may be redefined as more information about channel types becomes available.
   1. Map and field-verify streams, lakes, and estuaries by channel type and stream class for project planning and implementation.

III. Fish Stream Classification (reference FSH 2090.21 (2001) Chapter 10, Section 12)

A. Determine fish/water quality value class of all streams in the affected area prior to or during site-specific project planning. (Consult Riparian Forest-wide Standards and Guidelines.)

B. Use the following classification system across the Forest:
   1. Class I: Streams and lakes with anadromous or adfluvial fish or fish habitat, or high quality resident fish waters or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.
   2. Class II: Streams and lakes with resident fish or fish habitat—generally steep channels 6 to 25 percent or higher gradient—where no anadromous fish occur, and otherwise do not meet Class I criteria.
   3. Class III: Perennial and intermittent streams with no fish populations but which have sufficient flow, or transport sufficient sediment and debris, to have an immediate influence on downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.

A stream segment is designated Class III if, for the majority of its length, the bankfull stream width is greater than 1.5 meters (5 feet) and the channel incision (or entrenchment) is greater than 5 meters (15 feet).

Streams that do not meet both the width and incision criteria may be classified as Class III streams based on a professional interpretation of stream characteristics for the stream segment being assessed. The following characteristics **could** indicate a Class III stream:

a) Steep side-slopes containing mobile fine sediments, sand deposits, or deep soils that can provide an abundant source area for sedimentation.
b) Very steep gradient channels (greater than 35 percent slope).
c) Recently transported bedload or woody debris wedges (especially if deposited outside high water mark).
d) High water indicators (scour lines, drift lines, etc.) that greatly exceed observed wetted stream width.
e) Large sediment deposits stored amongst debris that could be readily transported if debris shifts.

4. Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capacity to directly influence downstream water quality or fish habitat capability. Class IV streams do not meet the criteria used to define Class I, II, or III streams. Class IV streams must have bankfull width of at least 0.3 meter (1 foot) over the majority of the stream segment. For perennial streams, with average channel gradients less than 30 percent, special care is needed to determine if resident fish are present (resident fish presence dictates a Class II designation).
5. Non-streams: Rills and other watercourses, generally intermittent and less than 1 foot in width, little or no incision into the surrounding hillslope, and with little or no evidence of channel scour. (Note: These micro-drainage features are not mapped in GIS hydrography layers.)

IV. Objectives/Guidelines for Management Affecting Fish Habitat

A. Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.
B. Use (and update) baseline fish habitat objectives as a reference to evaluate the relative health or condition of riparian and aquatic habitat. Use baseline fish habitat objectives, listed below (and others as developed), (Anadromous Fish Habitat Assessment Team 1995, Bryant et al. 2004, Woodsmith et al. 2005) to characterize the natural range of habitat conditions by channel types and process groups. Specific measurement protocols are described in the Alaska Region Aquatic Management Handbook (FSH 2090.21 – 2001-1).
   1. Width-to-depth ratio—Relationship between bankfull width and average bankfull depth, expressed as bankfull width / average bankfull depth.
   2. Large woody debris (LWD)—Frequency of qualifying large wood pieces per kilometer of stream.
   3. Total key pieces of LWD—Frequency of large, structurally integral pieces of wood scaled to channel size per kilometer of stream.
   4. Pools per kilometer—Frequency of qualifying pools per kilometer of stream.
   5. Pool spacing—Frequency of qualifying pools per unit area of channel, length of channel surveyed / average channel bed width / number of pools.
   6. Residual pool depth per channel bed width—Residual pool depth scaled to channel size, residual pool depth / average channel bed-width.
   7. Median particle size.
   8. Pool length per meter—Total qualifying pool length divided by length of survey.
   9. Pool size (relative depth)—Average residual pool depth / average bankfull depth.
   10. Relative submergence—Expressed as average bankfull depth.

C. Maintain or restore stream banks and stream channel processes.
   1. Stream Class I, and Class II streams that flow directly into Class I streams. Maintain, restore, or improve anadromous, adfluvial, and high-value resident fish habitat capability by providing natural or improved cover/pool ratio, pool-riffle sequences, and habitat features, such as stable LWD. Design management activities to maintain stream bank, channel, and flood plain integrity.
   2. Other Stream Class II. Maintain or restore habitat capability for resident fish populations by providing natural or improved cover/pool ratio, pool-riffle sequences, and habitat features, such as stable LWD. Design management activities to maintain stream bank, channel, and flood plain integrity. Avoid impacts to downstream Class I streams.
   3. Stream Class III. Design management activities to maintain or restore stream bank, channel, and flood plain integrity. Avoid impacts to downstream Class I and Class II streams.

D. Maintain or restore natural and beneficial quantities of LWD over the short- and long-term.
   1. Stream Class I, and Class II streams that flow directly into Class I streams. Maintain or restore anadromous, adfluvial, and high-value resident fish habitat capability by providing for natural and beneficial volumes of LWD for rearing, stream energy dissipation, and sources of organic matter to the stream ecosystem. Use biological and physical characteristics of the stream to determine size classes and distribution of LWD. Limit navigational clearing of large wood to the minimum necessary for safety.
   2. Other Stream Class II. Maintain or restore habitat capability for resident fish populations by providing LWD, and by designing for future sources of LWD at volumes determined by channel type biological and physical characteristics.
   3. Stream Class III. Maintain or restore LWD in channels and banks to prevent changes in natural stream bank and stream channel processes.

E. Maintain or restore water quality to provide for fish production.
   1. Stream Classes I, II, and III. Prevent adverse effects to rearing and spawning habitat. Maintain or restore anadromous, adfluvial, and high-value resident fish habitat capability. Maintain or restore capability for other resident fish populations to the extent feasible. Ensure no chronic sediment input following soil-disturbing activities. Prevent adverse impacts to fish habitat downstream by minimizing siltation.
   2. Implement applicable Best Management Practices (BMPs). (Consult National Core BMP Technical Guide FS-990a and the Alaska Region Soil and Water Conservation Handbook, FSH 2509.22.)

F. Maintain or restore optimum water temperatures for salmonids, considering both winter and summer habitat requirements, climate, and natural watershed characteristics.
   1. Stream Class I, and Class II streams that flow directly into Class I streams. Maintain or restore optimum salmonid summer stream temperatures at between 50° and 68°F or at natural levels. (Consult the current State of Alaska Water Quality Standards):
   2. Other Stream Class II. Maintain water temperatures below 68°F, or at natural levels, to maintain or restore habitat capability for resident fish populations. Manage watersheds and riparian streamsides to maintain appropriate water temperature for downstream Class I streams as described in F.1.
   3. Stream Class III. Manage watersheds and riparian streamsides to maintain water temperature standards and guidelines for downstream Class I and II streams.

G. Maintain, restore, or improve, where feasible (see Glossary), stream conditions that do not disrupt the migration or other movement of aquatic organisms inhabiting a waterbody.
   1. If a stream crossing cannot be avoided, the best solution for aquatic organism passage is generally to maintain the natural stream form and processes from the inlet, through the crossing, and into the downstream channel. Bridges, open-bottom culverts, and stream-simulated culverts designed and installed to applicable BMPs (Consult the National Core BMP Technical Guide FS-990a and the Alaska Region Soil and Water Conservation Handbook, FSH 2509.22) and design standards (Aquatic Habitat Management Handbook, FSH 2090.21) to best meet this objective.
   2. Some stream conditions, engineering constraints, or cost may make it desirable to install culverts that use a variety of weir/baffles or roughened channel to provide for passage.

These hydraulically designed culverts rely on matching culvert hydraulic conditions at a specified design flow to the swimming performance of a specified design fish (Aquatic Habitat Management Handbook, FSH 2090.21).

3. Stream crossing structures requiring aquatic organism passage will be designed to current standards by qualified professionals.
4. Consult applicable BMPs (see National Core BMP Technical Guide FS-990a and FSH 2509.22).
5. Consult and improve the inventory of identified fish stream crossings.
6. As per the Memoranda of Understanding (MOU) between the Forest Service and the Alaska Department of Fish and Game, culvert installation, stream alignment, or diversions; dams; low-water crossings; and construction, placement, deposition, or removal of any material or structure below ordinary high water may require State of Alaska concurrence.
7. Overall, the intent is to not disrupt the migration or movement of aquatic organisms, but occasionally it is not feasible to protect some sections of habitat and movement will be restricted. In determining feasibility, consider the following:
   a) Presence of known sensitive, isolated, or unique fish populations.
   b) Extent and quality of available habitat and how it is affected by the location of the stream crossing.
   c) Cumulative impacts of restricting fish passage at multiple sites in the same watershed.
   d) Upstream and downstream linkages between the anadromous and resident life strategies of the same species.
   e) Advice from the Alaska Department of Fish and Game (ADF&G) and ADNR.
   f) Length of time that a stream structure will restrict movement.
   g) Cost of providing ideal passage conditions compared to less than ideal conditions.
   h) Availability of suitable, cost-effective compensatory mitigation projects.
8. The discharge of dredge or fill material from normal silviculture activities such as timber harvest is exempt from Clean Water Act Section 404 permitting requirements in waters of the United States (404(f)(1)(A). Forest roads qualify for this exemption only if they are constructed and maintained in accordance with BMPs specified in 33 CFR 323.4(a). These BMPs have been incorporated into BMP 12.5 in the Alaska Region's BMP Handbook (FSH 2509.22).

V. Management Indicators

A. Use Forest Plan management indicators to evaluate the potential effects of proposed project management activities affecting fish habitat.

VI. Management Activities

A. Maintain a fish program schedule that includes anticipated inventory needs, proposed habitat improvement and maintenance projects, and monitoring requirements.

VII. Coordination

A. Coordinate activities that affect fish resources with other Forest disciplines through the Interdisciplinary Team process, and with other federal, state, and local agencies and groups.
   1. Develop and maintain Memoranda of Understanding/Agreements with appropriate state, federal, and local agencies, and aquaculture associations.
   2. Coordinate with the state and federal agencies, and the Pacific Northwest Research Station, to maintain a continuous program for research, monitoring, and assessment of impacts of land-use activities on fish habitat.

B. Consider the influence of proposed management activities on fishing use patterns.

C. Consider effects of off-highway vehicle (OHV) travel and road closures on fish habitat and populations.

VIII. Project Planning

A. Use the following priority for fish habitat project work: mitigation for unplanned impacts, rehabilitation/restoration, and enhancement. For both mitigation and rehabilitation, consider

alternatives for cost efficiency of performing off-site enhancement (enhancement of a different area than where the impact actually occurs).

1. Location of off-site enhancement shall be governed by the following priorities:
   a) First priority: same stream reach (same species)
   b) Second priority: same stream (same species)
   c) Third priority: same watershed (same species)
   d) Fourth priority: same anadromous fish harvest area (same species)
   e) Fifth priority: differing species, using above priority order

B. Enhance fish habitat to meet the objectives identified in this Plan. Opportunities may include, but are not limited to, instream enhancement, lake fertilization, cooperative bio-enhancement (e.g., stocking), incubation boxes, and fishway construction.
   1. Use the Cooperative Fisheries Planning process (consult the Alaska National Interest Lands Conservation Act, Section 507) and/or other cooperative agreements for developing priorities for the enhancement of fish resources.
   2. Determine habitat capability on streams and lakes identified for enhancement in the Cooperative Fisheries Planning process prior to construction of fish projects.
   3. Update the fish habitat enhancement list (Cooperative Fisheries Planning process) periodically.

C. Recognize bio-enhancement (e.g., stocking of juveniles, use of egg incubation boxes, transferring of adult fish to seed stream systems) as part of the fish improvement project costs when appropriate. Cooperate/coordinate with state and federal agencies and aquaculture associations to facilitate bio-enhancement. Recognize bio-enhancement as part of the fish improvement project costs when appropriate.

D. Fishpass projects abide by the standards and best practices for colonization projects included in the Comprehensive Salmon Enhancement Plan for Southeast Alaska, Phase III.

E. Coordinate new projects to enhance the use of National Forest System lands with the recreation program managers.

Fish Habitat Restoration and Improvement: FISH3

I. Planning

A. Improve or restore fish habitat to work toward the habitat objectives of the Forest Plan. Give priority to restoration projects.

B. Construct projects using the most cost-efficient methods, while achieving desired results consistent with the Land Use Designation.

C. During project planning consider the need to monitor the accomplishment of project objectives. Need shall be governed by the type of project, with high interest/high investment projects being monitored more intensively.
   1. Where needed, develop cooperative agreements with fish/aquaculture agencies and other groups to assess the effectiveness of Forest Service habitat improvement.

D. Coordinate habitat restoration and improvement projects with ADF&G and other appropriate agencies and groups.

II. Construction Coordination

A. Coordinate all fish habitat restoration and improvement using an interdisciplinary process.

III. Monitoring

A. Conduct monitoring of fish habitat restoration and improvement projects to ensure their continued function at the design level of operation.

B. Monitor fish production on a representative sample of restoration and improvement projects to evaluate effectiveness of individual projects, categories of similar projects, and the effectiveness of the overall improvement program.

Fish Habitat Maintenance: FISH4

I. Maintenance

A. Provide for the maintenance of fish habitat enhancements.
   1. Fund maintenance of existing projects prior to the construction of new ones.

2. Include funding for maintenance in the planning and budgeting for all projects.
3. Maintain restoration and improvement projects to ensure that investment objectives are met.
4. When maintenance and operation of an improvement become inefficient, reconstruct or remove the project.
5. If a project becomes inoperable, reconstruct or remove the improvement.

B. Develop a written maintenance responsibilities agreement with project cooperators prior to project construction.

Threatened, Endangered, and Sensitive Fish Species: FISH5

Consult FSM 2670 and R10 supplemental directions for Threatened, Endangered, and Sensitive species.

I. Threatened or Endangered Species

A. Currently there are no Threatened or Endangered fish species within the territorial boundaries of the Tongass National Forest.

II. Sensitive Fish Species[1]

A. Island King Salmon (Removed from Alaska Region Sensitive Species List in 2009)
1. Provide for the protection and maintenance of runs of king salmon that naturally occur on islands, including the runs in King Salmon and Wheeler creeks on Admiralty Island.
2. Coordinate with ADF&G and National Marine Fisheries Service (NMFS) on commercial, sport, and subsistence fish use, hatchery egg take programs, and other activities affecting the viability of king salmon runs in order to conserve these unique populations.
3. Avoid the placement of facilities or issuing of permits for activities near these streams that would increase harvest pressure on these king salmon runs.
4. Include culvert replacement as a conservation and restoration tool.

B. Northern Pike (Removed from Alaska Region Sensitive Species List in 2009)
1. Provide for the protection and maintenance of northern pike found in the Pike Lakes on the Yakutat Forelands. This population of northern pike is unique to Southeast Alaska.
2. Avoid the placement of facilities near the Pike Lakes that would increase harvest pressure to the point where the viability of these species is affected.
3. Coordinate with ADF&G on any activities that would affect the viability of the northern pike.
4. Include culvert replacement as a conservation and restoration tool.

C. Fish Creek Chum Salmon (Removed from Alaska Region Sensitive Species List in 2009)
1. Provide for the protection and maintenance of chum salmon in Fish Creek near Hyder. This population of chum salmon is characterized by their extraordinary large size.
2. Coordinate with ADF&G and NMFS on commercial, sport, and subsistence fish use, hatchery egg take programs, and other activities affecting the viability of the chum salmon runs in Fish Creek in order to preserve these populations.
3. Provide habitat improvement and maintenance including culvert replacement to sustain this run of salmon, as necessary.

[1] The Forest Service Alaska Region Sensitive Species List was updated in 2009 and supersedes previous lists.

FOREST HEALTH
Forest-wide Standards and Guidelines

Forest Health Management: HEALTH1

I. Forest Health Management

A. Achieve desired future condition of forest health by manipulating insect and disease populations to beneficial levels. Desirable forest health conditions are expected to vary according to different resource goals.
   1. Create ecological conditions that improve the health of vegetation by incorporating forest health principles into forest planning, decision-making, and implementation of project activities.
   2. Consider forest health management information dealing with insects, diseases, and invasive species of flora and fauna, and recommendations on management alternatives. These recommendations will include analyses of the ecological effects of insects and diseases and management alternatives, including no action, chemical, cultural, mechanical, and biological methods.
   3. For direction on the use of pesticides in forest management, consult the Pesticide Use and Vegetation Management guidelines in the Timber Forest-wide Standards and Guidelines.

B. Evaluate insect, disease, and invasive species impact(s) to resources.
   1. Conduct on-site evaluations to assess past, current, and future insect, disease, and invasive species impacts and their effect upon desired forest health.
   2. Use data from these evaluations to assist project planning and analysis.

C. Provide training, technology transfer, and technical assistance to area and district personnel to assist in the management of forest insects and diseases.

Forest Insect and Disease Survey and Inventory: HEALTH2

I. Insect and Disease Detection Survey

A. Conduct an annual insect and disease detection aerial survey in cooperation with State and Private Forestry, Alaska Region / Forest Health Protection (FHP) work group.
   1. Resource managers will establish survey priorities based on planning needs and current management concerns.
   2. Conduct aerial surveys of a variety of forest cover types and LUDs, concentrating on those areas identified as having the highest management priority.

HERITAGE RESOURCES and SACRED SITES

Forest-wide Standards and Guidelines

Heritage Resource Activities: HSS1

I. Management

A. Maintain a heritage resource management program to identify, evaluate, preserve, and protect heritage resources on a Forest-wide and project-specific level in compliance with the National Historic Preservation Act, the National Environmental Policy Act (NEPA), the American Indian Religious Freedom Act (AIRFA), the Archaeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), Executive Order 13287, their amendments and implementing regulations (consult 36 CFR 800, Forest Service Manual [FSM] 2360, and Forest Service Handbook [FSH] 2309.12).

B. Coordinate management of heritage resources with the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), Alaska Native tribes and corporations, and interested members of the public. Consult 36 CFR 800, FSM 2361, and the current Programmatic Agreement between the USDA Forest Service, Region 10, ACHP, and Alaska SHPO.

C. Identify and develop interpretive messages for heritage resource sites and activities that relate the historical value and contributions of natural and heritage resource management to the Tongass National Forest. Work closely with all interpretive services programs to ensure accurate and effective interpretation of heritage resources.

D. Coordinate the management, access, and use of Forest products to perpetuate Alaska Native culture and art forms. (See Standards and Guidelines for Plants and Timber.)

E. Develop a heritage resource management assessment that provides a framework for management decisions. Its objectives are to display the schedule of management activities, summarize current status, and identify priorities for future heritage resources inventory, evaluation, and protection.

1. Update the heritage resource assessment annually, for budget implementation and to fulfill requirements of the annual report to SHPO as stipulated in the Programmatic Agreement.
2. The assessment/annual report should include:
   a) An overview of new data and data management.
   b) Identification of projects reviewed under 36 CFR 800 or the Programmatic Agreement and areas requiring intensive site inventory, including non-project areas of the Forest.
   c) Identification, classification, and evaluation of heritage resources located.
   d) Re-evaluation and update of the heritage resource sensitivity zone system based on new data and/or understandings of each area's heritage resources and their locations.
   e) Identification of measures and priorities for the protection of heritage resources from vandalism, theft, and natural deterioration.
   f) Identification of prioritized needs for the stabilization, restoration, and repair of damaged sites.
   g) Identification of the need for maintenance of sites on, or eligible for inclusion in, the National Register of Historic Places.
   h) Identification of opportunities for interpretation of heritage resources for public education and recreation values.
   i) Identification of the interaction of heritage resources and other multiple uses, including consideration of management activities, and their impacts on heritage resource management.
   j) Identification of the coordination efforts with appropriate state heritage resource plans and planning activities of the SHPO, State Archaeologist, and other state and federal agencies.

II. Project Clearance/Inventory

A. Project Clearance. Any project, activity, or program that can result in changes in the character or use of historic properties and is under the jurisdiction of the Forest, licensed or assisted by the Forest, including new or continuing projects, activities, or programs and any of their

elements not previously considered under Sections 106 and 110 of the National Historic Preservation Act of 1966, as amended, shall be considered an undertaking and may require evaluation through inventory and survey.

1. Ensure that compliance with the Alaska Programmatic Agreement and/or 36 CFR 800 has been accomplished before a NEPA Decision Notice, Record of Decision, or Finding of No Significant Impact is signed prior to implementation of an undertaking (FSM 2361-04b-R10 Supplement).

III. Project Implementation

A. Inventory and evaluation may be accomplished at the operator's discretion and cost provided that the inventory and evaluation are accomplished under the supervision of a qualified heritage resources specialist authorized by a special use authorization. Determinations under 36 CFR 800 are made by the appropriate Forest Service line officer.

B. Include as part of the Section 106 project report specific protective and/or mitigative measures to be taken by the operator who is responsible for the cost of any such protective or mitigative measures.

C. When appropriate, mark known heritage resource sites within or adjacent to the project area prior to project implementation.

D. Include in each contract, permit, or lease a statement of the operating conditions required to protect heritage resources in the project area. Also include the pertinent clause notifying the operator of his or her responsibility to protect marked sites when working in the project area and the operator's liability for damage.

E. Provide training in the recognition, site inspection, and protection of heritage resources for all persons responsible for on-the-ground administration of contracts, permits, or leases.

1. If a site, human remains, or funerary object is discovered during project implementation, work shall be suspended by the project administrator to avoid potential site damage. The Forest Supervisor shall notify the SHPO and appropriate Alaska Native tribe and corporation contacts, and resumption of work will be authorized only after the consultation process has been completed. The project administrator shall keep the contractor, permittee, or lessee informed of anticipated delays in work resumption.

IV. Mitigation

A. In cases where in-place preservation of heritage values is the objective, the Forest Supervisor shall consider management options such as project design, location, or cancellations in meeting the objective. Consult 36 CFR 800 and the Programmatic Agreement for procedures to be followed in reaching a management decision.

B. The preferred management of sites listed in, nominated to, or eligible for the National Register of Historic Places is avoidance and protection.

1. When feasible, sites listed in, nominated to, or eligible for the National Register of Historic Places shall be managed to achieve a "No Adverse Effect" finding, in consultation with the SHPO and the Advisory Council on Historic Preservation. (Consult 36 CFR 800.)
2. The recovery (collection) of heritage resources can occur during the inventory, evaluation, or mitigation (data recovery) phases. Standard requirements include documentation of the resource, labeling of the artifacts, and curation of the recovered materials and resultant records.
3. Collection of artifacts, except under emergency circumstances, must be accomplished or directly supervised by a professional heritage resources specialist. A qualified heritage resources specialist may recover artifacts for purposes of evaluation.
4. Requirements for heritage resource collection include the following:
   a) Emergency collection. Artifacts collected in emergency situations shall be turned over to the Unit Heritage Resources Specialist for appropriate curation.
   b) Special agents and other law enforcement officers conducting criminal investigations may collect artifacts as evidence. Any material collected must be cataloged and stored in a secure area.
   c) Artifact samples may be collected from heritage resource sites, when they can be systematically recovered and properly recorded for further evaluation (caution must be

exercised to ensure that the collection of artifact samples is adequate for the purpose intended without causing unacceptable impacts to the resource). The sample size collected should be no more than the minimal amount necessary for the proposed analysis.

d) Data recovery (including collection of artifacts and photographic/archival recordation) must be conducted in accordance with a Forest Service/SHPO-approved Data Recovery Plan, which shall conform to the published guidelines in the Advisory Council on Historic Preservation, Handbook for the Treatment of Archaeological Properties.

5. Disinterment of human remains, associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony should occur only when consultation has been completed per NAGPRA with the direct lineal descendants or the representative tribe. A signed Memorandum of Understanding shall be in place prior to any planned disinterment activities. Inadvertent discoveries shall follow the procedures set forth in 43 CFR 10.

V. Enhancement

A. Identify opportunities and priorities for interpretation of heritage resources for public education and recreation. Public education efforts should emphasize the importance of heritage site stewardship and leaving in place what they find.

1. Manage significant and suitable heritage resource sites to realize their recreational and educational values to the public. Enhancement programs, including Passport In Time and Heritage Expeditions, should include in-service funding as well as opportunity for establishing partnerships with the private sector. The measure of suitability should be based upon accessibility, feasibility for protection, condition of the property, compatibility with other management activities, and value to the public.
2. Enhance suitable heritage values through interpretation, restoration, and the publication of reports, brochures, signs, films, videos, slide, and other interpretive programs. Interpretive services and facilities should be compatible with the nature, quality, and integrity of the resource selected for enhancement.
3. Cooperate with museums, universities, Indian tribes, and other recognized institutions, agencies, and knowledgeable persons in planning and constructing heritage resource exhibits and providing opportunities for scholarly/scientific use.
4. Manage heritage resources to ensure that properties and their records are protected to prevent degradation or unauthorized use under authority of the Archaeological Resources Protection Act of 1979 and the regulations in 36 CFR 296 and 36 CFR 79.

VI. Site Inspection

A. Assess condition, and document restoration or stabilization needs of cultural sites. Use this information for reporting the success of mitigation measures and other actions taken to ensure site preservation.

1. Frequency of inspection should seek to include one documented visit per selected site per year as available resources allow. If site damage is observed, additional inspections may become necessary. If an area is damaged through suspected human disturbance, inspect other sites in that vicinity. (Consult the Forest Heritage Resource Program Manager and/or Special Agent.)
2. Coordinate the assessments with District Rangers, the Forest Heritage Resource Program Manager, and the Special Agent.

B. Assessment procedures should include observations documenting the current site condition. Document assessments through a signed, written report that verifies which site was inspected and the observed condition.

C. Damage Assessment Report. If site damage is observed and it has not been previously recorded, a site damage assessment report will be prepared by the Forest Heritage Resource Program Manager or Unit Heritage Resource Specialist. The purpose of the damage assessment report is to identify the damage using quantitative measures, make recommendations to stabilize the site from further deterioration, determine the archaeological or

commercial value and the cost of restoration and repair, and evaluate the actions needed to prevent further damage.

D. Remain alert to cultural damage potentially attributable to criminal acts and safeguard investigation by avoiding further disturbance of the area.

E. Prioritize heritage sites to be assessed on a yearly basis as coordinated by the District Ranger, Forest or Zone Heritage Resource Program Manager, and Special Agent.

F. Include resource inspection in the measures for the protection of heritage resources from vandalism, natural destruction, or project activity. Evaluate and recommend measures such as stabilization, data recovery, or no action, for resources that have sustained damage from natural forces. Vandalism, collecting, illicit excavation, or project damage shall be evaluated for protective measures, such as signing, administrative closure, remote sensing, increased inspection, investigation, stabilization, data recovery, or other measures under the authority of the American Antiquities Act of 1906, the Archaeological Resources Protection Act of 1979 and regulations in 36 CFR 261, 36 CFR 296, and 36 CFR 800.

G. Complete or update condition assessments for 20 percent of all priority heritage assets each year based on field visits and updated cost information.

Sacred Sites Protection Activities: HSS2

I. Management

A. The Tongass National Forest will manage sacred sites as an integral part of its land management. To the extent practicable, accommodate access to and ceremonial use of sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sites. Provide reasonable notice of proposed actions or policies that may restrict access to or adversely affect the physical integrity of sacred sites. When there is a conflict among potential uses, we will prioritize the protection of sacred sites above other land uses.

The active participation of Indian tribes and Indian religious practitioners is critical to the success of sacred sites management. If a tribal government chooses not to consult, the Forest will rely on the best available information to make decisions about sacred sites.

Use the collective authorities and provisions of these laws and Executive Orders: Executive Order 13007, Indian Sacred Sites; Executive Order 12898, Environmental Justice; Executive Order 13175, consultation and coordination with tribal governments; American Indian Religious Freedom Act; National Historic Preservation Act (NHPA), as amended; Archaeological Resources Protection Act (ARPA), as amended; Religious Freedom Restoration Act; and Native American Graves Protection and Repatriation Act. Guidance on traditional cultural properties is presented in National Register Bulletin 38.

Executive Order 13007 defines a sacred site as “any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site.”

B. The Forest Supervisor, Deputy Forest Supervisor, and District Rangers will be responsible for sacred sites management. Heritage resource and tribal government relations specialists will collaborate to provide the Forest’s line officers information necessary to make decisions related to sacred sites management. These specialists will coordinate consultation between the Forest’s line officers, tribal government officials, and authoritative representatives.

1. Conduct sacred sites discussions with tribal government officials and authoritative representatives.

C. Regularly review proposed federal actions with tribal government officials and authoritative representatives and document their comments. This review should occur as early as possible before the public scoping occurs. Ensure adequate time is provided to assess the potential effect of a proposed action on the access, use, and physical integrity of sacred sites.

D. Develop a knowledge base about sacred sites and develop a record of any tribal protocols, management recommendations, proposed guidelines, policy, or concerns about a proposed federal action regarding potential effects to sacred sites within the Indian tribe's areas of cultural concern.

E. Protect the physical integrity of sacred sites by considering limits to public access and use, while accommodating access and use by authorized tribal representatives.

1. Use voluntary closures to the greatest extent possible to provide seclusion and privacy whenever requested by tribal government officials and their authorized representatives.
2. Identify specific locations and time frames in the closure order and provide notification to the unit Law Enforcement Officer.

F. Use alternative dispute resolution processes regarding sacred sites management to resolve differences between the Forest Service and tribal government officials and their authorized representatives. (Consult FSM 1563.2.)

II. Project Planning

A. As early as possible, consult with Indian tribal governments and authoritative representatives and conduct formalized government-to-government consultation with Indian tribes to develop agreements regarding the access, use, protection, and management of sacred sites.

B. Develop site-specific management strategies that detail protection issues and enforcement mechanisms for identified sacred sites within the area of potential effects in consultation with tribal government officials and authoritative representatives.

C. Protect the confidentiality of sacred sites information, which will not be shared with the public or media. Be respectful of traditional rock art, totemic and clan crests, icons, stories, and tribal words or language. The Forest Service will not use tribal knowledge, stories, rock art, totemic, or clan crests without permission.

1. Implement procedures to protect confidential information related to sacred sites to the maximum extent permitted by law. (Consult FSM 1563.03.7; NHPA, Section 304; ARPA, Section 9.)

III. Project Implementation

A. Maintain and protect the natural environment surrounding an identified sacred site while consulting with Indian tribes and Indian religious practitioners to seek agreement for further protection and site treatment measures.

1. When a sacred site is identified, meet with tribal government officials and authoritative representatives to determine if a site visit is advisable.
2. Consider tribal recommendations for protection until an assessment of management alternatives is made. When human remains or other funerary items are involved, follow the inadvertent discovery or intentional excavation requirements of the Native American Graves Protection and Repatriation Act.

B. Develop a protection plan that, as much as practicable, incorporates specific standards and methods as recommended by tribal government officials and authoritative representatives before authorizing federal actions, including the issuance of permits.

1. Employ management strategies and protective measures that are least disturbing to sacred sites and invite participation of tribal government officials and authoritative representatives.

C. Notify the affiliated tribal government(s) within 24 hours (or as soon as possible) should an activity inadvertently disturb a sacred site, or in the event that any sacred or burial object is observed through the action of water, weather, or other causes beyond the control of the Forest Service.

IV. Mitigation

A. Management strategies to lessen adverse effects to cultural properties generally follow the model outlined in the NHPA and its implementing regulations (36 CFR 800). Line officers should be aware that mitigation in that sense might not appropriately address concerns expressed by religious practitioners about the consequences of federal actions.

B. Determine in advance with tribal government officials and authoritative representatives what kinds of activities in or around a sacred site would constitute contamination or violation of sacredness.
C. Identify what kinds of mutually acceptable solutions are available (on a case-by-case basis) should a sacred site be potentially contaminated or violated.

V. Enhancement

A. Educate Forest Service personnel about the Tlingit, Haida, and Tsimshian people who associate spiritual qualities with the land, wildlife, and other natural and cultural resources. Encourage the participation of Indian tribes and Alaska Native individuals in this educational effort.
B. The Forest Service will make available information to tribal government officials and authoritative representatives about the distinctions between the provisions of NHPA and Executive Order 13007, Indian Sacred Sites.
C. Allow opportunities for tribal government officials and authoritative representatives to reconnect with their traditional homelands and sacred sites.

VI. Monitoring

A. Invite tribal government officials and authoritative representatives to collaborate in monitoring sacred sites and to evaluate the effectiveness of sacred sites protection measures and other management strategies.
    1. The Tongass National Forest will accomplish site monitoring in a careful and respectful manner according to professional standards and tribal government recommendations. Tribal government officials and authoritative representatives will be encouraged to participate in site monitoring.
    2. Establish standard protocols for site monitoring and for maintaining confidentiality. Established or known sacred sites shall be treated with dignity, care, and respect.
    3. Establish a format to record implemented protection measures and to document sacred site condition after each monitoring event.

INVASIVE SPECIES

Forest-wide Standards and Guidelines

Invasive Species Prevention: INV1

I. Invasive Species Inventory

A. Maintain consolidated invasive species inventory for the Forest and Districts in the corporate database in accordance with Forest Service Manual (FSM) 2900 and the most current and appropriate inventory protocols.

II. Project Planning

A. For all proposed projects or activities, the responsible line officer will determine the risk of invasive species (flora and fauna) introduction or spread and the need to implement appropriate mitigation measures.

B. Ensure that contracts, permits, and project design documents contain appropriate provisions concerning the prevention and/or spread of invasive species.

Invasive Species Early Detection and Rapid Response: INV2

I. Invasive Species Management

A. At the Forest level, evaluate new non-native species for risk of invasion and update Priority Species List as needed. (Consult FSM 2900)

B. Treat priority species infestations as practicable, using an integrated pest management approach.

Invasive Species Control and Management: INV3

I. Invasive Species Management

A. Reduce population sizes and/or limit the spread of Priority Invasive Species on the Tongass National Forest through the use of an integrated pest management approach.

Invasive Species Rehabilitation and Restoration: INV4

I. Rehabilitation and Restoration of Native Flora and/or Fauna

A. Rehabilitation of habitats impacted by invasive species will emphasize the use of native plant species in restoration activities.

KARST and CAVE RESOURCES
Forest-wide Standards and Guidelines

Karst Resources: KC1

I. Strategy

A. Maintain, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses where appropriate.

B. Strive to maintain the productivity of the soils of the karst landscape after harvest, to maintain the quality and quantity of the waters issuing from karst hydrologic systems, and to protect the many resources values within underlying significant cave systems as per the requirements of the Federal Cave Resources Protection Act of 1988 (FCRPA).

C. See Appendix H for additional guidance.

II. Management

A. Evaluate karst resources as to their vulnerability to land uses affecting karst systems, as described in the Karst and Cave Resource Significance Assessment, Ketchikan Area, Tongass National Forest, Alaska (Aley et al. 1993), Karst landscapes and associated resources: a resource assessment (USDA Forest Service Gen. Tech. Rep. PNW-383) (Baichtal and Swanston 1996), Karst Management Standards and Implementation Review, Final Report of the Karst Review Panel (Griffiths et al. 2002), and the information provided herein.

B. Seek participation from interested individuals and organizations, such as caving groups, scientists, recreationists, and development interests in managing the karst resources.

C. Integrate and coordinate karst management with the management of other resources. Consider the function and biological significance of the entire karst landscape; recognize the importance of protection of karst systems, not solely specific karst features.

D. Public education and interpretative programs should be developed to ensure an increased understanding of the components and function of the karst landscape.

E. Work with universities and other appropriate research facilities to foster partnerships to study and characterize the function and biological significance of karst landscapes.

F. Manage the karst lands with an adaptive management approach.

G. **Low Vulnerability Karst Lands.** Low vulnerability karst lands are those areas where resource damage risks associated with land management activities are negligible from a karst management perspective. No special direction is needed.

H. **Moderate Vulnerability Karst Lands.** Moderate vulnerability karst lands are those areas where resource damage risks associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands adjacent to areas of high vulnerability.

1. Road Construction
   - a) Existing roads shall be used in preference to the construction of new ones.
   - b) Roads shall avoid sinkholes and other collapse features and sinking or losing streams.
   - c) Roads shall not divert water to or from karst features. Measures shall be taken to reduce erosion and sediment transport from the road surface and cut slopes. Sediment traps, cut and fill slope revegetation, and road closure and revegetation may be appropriate.
   - d) Because subsurface drainage networks may be more open to the surface in moderate vulnerability areas, additional design criteria may be required.
2. Quarries
   - a) Existing quarries will be used in preference to the construction of new ones.
   - b) No quarry shall be developed atop karst without adequate site survey and design.
   - c) Quarries should be properly closed after abandonment.
3. Karst Feature Buffers
   - a) No surface disturbing activity such as timber harvest, road construction, and/or quarry development shall occur within a minimum of 100 feet of the edge of a cave, sinkhole, collapse channel, doline field, or other collapse karst feature. Manage an appropriate

distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness (RAW) of that zone (see Reasonable Assurance of Windfirmness Guidelines, Tongass National Forest, June 2006).

b) No surface disturbing activity such as timber harvest, road construction, and/or quarry development will occur on lands that overlie a known "significant" cave. "Overlie" is defined here as the area between lines projected from the outside walls of the cave passage at a 45-degree angle to the surface.

c) As cave discoveries are made and those caves are mapped and inventoried, it is quite probable that very significant cave systems will be discovered. Consider a Geologic Special Area on a case-by-case basis for such caves.

d) Protect all sinking or losing streams and their tributaries irrespective of whether the channels carry perennial, ephemeral, or intermittent flows. A non-harvest buffer is required of a minimum of 100 feet from the edge of a sinking or losing stream within no less than 0.25 mile (1,320 feet) upstream of their swallow hole or loss point.

e) The area surrounding resurgences should be protected to maintain the environment surrounding the springs and the quality of the waters flowing from them.

f) If at any time during project development or implementation an un-inventoried karst feature (or features) discovered, all activity in the vicinity of the feature (or features) shall cease until a karst vulnerability assessment can be conducted.

I. **High Vulnerability Karst Lands.** High vulnerability karst lands are those areas where resource damage risks associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These areas shall be managed to ensure conservation of karst values through the implementation of a high level of protection.

1. Karst lands found to be of high vulnerability shall be identified and removed from the commercial forest lands suitable land base. Timber management and related activities are excluded from these lands.
2. Limited recreational development may be appropriate.
3. Roads are considered inappropriate unless no other route or option is feasible. Small expanses of these areas may be crossed by roads to access areas where harvest is appropriate (i.e., low or moderate vulnerability karst lands and non-carbonate areas). If roads must be built across areas of high vulnerability, the following guidelines will apply:

a) Minimize clearing limits and grubbing. Flush cut stumps to the ground. Do not deck logs pioneered from the road clearing limits outside the clearing limits.

b) Use a fill-type construction rather than a balanced cut and fill design. This will most likely be possible because the slope gradient in these areas is generally less than 15 percent.

c) Use log stringer bridges or similar structures to span across collapse features, if necessary. Geotextile should be used to keep aggregate overlay from falling into the collapse feature.

d) Sediment traps and erosion control measures will be needed in most cases.

e) Same-season revegetation of the cut and fill slopes should be required to minimize sediment production potential.

f) No quarry development would be allowed on these lands.

III. Catchment Area Management

A. The catchment areas for karst systems, comprised of carbonate or non-carbonate substrate, are an integral portion of those systems. Catchment area management measures can be most effectively developed if both catchment types are delineated, and their sensitivity to cumulative land use activities is evaluated. Use the karst vulnerability assessment procedures to approximate the sensitivity of specific autogenic recharge areas.

IV. Salvage of Windthrown Timber on Karst

A. Salvage is appropriate on low to moderate vulnerability karst lands when the karst management objectives can be met. Generally, no salvage shall be permitted on lands determined to be of high vulnerability, within 100 feet of a losing stream, a karst feature, or on lands that overlie a "significant cave." For relatively minor, isolated features surrounded by low to moderate

vulnerability karst, if the logging system to salvage the windthrown timber can be designed to not disturb the timber spanning or blown into the feature, salvage shall be permitted within 100 feet of the lip or edge of the feature.

V. Mineral Development

A. The impacts of any proposed mineral development within the karst landscape can be analyzed through the environmental analysis that is triggered once a Plan of Operations is received.

Cave Resources: KC2

I. Management

A. Manage lands in a manner that, to the extent feasible, protects and maintains significant caves and cave resources. See direction in 36 CFR 290.3 and “definitions” for guidance determining cave significance. See Appendix H for specific guidance.

B. Locate, map, and describe caves, and evaluate and document the resource values discovered when appropriate. Although the word "inventory" is not used in FCRPA, it is clear that the significant cave designation process is an inventory process for identifying caves that will require some form of management. Carry out data storage and collection in a manner that is consistent, at a minimum, with the processes outlined in 36 CFR 290.3 and Forest Service Manual (FSM) 2881.42 for nomination, evaluation, and designation of significant caves.

C. Develop a comprehensive Cave Resource Management Strategy on known cave resources. Strategies for cave resource management are suggested in Appendix H and within these guidelines.

1. **Class 1. Sensitive Caves**. Caves considered unsuitable for exploration by the general public either because of their pristine condition, unique resources, or extreme safety hazards. These caves will be closed by a Forest Supervisor Order and entry allowed by permit only.
2. **Class 2. Directed Access Caves**. Caves with directed public access and developed for public use. These caves are shown on maps or have signs directing visitor access; public visitation is encouraged.
3. **Class 3. Undeveloped Caves**. Caves that are undeveloped, but are suitable for exploration by persons who are properly prepared. Location of these resources will not be advertised or shown on maps.

D. Develop public education and interpretative programs to foster an increased appreciation of the function and biological significance of the cave resources, caving ethics and safety, and safe and responsible uses of these resources for research and recreation purposes.

E. Specific information concerning Significant Caves on the Forest will not be made available to the public (FCRPA). This information is also not available under Freedom of Information Act requests. Treat this information as confidential and secure it in such a manner as to prevent access by unauthorized individuals.

F. Search and rescue in caves is the primary responsibility of the Alaska State Troopers. Supply appropriate support and equipment where needed and available.

G. The following are prohibited in caves:

1. In bat caves, or caves with sensitive species, it is prohibited to go into or be upon any area that is closed for the protection of threatened, endangered, rare, unique, or vanishing species of plants, animals, birds, or fish.
2. Applicable to all caves, except for purposes of research and exploration, it is prohibited to:
   a) Build, maintain, attend, or use a campfire or stove fire; fires may be allowed in regard to traditional native ceremonies in compliance with the American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act, their amendments, and implementing regulations;
   b) Smoke;
   c) Camp;
   d) Possess, discharge, or use any kind of fireworks or other pyrotechnic device;
   e) Discharge a firearm, air rifle, or gas gun; or
   f) Allow domestic animal access.

LANDS

Forest-wide Standards and Guidelines

Lands Preparation: LAND1

I. Land Status

A. Perform a land ownership review during early project planning stages, prior to management activities, to ensure protection of state, private, and other federal agency rights and interests. Consult source documents including deeds, patents, and Bureau of Land Management (BLM) Master Title Plats (MTPs), to identify land ownership encumbrances

II. Coordinating with Others

A. Coordinate activities, including environmental analysis on National Forest System (NFS) land, with adjacent state and private landowners. Solicit and consider their input when analyzing proposals that might affect them.

B. Cooperate with the State of Alaska and local communities in their land and resource planning efforts.

C. Coordinate activities on encumbered lands with interest holders, as appropriate.

Special Use Administration (non-Recreation): LAND2

I. Special Use Authorizations

A. Manage special use authorizations to best serve the public interest. (Consult 36 CFR 251.)

1. Do not authorize private uses of NFS lands when such uses can be reasonably accommodated on other lands.
2. Review new special use requests for their compatibility with Land Use Designations (LUDs), based on a consideration of environmental values and a determination of social and economic benefits. (Consult Forest Service Manual [FSM] 2700.)
3. In addition to the above criteria, special use applications may be denied if the authorizing officer determines that:
   a) The proposed use would not be in the public interest;
   b) The applicant is not qualified;
   c) The proposed use would otherwise be inconsistent with applicable federal or state law; or
   d) The applicant does not or cannot demonstrate technical or financial capability. (Consult 36 CFR 251.54.)
4. Review and adjust special use fees on a planned basis to comply with U.S. Office of Management and Budget (OMB) directives and Forest Service policy. (Consult OMB Circular No. A-25, and FSM 2700.)
5. Upon renewal or transfer of a permit, terminate or bring into conformance existing uses that are not compatible with the Forest Plan.
6. On lands encumbered by state selections, obtain concurrence from Alaska Department of Natural Resources (ADNR) prior to granting a special use authorization, in accordance with the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), Section 906 (k), and FSM policy. (Consult Forest Service handbook [FSH] 5509.11, R-10 Supplement.)
7. Do not issue special use authorizations on lands selected or withdrawn for selection by a Native corporation without the consent of that Native corporation, unless waived by the Regional Forester. (Consult FSH 5509.11, R-10 Supplement.)
8. Do not issue special use authorizations on lands for which there is a Native Allotment application without consent from the applicant and the Bureau of Indian Affairs (or their designees), unless the application has been adjudicated by BLM as being invalid and the case has been closed. Contact the Regional Forester prior to granting a Special Use Authorization within an active claim area, because Regional Forester authorization may also be required. (Consult FSH 5509.11, R-10 Supplement.)
9. Require that structures be constructed and maintained in a manner to blend with the surrounding environment, and be consistent with management objectives and other

allowed activities. To the extent feasible, locate new structures hidden from areas of concentrated visitor use, such as rivers, roads, trails, and public recreation cabins.

10. Manage authorized uses to maintain a neat and sanitary condition of the permit area. The preferred method of litter disposal is to remove all litter from NFS lands and dispose of it at appropriate sanitary facilities. If this is not feasible, require the permit holder to burn all burnables on site, at a location designated by the responsible Forest Service officer, and remove all materials that cannot be burned (including ash residue) for disposal at an approved disposal site.
11. Locate outdoor toilets away from lakes, rivers, and streams. Follow guidelines in the State Wastewater Disposal Regulations. Outdoor toilet locations will be approved by the Forest Service prior to construction. (Consult 18 AAC 72.)
12. To the extent allowed by law, regulation, and policy, allow applicants to conduct environmental analyses and supporting activities (such as cultural resource surveys), and submit them to the responsible official for consideration in Forest Service decisions.
13. Have electronic site proponents submit technical data required in Chapter 90 of the Special Uses Handbook (FSH 2709.11, Chapter 90).
14. Motorized access may be authorized as part of the special use authorization. Use of off highway vehicles may be allowed and must be in accordance with 36 CFR 212, 251, and 261 – Travel Management; Designated Routes and Areas for Motor Vehicle Use.

II. Cabins and Related Structures

A. Manage cabins and related structures that were existing, but unauthorized prior to ANILCA (December 2, 1980), in accordance with direction in the Regional Supplement to the Special Uses Handbook (FSH 2709.11) and the standards and guidelines discussed below. In Wilderness, consult FSM 2320 and the Wilderness and Wilderness Monument LUD prescriptions.

1. Allow the continuation of customary and traditional uses of cabins and related structures that were existing but unauthorized on December 2, 1980, in accordance with a nontransferable, renewable, five-year special use permit until the death of the last immediate family member of the original permit holder, when such uses are compatible with LUD direction, and are otherwise in compliance with ANILCA, Section 1303(b).
2. Prior to issuing a permit, in accordance with ANILCA, Section 1303(b)(3), require the permit applicant to:
   a) Reasonably demonstrate by affidavit, bill of sale or other documentation, proof of possessory interest, or right of occupancy;
   b) Submit a sketch or photograph of the cabin and a map showing its location;
   c) Agree to vacate the cabin and remove all personal property from it within a reasonable time period following nonrenewal or revocation of the permit; and
   d) Acknowledge in the permit application that the applicant has no interest in the real property on which the cabin is located.
3. When issuing these permits, list all qualifying immediate family members along with the original permit holder, and require that one person be designated to represent all permit holders. The original permit holder is the holder of record, listed on an existing permit on or before December 2, 1980.

B. Manage cabins and related structures that were authorized on December 2, 1980, in accordance with direction in the Regional Supplement to the Special Uses Handbook (FSH 2709.11). For Wilderness cabins and related structures, consult FSM 2320 and the Wilderness LUD prescription.

1. Allow the continued use of cabins, homesites, and similar structures that were authorized on December 2, 1980, in accordance with the terms of the original permit. Generally renew these permits (if the terms of the permit in effect on December 2, 1980 allow for renewal), subject to reasonable regulations and provisions of ANILCA, Section 1303(d), unless continuation of the use would constitute a direct threat or significant impairment to the purposes for which the National Forest or conservation system unit was established. A reasonable fee may be imposed on cabins previously under free use, or existing fees may

be increased by a reasonable amount, to keep pace with inflation, or for other justifiable purposes.

2. These permits may be transferred to one other person at the election or death of the permittee of record on December 2, 1980, if the conditions of the original permit allow for such transfer.
3. Names of immediate family members of the holder may be added as additional permit holders. Immediate family members are defined in the Regional Supplement to the Special Uses Handbook (FSH 2709.11).

C. Manage new cabins and related structures, in accordance with direction in the Regional Supplement to the Special Uses Handbook (FSH 2709.11, FSH 2709.14). For Wilderness cabins, consult FSM 2320.
   1. The construction of new cabins is prohibited with the following limited exceptions. A nontransferable, five-year special use permit may be issued in some circumstances, following a determination that:
      a) The proposed use, construction, and maintenance of the cabin are compatible with LUD objectives;
      b) Use of the cabin is directly related to administration of the area or is necessary for continuation of an ongoing activity, allowed within the area; and
      c) The applicant has no reasonable alternative.
   2. Do not permit construction of new cabins for private recreational or residential uses. Consider permitting new cabins for some commercial uses, when a cabin is necessary to provide a needed public service (generally, public need is identified in a prospectus) or within areas where such commercial use of cabins was an established customary and traditional use prior to December 2, 1980. Consider permitting new cabins for administrative use by other agencies, such as Alaska Department of Fish and Game, when no feasible alternatives exist.
   3. All new cabins will be deeded over to, and become the property of, the United States Government, as provided in the ANILCA, Section 1303(b)(4).
   4. Prior to issuing a permit, in accordance with ANILCA, Section 1303(b)(3), require the permit applicant to:
      a) Submit a sketch or photograph of the proposed cabin and a map showing its location;
      b) Agree to vacate the cabin and remove all personal property from it, within a reasonable time period following nonrenewal or revocation of the permit;
      c) Acknowledge in the permit application that the applicant has no interest in the real property on which the cabin will be constructed; and
      d) Quit claim deed the cabin to the United States Government.

D. Provide for subsistence uses by authorizing temporary facilities, such as tent platforms, rather than new cabins. Follow procedures and design standards for temporary facilities, found in Section 1316 of the ANILCA, the following section on temporary facilities, and FSM 2720.

III. Temporary Facilities

A. A temporary facility is defined as “any structure or other human-made improvement which can be readily and completely dismantled and removed from the site when the authorized use terminates." (Consult FSM 2720.)
B. Permit temporary campsites, tent platforms, shelters, and other temporary equipment, directly and necessarily related to the taking of fish and wildlife, subject to:
   1. Reasonable regulation to ensure compatibility;
   2. Conditions of ANILCA, Section 1316;
   3. Forest Service Manual direction; and
C. Consistency with management prescriptions direction. (Consult FSM 2720. In Wilderness, consult FSM 2320.)B. When issuing new permits for subsistence-related facilities, authorize tent platforms and associated temporary facilities only.
D. To the extent feasible, locate subsistence camps out of sight of high use areas such as rivers, roads, trails, public recreation cabins, and other user facilities.

IV. Aquatic Farming Permits

A. For direction on the management of aquatic farm permits, consult the Regional Supplement to the Special Uses Handbook (FSH 2709.11).

B. "Aquatic farming" should not be confused with "aquaculture." Aquatic farming is provided for in Alaska State Law (AS 16.40.100 - 16.40.199). It involves growing aquatic plants or shellfish for sale, either in captivity or under positive control. Typically shellfish are pen-reared. Finfish are generally not included and release of the organism does not result in a product becoming available as a common property resource. Aquaculture is provided for in ANILCA, Section 1315(b). It involves the maintenance or improvement of fish stocks. It includes facilities such as fish hatcheries and projects such as fish stocking or lake fertilization. It includes finfish and release results in a product becoming available as a common property resource.

C. Cooperate with state and federal agencies to meet industry and public needs for aquatic farming programs and ensure compatibility with other resources and activities.

1. During evaluation of requests for Forest Service permits, carefully analyze the effects of aquatic farming activities on other resources and other activities, such as recreational uses marine access points including log transfer facilities, and access to adjacent uplands. Oppose aquatic farm development in or adjacent to designated Wilderness.
2. Coordinate responses to aquatic farming proposals with Alaska Department of Natural Resources (ADNR).
3. Initially, issue permits only for low investment, minimum development, temporary support facilities (not to include cabins) that can be readily removed from the site if the project ceases to be viable for the operator. Consider permitting additional support facilities on National Forest System lands, only after a viable business is established and need for the facilities can be demonstrated.

V. Floathouses

A. Manage residential floathouses in accordance with the standards and guidelines discussed below.

1. Issue Special Use Authorizations for floathouse shore ties only at locations where the activity is specifically provided for in the approved coastal zone area plans.
2. Cooperate with the State of Alaska and local communities to help develop criteria that address floathouse placement. In developing new state or city plans, encourage locating floathouses near communities or adjacent to private uplands. Avoid locating them:
   a) Adjacent to designated Wilderness or other areas where they would be incompatible with upland management objectives;
   b) Where they may adversely affect forest resources; or
   c) Where they may conflict with higher priority public uses.
3. As a condition of the special use authorization, require applicants to obtain all necessary authorizations from other appropriate agencies, such as ADNR and the U.S. Army Corps of Engineers.

VI. Fish Camps

A. Manage special use permits for commercial set net fish camps in accordance with direction in the Regional Supplement to the Special Uses Handbook (FSH 2709.11) and the standards and guidelines discussed below.

1. Where the use of commercial fish camps, including primitive cabins, is a customary and traditional use, allow this use to continue within traditional locations, at approximately traditional densities, as established prior to ANILCA (December 2, 1980), if compatible with LUD objectives.
2. New facilities will usually be tent platforms and associated temporary facilities unless a need can be demonstrated for a cabin.
3. New cabins, if authorized, will not exceed 500 square feet in size. Limit new cabin authorizations to one cabin per set net permit. If needed, authorize additional sites for use with a tent platform.

4. Assign a permit tenure of 5 years for cabins and 1 to 5 years for tent platforms with the provision that, unless revoked for violation of permit conditions, these permits may be renewed upon expiration.
5. Assign new fish camp permit holders areas up to 1/4 acre in size, based on need.
6. Within areas traditionally used for fish camps, allow uses currently under permit to continue. Do not allow fish camp permit holders to engage in outfitter/guide or lodge/resort activities from their fish camps, unless already authorized by permit.
7. Consider authorizing requests for subsistence uses from fish camps; however, any authorization for subsistence uses from fish camps will be documented in writing to the permit holder, along with conditions, if any, that may be necessary to protect resources and the rights of other users. Do not permit residential uses of fish camps.
8. To obtain a fish camp permit, require applicants to hold a commercial set net permit from the Alaska Department of Fish and Game, valid for the area in which the proposed facility is to be located. Camp occupancy will generally correspond to the dates of the open set net season, with exceptions allowed for camp set up and take down (if necessary) and for subsistence uses, if authorized.
9. Some fish camp permits have traditionally been issued free of charge. In compliance with OMB directives and Federal Regulations (36 CFR 251 .57), assess appropriate fees in conjunction with all commercial fish camp uses.
10. Natural hydrologic changes may lead to use areas being relocated. This need is recognized and new use areas may be authorized, if necessary, following separate environmental analysis, as rivers change their course or other changes lead to shifts in the location of fish runs. Issue permits for tent platforms in new locations where cabin use is not already established.

VII. Right-of-Way Grants

A. Grant reasonable access across NFS land to allow inholders and other landowners use of their land without unnecessarily reducing Forest Service management options or damaging NFS lands or resources. (Consult FSM 2730.)
   1. Ensure that roads constructed through authorizations are designed according to standards appropriate to the planned uses, considering safety, cost of transportation, and effects upon lands and resources. Ensure these roads are planned and designed to re-establish vegetative cover on the disturbed area within a reasonable period of time (not to exceed 10 years) after the termination of the permit or lease, unless the road is determined necessary as a permanent addition to the National Forest transportation system. (Consult 36 CFR 219.27 (1982).

B. Apply the approval authorities discussed below, as applicable, when processing right-of-way grant requests.
   1. Continue to use existing authorities such as the Federal Land Policy and Management Act (FLPMA), the Forest Road and Trail Act (FRTA), and the Highway Act of 1958, except when prohibited by other applicable law.
   2. When proposed rights-of-way cross, or enter upon, a Conservation System Unit (as defined in ANILCA, Section 102(4)), follow procedural requirements found in ANILCA, Section 1104.
   3. When proposed rights-of-way will provide access to state or private inholdings or valid occupancies (such as a mining claim or special use authorization) surrounded by, within, or effectively surrounded by a Conservation System Unit, use authorities found in ANILCA, Section 1110(b).
   4. When proposed rights-of-way will provide temporary access to non-federal lands, to or across a Conservation System Unit, for purposes of survey, geophysical, exploratory, or other temporary uses that will not result in permanent resource harm, use authorities found in ANILCA, Section 1111.
   5. When proposed rights-of-way will provide access to non-federal inholdings, either within or outside of a Conservation System Unit, use authorities found in ANILCA, Section 1323(a).

C. Allow the following activities to occur without requiring a special use authorization. (Consult ANILCA, Section 1110(a).)

1. The use of snowmachines, motorboats, fixed-wing airplanes, and non-motorized surface transportation methods for traditional activities that are permitted by law and for travel to and from villages and homesites, subject to reasonable regulations to protect resource values. These uses do not require a permit and may be prohibited only following a notice and hearing in the vicinity of the affected area, and a determination that such uses would be detrimental to resource values.
2. This direction does not authorize the construction or maintenance of improvements or facilities on NFS lands, nor does it authorize use of off-highway vehicles, other than snowmachines.

D. Accommodate new transportation and utility proposals to the maximum extent feasible.
1. Site-specific locations and mitigation measures will be determined by project-level planning, which will analyze environment considerations, such as scenic resources, wildlife habitat, and soil conditions.

VIII. Military Training Activities

A. Authorize military training activities on NFS lands in accordance with the Master Agreement between the Department of Defense and the Department of Agriculture, which governs the use of NFS lands for these purposes. (Consult FSM 1530.)
1. Authorize military training activities on NFS lands when these activities:
   a) Will be compatible with other uses;
   b) Conform to LUD direction; and
   c) After the Department of Defense has determined and substantiated that lands under its administration are either unsuitable or unavailable.
2. Determine probable effects of proposed activities, necessary mitigation measures, and effective monitoring techniques, on a case-by-case basis, with a site-specific environmental analysis, conducted in accordance with the Master Agreement.
3. When local supplemental agreements with military agencies exist, consult such agreements for additional direction.

IX. Sanitary Landfills

A. Manage landfills in accordance with the following national policy but subject to approved special provisions for Alaska.
1. Require strict compliance with applicable Environmental Protection Agency (EPA) guidelines.
2. Avoid authorizing new solid waste disposal sites and the expansion of existing sites on NFS lands, subject to exceptions approved for the Alaska Region.
3. Provide for solid waste disposal sites through exchange, sale under the Townsite Act (7 U.S.C. 1012a; 16 U.S.C. 478a), or selection by the State of Alaska of NFS lands when there is no viable alternative on non-federal land and where there will be no adverse impacts to other National Forest resources or land. Encourage the State of Alaska to request conveyance of those areas suitable and needed for solid waste disposal near existing and proposed communities to eliminate the need to use NFS. Provide conditions for the conveyance document to ensure the land will be controlled by a government entity, and activities that interfere with the management and protection of adjacent NFS lands will not occur.
   a) Solid waste disposals must comply with EPA regulations in 40 CFR 257 and 258, and State of Alaska Administrative Code 18 AAC 60 et seq. These EPA regulations are very restrictive and may preclude continued operation of small landfills. Encourage close out of landfills on NFS lands. Those not closed prior to October 9, 1993 require continued monitoring and management of the landfill by the owner or operator for 30 years after landfill closure, in accordance with EPA regulations. Forest Service policy in FSM 2130 discourages waste disposal on NFS lands and allows this activity to occur only where it is determined to be the highest and best use of the land.

Land Ownership Administration: LAND3

I. Land Selections

A. When making land management decisions, consider valid state selection applications (pursuant to the Alaska Statehood Act), village and regional corporation selection applications (pursuant to the Alaska Native Claims Settlement Act [ANCSA], as amended), and Native allotment claims (pursuant to the Alaska Native Allotment Act of 1906). Protect legal rights of the State of Alaska, Native corporations, and Native individuals when managing selected or withdrawn lands, or lands under Native claim. Apply the standards and guidelines discussed below to lands encumbered by state selections, Native selections or withdrawals, and Native allotment applications, until these lands are either conveyed into state or private ownership, or they revert back to unencumbered NFS land.

1. Cooperate with the State of Alaska, Native corporations, Native allotment applicants, BLM, the Bureau of Indian Affairs (or their designee), and other federal agencies, to assist in processing legitimate claims or applications. Encourage other parties involved to assist in finalizing conveyance of full legal entitlement in a timely manner.
2. Assess investment of Forest Service funds for improvements on lands encumbered by state selections, Native withdrawals or selections, or Native allotment applications.
3. Carefully review each selection, prior to conveyance, to identify third-party interests and needed right-of-way reservations that are allowed under applicable legislation.

B. Manage state selections, as authorized under the Alaska Statehood Act, according to the standards and guidelines discussed below. Consult 43 CFR 2627.

1. Encourage conveyance of state selections adjacent to existing communities. Work with state agencies and local communities to substantially eliminate Forest ownership in and adjacent to communities where state, borough, or community governmental improvements and jurisdiction should logically preside.
2. Obtain concurrence from ADNR prior to any surface-disturbing activity or granting any occupancy permit, contract, easement, or other similar use authorization on state selected lands, in accordance with ANILCA, Section 906(k), and FSM policy. Consult FSM 5450.
3. Deposit 90 percent of all proceeds from contracts, leases, licenses, permits, rights-of-way, easements, or from trespass, on unconveyed state-selected NFS lands, into a suspense/escrow account, for future transfer to the state upon conveyance. Consult Section 906(k)(2) of ANILCA, and Regional Supplement to FSH 2709.11, Chapter 30.

C. Apply the standards and guidelines discussed below to LUDs encumbered by Native selections or withdrawals, made under authority of ANCSA, as amended, until these lands are either conveyed into private ownership, or they revert back to unencumbered NFS land. Consult 43 CFR 2650.

1. Do not issue occupancy permits, contracts, easements, or similar authorizations on lands selected, or withdrawn for selection, by a Native corporation under authority of ANCSA, without coordination and consent from that Native corporation, unless permission is first obtained from the Regional Forester. Consult FSM 5450.
2. Deposit all proceeds from any contracts, leases, licenses, permits, rights-of-way, easements, or from trespass on unconveyed NFS lands that are selected or withdrawn for selection under ANCSA, into an escrow account, for future transfer to the appropriate Native corporation, upon conveyance. Consult Section 1411 of ANILCA.

D. Apply the standards and guidelines discussed below to lands encumbered by Native allotment applications, submitted under authority of the Alaska Native Allotment Act of 1906, until these lands are either conveyed into private ownership, or they revert back to unencumbered NFS land. Consult 43 CFR 2561.

1. Do not issue use authorizations, such as permits, contracts, or easements, on lands for which there is a Native allotment application, without consent from the applicant and the Bureau of Indian Affairs (or their designee), unless the application has been adjudicated by BLM as being invalid and the case has been closed. Contact the Regional Forester prior to granting use authorizations within a valid claim area, because authorization from the Regional Forester may be required. Do not authorize construction of new roads on a valid claim area unless a deed of further assurance has been obtained and recorded, or clearance has been received from the Regional Forester. Consult FSM 5450.

Lands Activity Maintenance and Landline Location: LAND4

I. Establishing Forest Boundaries

A. When maintaining established National Forest property boundary lines and corners, or when locating, surveying, and posting new National Forest property boundaries and corners:

1. Coordinate with BLM for original boundary line survey. Encourage cooperative work with the BLM to mark and post original National Forest/state and National Forest/Native boundaries to Forest Service standards. The Forest Service will maintain these boundary lines and corners after the original survey. These boundaries should not be surveyed, marked, or posted until after conveyance of the land.
2. Maintain the existing inventory of surveyed and unsurveyed boundary lines to establish survey priorities. Establish program priorities to coincide with FSM direction. Consult FSM 7150.

II. International Boundaries

A. When locating or maintaining international boundary lines and corners:

1. Ensure compliance with the United States/Canada Treaty of 24 February 1925. Coordinate the location, survey, posting, marking, and maintenance of the International Boundary with the United States/Canada International Boundary Commission, U.S. Department of State.
2. Ensure compliance with Presidential Proclamations of June 15, 1908 and May 3, 1912. Do not permit any occupancies or management activities, within 60 feet of the United States side of the United States/Canada International Boundary, without prior approval from the International Boundary Commission.

III. Legislated Boundaries

A. When considering land-disturbing activities in LUDs adjacent to Wilderness, Wilderness and Nonwilderness National Monument, and LUD II boundaries:

1. Boundaries should be surveyed, marked, and posted prior to implementing land-disturbing activities. Approximate boundaries are not acceptable.
2. Locating and marking boundaries should be supervised by a professional surveyor with the benefiting function funding all necessary survey activities. Consult FSM 2320, FSH 2309.19, and FSM 7150 (including R10 Supplement) for additional survey and marking standards.
3. The District Ranger or Forest Supervisor who approves a project will ensure adjacent legislated boundaries are located and marked, making certain there is no encroachment.

Rights-of-Way (ROW): LAND5

I. Rights-of-Way Acquired

A. Acquire across non-NFS land, road, and trail rights-of-way that are adequate for the protection, administration, and use of the Tongass National Forest. Consult FSM 5460.

1. Generally acquire rights-of-way identified in project plans at least one year prior to scheduled activity.
2. Generally acquire unlimited easements, granted in perpetuity. Limited easements (e.g., those authorizing administrative use, but not public use) may be acquired when public use is not desirable, as determined through the project planning process.
3. Encourage the use of cost-share agreements, when feasible, to avoid economic and resource impacts associated with duplicate road systems and log transfer facilities (LTFs).
4. Monitor compliance with stipulations of existing rights-of-way to ensure long-term retention of needed rights-of-way. Dispose of rights-of-way that are no longer needed. Review easements acquired under Section 17(b) of ANCSA, and take appropriate steps toward construction of transportation facilities prior to easement expiration dates.
5. Identify and request all needed rights-of-way across lands selected by the state or Native organizations, as provided by federal law. Carefully review selections prior to conveyance.
6. Secure adequate rights-of-way before issuing contracts or constructing facilities in intermingled land ownerships. Consult FSM 5400.

7. Follow the BLM/Forest Service Memorandum of Understanding on ANCSA 17(b) easement administration.

B. Acquire log transfer facility (LTF) authorizations on tidelands in accordance with the following standards and guidelines.
   1. Coordinate LTF activities (location, construction, operation, etc.) with the U.S. Army Corps Engineers, U.S. Environmental Protection Agency, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Alaska Department of Natural Resources, Alaska Department of Fish and Game, local communities, and adjacent landowners, as appropriate. (Also see the Transportation Forest-wide Standards and Guidelines.)
   2. Acquire long-term leases (preferably at least 25 years) for permanent LTF sites.

Land Ownership Adjustment: LAND6

I. Priorities

A. Land acquisition priorities have been described and summarized in the document, Alaska Submerged Lands Act Report, Analysis of Inholdings, Acquisition Priorities and Recommendations to Reduce Impacts on Conservation System Units in Alaska, dated August 1990, by the U.S. Fish and Wildlife Service, BLM, National Park Service, and USDA Forest Service. Acquisition decisions should be based on this analysis and report, as updated by future revisions. Maps identifying the location of parcels are available from Forest Service, Alaska Regional Office lands personnel.

B. Federal lands available for conveyance are lands approved by the Regional Forester for selection by the State of Alaska, lands selected by Native corporations under ANCSA, and Native allotment claims adjudicated valid by the BLM. These lands are available only to the respective applicants described above, as provided by federal law. If applications or claims are relinquished or declared invalid, the affected lands are no longer available for conveyance.

C. Consider proposals for other lands not described above, on a case-by-case basis, using the following criteria. Consult FSM 5400.
   1. Work cooperatively with the State of Alaska and Native corporations to improve land ownership patterns and management opportunities resulting from state and Native land conveyances.
   2. Retain NFS lands that best serve the public interest in federal ownership.
   3. Consolidate NFS lands, when feasible. Attempt to reduce miles of property boundary lines and number of corners to locate and maintain.
   4. Generally acquire and convey land with as few reservations and outstanding rights as feasible. Consult FSM 5420, 5430, and 5470.
   5. Avoid separating the surface and subsurface estate, unless it is clearly in the public interest. Consult FSM 5430.
   6. Consider wetland and flood plain values.
   7. Pursue land adjustments that reduce administrative costs or increase the output of goods and services. Avoid land adjustments that do not enhance Forest Service programs. Consult FSM 5430.
   8. Generally pursue land exchanges on an equal value basis. Exchanges may be made for other than equal value if the parties agree and the exchange is determined to be in the public interest, as provided in Section 1302(h) of ANILCA and Section 22(f) of the Alaska Native Claims Settlement Act, as amended by Section 17 of Public Law 94-204. (Consult FSM 5430.) When considering land exchanges of unequal value, submit the proposal through proper channels, for Congressional oversight, as appropriate, prior to entering into any binding agreements.
   9. Major discretionary land adjustment proposals will be considered if the proposed exchange of lands maintains the conservation strategy, ensures public access for subsistence uses, and at least a portion of the timber volume from the lands conveyed from the Tongass National Forest contributes to the timber manufacturing industry in Southeast Alaska.

II. Acquisition

A. For land acquisition activities:
   1. Acquire isolated inholdings at critical locations if public benefits will occur.

2. Within Congressionally designated areas, such as Wilderness, acquire private inholdings as opportunities permit. Wilderness inholdings are priority acquisitions until after the state and Native selection process is completed.
3. Within administratively designated areas, such as Special Interest Areas, generally acquire private inholdings, as opportunities arise.
4. Acquire private lands necessary for efficient management of the Forest.
5. Generally acquire lands by exchange or donation. Attempt to purchase lands on a willing seller/willing buyer basis when exchange or donation is not feasible and funds are available for purchase.
6. In any land adjustment proposal, consider performing a watershed and other resource condition assessment to determine resource restoration needs. Where rehabilitation is needed to comply with federal law such as the Clean Water Act, prepare a cost estimate for rehabilitation prior to the land acquisition.
7. Evaluate parcels proposed for acquisition for the presence of hazardous substances, and document the findings in conformance with established regulatory guidelines for conducting these evaluations.

III. Conveyance of Federal Lands

A. For conveyance of federal lands to non-federal owners:
   1. Do not exchange NFS lands selected by the State of Alaska, or a Native corporation, or lands under Native allotment application, which have not yet been conveyed, unless specifically provided for in legislation. If the party holding the encumbrance desires ownership adjustments, they may relinquish their selection. The Forest Service may then pursue land ownership adjustment, if otherwise appropriate.
   2. Convey NFS lands that would best serve the public interest in private ownership, provided the action will not decrease ability to meet NFS management objectives. Examples may include:
      a) Isolated small parcels that are impractical to manage;
      b) Parcels where a greater general public value can be derived in private ownership; or
      c) Areas necessary for community expansion. Consult 36 CFR 254.
   3. Within Congressionally designated areas, retain existing NFS lands unless exchanging out of these lands to acquire new lands, or interest in lands, for the purposes of ANILCA (Consult ANILCA Section 1302(h)). Within administratively designated areas, generally retain NFS land, unless there are compelling reasons for conveyance.

MINERALS and GEOLOGY
Forest-wide Standards and Guidelines

Minerals and Geology Resource Preparation: MG1

I. Resource Inventory

A. Maintain the Mineral Resource Inventory. Include historic and current mining activity, regional and local geology, access routes, and geologic and mineral terrains. Continue to work with the United States Geological Survey (USGS) to update and map the geology on the Forest and incorporate the new data into the Tongass Geology Layer. Geologic inventory includes the collection, analysis, and interpretation of geologic data necessary for identification and solution of management problems, and for the assessment and development of the geologic resources. The creation of geologic inventories is basic to carrying out geologic resources and services. Geologic inventory includes bedrock geology, surficial geology, stratigraphy, hydrogeology, geomorphic features, geological hazards, karst features, caves, and paleontology, including potential for geologic formations to yield fossil resources of scientific and other values. (Consult Forest Service Manual [FSM] 2881 for specific direction.)

II. Resource Planning

A. Assemble and provide minerals and geology information as needed for project planning. Conduct inventories and assessments of geologic resources and hazards, paleontologic resources, and mineral resources for use in land management planning (FSM 2884.11). Geologic reports written for specific projects as the result of geologic inventory and/or investigation may include some combination of the geologic history; location and extent of locatable, leasable, and salable minerals; location and extent of aquifers; groundwater quality and quantity; structural features; geologic and geomorphic processes affecting the area; cave and karst resources; and paleontological resources.

III. Resource Preparation

A. Conduct compliance checks, validity and patent exams, and review operating plans, lease proposals, and applications. Provide expert testimony or opinions for contests, hearings, or appeals. Conduct geotechnical engineering and interpretive geology investigations as required.

IV. Resource Coordination

A. Coordinate minerals and geology inventories and minerals administration with state and other federal agencies, including the Bureau of Land Management (BLM) and USGS.

Minerals and Geology Administration: MG2

I. Forest Lands Withdrawn from Mineral Entry

A. Claimants with claims located in areas withdrawn from mineral entry retain valid existing rights, if such rights are established prior to the withdrawal date.

B. Conduct on-the-ground validity examinations by a certified minerals examiner to establish or reject valid existing rights on active mining claims within Wilderness areas and other areas withdrawn from mineral entry.

C. Permit reasonable access to mining claims in accordance with the provisions of an approved Plan of Operations. Motorized access to sites may be authorized as part of the Plan of Operations. Use of off-highway vehicles may be allowed and must be in accordance with 36 CFR 212, 251, and 261 – Travel Management; Designated Routes and Areas for Motor Vehicle Use.

II. Forest Lands Open to Mineral Entry

A. Encourage the exploration, development, and extraction of locatable, salable, and leasable minerals and energy resources.

B. Assure prospectors and claimants their right of ingress and egress granted under the General Mining Law of 1872, Alaska National Interest Lands Conservation Act of 1980 (ANILCA), and the Forest Service Mining Regulations (36 CFR 228).
C. Permit reasonable access to mining claims and mineral leases in accordance with the provisions of an approved Plan of Operations.

III. Locatable Mineral Operations

A. A Notice of Intent and/or a Plan of Operations is required for locatable operations. (Consult FSM 2810 and 36 CFR 228.)
   1. A Plan of Operations will receive prompt evaluation and action within the time frames established in 36 CFR 228.
   2. Conduct an environmental analysis with appropriate documentation for all operating plans.
   3. Locatable mineral exploration and/or development situated in areas identified in the Forest Plan for intensive development (minerals overlay) must be consistent with standards and guidelines for mineral development.
   4. Following locatable mineral exploration and/or development site rehabilitation and restoration will be designed to return the site to as near as practicable to a condition consistent with the underlying non-mineral Land Use Designation (LUD).
B. Work with claimants to develop a Plan of Operations that adequately mitigates adverse impacts to LUD objectives. Include mitigation measures for locatable actions that are compatible with the scale of proposed development and commensurate with potential resource impacts.
   1. Maintain the habitats, to the maximum extent feasible, of anadromous fish and other foodfish, and maintain the present and continued productivity of such habitats when such habitats are affected by mining activities. Assess the effects on populations of such fish in consultation with appropriate state agencies. (Consult ANILCA, Section 505(a).)
   2. Apply appropriate Transportation Forest-wide Standards and Guidelines to the location and construction of mining roads and facilities.
   3. Reclaim disturbed areas in accordance with an approved Plan of Operations. Apply approved seed mixtures as needed (see Standards and Guidelines for Plants.
   4. Apply Best Management Practices (BMPs) to maintain water quality for the beneficial uses of water. (Consult National Core BMP Technical Guide FS-990a and FSH 2509.22.)
   5. Periodically inspect minerals activities to determine if the operator is complying with the regulations of 36 CFR 228 and the approved Plan of Operations.

IV. Leaseable Mineral Operations (Oil and Gas, Coal, Geothermal)

A. Leasing may occur on a case-by-case basis following site specific analysis.
B. Include mitigation measures for leaseable mineral operations and include standard and special stipulations in leasing actions that are compatible with the scale of proposed development and commensurate with potential resource impacts.
C. Operating plans will be reviewed and approved by the authorized officer. (Consult FSM 2820 and 36 CFR 228.)
D. Areas determined to be available for leasing all operations, including site restoration and rehabilitation, must be consistent with the standards and guidelines for the LUD as displayed in the Forest Plan.
E. During exploration, consider alternatives that minimize encumbrance and disturbance of National Forest System lands, such as permitting in lieu of leases for exploration.

V. Salable Mineral Operations (Mineral Material Sales and Free-use)

A. Operator shall have an operating plan that includes a development or quarry plan with a map. Quantity estimates shall be included.
B. Permit mineral material sites only after an environmental analysis assures other resources are adequately protected, the site location and operating plan are consistent with the LUD emphasis, and such resources are not reasonably available on private land. Require bonds and reclamation as appropriate. (Consult FSM 2850 and 36 CFR 228.)

C. Where the opportunity exists, design, excavate, and reclaim material sites to facilitate their use for dispersed recreation or other desirable uses such as conversion to salmonid rearing ponds and spawning channels.

D. Include mitigation measures for salable mineral operations and include standard and special stipulations in permitted actions that are compatible with the scale of proposed development and commensurate with potential resource impacts.

VI. Bonds

A. A bond will be required for locatable, leasable, and salable mineral operations to ensure operator performance and site reclamation are completed. (Consult 36 CFR 228.)

VII. Split Estates

A. Seek to avoid separating the surface and subsurface estates. Coordinate with BLM, the state, Native corporations, and private landowners to manage split estates in accordance with individual patents or deeds.

VIII. Paleontologic Resources

A. Develop and maintain a paleontological resource program that identifies, inventories, facilitates research, and emphasizes protection of the resources. Protect paleontological resources from loss due to threat, vandalism, or the natural elements through responsible planning, management, partnerships with qualified museums and other institutions, and collaboration with Forest Service law enforcement (FSM 2882.03). Elements of this program may include:

1. Inventory paleontological resources. Develop Fossil Yield Potential Classification (FYPC) values. These values rank the degree to which a bedrock unit, usually at the formation or member level, is likely to yield scientifically significant fossil resources. FYPC values are assigned to geologic units on the basis of empirical data gathered through literature or database research and field research by Forest Service paleontologists or the Forest Geologist (FSM 2881.3).
2. Protect and preserve known significant paleontological resources. Actively promote partnerships with museums and other institutions having professional paleontologists and appropriate facilities to evaluate these resources. Coordinate all excavation or collection with the appropriate state agencies. Ensure that appropriate terms and conditions are included in special use authorizations for paleontological resources to minimize resource conflicts. Protect and preserve collections curated in non-federal repositories (Paleontological Resources Preservation Act of 2009 and 36 CFR 291).
3. Develop a monitoring program to protect paleontological resources from loss due to threat, vandalism, or the natural elements. If, through monitoring, it is determined that fossil theft and/or vandalism is occurring, collaborate with Forest Service law enforcement.

PLANTS
Forest-wide Standards and Guidelines

Threatened, Endangered, Sensitive, and Rare Plants: PLA1
Consult Forest Service Manual (FSM) 2670 for Threatened, Endangered, and Sensitive Species.

I. Threatened or Endangered Plants

A. Currently there are no threatened and endangered plants on the Tongass National Forest.

II. Sensitive Plants[2]

A. Consider providing protection around the plant population that meets the habitat needs of the species. Protection measures can include, but are not exclusive to, avoiding known sensitive plant populations during project activities, directional falling and yarding of trees away from sensitive plants, and partial retention of forest structure (25 to 50 percent of the basal area) in the area around sensitive plants in forested habitats. Apply adaptive management principles.

B. Where it is necessary to protect sensitive plant species or communities from a proposed project, implement a Monitoring and Evaluation Plan to include a review of the implementation and effectiveness of conservation actions, and apply adaptive management principles.

C. No herbicide may be applied from the air within 600 feet, nor ground-applied within 60 feet, of any identified population of a sensitive plant species.

III. Rare Plants

A. Implement national (National Forest Management Act, Ecosystem Management) and regional Forest Service policy and direction (FSM 2670 and 36 CFR 219.27 (g)) for the conservation, management, inventory, and monitoring of rare plant species.

B. Collecting or disturbing rare plants or plant parts is prohibited unless authorized by the responsible official. In cases of scientific or educational use, permits will be required to collect rare plants. Such collections must not adversely affect the continued existence or vigor of a rare plant population.

C. Avoid, minimize, or mitigate adverse effects to rare plants and populations during project planning to maintain known distributions throughout the Tongass National Forest.

D. Where desirable, rehabilitate and/or restore rare plant populations that have been adversely affected by management or natural disturbances.

E. Coordinate with appropriate federal and state agencies as well as other entities to support monitoring, research, and inventory for rare plants.

F. Consider providing protection around the plant population that meets the habitat needs of the species. Protection measures can include, but are not exclusive to, avoiding known rare plant populations during project activities, directional falling and yarding of trees away from rare plants, and partial retention of forest structure (25 to 50 percent of the basal area) in the area around rare plants in forested habitats. Apply adaptive management principles.

G. When a population or habitat decline for a rare plant species or subspecies indicates that long-term viability is at risk, evaluate the particular species for designation as a Region 10 Sensitive Species by the Regional Forester. (Consult the Threatened, Endangered, and Sensitive Species Forest-wide Standards and Guidelines and FSM 2670.)

Invasive Plants: PLA2

I. Invasive Plants

A. See Invasive Species Forest-wide Standards and Guidelines.

B. Follow established guidance on the use of plant materials for revegetating an area and habitat restoration.

Plant Surveys and Vegetation Mapping: PLA3

I. Plant Surveys and Vegetation Mapping

[2] The Forest Service Alaska Region Sensitive Species List was updated in 2009 and supersedes previous lists.

A. Plant survey protocols for National Environmental Policy Act (NEPA) and other projects should follow FSM 2670, R10 protocols, and Tongass Forest-wide Standards and Guidelines.
B. When implementing any invasive and sensitive species field surveys or inventories, a complete list of vascular plants found should be created for each survey.
C. For biological evaluations, consult FSM 2670.
D. Resource report should be prepared to document the findings or absence of rare plants during field surveys for NEPA projects.
E. Use the Existing Vegetation Classification, Mapping and InventoryTechnical Guide (FSM 1940) and the most current and available methods to develop baseline vegetation types Forest-wide.
F. Identify vegetation inventory needs for all Wildernesses to meet the "minimum stewardship levels" per the Wilderness Act of 1964. Accomplish baseline vegetation inventory needs commensurate with other Forest inventory efforts.
G. Accomplish baseline vegetation inventory needs commensurate with other forest inventory efforts.

Non-Timber Forest Products: PLA4

I. Non-Timber Forest Products

A. See FSM 2460 for non-timber forest product direction.
B. Make non-timber forest products (see Plants Standards and Guidelines) available and consistent with LUD management objectives.
C. Address requests for green saw-timber personal use wood as soon as feasible.
D. Designate personal use wood planned for harvest.

II. Commercial Program

A. Allow harvest of non-timber forest products in ways that ensure the continued integrity of the forest stand.
B. Permits shall be required for commercial collection of any non-timber forest products.
C. Commercial harvest shall occur only where adequate quantities of the resource are known to be available on harvestable sites.
D. Selling units (bushels, pounds, sacks, etc.) for specific non-timber forest products shall be consistent across the Forest to make record-keeping, reporting, and monitoring more accurate and efficient.
E. Collection of special forest products adjacent to trails and roads shall be avoided where scenic quality would be impaired. Collection should be no closer than twenty to fifty feet from the trail or road. Site-specific prescriptions will vary by class of trail or road.

RECREATION and TOURISM
Forest-wide Standards and Guidelines

Recreation Resource Inventory: REC1

I. Recreation Resource Opportunities

A. Maintain an inventory of recreation resource opportunities throughout the Forest.
   1. Use the Recreation Opportunity Spectrum (ROS) system and Tongass National Forest Recreation Places Inventory. (Consult Forest Service Manual [FSM] 2310 and national/ regional ROS handbooks.)
   2. Update existing ROS inventories as a part of specific project planning and implementation, and whenever project activities cause a change in recreation setting conditions significant enough to reclassify the affected area.
   3. Maintain the necessary data to determine the individual and/or cumulative changes in ROS class distribution throughout the Forest.

Recreation Resource Planning: REC2

I. Interagency Planning

A. Accomplish outdoor recreation planning by providing opportunities and programs that are appropriate to the Forest environment, dependent upon natural settings, and help participants experience and understand nature.
   1. Determine the appropriate role of National Forest System (NFS) lands in providing natural resource-based recreation opportunities, sites, facilities, and experiences. Within the context of national policy, cooperate and coordinate with national, state, and local agencies in providing a balance of outdoor recreation opportunities throughout Southeast Alaska.
   2. Use the ROS framework of settings and experience opportunities to define the capabilities of NFS lands to meet identified recreation needs and services. (Consult ROS handbooks and Forest ROS maps.)

B. Provide recreation opportunities on NFS lands in concert with, and supplemental to, those opportunities that are located on other land ownerships and jurisdictions. Generally, recreation areas, sites, and facilities located on NFS lands should:
   1. Complement commercial public services (i.e., resorts, marinas, stores, service stations) within communities or on private or other public land.
   2. Support a system of anchorages suitable for recreation boats along small boat waterways that connect communities or provide access to popular recreation attractions.
   3. Provide other appropriate facilities to meet specific identified recreation needs on a case-by-case basis.

C. Cooperatively participate with local communities and user groups when implementing recreation development projects. Implementation should:
   1. Involve the public and affected communities, landowners, and other affected interest groups in the project planning process.
   2. Recognize that recreation use by residents and tourists radiate from communities and service centers to use lands and facilities under a variety of ownerships and jurisdictions.
   3. Verify the local role of the Forest Service in providing recreation opportunities, services, and facilities.
   4. Verify the basis for developing Forest Service recreation-related projects.
   5. Identify sites and activities where joint or cooperative development or management is desirable. Include opportunities for such things as on-site interpretation of natural and cultural resources, particularly on lands of mixed ownership; providing public information through joint publications; joint cabin reservation systems; or construction, operation, and maintenance agreements.
   6. Consult FSM 2300 and internal Forest-wide handbooks.

II. Integrated Resource Planning

A. During non-recreation project planning, assess the effects of these projects on the diversity and quality of recreation settings and activity opportunities within, and adjacent to, the project area.
   1. Where recreation resources may be affected, analyze the opportunities foregone due to resource management actions. During project planning and design, consider valid substitutes for recreation settings and activity opportunities.

B. Identify opportunities to enhance existing, and provide additional, recreation activities, opportunities, and services where desirable to meet local or Forest-wide recreation demands. Give particular attention to opportunities that are in relatively short supply within the day-use travel distance of communities, are important to local users, are important to tourism and commercial service providers, provide a base for visitor use of Primitive and Semi-Primitive areas, compliment recreation programs of communities, the state, and private landowners, contribute to the supply of Semi-Primitive Motorized opportunities, and are related to the unique combination of marine, wildlife, and fish resources characteristic of Southeast Alaska.

C. Coordinate, to the extent feasible, recreation project development with other resources (for example wildlife, transportation).

D. Coordinate off-highway vehicle (OHV) use through travel management planning.
   1. OHV planning will be in accordance with the final rule for Travel Management; Designated Routes and Areas for Motor Vehicle Use published in the Federal Register (FR) on November 9, 2005 (70 FR 68264). Each Ranger District will designate the roads, trails, and areas open to motor vehicle use on a motor vehicle use map. All operations must be in accordance with those designations.
   2. Coordinate OHV planning and management with other resource concerns, the State of Alaska, and adjacent landowners.
   3. Provide a diversity of OHV recreational opportunities across the Forest where consistent with the criteria in FSM 2355 and 36 CFR 212, which includes:
      a) The use is compatible with established land management and resource objectives.
      b) The use is consistent with the capability and suitability of the resource.
      c) There is demonstrated demand that cannot be better satisfied elsewhere.
   4. Update access and travel management plans. Identify specific areas, roads, trails, and water surfaces that are open, restricted, or closed to motorized and non-motorized mechanical conveyance, watercraft, and conditions of use. Recreation, subsistence, and authorized uses may be considered separately depending on the circumstances.

III. Tourism

A. Tourism is a major industry in Southeast Alaska. The Forest provides the backdrop as well as the land base for many tourism activities, including several of the state's leading attractions. The size and extent of the Forest has a profound influence on the amount and nature of opportunities for the tourism industry.
   1. Work with the tourism industry and government agencies in assessing the value and contribution of the industry to the economy of Southeast Alaska. Identify the role and contribution made by the Tongass National Forest to the industry and the region.
   2. Cooperate with the tourism industry and appropriate government agencies in conducting and assessing visitor studies. These studies include identification of activities, attractions, and attributes visitors seek; response to management activities; demographic traits; and detection of changing trends.
   3. Coordinate information and marketing efforts with tourism providers and promoters to complement efforts, target markets for new and existing opportunities, and to meet Forest Service management objectives.
   4. Work with government agencies, organizations, and the private sector to identify, facilitate, and develop tourism opportunities.
   5. Consider access, infrastructure, and other needs of the tourism industry at the project planning level. Incorporate these needs into project design and implementation.
   6. Commercial services may be performed within the Wilderness to the extent necessary for activities that are proper for realizing the recreational or other Wilderness objectives for the area.

Recreation Use Administration: REC3

I. Coordination with Wilderness Management

A. Evaluate the effects of location, design, and operation of developed sites and roads adjacent to Wilderness. Develop and operate projects to complement Wilderness management objectives and to preserve the Wilderness character.

B. Ensure that recreation special use activities and facilities adjacent to Wilderness are located, designed, and operated in a manner that complements Wilderness management objectives and preserves Wilderness character.

II. Recreation Special Uses

A. Commercial Recreation Opportunities

1. Work with recreation service partners and the tourism industry in identifying and developing services and opportunities. Recreation service partners provide services and opportunities that supplement the use and enjoyment of the national forests by a variety of people.
   a) Identify opportunities for commercial recreation use, services, and developments.
   b) Facilitate authorizing commercial recreation use, services, and developments by:
      (1) Authorizing commercial recreational developments and services where there is a public need and no private lands are available or suitable for development. Refer to each Land Use Designation (LUD) management prescription to determine its appropriateness for development.
      (2) Managing recreation special uses in accordance with the direction in –LAND 2 – Special Use Authorizations (items I, A.1-12 apply to recreation special uses) and outfitter/guide services in this section.
      (3) Working with recreation service partners to provide agency identity, customer information and programs, natural resource education, and to instill a land stewardship ethic.
2. Use the following guidelines in addressing the appropriateness of recreation special use proposals in each of the LUDs after evaluating factors in 1.b. above. They provide a framework to guide major and minor development proposals. Four strategies (not allowed, discouraged, case-by-case, compatible) are identified for guidance; one is assigned to each LUD to address major and minor proposals (see LUD direction). The definitions and strategies applied to major and minor developments are discussed below (also see Appendix I).
   a) Major Development. Major recreation and tourism developments provided by the private sector involve long-term commitment of the land base, with a moderate to high level of site modification. They involve large buildings or complexes of buildings and facilities, and often provide several services in a concentrated area. Comfort and convenience are provided for guests, and facilities can generally accommodate more than 12 people. The proposals are typically Development Scale 3, 4, or 5, and Roaded Natural or Rural ROS settings. Site reclamation involves extensive removal of facilities and improvements, revegetation, recontouring, etc.; a natural appearance usually takes more than five years to attain. Examples include destination resorts and lodges, food and beverage services, downhill ski areas, marinas and gas stations, and full-service campgrounds.
   b) Minor Development. Minor recreation and tourism developments provided by the private sector involve only minor site modifications. They involve small rustic facilities and/or improvements, generally with a single purpose or service, and may involve several sites or an extensive area. Basic essentials are typically provided, and can generally accommodate 12 or fewer people per site. The proposals are typically Development Scale 1 and 2, with a Semi-Primitive ROS setting. Site reclamation involves simple removal of facilities and little or no revegetation; a natural appearance can be attained in a few years. Examples include cabins, huts, small docks, cross-country ski trails with simple facilities, temporary or portable camps, and simple and rustic campgrounds.

3. Public Outfitter/Guide Services
   a) Authorize the services of qualified outfitters and guides to the public where the need for the service has been identified and is compatible with the objectives and management direction of the affected LUDs. The services of outfitters and guides should facilitate the use, enjoyment, understanding, and appreciation of National Forest recreation settings.
   b) Manage outfitter and guide services as partnerships with the Forest Service, as a way to nurture and encourage assistance and support for attaining the objectives of the LUD, and to assist in increased public understanding and appreciation of the Forest Service's mission and goals.
   c) Administer outfitter/guide special use authorizations in accordance with the direction in FSM 2720, FSH 2709.11, FSH 2709.14, and Regional Supplements.
      (1) Outfitting and guiding operations should not require permanent improvements occupying NFS lands. Encourage operations that require only temporary facilities that are easily removed at the end of the use season.
      (2) Authorize outfitter/guide operations on the basis of the following criteria:
         (a) The affected ecosystem(s) have the capability to accommodate the expected kinds of activities and amounts of use without degradation of ecosystem composition and structure.
         (b) Existing or proposed operations and activities are appropriate for the specific ROS settings within the LUD.
         (c) Adverse impacts to popular or high-valued local areas with outfitter/guide operations are minimized.
         (d) There is a demonstrated public need for the services to be offered and/or the services will enhance the objectives of the LUD.
         (e) The operations can be carried out in a manner that is compatible with existing or expected use by the non-guided public.
         (f) Adverse impacts to subsistence users are minimized.
      (3) Authorize outfitter/guide operations through the issuance of priority use permits, whenever possible, supplemented with temporary permits. Assign priority use and temporary use permits within a LUD based on the following:
         (a) Generally allocate no more than one-half the capacity of the LUD to outfitter/guide operations. For specific locations, consider different allocations based on historical use, changing demand, spatial zoning, or temporal zoning.
         (b) Party size and distribution of groups.
            (i) **Wilderness, Monument, and Wild River LUDs**. Group size is limited to no more than 12 persons for commercial or general public use of a Wilderness, unless otherwise approved by the appropriate line officer. Refer to REC3 in Chapter 3 for exceptions. Encounters should be less than three groups per day as to maintain the more primitive experience.
            (ii) **Semi-Primitive ROS settings outside of Wilderness**. Party size should generally be limited to 12 to 20 people. Within the LUD II, Old-growth Habitat, and Semi-Remote Recreation LUDs, larger party sizes may be allowed in limited locations for up to 15 percent of the primary use season for nature-based interpretive activities if there is no degradation to the physical site conditions. Larger party sizes may be allowed to go ashore at one location and split up into smaller parties not within sight or sound of each other.
            (iii) **Other ROS settings**. Consider site capacities and impacts to other users and resource values to establish party size limits.
      (4) Where there is surplus capacity not being used by the general public, temporary use for specific periods of time (not to exceed one year) may be authorized. Such temporary use does not qualify for credit toward priority use by a permit holder.

d) Motorized access to sites may be authorized as part of the special use authorization. Use of OHVs or over-snow vehicles may be allowed in accordance with 36 CFR 212, Subpart C.

e) Cooperate with state and local authorities and user organizations to resolve situations where illegal outfitters are known to be operating. (Consult FSM 5300.)

B. Non-Commercial Recreation Uses

1. Issue no authorizations to construct new private recreation facilities, such as private recreation cabins.
2. Manage non-commercial recreation special use authorizations as provided for in FSM 2347. Allow replacement of existing facilities with similar facilities.
3. Manage cabins and related structures that were existing, but unauthorized, prior to the Alaska National Interest Lands Conservation Act of 1980 (December 2, 1980), in accordance with the direction in LAND2 – Cabins and Related Structures.
4. Manage recreation special uses in accordance with the direction in LAND2 – Special Use Authorizations.

III. Recreation Settings

A. Provide a broad spectrum of outdoor recreation opportunities in accordance with the existing capabilities of the National Forest, and in accordance with the ROS Class Standards and Guidelines in Appendix I.

1. Manage recreation use in a manner that is compatible with the long-term objectives of the LUD. Maintain the capability of all LUDs to provide quality recreation opportunities on a sustained basis.
2. In LUDs where non-recreation resource management activities are emphasized, continue providing the current settings and opportunities until scheduled activities and practices cause a change in the ROS setting. The ROS settings for these LUDs may also change to accommodate new recreation facilities or increases in commercial recreation use when this use is compatible with the desired condition for that LUD. When there is a decision that results in a change to the recreation setting, the management decision should adopt the appropriate ROS class. The adopted ROS call will provide the direction for the design of any new facilities.

B. Manage recreation resource activities and facilities in accordance with the established regional guidelines and the ROS guidelines in Appendix I, or Wilderness-specific ROS guidelines approved by the Forest Service officer with delegated authority. All recreation planning and management activities will address the setting indicators. They are described by ROS class in the guidelines in Appendix I.

C. Use the ROS charts in Appendix I for project planning and analysis, and as guidelines to establish appropriate levels of use, scale, and kinds of facilities, Scenic Integrity Objectives, types of access, and services to meet local and regional needs and desired recreation setting conditions.

IV. Developed Site Management

A. Manage the Forest's recreation infrastructure in alignment with the resources available to operate and maintain it to standard. The Forest recreation infrastructure includes all recreation sites and the facilities associated with them.

V. Recreation Construction and Rehabilitation

A. Provide development facilities appropriate to the ROS setting after determining that the private sector is not able or willing to meet the demand.

B. Maintain cost-effective developed recreation facilities that complement non-Forest Service developments in the same community home range or service center area.

C. Provide barrier-free, accessible facilities appropriate to the site development level and area ROS setting.

D. Evaluate the location and need for recreation facilities that lie within identified 100-year flood plains as to the specific hazards and values involved with the site and its use. Thoroughly explore viable alternatives. (Consult FSM 2527.)

E. Use the regional recreation capital investment process and criteria for the identification of recreation construction and reconstruction projects.

VI. Interpretive Services

A. Provide an Interpretive Services Program that is designed to accurately and adequately develop an interest and understanding of the environments of the Forest and Southeast Alaska, and the mission of the Forest Service in managing the National Forest.
B. Conduct on-site interpretive activities to a level consistent with LUD objectives.
C. Assist visitors and users to understand the role of natural and cultural resources in the development of industry, heritage, and culture in Southeast Alaska. Relate these roles to the rest of the state, Canada, and the nation.
D. Promote visitor understanding of the NFS, forest research, and state and private forestry programs.
    1. Emphasize understanding of stewardship of public lands and their productivity through professional forest management with balanced use of natural resources.
    2. Develop Interpretive Services programs for all principal resource management programs. Information should emphasize the integration of management activities designed to achieve the goals and objectives developed for specific areas.
E. Inform visitors of the distribution, differences, and roles of the federal, state, and private lands found in Southeast Alaska and the range of recreation and cultural interest opportunities and facilities available.
    1. Continue to pursue and implement cooperative interpretive partnerships with other federal and state land management agencies consistent with the principal travel routes and activity centers used by forest visitors.
    2. Provide an array of imaginative and dynamic media by which interpretive messages are made available to the visitor. Use a spectrum of media and presentation designs that are appealing, appropriate for the setting, easily understood by the intended audience, and reflect the Forest Service as a professional and caring land management agency.
    3. Continue to provide accurate and timely information about Southeast Alaska and the Tongass National Forest. Continue the Forest Service's leadership role for the Southeast Alaska Discovery Center.
    4. Continue to provide or improve interpretive services programs and facilities such as Tongass visitor centers. Support shall include identification of current issues and events of interest to forest visitors, adequate staffing to meet program objectives, assistance in training the seasonal and volunteer staff, and objective evaluation of programs to ensure accurate and positive coverage of the natural and cultural resources on the Tongass National Forest and their management.
    5. Expand the use of Alaska Geographic as an interpretive partner to provide forest visitors with a broad range of interpretive media. These may include, but are not limited to, publications, video and audio tapes, and other media that feature the natural and cultural resources of the Tongass National Forest and the heritage of Southeast Alaska. Encourage all types of support and donations to Alaska Geographic that can be used to develop additional materials and programs.
    6. In partnership with communities, organizations, and individuals, develop additional Alaska Geographic outlets at locations that will best serve Forest customers.
    7. Continue to support the Elderhostel Education Program in local communities and aboard the Alaska Marine Highway as budgets will allow.
F. Provide a coordinated program of awareness and training for all employees and partners (including outfitter/guides and other public service permit holders) to ensure a consistent program of public service.
    1. Encourage other agency participation in Forest Interpretive Services training programs.
    2. Ensure that the Forest Service mission and image remain predominantly visible at all Forest Service facilities through the use of uniformed Forest Service personnel, the Forest Service shield, and other media.

3. To the extent feasible, provide training about National Forest resources, points of interest, and management to all interested outfitter/guides, industry representatives, and other partners.

VII. Recreation Use

A. Gather recreation use information to use in project and forest planning. Many sources of information should be used to gather data, such as cabin rentals, campground, visitor center use, trailhead registers, outfitter/guides, ferry and cruise ship arrivals, and employee or public observations.

B. Identify those recreation uses that may be in conflict with each other. Reduce recreation user conflicts and polarization. Work with affected publics in finding solutions to defuse or resolve conflicts or concerns.

RIPARIAN
Forest-wide Standards and Guidelines

Riparian area: RIP1

I. Definition

A. Riparian areas encompass the zone of interaction between aquatic and terrestrial environments associated with streamsides, lakeshores, and floodplains, and display distinctive ecological conditions characterized by high species diversity, wildlife value, and resource productivity.

II. Objectives

A. Maintain riparian areas in mostly natural conditions for fish, other aquatic life, old-growth and riparian-associated plant and wildlife species, water-related recreation, and to provide for ecosystem processes, including important aquatic and land interactions. For further direction, refer to the Fish, Wildlife, Recreation and Tourism, Beach and Estuary Fringe, and Soil and Water Forest-wide Standards and Guidelines, as well as the Riparian Standards and Guidelines criteria for each process group contained in Appendix D. The following is a list of objectives pertaining to riparian areas. (Consult Forest Service Manual [FSM] 2526.)

1. Protect riparian habitat.
2. Manage riparian areas for short- and long-term biodiversity and productivity.
3. Maintain natural streambank and stream channel processes.
4. Maintain natural and beneficial quantities of large woody debris over the short and long term.
5. Protect water quality by providing for the beneficial uses of riparian areas. (Consult Best Management Practices [BMPs], Chapter 10 of the Soil and Water Conservation Handbook, FSH 2509.22.)
6. Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.
7. Consider the management of both terrestrial and aquatic resources when managing riparian areas. Consider the effects of terrestrial and aquatic processes on aquatic and riparian resources.
8. In watersheds with intermingled land ownership, cooperate with the other landowners in striving to achieve healthy riparian areas.
9. Design and coordinate road management activities to provide for the needs of wildlife and provide passage of fish at road crossings. (Consult the Fish Forest-wide Standards and Guidelines and the Aquatic Habitat Management Handbook, Forest Service Handbook [FSH] 2090.21.)
10. Evaluate the effect of management (including windthrow) of adjacent areas on riparian habitats.
11. Coordinate and consult with state and federal agencies on riparian management issues, as appropriate.
12. Coordinate and consult with Alaska Department of Environmental Conservation (ADEC) regarding management of public water systems source watersheds.

Riparian Planning: RIP2

I. Project Planning

A. Identify and delineate Riparian Management Areas (RMAs) for each project where ground disturbance will occur or resources will be extracted. RMAs are areas of special concern to fish, other aquatic resources, and wildlife. They are generally delineated as identified in the Process Group direction in the Riparian Forest-wide Standards and Guidelines. Riparian areas are differentiated from adjacent reserve areas, such as wildlife reserves or areas managed to provide reasonable assurance of windfirmness.

B. Complete a watershed analysis before making site-specific adjustments to Process Group Standards and Guidelines (see Appendix D). Riparian guidelines may be adjusted only if the

stream process group objectives can be met. Consult Appendix C of the Forest Plan for direction on adjusting riparian guidelines.

C. On those projects and activities that are in, or influence, RMAs, ensure interdisciplinary involvement and consideration of riparian resources in project planning and in the environmental analysis process.
   1. The location and design of wildlife habitat reserves and mitigation measures should be closely integrated with the design and layout of RMAs.
   2. Logging engineers and aquatic specialists should conduct joint reviews of preliminary harvest unit designs to ensure that site-specific stream protection measures meet riparian objectives, as well as logging system feasibility and timber harvest economic objectives.

D. Ensure that permit holders, contractors, and/or purchasers understand RMAs and riparian management objectives.

E. Evaluate RMA windthrow risk when locating and designing adjacent management activities (Reasonable Assurance of Windfirmness [RAW] Guidelines: Landwehr 2007 and subsequent versions). Minimize accelerated windthrow in RMA buffers. In situations where a high risk of blowdown factors is present, indicating a high windthrow risk, a RAW buffer should be prescribed. In situations where multiple low risk factors are present and high risk factors are minimal, a RAW zone addition to riparian buffers is not warranted. Where high-value aquatic resources (such as a Class I stream or drinking water supplies) are at-risk, use of a wider buffer may be warranted even when the risk of windthrow is judged to be low or moderate. The RAW zone is not necessarily a no-harvest zone; partial harvest may be appropriate in RAW buffers depending on site-specific conditions. (Consult BMP 12.6a of the Soil and Water Conservation Handbook—FSH 2509.22 and the Process Group Standards and Guidelines.)

II. General Standards and Guidelines by Activity

A. Special use administration(Non-Recreation)
   1. Permit activities, consistent with other special use direction, that do not significantly reduce the capability of RMAs to 1) maintain or improve associated fish or wildlife habitat, or 2) protect water quality for beneficial uses.

B. Minerals and Geology Administration, Plan of Operations
   1. Use state-of-the-art techniques for developing minerals to reduce impacts to riparian resources to the extent feasible. Include mitigation measures that are compatible with the scale of proposed development and commensurate with potential resource impacts.
   2. Apply appropriate Transportation Forest-wide Standards and Guidelines to the location, construction, and maintenance of mining roads affecting riparian areas.
   3. Manage mineral exploration and development activities to be compatible with the Process group goals and objectives for RMAs.
   4. Manage mineral activities to maintain the present and continued productivity of anadromous fish and other foodfish habitat to the maximum extent feasible. (Consult the Alaska National Interest Land Conservation Act of 1980, Section 505 [a].) Plan of Operations for mining must comply with Clean Water Act, Sections 401, 402, 404, as applicable. (Consult FSM 2817.23a.)
   5. Apply timing restrictions to instream construction and other minerals activities to protect fisheries habitat and mitigate adverse sedimentation, and to avoid critical wildlife mating, hatching, and migrating periods.
   6. Minimize the effects of mineral development and related land disturbance activities on the beneficial uses of water by applying BMPs.
   7. Locate material sites and marine transfer facilities outside RMAs if reasonable alternatives exist.
   8. Ensure that disturbed areas are revegetated in accordance with project plans.
   9. Approve reclamation plans in which mineral activities leave riparian project areas as natural in appearance and function, as is feasible.

C. Recreation Use Administration
   1. Locate, design, and operate only those recreation projects that are necessary to accommodate public use of the water and shoreline areas (i.e., boat or floatplane docks, launching ramps, and associated access roads and trails). Where feasible, locate parking, campgrounds, sanitation, and other recreation facilities outside the RMAs to avoid adverse effects on water quality and riparian function.
   2. For existing facilities, consider relocating the facility outside of the RMA. Consideration should be based on current and anticipated effects on riparian values, desired recreation experience, public issues, application of BMPs to minimize the effects of recreation facilities on the beneficial uses of water and costs of relocating the facility.

D. Watershed Resource Planning
   1. Manage activities to meet state water quality standards and protect aquatic and terrestrial riparian habitats, channel and streambanks, and provide for flood plain stability.
      a) Identify soil and water quality requirements for project-level activities.
      b) Apply BMPs to minimize the effects of land disturbing activities on the beneficial uses of water.
      c) Determine flood plain values and plan to avoid, where possible, the long- and short-term adverse impacts to soil and water resources associated with the occupancy and modification of flood plains.
      d) Complete a watershed analysis before making project-level, site-specific adjustments to Process Group Standards and Guidelines. Adjustments to the guidelines may be made only if the objectives of the process group(s) can be met. Consult Appendix C of the Forest Plan for direction on watershed analysis. The intensity and scope of watershed analysis will vary according to the issues of concern.

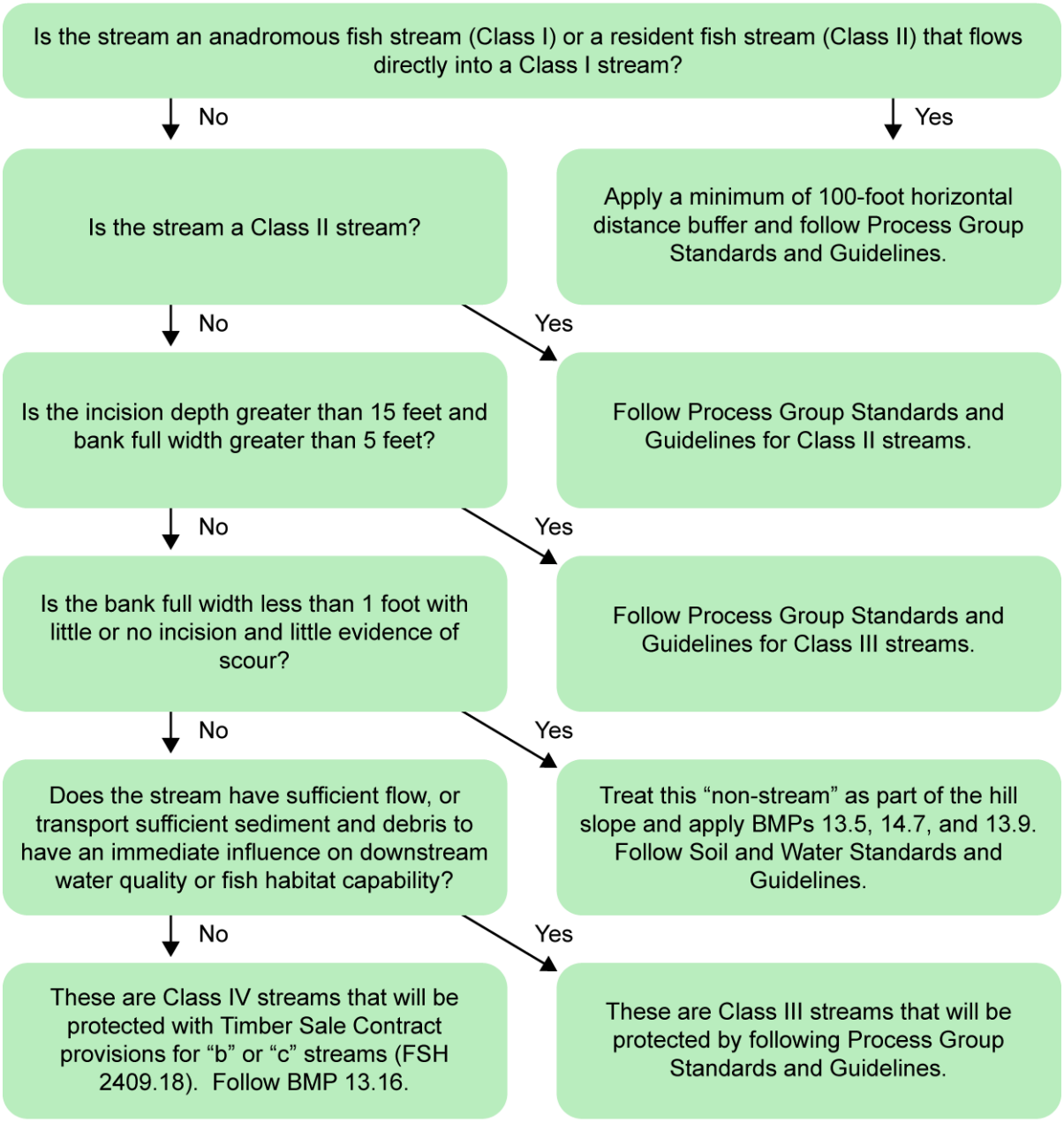
E. Timber Resources
   1. No commercial timber harvest is allowed within 100 feet horizontal distance either side of Class I streams and Class II streams that flow directly into a Class I stream. (Consult the Tongass Timber Reform Act.)
      a) Included in the definition of Class II streams flowing directly into a Class I stream are all Class II tributaries of a Class II stream that flow into a Class I stream without an intervening Class III segment. Mandatory minimum 100-foot buffers will not apply to 1) a Class II stream that flows directly into the ocean or joins a Class I stream only at lower than mean high tide; and 2) a Class II tributary stream segment that flows into a Class III stream that in turn flows into a Class I stream.
      b) The 100-foot measure is a horizontal distance measure from the bankfull margins.
   2. Protect RMAs, in accordance with the intent of the Alaska Anadromous Fish Habitat Assessment (1995), through application of the direction contained in Process Group Standards and Guidelines (Appendix D). Apply additional BMPs (National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook FSH 2509.22) to minimize the effects of timber harvest and related land disturbance activities on beneficial uses of water. In situations where multiple high risk factors are present, indicating a high windthrow risk, a Reasonable Assurance of Windfirmness (RAW) zone adjacent to the RMA buffer should be established (see RAW Guidelines: Landwehr 2007 and subsequent versions).
   3. Avoid RMAs when other feasible locations for personal use wood cutting are available. If personal (free) use timber harvest in RMAs is allowed, free use permit requirements must satisfy process group objectives (refer to Personal Use Program, section TIM4). Personal use timber harvest will be regulated and its cumulative effects monitored in LUDs that are not suitable for timber production to ensure that the LUD objectives are fulfilled.
   4. Provide protection to fish and wildlife during critical periods of their life cycles by applying seasonal restrictions on timber harvest and road use activities, to the extent feasible.

5. When stream crossings are required to harvest timber, assess the environmental effects of road crossings versus yarding corridors, and select the action of least environmental impact where practicable.
6. Streamcourse protection plans (consult BMP 13.16) are required for harvesting activities within the required minimum 100-foot buffers designated in E (1) above.
   a) Provide thorough documentation of RMA design and BMP mitigation provision on timber sale unit cards and maps. “As-laid-out” (or phase II) unit cards are a useful tool for facilitating application of RMA and streamcourse protection during sale administration, and for monitoring compliance with and implementation of Riparian Forest-wide Standards and Guidelines.
7. Allow no commercial timber salvage within 100 feet in width on each side of Class I streams or on those Class II streams that flow directly into Class I streams. In addition, allow no timber salvage in RMAs defined for each process group, with the following exception: salvage could be allowed, with Line Officer approval, following watershed analysis if the salvage activity is needed to meet or further riparian management objectives for the process group (see Appendix C for guidance on watershed analysis). RMA salvage timber will not contribute toward the Projected Timber Sale Quantity (PTSQ).
8. Plan timber harvest settings that cross or are immediately adjacent to streamcourses (Class I, II, III, and IV Channels) so as to avoid adverse impacts to RMAs, and soil and water resources. (Consult FSH 2409.18 and FSH 2509.22.)
9. Stream process group-specific standards and guidelines for timber harvest are presented in Appendix D, along with descriptions of each process group and channel type. The standards and guidelines (except for the minimum 100-foot buffers required by TTRA) may be adjusted for a project on a site-specific basis following completion of a watershed analysis. Adjustments to the standards and guidelines may be made only if the objectives of the process group(s) can be met. Consult Appendix C for direction on watershed analysis.

F. Wildlife Resources
1. Integrate RMAs into any modifications to the design and location of small old-growth reserves. (Consult the Old-growth Habitat LUD and Appendix K.)
2. Use riparian corridors in the design of wildlife travel corridors to provide horizontal connectivity between watersheds, and vertical connectivity between lowland and alpine areas.
3. Consider wildlife needs in the design and management of RMAs. Give special emphasis to habitats of riparian associated species, for example, designated brown bear feeding areas. (See Wildlife Forest-wide Standards and Guidelines.)

G. Transportation Systems
1. Use road closures, maintenance, and other measures to keep road-surface and road-side erosion at low or near background levels. Ensure long-term fish passage through structures at road crossings on Class I and II streams as described in Process Group direction and the Fish Standards and Guidelines. Use BMPs (National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook FSH 2509.22 [BMP 14-20]) to control effects of transportation systems on water quality and fish habitat. Also refer to the Alaska Forest Practices Act (11 AAC 95.320) for road closure requirements.

Key to Streamcourse Protection on the Tongass National Forest



Special Provisions: If any of the above streams flow into karst features or contribute to public or domestic water supplies, more stringent standards may apply. Follow Karst Standards and Guidelines or guidance in State of Alaska Statute 18 AAC 80.

RURAL COMMUNITY ASSISTANCE
Forest-wide Standards and Guidelines

Activities: RUR

I. Resource Management Decisions Affecting Communities

A. Emphasize, where appropriate, local needs and opportunities for rural community assistance in Forest programs and budgets.
   1. Consider rural interests, including Native organizations, in resource decisions by jointly identifying and developing natural resource opportunities.

B. Consider social, cultural, and economic issues in resource management by:
   1. Considering local communities' needs in project plans.
   2. Evaluating community-based sources of goods and services for implementing Forest projects.
   3. Considering community organization and protocol in resource planning and decision processes.
   4. Providing information pertaining to resource management and development on National Forests with communities.
   5. Encouraging local rural development entities to include Forest Service employees in their local rural development planning.

SCENERY

Forest-wide Standards and Guidelines

Scenery Operations: SCENE1

I. Scenery Management

A. This plan adopts Scenic Integrity Objectives (SIOs) that provide direction and objectives for landscapes within each Land Use Designation (LUD). The long-term desired future scenic condition for a specific area is the maintenance of a scenic integrity level that is at least as high as the adopted SIO for that area. Adopted SIOs are described in the scenery section of each LUD.

B. Perform landscape/viewshed analysis, using as much of the available tools and technology as possible, when planning projects within viewsheds seen from Visual Priority Travel Routes and Use Areas (VPRs). Some level of analysis may be appropriate in some areas involving non-priority use areas. More comprehensive viewshed analysis such as long-term, full corridor planning may be used in the most sensitive viewsheds. See Appendix F of this Plan for a listing of the designated VPRs. As a part of the planning for major (e.g., large scale mining operations) land-disturbing activities, consider whether changes to the VPR list are necessary.

C. Consider the scenic condition of adjacent non-National Forest System lands during the planning of development activities on the National Forest.

D. Consult the USDA Forest Service Agriculture Handbooks (nos. 434, 462, 478, 483, 484, 559, 608, 617, 666) and Agriculture Handbook 701, Landscape Aesthetics, for scenery management guidance.

Scenery Preparation: SCENE2

I. Scenery Integrity Objectives: Application

SIOs are applied to any activity that has the potential to affect the scenic character of the landscape. The foreground, middleground, and background SIOs are adopted as seen from the VPR (Appendix F). Non-priority travel routes and use areas, as well as those areas not seen from the VPR, are managed according to the “Seldom Seen or Non-Priority” column. Activities could include, but are not limited to recreation facilities: trails, cabins, restrooms, interpretive displays; timber sales: roads, harvest units, logging camps, sort yards, log transfer facilities (LTFs); rock pits; gravel pits; mineral development; fish enhancement projects: in-stream fish pass structures, gabions; facilities authorized under special use authorizations: electronic facilities, hydroelectric projects, etc. In designing activities to meet specific SIOs, a number of factors must be considered. Some of these factors include the following:

A. The landscape's Existing Scenic Integrity (ESI) rating. This is an inventoried condition that rates the degree of change that has already occurred on the ground. It is important to compare the ESI of the project area to the SIOs assigned by the Forest Plan. Should there be conflicting conditions presently existing and the intent of the LUD is not presently met, it would be appropriate to consider either 1) some specific rehabilitation measures, or 2) project deferral that would allow the landscapes in the project area time to regenerate sufficiently.

B. Visual Absorption Capability (VAC), which is an estimate of the relative ability of a landscape to absorb management activities. High, Intermediate, and Low VAC ratings are used. These ratings reflect the degree of landscape variety in an area, viewing distance, and topographic characteristics. As examples, a Low VAC setting generally has steep slopes, with little landscape variety, while a High VAC setting may be relatively flat and/or has a high degree of variety in the landscape.

C. Size, shape, orientation to viewer, color, texture, etc. are critical elements in determining whether or not an activity meets the adopted SIO. Consideration for the scenery is essential early on in planning processes, particularly in areas seen from a VPR. However, each landscape setting is different, and should be evaluated on a case-by-case basis. There may be instances where the SIO can be met while the proposed activity is greater than the guideline, or there also may be cases where the activity must be smaller to meet the intent of the SIO.

Adopted Scenery Integrity Objectives for Each Land Use Designation[1,9]

Land Use Designation	Foreground from Priority Travel Routes and Use Areas	Middleground from Priority Travel Routes and Use Areas	Background from Priority Travel Routes and Use Areas	Seldom Seen/ Non-Priority
Wilderness Wilderness Nat. Monument Research Natural Area Special Interest Area [2, 4] Remote Recreation Old-growth Habitat [4] LUD II [4]	High	High	High	High
Special Interest Area [3, 4]	Low	Moderate	Moderate	Moderate
Semi-remote Recreation [4]	Moderate	Moderate	Moderate	Moderate
Wild River [6]	High	High	High	High
Scenic River [4, 6]	High	Moderate	Moderate	Low
Recreational River [4]	Moderate	Low/Moderate [6]	Low/Moderate [6]	Very Low
Scenic Viewshed [4, 3]	High	Moderate	Moderate	Very Low
Modified Landscape [4]	Moderate	Low	Low	Very Low
Timber production Minerals Experimental Forest [5]	Low	Very Low	Very Low	Very Low
Municipal Watershed [7]	High	High	High	High
Nonwild. Nat. Monument [8]	High	High	High	High

[1] The foreground, middleground, and background Scenic Integrity Objectives (SIOs) are adopted as seen from the Visual Priority Travel Routes and Use Areas (Appendix F). Non-priority travel routes and use areas, and those areas not seen from the Visual Priority Routes and Use Areas, are managed according to the direction listed in the "Seldom Seen/Non-Priority" column.

[2] Except for the developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier, Ward Cove, and Blind Slough.

[3] Applies only to the developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier, Ward Cove, and Blind Slough. Undeveloped areas are managed according to the guidance on the previous line.

[4] Exceptions for small areas of non-conforming developments, such as recreational developments, transportation developments, log transfer facilities, and mining development, may be considered in these LUDs on a case-by-case basis.

[5] The SIO may vary depending on the research objectives of the Experimental Forest.

[6] Apply the Moderate SIO in corridors where scenic quality is included as one of the "outstandingly remarkable" values for that corridor. If it is not, apply the lower SIO.

[7] SIO is High, but may range down to Very Low as a result of the municipality's watershed management objectives.

[8] SIOs will range from High, in those portions of the Monument without access, to Very Low in those portions developed in connection with mineral activities. Site-specific SIOs will be identified in the specific Plan of Operations for mineral development.

[9] See Young Growth, Renewable Energy, and Transportation Systems Corridors Plan Components in Chapter 5 (S-YG-SCENE-01, S-RE-SCENE-01 and S-TSC-SCENE-01).

D. Depending on the assigned SIO, specific time frames are allowed for meeting the SIO following project completion. Long-term projects (i.e., those with no specific completion date) should be initially designed to meet the assigned SIO as the project progresses.

II. Scenic Integrity Objectives: Specific Guidelines

A. SIO High. Design activities to not be visually evident to the casual observer. This objective should be accomplished within six months following project completion.

1. Facilities
   a) Keep vegetation clearing to a minimum and within proximity of the site.
   b) Select materials and colors that blend with those found in the natural surroundings.

3

c) Screening should be used from viewpoints and travel routes if feasible.

2. Transportation
   a) Rock Sources. When a forest development road is a VPR, locate rock sources off the road, when possible. Spur road access may be necessary to minimize the visual impact. Rock source development should not be apparent from the road, use area, or marine travel route to meet this scenic objective.
   b) Corridor Treatment. Provide roadside cleanup of ground-disturbing activities. Depending on site conditions, cut stumps as low as possible and angled away from the viewer. Incorporate this treatment in the timber sale contract.
   c) Log Transfer Facilities. LTFs are generally not appropriate in this SIO setting (with exceptions noted in the table above).
3. Timber Harvest: VAC Setting, Typical Regeneration Method, and Unit Size
   a) Low VAC: Single tree selection or group selection (group openings less than 2 acres)
   b) Intermediate VAC: Single tree selection or clearcut (openings approximately 5 to 15 acres)
   c) High VAC: Clearcut (openings approximately 15 to 30 acres)

B. SIO Moderate. Design activities to be subordinate to the landscape character of the area. This SIO should be accomplished within one year of project completion.
1. Facilities
   a) Keep vegetation clearing to a minimum and within proximity of the site.
   b) Emphasize enhancement of views from recreational facilities.
   c) Select materials and colors that blend with those found in the natural surroundings.
2. Transportation
   a) Design rock sources to be minimally apparent as seen from VPRs. Rehabilitation is usually necessary following closure of rock source developments. It may be necessary to modify some ground-disturbing activities seen from the foreground of VPRs.
   b) Corridor Treatment. Roadside cleanup of ground disturbance activities may be necessary.
   c) LTFs (temporary or permanent). Perform a Scenic Integrity analysis during LTF planning and design. Consider low profile designs to minimize visibility from VPRs. For temporary LTFs, incorporate rehabilitation measures into the project analysis and contract package.
3. Timber Harvest: VAC Setting, Typical Regeneration Method, and Unit Size
   a) Low VAC: Group selection (group openings less than 2 acres) or clearcut (openings approximately 5 to 10 acres)
   b) Intermediate VAC: Clearcut (openings approximately 15 to 40 acres)
   c) High VAC: Clearcut (openings approximately 40 to 60 acres)

C. SIO Low. Activities may visually dominate the characteristic landscape, but must have visual characteristics similar to those of natural occurrences within the surrounding area or character type. This SIO should be met within one year in the foreground distance zone and within 5 years in the middle and background distance zones following project completion.
1. When planning activities, use naturally established form, line, color, and texture found in the landscape.
2. Facilities. Siting and design should borrow from naturally occurring patterns in the landscape, and should not be visually dominant when viewed in the background distance zone.
3. Transportation
   a) Rock source operations and resulting landform modifications may be evident to the casual observer as seen from VPRs. However, the quarry location and design should mitigate, to the extent feasible, the apparent visual size and dominance of the activity (e.g., shaping of backwalls, roadside screening, and general orientation of the opening).
   b) LTFs (temporary or permanent). Perform a Scenic Integrity analysis during LTF planning and design.

4. Timber Harvest: VAC Setting, Typical Regeneration Method, and Unit Size
   a) Low VAC: Clearcut (openings approximately 15 to 40 acres)
   b) Intermediate VAC: Clearcut (openings approximately 40 to 60 acres)
   c) High VAC: Clearcut (openings approximately 60 to 100 acres)

D. SIO Very Low. Activities may dominate the characteristic landscape, yet when viewed as background, should appear to be a natural occurrence.
   1. Locate and design management activities to take advantage of existing (both natural and imposed) pattern and texture found in the landscape when viewed in the middleground from VPRs.
   2. Design activities to resemble natural occurrences as viewed in the background distance zone.
   3. Timber Harvest: VAC Setting, Typical Regeneration Method, and Unit Size
      a) Low VAC: Clearcut (openings approximately 50 to 75 acres)
      b) Intermediate VAC: Clearcut (openings approximately 80 to 100 acres)
      c) High VAC: Clearcut (openings approximately 80 to 100 acres)

E. Graphic illustrations of timber harvest activities designed to meet each SIO are located at the end of this section. The undeveloped landscape is provided for comparative purposes.

III. Scenic Integrity Objectives - Silvicultural Prescriptions Other Than Clearcutting

The timber harvest-related scenery management guidelines described previously are based on several analyses of harvested viewsheds throughout the Tongass that represented different VAC characteristics and different levels and scales of harvest. The following paragraphs provide some general guidelines concerning the use of silvicultural methods other than clearcutting.

A. Two-aged Management. Based on a few observations of some recent treatments of this type, it would appear that if approximately 20 to 30 percent of the trees within a harvest unit are retained, the size of that harvest area might be increased and still meet the same SIO. It may also be possible to meet a higher SIO by leaving an appreciable percentage of reserve trees within an area. However, many factors such as natural vegetative patterns, steepness and obliqueness of slope, windfirmness, and viewing distance determine how to apply this silvicultural method in a specific landscape.

B. Uneven-aged management - single-tree or group selection. Meeting a High or Moderate SIO in a low VAC setting requires a relatively small percentage of stems removed on a single-tree basis—anywhere from 5 to 20 percent. The exact amount depends on the slopes, viewing distances, and natural characteristics of the stand. To meet a Low SIO, a larger percentage could be removed. Exactly how much and what the limit would be is also based on the existing landscape characteristics. When using a group selection method, the appropriate size and distribution of the groups needs to be considered, as well as the natural landscape characteristics. The design of the groups should replicate natural openings and avoid the use of geometric shapes.

Scenery Administration: SCENE3

I. Mitigation, Enhancement, and Monitoring

A. Minimize potential scenic impacts through scheduling or timing of management activities so that they are dispersed and not concentrated, subject to considerations given to other resources (e.g., wildlife).

B. Rehabilitate, where feasible, existing projects and areas that do not meet the Adopted SIOs. Consider the following in setting priorities:
   1. Relative importance of the area (public sensitivity).
   2. Projected length of time to naturally attain the Adopted SIO in comparison to the use of rehabilitation techniques. Examples of rehabilitation include seeding road cuts and fills, recontouring temporary roads, removing roadside slash and debris, re-shaping harvest unit boundaries, cutting roadside stumps as low as possible, shaping or spreading excess overburden, etc.
   3. Benefits to other resources by accomplishing rehabilitation.

C. Use enhancement measures, where feasible, to create variety where little variety now exists through addition, subtraction, or alteration of vegetation, earth forms, water forms, etc. Examples include opening up vistas or screening out undesirable views and planting species to give unique form, color, or texture to an area.

High SIO

Undeveloped Landscape

Low SIO

Moderate SIO

Very Low SIO

SOIL and WATER
Forest-wide Standards and Guidelines

Soil Inventory: SW1

I. Inventory

A. Maintain the Soil Resource Inventory (SRI) or National Hierarchical Framework of Ecological Units (TEUI). (Consult Forest Service Manual [FSM] 2550, Soil Management Handbook, Ecological Classification and Inventory Handbook [FSH 2090.11-91-1], National Soil Handbook-430-VI, Soil Survey Manual-430-V.)

1. Determine and implement the level of SRI necessary to meet planning and implementation needs for proposed management projects.

B. Use the TEUI to inventory and classify ecosystems.

Water Inventory: SW2

I. Inventory and Evaluation

A. In conducting water investigations, consider and evaluate the following elements in Water Resource Inventories (WRIs):

1. Climate
2. Water quality
3. Water quantity
4. Channel types
5. Water uses and developments
6. Watershed condition

B. Consult FSM 2530 and Aquatic Habitat Management Handbook FSH 2090.21.

1. Determine the level of WRI to meet project planning and implementation needs.
2. Use the TEUI (Aquatic ECOMAP) to inventory and classify watersheds, streams, lakes, and groundwater systems.

C. Develop and maintain up-to-date inventories and case folders for all public water systems. (Consult FSM 2542.)

D. Accomplish baseline inventory needs commensurate with other Forest inventory efforts.

Watershed Resources Planning: SW3

I. Land Use Activities

A. Plan and conduct land use activities to avoid irreversible or serious and adverse effects on soil and water resources.

1. Include soil and water resource data and interpretations in project analyses. (Consult FSM 2530 and 2550.)
2. Maintain water quality and quantity to protect the state-designated beneficial uses. Consult the Alaska Nonpoint Source Pollution Control Strategy, the Soil and Water Conservation Handbook (Alaska Region Soil and Water Conservation Handbook FSH 2509.22, Chapter 10), the Soil Management Handbook (FSH 2509.18), and the Forest Service Alaska Regional Water Quality Management Plan addressed in the Memorandum of Agreement dated April 6, 1992 (as amended), with the Alaska Department of Environmental Conservation.
3. Apply Best Management Practices (BMPs) to all land-disturbing activities as a process to protect the beneficial uses of water from nonpoint sources of pollution (National Core BMP Technical Guide FS-990a and FSH 2509.22). Also consult FSM 2530, Facilities, Transportation, and Fish Forest-wide Standards and Guidelines, U.S. Army Corps of Engineer Regulations (33 CFR 323.4), and the Clean Water Act.
4. Apply soil conservation practices to meet regional Soil Quality Standards (SQS) on all land-disturbing activities as a process to prevent detrimental soil disturbance. Detrimental soil disturbance is defined as significant changes or impairment in soil properties that are expected to result in reduced short- or long-term productivity of the land. (Consult FSM 2520 and 2550, FSH 2509.18 and R10 Supplement to FSM 2554 #2500-92-1, effective

January 15, 1992 [as amended].) BMPs also include some soil conservation practices (National Core BMP Technical Guide FS-990a and FSH 2509.22, Chapter 10); develop other specific soil conservation practices during project planning, as needed.

5. Evaluate soil stability (BMP 13.5) potential soil mass wasting effects, and stability of Class IV channels and minor drainage ways ("nonstreams"). At the Forest Plan level, slope gradients of 72 percent or more are removed from the lands suitable for timber production due to high risk of soil mass movement and accelerated erosion of Class IV channel systems. At the project planning level, the Forest Supervisor or District Ranger may approve timber harvest on slopes of 72 percent or more on a case-by-case basis, based on the results of an on-site analysis of slope and Class IV channel stability and an assessment of potential impacts of accelerated erosion on downslope and downstream fish habitat, other beneficial uses of water, and other resources. It is anticipated that harvest of these areas will be a small percentage of the total harvest unit. To document the analysis for allowing harvest on steep slopes, the following checklist should be used:
   a) Steepness
   b) Channel dissection
   c) Parent material
   d) Soil drainage
   e) Precipitation (rain-on-snow zone)
   f) Potential impacts on downslope/downstream beneficial uses

   If the stability analysis is undertaken prior to the signing of the decision document, the approval (if approved) should be documented in the decision document. If the slope stability information is not available prior to the signing of the NEPA decision document, it should be documented in the Change Analysis. (Also see Fish and Riparian Forest-wide Standards and Guidelines for definitions of Class IV streams and BMP 13.16 in the Soil and Water Conservation Handbook.)
6. Avoid locating roads and landings on a slope greater than 67 percent, on an unstable slope, or in a slide-prone area, where feasible (BMP 14.7).
7. Soil Map Units (SMUs) with McGilvery soil require harvest systems capable of at least partial suspension over the entire length of the yarding distance.

B. Seek to avoid adverse impacts to soil and water resources (such as accelerated surface erosion or siltation of fish habitat) when conducting land use activities on wetlands, flood plains, and riparian areas. (Consult Executive Orders 11988, 11990, and 11514; FSM 2510 and 2520; U.S. Army Corps of Engineers regulations [33 CFR 323]; NFMA Planning Regulations [36 CFR 219.27]; BMPs [National Core BMP Technical Guide FS-990a and FSH 2509.22, Chapter 10] for wetlands, flood plains, and riparian areas; and Wetlands and Riparian Forest-wide Standards and Guidelines.)

C. Under applicable state and federal law, reserve both ground and surface water rights to manage National Forest System lands. (Consult FSM 2540.)
   1. Review projects and reserve water rights or notify the state of water uses for reservation management purposes, when it is determined such uses are necessary for carrying out the purposes of the project. Be sure review of uses and needs includes at least the following items:
      a) In-stream flow needs
      b) Adequate flow for fish passes and habitat
      c) Forest Service administrative and domestic use
      d) Developed special uses and recreation sites

D. Consult with state, federal, and local government agencies and Native American communities for the protection, mitigation, and/or improvement of the water and soil resources.

E. Participate actively in planning by other federal, state, and local agencies when these plans could affect the water resources on NFS lands.

F. Cooperate with state and federal agencies having overlapping resource management responsibilities, including the Alaska Department of Fish and Game, Alaska Department of Environmental Conservation, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service. Execute plans and decisions in consideration of the statutory responsibilities of these agencies.

II. Watershed Analysis and Cumulative Watershed Effects

A. Watershed analysis (Appendix C) is required in the following circumstances:
   1. Before making site-specific adjustments to Forest-wide Riparian Standards and Guidelines (including timber salvage in riparian areas).
   2. Before authorizing management activities in public water system source watersheds. A watershed analysis must be documented as part of the NEPA decision in these circumstances.
   3. Watershed analysis (as described in Appendix C) is otherwise not required, but may be conducted at the discretion of the responsible official.

B. Minimize cumulative watershed effects that could adversely affect soil and water resources and change stream channel equilibrium, such as 1) changes in sediment transport or stream flow leading to stream aggradation, degradation, and/or streambank erosion; 2) silting in of pools; and 3) reduction in aquatic habitat capability. Evaluate cumulative effects at the watershed scale during project planning and analysis; consider completing a watershed analysis. (Consult National Core BMP Technical Guide FS-990a and BMP 12.1 [FSH 2509.22] for cumulative watershed effects analysis guidance.)

III. Public Water Systems/Domestic Source Waters

A. Secure "favorable conditions of water flows" (Organic Administration Act of 1897). Maintain water quality consistent with Alaska Water Quality Standards (18 AAC 70) and protect source watersheds consistent with the federal Safe Drinking Water Act and the Alaska Drinking Water Regulations (18 AAC 80). Do not authorize activities that create or maintain a condition that has a significant potential to cause or allow the pollution or contamination of a public water system. Conduct watershed analysis (see Appendix C) and consult with the Alaska Department of Environmental Conservation and the water system owner/operator before authorizing management activities in source watersheds for public water systems. Develop site-specific BMPs for all management activities that may affect public water supplies. Refer to FSM 2542 and 36 CFR 251.9 for guidance. Refer to 18 AAC 80.620(c)(3) for systems that seek to avoid filtration.
   1. In Municipal Watershed LUDs, refer to the Municipal Watershed LUD Management Prescriptions.
   2. For state classified public water systems (as defined by 18 AAC 80.1190), consult with ADEC and owners or operators of public water systems to meet watershed protection needs on a case-by-case basis.
   3. For other domestic source water systems, apply appropriate BMPs for all management activities that may affect the water supply.

Watershed Restoration: SW4

I. Soil and Water Quality Protection and Restoration

A. Protect or restore water quality and sustain soil productivity.
   1. Conduct Watershed Condition Surveys and develop Watershed Restoration Plans to determine treatment priorities and needs. Consideration of treatment needs should include evaluating changed fish habitat and population levels, riparian vegetation community structure and function, and hydrology, as measured against natural conditions predicted by baseline objectives (see Fish Forest-wide Standards and Guidelines). Identify and prioritize needs in the NRIS Watershed Restoration Tracking database. Complete watershed restoration project plans and coordinate with fish habitat restoration projects. Include projects in Sale Area Improvement Plans and use K-V funds as appropriate. (Consult FSM 2510 and 2520.)
   2. Give priority to cost-effective watershed restoration projects with the most erodible conditions directly affecting the beneficial uses of water.
   3. For revegetation of disturbed sites, erosion control, fire rehabilitation, riparian restoration, forage enhancement, and other revegetation projects, consider natural revegetation as an alternative to seeding or planting. Encourage natural revegetation where seed source and soil conditions are favorable. Use native species of seeds and plant in revegetation

projects where seeding or planting is appropriate. Native plant material sources include agency native seed programs and local seed collection.

4. Inspect all watershed restoration projects until the final evaluation indicates that maintenance is no longer needed.
5. Road decommissioning and storage projects to restore watershed conditions should pay special attention to fish passage, channel stability, and water quality issues. (Consult Transportation, TRAN 7 , National Core BMP Technical Guide FS-990a and FSH 2509.22.)

SUBSISTENCE
Forest-wide Standards and Guidelines

Subsistence: SUB

I. Subsistence

A. In accordance with Title VIII of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), it is the policy of the Forest Service that:
   1. Consistent with the purposes for which National Forest System (NFS) lands in Alaska were established, sound management principles, and the conservation of healthy populations of fish and wildlife, the use of NFS lands in Alaska is to cause the least adverse impact possible on rural residents who depend upon subsistence.
   2. Provide for the continuation of the opportunity for subsistence uses by rural Alaskan residents, including both Natives and non-Natives.
   3. Non-wasteful subsistence uses of fish and wildlife shall be the priority consumptive uses of such resources on NFS lands in Alaska when it is necessary to restrict the taking of such resources.
   4. Cooperate with the State of Alaska, adjacent landowners, and land managers in managing subsistence activities and in maintaining the continued sustainability of all wild renewable resources on NFS lands.

B. Consult the Southeast Alaska Federal Subsistence Regional Advisory Council for opinions and recommendations on current and proposed management actions, pursuant to ANILCA, Title VIII, Section 805.

C. Locate and manage Forest management activities considering impacts upon rural residents who depend upon subsistence uses of the resources of NFS lands. (consult ANILCA, Title VIII, Sections 810 and 811, and the Region 10 Subsistence Management and Use Handbook FSH 2090.23), the Forest Service shall:
   1. In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of NFS lands, evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands, and other alternatives that would reduce or eliminate the use, occupancy, or disposition of NFS lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy, or disposition of such lands that may significantly restrict subsistence uses shall be effected until the following actions are accomplished:
      a) Notice is given to the appropriate federal and state agencies, local committees, recognized tribal governments, Alaska Native Corporations and the Southeast Federal Subsistence Regional Advisory Council established pursuant to Section 805 of ANILCA;
      b) Notice of a hearing is given and a hearing is held in the vicinity of the area involved;
      c) A determination is made that: 1) such a significant possibility of a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands; 2) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and 3) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.
   2. The environmental analysis will include the notice, hearing, and findings required in 1 above.
   3. Regardless of whether or not an EIS is required, in all project scoping, include initial and ongoing contact with the appropriate federal and state agencies, local committees, recognized tribal governments, and the Southeast Alaska Federal Subsistence Regional Advisory Council.

4. After compliance with the procedural requirements of Section 810 of ANILCA and other applicable law, the responsible Forest Service official may manage or dispose of public lands under their primary jurisdiction for any of those uses or purposes authorized by ANILCA or other laws. Management to accommodate identified subsistence uses could include:
   a) Implementing planned project;
   b) Canceling all or part of the planned project;
   c) Substituting another site for the project and prepare another environmental analysis if the change is significant; and/or
   d) Implementing appropriate mitigation measures.

D. Evaluate changes in subsistence use patterns and activities in cooperation with appropriate state and federal agencies by conducting periodic surveys of fish and wildlife populations and subsistence harvest, and consulting with subsistent user groups.

E. Make recommendations for subsistence regulations to the Southeast Alaska Federal Subsistence Regional Advisory Council and the Federal Subsistence Board, and provide technical support to these two bodies for analyzing the effects of proposed regulations on NFS lands.

F. Provide for enforcement of subsistence use regulations promulgated by the Southeast Alaska Federal Subsistence Board.

G. Provide public information concerning subsistence management on NFS lands.

H. In cooperation with state and federal agencies, and recognized tribal governments, maintain a subsistence monitoring program and database.

I. Maintain reasonable access to subsistence resources as required by ANILCA, Section 811. Address subsistence concerns when developing road management objectives (RMOs) for forest roads. (See Transportation Forest-wide Standards and Guidelines.)

J. Seek to maintain abundance and distribution of subsistence resources necessary to meet subsistence user needs.

K. Consider subsistence users' needs in the scheduling, locating, and designing of fish and wildlife habitat improvement projects.

L. In the development of access and facilities, seek opportunities to provide for subsistence users (e.g., anchorages and shelters). Such access and facility opportunities should be identified and planned with local subsistence users.

TIMBER
Forest-wide Standards and Guidelines

Integrated Resource Inventory - Existing Vegetation: TIM1

I. Inventory

A. Coordinate vegetative inventories with other data collection efforts to minimize duplication and to maximize the use of the resulting information. Emphasize multiple resource or integrated resource inventories.

B. Reinventory forest vegetation on a 10- to 15-year cycle.

Silvicultural Examination and Prescription: TIM2

I. Stage II Intensive Inventory

A. Manage vegetation according to a silvicultural prescription certified by a Region 10 certified silviculturist; this applies to any vegetative manipulation activity.

B. Conduct silvicultural examinations and develop silvicultural prescriptions for proposed resource management activities where vegetative manipulation of the Forest is involved. (Consult Region 10 Silvicultural Examination and Prescription Handbook - 2409.26d).

C. Conduct silvicultural examinations as part of timber sale analysis. Silvicultural examination is the process of gathering vegetative data to provide a basis for silvicultural and other management decisions.

D. Develop silvicultural prescriptions to be approved by a R10 certified silviculturist as part of project planning. Complete all prescriptions before project implementation where implementation is defined as either the Final Record of Decision, Environmental Assessment Decision Notice, or Decision Memo. Base silvicultural prescriptions on silvicultural examinations; include a written description of the current stand conditions, the anticipated future condition based on management activities, and a statement on land management and resource objectives. The prescription should also include silvicultural practices, cutting methods, or other management actions that will be applied sequentially to achieve the desired stand condition and structural attributes. A silvicultural analysis for project planning should address both stand and landscape conditions.

E. Facilitate development of appropriate silvicultural system prescriptions by describing desired conditions in terms of structural attributes.

F. Include an appropriate species mix for regeneration in the silvicultural prescription prepared during the environmental analysis. The "appropriate species" is based on the potential of the site as indicated by plant associations and adjacent stand conditions.

G. Evaluate the natural reproduction potential and existing reproduction as part of the silvicultural analysis and prescription. Where possible, harvest prescriptions should consider leaving advance regeneration to meet reforestation needs and stand objectives.

H. Consider regenerating and maintaining a mix of dominant overstory tree species, where appropriate, for the site, to provide for the diversity of future stands and to augment the future availability of forested habitats used by other species (wildlife and plants). Common, but less represented Forest-wide overstory species include yellow-cedar and western redcedar. Pacific yew, Pacific silver fir, and subalpine fir are considered rare tree species (see Plants Standards and Guidelines for rare plants).

I. Select a silvicultural system that meets the resource and vegetation management objectives of the area, including objectives for biological diversity, long-term site productivity, scenic integrity, and forest health.

J. Even-aged, two-aged, and uneven-aged systems shall be available for use.

K. Select rotations that produce sawtimber products, unless otherwise provided for in the LUD.

L. Even-aged timber stands shall not be scheduled for final harvest before stand growth has reached or surpassed 95 percent of the Culmination of Mean Annual Increment in cubic feet. Exceptions may be made where special resource considerations require earlier harvest. Exceptions also may be made where small inclusions of young stands in harvest units that otherwise meet this requirement will result in more logical management units allowing greater

efficiency or less resource impacts. Additional exceptions are provided by Public Law 113-291 (See Chapter 5, S-YG-01).

M. Even-aged stands may be regenerated without having reached Culmination of Mean Annual Increment where salvage is prescribed after windthrow, where stands are in imminent danger from insect or disease attack or cutting for experimental and research purposes.

Timber: TIM3

I. Information Gathering and Maintenance

A. Provide timber resource information necessary to prepare timber harvest projects. This includes maintenance of inventories, analysis of data, and input for environmental analysis.

B. Determine operability based on site-specific project conditions; classify the suitable lands according to the NIC definitions.

C. Consider the management prescription of the LUDs within the project area in project design and environmental analysis for timber activities. Timber harvest unit cards will document resource concerns and protection measures. The unit cards, including a map with relevant resource features, will be provided electronically when Draft or Final NEPA documents and decisions are published. (Consult Tongass National Forest Supplement 1909.15-2015-1.)

D. Develop the Sale Area Improvement Plan, including any projects that could be funded by Knutson-Vandenburg funds during the interdisciplinary NEPA process to identify resource improvement opportunities consistent with the Forest Service Renewable Resources Handbook. Schedule essential reforestation prioritized by mitigation or enhancement.

Timber Sale Preparation: TIM4

I. Regeneration Methods

A. Regeneration methods refer to the manner in which a new stand is created. There are three categories of regeneration systems: even-aged, two-aged, and uneven-aged silvicultural systems. Even-aged systems include clearcutting, seed tree, and shelterwood. Two-aged systems include clearcutting with reserves, seed tree with reserves, and shelterwood with reserves. Uneven-aged systems include single-tree selection, group selection, and group selection with reserves.

1. Consider silvicultural systems other than clearcutting to meet other resource objectives at the project level. As part of the project NEPA process, analyze current scientific information related to the applicability of alternative timber harvest methods.

II. Even-Aged Systems

A. Apply even-aged silvicultural methods in such a way that isolated stands of timber will not be created. Avoid locating harvest units where future harvest activities will destroy regeneration under earlier regeneration harvest activities.

B. Clearcutting is an even-aged regeneration method. There are a number of supportive reasons for the use of this method in Alaska's western hemlock-Sitka spruce forests. These include excellent regeneration of desired species, effective dwarf mistletoe control, viable harvest economics, and compatibility with the use of standard logging systems.

1. Use clearcutting only where it is determined to be the best system to meet the objectives and requirements of LUDs.
2. Apply clearcutting where trees are cut to achieve timber production objectives, where there is risk of dwarf-mistletoe infection and disease control is desired, or where there is a high risk of windthrow.
3. Forest Service Manual (FSM) 2470 Supplement No.: R-10 2400-2005-1 clarifies limitations on "clearcutting." It is limited to areas where it is essential to meet Forest Plan objectives and may involve one or more of the following circumstances:
   a) To establish, enhance, or maintain habitat for Endangered, Threatened and Sensitive species.
   b) To enhance wildlife habitat or water yields, or to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs or similar development.
   c) To rehabilitate lands adversely impacted by events, such as fires, windstorms, or insect or disease infestations.

d) To preclude or minimize the occurrence of potentially adverse impacts from insect or disease infestations, windthrow, logging damage, or other factors affecting forest health.
e) To provide for the establishment and growth of desired trees or other vegetative species that are shade intolerant.
f) To rehabilitate poorly stocked stands due to past management practices or natural events.
g) To meet research needs.

III. Size of Clearcuts/Even-Aged Openings

A. National Forest Management Act regulations provide that 100 acres is the maximum size of created openings allowed for the western hemlock-Sitka spruce forest type of coastal Alaska, unless standards for exceptions exist under specific conditions. Cedar and hardwoods are usually considered to be a component of the western hemlock-Sitka spruce ecotype in Southeast Alaska and, therefore, the 100-acre limit will also apply to these types of stands.

B. Recognizing that harvest units must be designed to accomplish management goals, created openings may be increased in size where larger units will produce a more desirable contribution of benefits.

1. Use the following factors when proposing units that would exceed 100 acres:
   a) Natural and biological hazards to the survival of residual trees and surrounding stands
   b) Topography
   c) Relationship of units to other natural or artificial openings and the proximity of units
   d) Coordination and consistency with adjacent LUDs
   e) Effects on water quality and quantity
   f) Visual Absorption Capability
   g) Effect on wildlife and fish habitat, based on the best available science
   h) Regeneration requirements for desirable tree species
   i) Transportation and regeneration method requirements
   j) Relative total costs of preparation, logging, and administration of harvest

C. Where it is determined by an environmental analysis that exceptions to the size limit are warranted, the actual size of openings may be up to 200 acres, if required due to natural biological hazards to the survival of residual trees and surrounding stands, and up to 150 acres for the remaining factors, with the approval of the Forest Supervisor. (Consult R10 supplement FSM 2400-2002-1.)

D. The established limits and exceptions do not apply to the size of areas harvested as a result of natural catastrophic conditions, such as insect and disease infestation or windthrow.

E. Created openings will be adequately stocked with desirable tree species, which are approximately 5 feet in height, before the area will no longer be considered an opening for the purposes of determining limitations on the scheduling, locating, and calculating the size of additional created openings. Small inclusions within openings do not constitute division to the openings for purposes of reducing size.

F. Leave strips between openings must be of sufficient size and composition to be managed as a separate stand (minimum stand mapping size is 10 acres).

IV. Two-Aged System

A. Two-aged silvicultural systems are designed to maintain and regenerate a stand with two-age classes. The resulting stand may be two-aged or trend towards the uneven-aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserve trees that may represent one or more age classes. The reserve trees provide structural diversity and a biological legacy. Two-aged management regimes can produce stands of greater structural diversity than even-aged management. This method may be used where windthrow or dwarf mistletoe are not major threats or can be tolerated.

1. Emphasize green-tree and snag retention in landscape management. The actual number and attributes of the trees retained is dependent on Forest Plan and site-specific

silvicultural objectives. To the extent feasible, residual patches and single trees should include large, old trees and snags.

2. Retained patches or residual trees should not be scheduled for removal. The retained patches and residual trees will provide support for those organisms that require old forests.
3. Address safety issues by using the guidelines in Reserve Tree Selection Guidelines, R10-MB-215, March 1993.

V. Uneven-Aged Systems

A. Uneven-aged silvicultural systems are methods of regenerating a forest stand, and maintaining an multi-aged/multi-layered structure, by removing some trees in all age groups and stratum either individually, in small groups, or in strips. Overstory density is regulated to avoid the suppression of understory trees and to maintain understory vigor.

B. All timber types on the Tongass National Forest may be harvested using uneven-aged silvicultural methods.

1. Use uneven-aged management where the interdisciplinary process determines the system is appropriate to meet the goals, objectives, and requirements of the LUD, including the protection of excessively steep or unstable soils, scenery, wildlife and fish habitat, recreation, timber supply, economics, and to supply commercial and noncommercial wood products (fuelwood).
2. Limit uneven-aged management systems to areas where yarding equipment suited to selective logging can be used.

VI. Intermediate Treatment Methods

A. These activities include those treatments that improve the composition, health, value, and growth of a timber stand.

B. Implement thinning treatments in young conifer stands to increase timber volume or value of remaining trees, improve wildlife habitat, improve scenic quality, and improve future growth. Promote and emphasize commercial treatments. Promote stewardship treatments as funding permits.

C. Assess areas that have received precommercial thinning, release and weeding, pruning, or commercial thinning treatments to ensure management objectives have been met. Certify that the treatment met the prescription objectives.

VII. Salvage Harvest

A. Salvage cutting is the removal of dead trees or trees being damaged or dying due to injurious agents other than competition. It is also used to recover value that would otherwise be lost.

B. Sale and utilization of dead, blown-down, and other deteriorating timber will receive high priority in LUDs where the harvest of timber is compatible with the LUD's management objectives. Salvage may include trees damaged by road construction or rock pit development.

C. For catastrophic events that occur on Forest lands within Non-development LUDs not withdrawn from harvest, consider an appropriate range of management alternatives to meet varying levels of resource protection and commodity outputs. These lands will not be substituted for lands suitable for timber production.

1. LUD objectives need to be met before approving salvage harvest on these lands.

D. If beach log salvage involves both State and National Forest System lands, coordinate with the appropriate state agency.

1. Beach log salvage of old-growth material does not count toward the annual PTSQ.

E. Where catastrophic events cause heavy tree losses on lands suitable for timber production, commercial timber harvest will be given high priority to maximize utilization.

F. Refer to the Riparian Forest-wide Standards and Guidelines for salvage in riparian areas.

VIII. Utilization Standards

A. Industrial wood products on the Tongass National Forest will be managed for quality sawtimber material and other merchantable wood products.

1. Require utilization and optimum feasible use of wood material. Promote the use of wood for its highest value product commensurate with present and anticipated supply and demand.
2. Improvements in utilization will be made through sale preparation, appraisals, contract administration, and dissemination of research information.
3. Consult current regional direction for precise standards.

IX. Competitive Bidding and Small Business

A. Private enterprise shall be encouraged to use National Forest timber resources.
   1. The Forest Service will plan sale offerings to encourage competitive bidding in a range of total sale volume and species that provides opportunities for purchasers.

X. Windthrow

A. Special consideration will be required in the design of harvest units adjacent to LUDs or other areas that limit or prohibit timber harvest activities. Where the chance of windthrow in adjacent stands is increased by timber harvest, measures will be taken to contain the windthrow within the LUD where timber harvest is allowed. (Also see the Riparian Standards and Guidelines.)

Commercial Sale Administration: TIM5

I. Contract Administration

A. Administer timber sale contract provisions, post-sale measurement, and financial oversight of all sales.
   1. Frequency of timber sale inspection will be determined by the complexity of the timber sale and operator performance, with the objective being to ensure full contract compliance.
   2. Sale administrators will work with the other specialist(s) to ensure that the project goals are obtained.
   3. Consult with the designated Forest Monitoring Coordinator to determine BMP measurement and reporting requirements.

Other Forest Products: TIM6

I. Personal Use Program

A. Make fuelwood available in areas accessible to the public, consistent with NEPA requirements and LUD management objectives.
B. Address requests for green personal use wood as soon as feasible.
C. Designate green personal use timber planned for harvest.
D. Any area that is off-limits for personal use timber harvest within Development LUDs should be identified by the District Ranger.
E. Areas within Non-development LUDs can be considered for personal use if compatible with the LUD objectives (see Chapter 3) and other resource standards and guidelines, and should consider accessibility and other needs of the permitee. The District Ranger will determine if LUD objectives will be met before approving personal use on these lands.

II. Commercial Non-Timber Forest Products

A. Allow harvest of non-timber forest products in ways that ensure the continued integrity of the forest stand and ecological values.

III. Administrative Use of Timber

A. Administrative use on the Tongass National Forest consists mainly of trees used for improvements of value to the National Forest or other federal land. (Consult FSM 2463.)
B. Administrative use includes, but is not limited to, those trees used in construction activities for roads, trails, and facilities, as well as wood used in restoration and enhancement projects.
C. Administrative use of timber is allowed on lands suitable for timber production, but does not count towards the Projected Timber Sale Quantity (PTSQ).

D. Administrative use is also allowed on areas within Non-development LUDs if compatible with the LUD objectives (see Chapter 3) and other resource standards and guidelines. The District Ranger will determine if LUD objectives will be met before approving administrative use on these lands.

See the Plant section (Non-Timber Forest Products PLA4) for other products.

Pesticide Use and Vegetation Management: TIM7

I. Pesticide Use

A. Pesticide use is not prescribed in the Forest Plan, but may be considered on a case-by-case basis. Biological, environmental, and economic costs and benefits of pesticide use are to be identified and weighed prior to Forest Service use of pesticides on the Forest.

B. Pesticides will be employed only after such use has been evaluated in an environmental analysis and approved by the Forest Service officer with delegated authority.

C. When pesticide use is judged necessary, selection and application will be based on the following guidelines:

1. Those application methods and formulations will be used that are most effective in suppressing the pest, most specific to the target organisms, and least harmful to non-target components of the environment.
2. In operational pest management programs, only those pesticides that are registered in accordance with the federal Insecticide, Fungicide and Rodenticide Act, as amended, will be used, except as otherwise provided in regulations issued by the Environmental Protection Agency or the Department of Agriculture.
3. Application will be restricted to the minimal effective dosage that, when precisely applied to the target area at optimum times, will accomplish the resource management objectives.

Reforestation: TIM8

I. Site Preparation, Planting, Stocking

A. This activity comprises all treatments and activities aiding the re-establishment of desirable tree cover following timber harvest.

1. Examine all Forest lands treated.
   a) No first-year surveys are required if the silvicultural prescription anticipates natural regeneration.
   b) Examine artificial seeding or planting treatments 1 and 3 years after treatment.
   c) Stands will be certified as stocked, if the third-year survey indicates that the area meets stocking standards. Permanent openings are allowed, and do not need certification, where created for wildlife habitat improvement, vistas, recreation uses, and similar practices.
   d) Prescribe artificial regeneration if the third-year survey indicates that natural regeneration is highly unlikely.
   e) Schedule another survey no later than five growing seasons after harvest if the third-year survey indicates the area is very likely to be stocked, but more time is required to make this determination.
   f) Certify that every unit that receives a final harvest meets or surpasses the stocking guidelines and certification standards (consult Silvicultural Practices Handbook - FSH 2409.17) within the 5-year regeneration period established by law. A unit may be certified as adequately stocked at any time during this 5-year period. (Also see the Forest Plan Monitoring Program.)
   g) Certify that a planted or seeded area has attained a stocking level above a defined minimum in terms of number and distribution of acceptable species, whether planted, seeded, or natural.

TRAILS
Forest-wide Standards and Guidelines

Trail Activities: TRAI1

I. Opportunities

A. Provide for a diversity of outdoor recreation trail and waterway opportunities that are appropriate for the Land Use Designation (LUD). Include such activities as hiking, mountaineering, spelunking, cross-country skiing, snowmobiling, off-highway vehicle (OHV) use, motorized trail bike riding, mountain bike riding, motorboating, canoeing, and kayaking.

B. Emphasize opportunities in all Recreation Opportunity Spectrum (ROS) classes, as applicable, for activities that are in harmony with the natural environment and consistent with the recreation role of the National Forest System lands in a given area. Wilderness and Wilderness Monument LUDs should accommodate trail features in the Primitive ROS class unless the design accommodates a mitigation of impacts to other resources such as soils, water quality, fisheries, etc.

C. Locate and operate trails to make the best use of available recreation opportunities. Establish trail management objectives (TMOs) and associated management actions by examination of the interaction of all resource activities, opportunities inherently present, and the objectives of the LUD.

D. Coordinate trail planning, location, design, and operation with the recreation management goals and objectives of other national, state, local agencies, and private operations. Make an effort to provide loop trail opportunities through the integration of systems regardless of jurisdiction. Design trails to be consistent with the ROS class approved by the deciding officer for the TMOs. A signed TMO is required to approve any additions or deletions to the Forest trails inventory managed for public use.

E. Provide access to high quality recreation places with trail systems that will enhance the total experience of the user.

F. Emphasize trail systems that offer the following opportunities as may be appropriate and feasible in a given area:

1. Connected, multi-day trip opportunities for both land trails and water trails.
2. Trails linked with existing (or emerging) road systems.
3. Alpine trail systems with quick access from saltwater anchorages, cabins, local communities, and resorts.
4. OHV trail systems using connections with existing road systems to form loop trips and access to recreation attractions.
5. Loop trail systems in connection with recreation cabins.
6. Access from local communities to snowline where snow trails are feasible.
7. Heli-hiking trails within a reasonable distance (based on cost) from local communities and service centers.
8. Trail use for health benefit opportunities to members of local communities.

Trail Administration: TRAI2

I. Inventory, Construction, and Maintenance

A. Maintain an inventory of existing National Forest System trails that will assist in determining the desirability of retaining trails in their current locations, their contribution in meeting overall recreation objectives, their affordability, and actions needed to bring the system up to desired standards and to maintain those standards. (Consult FSH 2309.18 and Alaska Region Trail Construction and Maintenance Guide.)

B. Construct, reconstruct, and maintain trails and waterway facilities as part of the Forest transportation system.

1. Prioritize and schedule trail construction and maintenance to meet public needs as follows:
   a) Existing trails that are causing resource damage or to protect investments.
   b) Existing trails and waterways serving local community needs and tourist centers.

c) Existing trails and waterways providing access to recreation cabins.
d) Existing trails and waterways in Wildernesses.
e) New trails and waterways that will serve local communities, tourist centers, and resorts.
f) New trails in Wilderness that will disperse use and are needed to help protect Wilderness resources from degradation.

2. Provide trailheads in locations to allow access to the greatest number and types of trails practicable within an area. Consider use for both snow and snow-free trail access (during different seasons) from the same trailhead when practicable. Match the capacity of the trailhead with the desired capacity of the area being served.
3. Construct and maintain trails to the standard appropriate for the type and amount of use desired in a given area. If the trail is to be used by multiple types of users, design and construct it to adequately and safely accommodate the most demanding or impacting type of use. (Consult FSH 2309.18.)
4. Design and construct bridges to support the maximum expected snow and ice load, construction or maintenance equipment, and anticipated user equipment. Bridges must be appropriate for the prescribed ROS class and meet the adopted Scenic Integrity Objective for the area.
5. Plan and provide trails for a variety of accessibility challenge levels, appropriate to the ROS setting.
6. Use volunteer, human resource, and cooperative programs and partners to augment trail construction and maintenance budgets, as well as provide land use education opportunities for the public. Integrate these resources into the total trail management system. Encourage local organizations to "adopt a trail" to provide needed maintenance on a continuing basis. Crews must be under the supervision of a qualified trail supervisor. Help develop qualified supervisors in volunteer organizations and other cooperative programs. (Consult Alaska Region Trail Construction and Maintenance Guide.)

C. Trails and associated waterways within LUDs and recreation places often become the principal tools for achieving management objectives. Construct and maintain trails and related facilities so that they contribute to desired conditions and appear to be an appropriate part of the Forest setting and not an intrusion upon it. (Consult FSH 2309.18.) Use Best Management Practices to reduce the effects of trail activities on the beneficial uses of water (Consult National Core BMP Technical Guide FS-990a, and FSH 2509.22).

1. Develop and incorporate in project plans an erosion control and stabilization plan for stabilizing all human-caused soil disturbances. Develop and incorporate into project an erosion control and stabilization plan for stabilizing all human-caused soil disturbances. Use approved seed mixtures for revegetation of disturbed sites.
2. Locate trail crossings at right angles to streams and at suitable bridge locations. Design and maintain trail treads to protect riparian values and minimize soil erosion.
3. Locate stream crossings only in stable reaches. Design crossings of V-notched drainages to prevent debris jamming. Drainage structure gradients should follow natural gradient for non-fish streams, where needed, to prevent downstream erosion. Require brow logs for dirt and rock-surfaced log stringer bridges and turnpike sections to contain materials and prevent entry of sediment into the stream. For further location and design guidance, consult the Trails Handbook and Drainage Structures Handbook.
4. Allow construction of trails parallel to and crossing fish streams only where objectives for the management of fish habitat can be met. Where trails are located near fish streams, minimize the introduction of sediment during clearing, construction, and operation activities. Sidecasting and waste materials must not encroach upon the stream course, and as much undisturbed groundcover as practicable shall be left between the trail and the stream. Complete endhaul of waste material will be required where trails are located near fish streams when there is the probability of downhill movement of the material into the stream. Fill will be allowed in fish streams only when considered through the interdisciplinary team process to be the best alternative.

5. Meet fish passage direction at all locations where trails cross fish streams. Refer to Fish Forest-wide Standards and Guidelines. Contracts will specify permissible uses of motorized equipment and the timing of trail construction activities based on agreement with the Alaska Department of Fish and Game and as determined by environmental analysis and line officer approval.

TRANSPORTATION
Forest-wide Standards and Guidelines

Transportation System Inventory: TRAN1

I. Inventory Updating and Maintenance

A. Maintain an inventory of all Forest transportation facilities, including National Forest System roads, bridges, and major culverts (including those which require fish passage); log transfer facilities (LTFs), and airfields. (Consult Forest Service Manual [FSM] 7710.)
   1. Use the Infrastructure (INFRA) system, or subsequently developed and approved system, as the data management system for the Forest road, bridge, and major culvert inventory.
   2. Update changes on transportation maps annually. Map all roads, as an historical record, regardless of administrative classification.

Road and Bridge Administration: TRAN2

I. Road Management

A. Manage the National Forest System roads and bridges based on road management objectives using the criteria listed below:
   1. Keep the designated National Forest System roads open to public motorized use unless:
      a) Use conflicts with Land Use Designation (LUD) objectives, such as the need to protect fish or wildlife habitat, or to retain a non-motorized recreation experience.
      b) Financing is not available to maintain the road or manage the associated use of adjacent lands.
      c) Use causes unacceptable damage to roadway or adjacent soil and water resources.
      d) Use results in unsafe conditions.
      e) There is little or no public need.
   2. Manage road use by seasonal closure if any of the following conditions are anticipated:
      a) Seasonal conflicts with LUD objectives, such as the need to provide security for wildlife during critical times of the year.
      b) Traffic hazards or unacceptable damage to roadway or adjacent soil and water resources due to weather or seasonal conditions.
   3. Restrict public use by temporary closure if:
      a) Concurrent use between commercial and other traffic is unsafe.
      b) The potential for damage to equipment from vandalism is high.
   4. Allow administrative use of closed or restricted roads where exempted by 36 CFR 261.13 and deemed appropriate by the Forest Service officer with delegated authority.

B. Consider the opportunities to manage road use cooperatively with applicable state, tribal, and other federal agencies to meet resource management objectives.

C. Consider future needs for transportation using the travel analysis process (Forest Service Handbook [FSH] 7709.55).

D. Avoid the introduction or spread of invasive species during road construction, reconstruction, and maintenance. (Refer to FSM 2900, for specific guidance.)

II. Permitting

A. Authorize, by issuing a road use permit, commercial use of the National Forest road system not otherwise authorized by a Forest Service contract, or special use authorization, operating plan, or other similar agreement. Include investment sharing and maintenance requirements and rules of use as terms of the road use permit. (Consult FSM 7730 R-10 supplement).

B. Obtain needed permits for the construction of bridges across navigable waters, and for log transfer facilties.

III. Cost Share Management

A. Administer cost-shared roads in accordance with the terms of the agreement between the Forest Service and the cooperators.

1. Collect data about traffic volume and types of users on the National Forest road system, as needed, to determine investment sharing and commensurate maintenance responsibilities.

Transportation Improvement Planning: TRAN3

I. Planning

A. Plan transportation facilities that will efficiently integrate and achieve Forest Plan direction, including consideration of landscape-scale ecological objectives. Take advantage of resource opportunities recognized during project scoping, such as providing access to a recreation attractor or mineral deposit.

B. Direct the orderly development and management of the transportation system, and ensure the documentation of decisions affecting the system.

C. Coordinate transportation corridor development with the applicable Canadian, federal, state, and local government agencies and private landowners. Consider opportunities to enhance the overall transportation system by locating roads coincident with the existing and proposed transportation systems corridors. Make no road connections between communities or emerging communities without the participation and collaboration of state and local governments, communities, and affected individuals.

D. During project planning, identify resource concerns and site-specific mitigation measures. Clearly document these mitigation measures to facilitate project implementation and monitoring.

II. Access and Travel Management Planning and Road Management Objectives

A. Undertake access and travel management planning based on Forest Plan goals, objectives, and desired conditions. As part of the planning process, update road management objectives for all National Forest System roads. Road management objectives include access objectives, design criteria, environmental and resource considerations, operation and maintenance criteria, and other road attributes.

Road and Bridge Preconstruction: TRAN4

I. Road Standards

A. Perform route or site selection, location, geotechnical investigations, survey, and design to a technical level sufficient to meet the intended use and commensurate with both ecological objectives and the investment to be incurred. Ensure consistency with Forest-wide Standards and Guidelines and Best Management Practices. (Consult National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook FSH 2509.22.)

1. Consider each of the following factors when determining standards for the intended uses:
   a) Cost of transportation (including operation and maintenance),
   b) Safety,
   c) Intended purpose and ecological objectives, and
   d) Impacts on land and resources on both local and landscape points of view.

B. Construct roads in the most cost-effective manner consistent with LUDs and intended purposes. Use joint financing with other state and federal agencies to construct roads to a higher standard, when determined appropriate to meet road management objectives.

C. Evaluate each proposed road construction or reconstruction project to determine the least cost road (considering cost of construction, maintenance, and hauling) that meets the intended purpose. Compare the road construction standard required for the immediate harvest and removal of timber with that needed to meet long-term road management objectives. When a higher standard facility is required to meet multiple-use objectives or for future management, include supplemental funding (Forest Service funds) to construct the higher standard. The purchaser of National Forest timber shall not bear that part of the cost necessary to meet the higher standard. (Consult FSM 2430.)

D. Cooperate with the Alaska Department of Transportation and Public Facilities and the Federal Highway Administration in the administration of the Federal Highway Programs. Provide nominations of routes to be upgraded and encourage their transfer to state jurisdiction, in order to provide safe facilities and adequate maintenance between communities linked by the Forest Transportation System. (Consult FSM 7700.)

E. Build and manage roads primarily to meet public needs. Include considerations for a full range of access forms such as cars, trucks, bicycles, off-highway vehicles (OHVs), and foot travel. Where roads will provide potential access to private or State of Alaska lands, recognition of the route as a potential state route should influence location and alignment standards to avoid future duplication of construction. Such consideration must not, however, be considered justification for a higher cost road than is necessary for Forest Service resource management.

F. Consider conservation of petroleum energy supplies in the location, design, and operation of the transportation system.

II. Location and Design

A. Locate and design National Forest System roads in a manner that will use both local and landscape scale ecological objectives, as well as Best Management Practices. Seek to minimize effects on wildlife and fish habitat, riparian habitat, and wetlands. (Consult the Forest Service Road Preconstruction and Drainage Structures Handbooks, FSH 7709 section 56.44, and the Alaska Region Soil and Water Conservation Handbook, FSH 2509.22).

1. Incorporate erosion control and stabilization measures in project plans for stabilizing all human-caused soil disturbances. Ensure Best Management Practices can be implemented in construction, operation, and maintenance of the road.
2. Avoid construction on highly unstable uplifted marine sediment as identified in the Soil Resource Inventory (SRI), or use geotechnical engineering designs to maintain stability. Obtain line officer approval after on-site consideration and stability analysis.
3. Roading on slopes in excess of the soil's internal angle of friction, as identified in SRIs, requires geotechnical investigation and appropriate designs. Obtain line officer approval after site-specific investigation has been conducted to determine degree of risk and the potential effects from mass wasting. Conduct stability analysis to determine the most effective and lowest cost method of reducing the risk of roadway failure. Consider constructing full bench roads and end-hauling excess excavation. End-hauled excess excavation shall be deposited at appropriate locations that prevent the excess material from entering streams. Stabilize and revegetate end-hauled materials in accordance with prescribed erosion control measures specified in the project plan.
4. Locate stream crossings in stable reaches, unless mitigation measures are taken. Design crossings of V-notched drainages to prevent debris jamming. Design and install culverts to prevent downstream erosion. When embankment material is used for surfacing native log bridges, install side logs, wood chinking, and a geotextile fabric blanket prior to embankment placement to contain surfacing materials and prevent entry of sediment into the stream.
5. Avoid locations of roads near fish-bearing streams. Seek locations that avoid fish streams, crossing streams when other locations are not feasible and fish habitat can be protected. Where roads are located near fish streams, avoid the introduction of sediment during clearing, construction, and operation activities. Excess excavation material must not encroach upon the stream course. Leave as much undisturbed ground cover between the road and the stream as feasible. Require complete endhaul of excess excavation where there is the probability of downhill movement of that material into the stream. Place fill into fish streams only when it is considered by the environmental analysis process to be the best alternative, and following consultation with the Alaska Department of Fish and Game (ADF&G).
6. Meet fish passage direction at locations where roads cross fish streams. (Consult Forest-wide Standards and Guidelines for Fish Habitat Planning, FISH2.) Specify permissible uses of heavy machinery and the timing of road construction activities in contracts based on consultation with ADF&G and as determined by interdisciplinary analysis and on approval by the appropriate line officer.
7. In areas where erosion due to heavy rains on disturbed soil is a resource protection concern, provide special project specifications that prescribe the maximum distance beyond the end of embankment placement that pioneering operations (preliminary clearing of the road right-of-way) may occur.

8. Slope drainage ditches along the roadbed to the nearest relief culvert. Discharge from road ditches should be cross drained to filter on natural forest floor, rather than flowing directly into streams.
9. Design bridge abutments to minimize disturbances to streambanks.
10. Promptly rehabilitate temporary roads in accordance with erosion control and stabilization measures prescribed in the project plan. Establish vegetation on roadbeds of temporary roads within 10 years following termination of use. Design roads to conform to the Memorandum of Understanding with the U.S. Fish and Wildlife Service on eagles, or obtain variances.
11. Avoid ditching across wetlands if surface water control is not required for safety or protection of the running surface.

B. Design and construct roads to conform to the Adopted Scenic Integrity Objectives.
   1. For guidance, consult National Forest Landscape Management Handbook, Volume 2, Chapter 4: Roads.
   2. Consider the following practices during road design on, or seen from, Visual Priority Travel Routes and Use Areas (see Appendix F):
      a) Vegetating slopes seen from the road,
      b) Providing "planting pockets" or terraces on slopes, where needed,
      c) Minimizing landform modifications through road location and design, and
      d) Considering vegetative treatment of clearing edges such as feathering or free-flowing, undulating edge to break up the straight line.

C. Plan, design, and construct roads to minimize conflicts or mitigate conflicts with existing facilities such as trails, pipelines, utilities, and cabins.

III. Wetlands, Flood Plains, Estuaries, and Tidal Meadows

A. Locate and design National Forest System roads to minimize impact to soils, water, and associated resources in accordance with BMPs. Avoid development activities, to the extent feasible, in areas of important wetland value identified during project interdisciplinary team analysis.
   1. Do not construct roads across alluvial flood plains, mass wastage areas, or braided stream bottom lands unless an interdisciplinary team investigation indicates that individual site-specific mitigation can be applied to provide protection for the soils, water, and associated resources.
   2. For roads or other facilities approved for location near estuaries, fills and excess excavation materials must not encroach upon such areas unless approved by the appropriate decision maker following interdisciplinary analysis.
   3. Use the following criteria for siting water-dependent transportation facilities, other than log transfer facilities (LTFs), such as docks, landings, floats, and boat ramps:
      a) Locate far enough from known anadromous fish streams to avoid significant interference (generally a minimum of 300 feet away);
      b) Locate far enough from tideflats or subtidal beds of aquatic vegetation to avoid significant impairment (generally a minimum of 300 feet away);
      c) Restrict the filling of intertidal and subtidal areas to those sites having the least value as habitat for marine organisms and vegetation, unless interdisciplinary team and interagency (U.S. Fish and Wildlife Service [USFWS], National Marine Fisheries Service [NMFS], and ADF&G) joint analysis determines that for other resource reasons it is desirable to fill the more productive site;
      d) Avoid areas with established uses, such as areas used for commercial and sport fishing, hunting, and anchorages for commercial and recreational vessels, unless interdisciplinary review determines that location of sites may be accomplished in a manner that is compatible with such uses; and
      e) Ensure that all needed permits, leases, and accesses are acquired. Work cooperatively with other agencies such as NMFS, USFWS, U.S. Army Corps of Engineers, ADF&G, Alaska Department of Environmental Conservation, and ADNR on these efforts.

IV. Quarry and Borrow Sites

A. Locate and design quarry (shot rock pit) and borrow (gravel pit) sites, and time their use to minimize the impacts upon other resource values, existing facilities, and to meet LUD objectives. During the design phase, consider the potential for use of the pit to improve fish habitat and dispersed recreation opportunities.

1. Plan rock quarries and borrow pits through the interdisciplinary team process. On potentially landslide-prone areas, blasting will be avoided during or within 72 hours following a 2-year, 24-hour storm (total amount of expected rainfall from a storm event that would statistically occur once every two years, or until determined that the soil groundwater level does not constitute a high-risk situation. Where other sources are available, do not locate borrow pits on landslide-prone areas. Where no other feasible alternative exists, strip quarries of their overburden and haul excavated material to a stable location. Stabilization of the overburden material will conform to the erosion control and stabilization measures developed during the planning of the quarry or borrow pit.
2. Design quarry and borrow pits to minimize the possibility of sediment being carried into watercourses by run off. Whenever locations near streamcourses or other water bodies are considered, erosion control measures must provide for drainage to run off through a filter strip, buffer, or sediment basin prior to entering a water body, unless the quarry or borrow pit is to be used for fish habitat management.
3. Limit blasting that adversely affects fish spawning beds to times when eggs and alevins are not vulnerable. Safe times and distances will be determined on a site-by-site basis after consultation with agencies such as ADF&G, NMFS, and USFWS.
4. Do not allow the use of intertidal gravel as a source of borrow.
5. Drain borrow pits and quarries no longer needed, unless developed for fish or waterfowl habitat, and revegetate mineral soil.
6. Consider screening borrow pits, quarries, and access roads along priority travel routes (refer to Appendix F).

V. Log Transfer Facilities Siting, Construction, Operation, and Monitoring

A. Site new LTFs in locations that will best avoid or minimize potential impacts on water quality, aquatic habitat, and other resources. During site analysis, cooperate with state and federal agencies to assemble required data and evaluate alternatives.

B. When considering alternative siting, construction, and operation of LTFs, use both regulatory guidelines established by the Clean Water Act (40 CFR Part 230), and the Alaska Timber Task Force Log Transfer Facility Guidelines (See Appendix G). All LTFs are evaluated by regulatory agencies using these two sets of guidelines (items 1 and 2 below).

1. The Log Transfer Facility Siting, Construction, Operation and Monitoring/Reporting Guidelines (1985), developed by the Alaska Timber Task Force (ATTF) Log Transfer Facility Guidelines Technical Subcommittee, are used by the regulatory agencies in evaluating applications for meeting requirements of the Clean Water Act. These guidelines are to be used when evaluating proposals for log transfer and associated facilities. The introduction to the guidelines say "the objective is to consider all the guidelines and develop the "best mix" which allows the activities to proceed while meeting all applicable statutory and regulatory requirements." The ATTF Guidelines may be found in Appendix G of this document.
2. Alternatives for siting, construction, and operation must also be evaluated using the 40 CFR part 230 - section 404(b)(1) process of the Clean Water Act, as amended, and the requirements of 40 CFR 230.12(a)(3) to determine one of the following:
   a) There is a feasible alternative to the proposed discharge that would have less adverse effect on the aquatic ecosystem, so long as such alternative does not have other significant adverse environmental consequences;
   b) The proposed discharge will result in significant degradation of the aquatic ecosystem;
   c) The proposed discharge does not include all appropriate and feasible measures to minimize potential harm to the aquatic ecosystem;

d) There does not exist sufficient information to make a reasoned judgment as to whether the proposed discharge will comply with these guidelines; or
e) The "proposed discharge" refers to the discharge of logs, bark, any other dredged or fill material, and storm water into the aquatic systems.

C. Use the additional following guidelines, consistent with 40 CFR part 230 - section 404(b)(1) process of the Clean Water Act, as amended, and the Log Transfer Facility Siting, Construction, Operation and Monitoring/Reporting Guidelines (1985) as described in Part A above, when evaluating alternatives for log transfer. The guidelines described in Part A take precedence over these guidelines.
1. Minimize the number of LTFs and storage areas by selecting locations that will accommodate future logging without requiring additional transfer or storage sites.
2. Give preference to locating LTFs along straits or channels when feasible. When located in bays, large bays are preferred to small bays, and deep bays are preferred to shallow bays. Sites near the mouths of bays are preferred to sites near the heads of bays. Give preference to sites where marine vegetation is sparse or absent over sites with vegetation.
3. Avoid, where practicable, siting log transfer, rafting, and storage facilities in areas with established commercial, subsistence, and sport fishing activity, high levels of recreation use, areas of high scenic quality, or documented concentrations of species commonly pursued by commercial, subsistence, and sport fishers.
4. When an existing LTF in a less than optimal location is considered for reconstruction, perform environmental analysis to determine whether adverse impacts of relocating the facility exceed those resulting from continued use at the existing site.
5. Site locations that have foundation materials, determined by appropriate subsurface investigation that can economically and effectively support the structure through the duration of its design life.
6. Consider the visual impact of a proposed structure in the selection of alternative designs. In areas of high visual sensitivity, emphasize designs that would be less likely to dominate the landscape (such as a low-angled slide rather than a bulkhead design).

Road and Bridge Construction/Reconstruction: TRAN5

I. Construction

A. Construct National Forest System roads and bridges that provide the stability and durability appropriate for their intended use as documented in the road management objectives.

II. Reconstruction

A. Reconstruct roads and bridges in accordance with the following limitations:
1. Correction of unsafe conditions that cannot be corrected by traffic restriction
2. Repair of situations where use will cause environmental impacts inconsistent with Forest Plan direction
3. Upgrading of a facility that was not originally constructed to accommodate current or anticipated use
4. Repair of surfacing, bridges, and LTFs, where analysis clearly shows an economic advantage to protect the investment
5. Removal of vegetation, repair of surfacing, repair or replacement of culverts and bridges where necessary to bring roads up to timber haul standards.

B. Reconstruct roads and bridges using Best Management Practices (BMPs). Consult ADF&G on reconstruction activities affecting fish-bearing streams.

Road Maintenance: TRAN6

I. Maintenance Levels, Conditions, and Inspections

A. Operate and maintain National Forest System roads in a manner which meets the road management objectives. Use road closures, maintenance, reconditioning, and other measures to keep road surface and road site erosion at low or near background levels. Maintain roads to meet BMPs regardless of the methods used to obtain the maintenance work. Manage roads to provide cost-effective support to LUD objectives and safe travel to users of the system, while

protecting the environment, adjacent resources, and the public investment. (Consult FSH 7709.59.)

1. Consider protection needs of adjacent resources when planning and conducting road maintenance activities. Where consistent with road management objectives, consider incorporating design features that will protect water quality by minimizing long-term maintenance needs (e.g., driveable dips adjacent to culverts, oversized culverts, outsloping roads).
   a) Maintain road running surfaces and bridge decks to minimize the amount of road surface sediment entering adjacent streams and lakes.
   b) Maintain ditches and culverts to keep water effectively flowing, and minimize sediment entering streamcourses.
   c) Provide for the disposal of materials collected during road maintenance (soil, rock, and debris) in a manner that minimizes sediment entering streams and lakes and meets LUD objectives (particularly those regarding Scenic Integrity).
   d) During snow plowing operations, do not use bodies of fresh water as disposal sites for snow (and accompanying road surface sediments).
2. Perform Condition Surveys in accordance with INFRA guidelines. The intensity of survey will be commensurate with the risks and potential effects of structure failure. Itemize deficiencies needing correction and present recommendations for corrective action.
3. Inspect bridges at frequency and standards specified in FSM 7730.
4. Implement requirements of the Forest Service Highway Safety Program (consult FSM 7730), which include recording the location of all known accidents and identifying locations, design, and operating features that are potential high hazards. Prioritize hazards for correction based on traffic volume, traffic mix, and degree of hazard. Program the elimination of identified hazards on a systematic basis, and as funding permits.
5. Use of traffic control devices will be in accordance with the guidelines contained in the Manual on Uniform Traffic Control Devices (U.S. Department of Transportation, Federal Highway Administration, Publication Number FHWA - SA-89-006; HTO-21/2-89 (15M)P.)
6. Place roads identified through environmental analysis as needed on an intermittent basis into storage (Maintenance Level I) to be in a self-maintaining status (Maintenance Level I), as funding permits. (Consult the National Core BMP Technical Guide FS-990a.)

Road Decommissioning: TRAN7

I. Planning

A. Decommission roads identified through environmental analysis in a condition that maintains stream connectivity and minimize impacts to the watershed.
B. Use an interdisciplinary process to develop project objectives.

II. Design

A. Use an interdisciplinary process to identify standards and/or typicals to be used for units of work and problem locations along the road. (Consult National Core BMP Technical Guide FS-990a, and FSH 2509.22 [BMPs 14.9, 14.12, 14.14, 14.24].)
   1. Consider headcut potential on removed culverts in live streams and ditches, especially in AF, MM, FP, PA channels (see Appendix D) and in channels and ditch lines with high erodible soils.
   2. Consider the effect of sediment pulses from sediment accumulated above undersized culverts and long-term accumulations in the ditches.
   3. Reconstruct channel connectivity and planform in fish bearing streams after culvert removal.
   4. Establish grade control structures in steep gradient streams and as necessary to prevent headcuts.
   5. Maintain water quality with sufficient drainage structures (waterbars), headcut control, minimizing disturbances in well vegetated ditches, and revegetative measures (bioengineering, seeding, and planting).
   6. Design channel form for steep streams.

III. Review

A. Decommission projects will be field reviewed before contract implementation by Ranger District and Supervisor Office specialists.

WETLANDS
Forest-wide Standards and Guidelines

Wetlands: WET

I. Objectives

A. Avoid alteration of, or new construction on, wetlands wherever there is a practicable, environmentally preferred alternative, considering the functions of wetlands as well as other non-wetland ecosystems in the project area. Practicable alternatives take into consideration costs, existing technology, and logistics in light of overall project purposes. (Consult 40 CFR 230.3[q].)

B. Minimize the loss of higher value wetlands (especially fens) and the adverse impacts of land management activities on wetlands. (Consult Executive Order 11990 and Alaska Region Soil and Water Conservation Handbook FSH 2509.22 [BMP 12.5] for guidance on wetland protection.)

C. Seek to maintain the natural and beneficial functions of wetlands.

II. Inventory and Evaluation

A. Use the most current technical criteria for wetland identification and delineation. Consult the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, 1987 (or its revision), as appropriate. Refer to the Interim Regional Supplement to the U.S. Army Corps of Engineer's Wetland Delineation Manual for the Alaska Regional, 2006.

III. Land Use Activities

A. The discharge of dredged or fill material onto wetlands is regulated under Section 404 of the Clean Water Act, which is administered by the U.S. Army Corps of Engineers (Corps) and U.S. Environmental Protection Agency (EPA). Certain categories of activities are exempt from regulation, while others may be permitted (refer to 33 CFR 323.4 Part 330 Appendix A 325). Consult with the Corps early in the planning process to determine whether a 404 permit is required. For non-exempt activities, permit requirements may include compensation or replacement of any lost aquatic function.

B. Consistent with the Clean Water Act, as amended, use Best Management Practices (BMPs) in all management activities that could affect water quality of wetlands. BMPs are intended to ensure that flow and circulation patterns, as well as chemical and biological characteristics of water are not impaired. (Consult Alaska Region Soil and Water Conservation Handbook FSH 2509.22 [BMP 12.5], and National Core BMP Technical Guide FS-990a)

C. Before issuing authorizations, leases, easements, rights-of-way, or exchanging lands containing wetlands, identify uses that are restricted under identified federal, state, or local wetlands regulations. Incorporate appropriate restrictions, where necessary, to protect or minimize wetland impacts, or withhold such properties from exchange.

D. Cooperate with state and federal agencies having overlapping resource management responsibilities for wetlands, including the Alaska Department of Fish and Game, Alaska Department of Environmental Conservation, Alaska Department of Natural Resources, Corps, EPA, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service.

E. Mitigate to minimize impacts caused by activities when BMPs do not perform as expected.

F. When decommissioning roads through wetlands, restore natural drainage patterns.

G. Timber harvest may occur on forested wetlands on lands identified as suitable for timber production in development LUDs.

WILDLIFE
Forest-wide Standards and Guidelines

Wildlife Habitat Planning: WILD1

I. Coordination/Cooperation with Other Agencies, Institutions, and Partners

A. Coordinate with the Alaska Department of Fish and Game (ADF&G), other state agencies, the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), tribal governments, and other cooperators and partners during the planning of activities that may affect wildlife.
   1. The Forest should meet at least annually with state and federal wildlife agencies to review resource activities, present progress reports on implementation of past cooperative work or agreements, and schedule cooperative work.
   2. Seek to maintain Memoranda of Understanding with appropriate state, federal, and local agencies and associations.

B. Emphasize management for native wildlife species and natural habitat, except in cases where the Forest Service, in cooperation with the ADF&G and USFWS, find desirable alternatives. Special consideration should be given to the possible adverse effects on habitat of sensitive, threatened, and endangered species.

C. Coordinate wildlife habitat surveys, studies, plans, and improvement projects with the ADF&G, USFWS, NMFS, and other appropriate state, federal, tribal, local, and private agencies. Use the Sikes Act authorities for cooperative work with the state. Use agreements and other partnerships to cooperate with other partners.

D. Coordinate with the ADF&G in development of state strategic plans and population goals and objectives for wildlife species, and attempt to incorporate wildlife goals and objectives into forest management.

E. Provide habitat information to the ADF&G to assist in correlating hunting seasons, permits, and bag limits to on-the-ground habitat conditions so that population and habitat objectives can be achieved.

II. General Habitat Planning/Coordination

A. Recognize as wildlife habitat, areas of land and water that can contribute to achieving wildlife objectives for consumptive and non-consumptive uses.

B. Provide the abundance and distribution of habitat necessary to maintain viable populations of existing native and desirable non-native species well-distributed in the planning area (i.e., the Tongass National Forest). (Consult 36 CFR 219.19 and 36 CFR 219.27 (1982).)

C. Cooperate with the state and, as appropriate, the USFWS in managing vehicle, boat, and other human use (e.g., hunting and fishing seasons and bag limits), as necessary, to achieve wildlife objectives, recognizing the access provisions of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). Emphasize management to reduce human disturbance in high value habitat areas and during critical periods of wildlife use.

D. Maintain a Forest program schedule that includes anticipated wildlife habitat and population inventory needs, monitoring requirements, and proposed habitat improvement and maintenance projects.

E. Use Forest Plan Management Indicator Species to evaluate the potential effects of proposed management activities affecting wildlife habitat. (Consult FSM 2620.)

F. Develop interagency habitat capability models for any or all of the management indicators to systematically assess the impacts of proposed projects during project level analysis. Periodically review and update models to reflect the most current habitat relationships and habitat modeling technology.

G. Cooperate with ADF&G to seek to prevent existing populations of invasive species from dispersing into Wilderness areas. Address issues regarding management, introduction, and re-introduction of wildlife species consistent with national and regional policy.

H. When population or habitat declines for a plant or animal species or subspecies indicates that long-term persistence is at risk, evaluate the particular species for designation as a Regional Sensitive Species by the Regional Forester. (Consult FSM 2670.)

III. Habitat Improvement Planning

A. Identify habitat improvement projects to meet wildlife habitat and population objectives.

1. Consider the following factors to assess habitat improvement project opportunities and priorities:
   a) To meet state wildlife population objectives
   b) To meet subsistence use needs
   c) Existing habitat in poor condition compared to its potential
   d) Habitat with a history of receiving high levels of use
   e) Treatments with a favorable benefit/cost ratio.
2. Use silvicultural practices, where applicable, to accomplish wildlife habitat objectives.

IV. *Legacy Forest Structure*

A. Objectives

The intent of the Legacy Standard and Guideline is to ensure that sufficient residual trees, snags, and clumps of trees remain in timber harvest units within value comparison units (VCUs) that have had concentrated past timber harvest activity and are at risk for not providing the full range of matrix functions (as shown in Section D), in order to meet the intent of the conservation strategy while providing flexibility to address on-the-ground implementation issues.

B. Legacy Standard

In harvest units greater than 20 acres within VCUs identified in Section D, leave 30 percent of the entire unit (based on area) in legacy forest structure. For the purpose of this standard, the unit is defined as the original Logging System/Transportation Analysis (LSTA) boundary prior to field verification. Legacy forest structure should remain indefinitely after harvest and shall be tracked through the life of the next stand. Salvage logging of legacy trees is generally prohibited unless the rationale is clearly documented and the effects are clearly neutral or an improvement.

C. Distribution and Composition of Legacy Forest Structure

Legacy forest structure should be arranged primarily in clumps. The intent of leaving legacy forest structure is to provide structure within the opening; therefore, clumps should be left well inside the unit, compatible with logging system capabilities. Clumps may be placed along the external yarding boundaries within harvest units in situations where cable logging systems make leaving residual trees in other parts of the unit impractical due to operational or safety considerations. Structure left within units for other resources counts towards the 30 percent, provided it meets the old growth stand characteristics below. Mapped TTRA stream buffers do not count toward the 30 percent. Legacy forest structure shall be representative of the existing old-growth stand characteristics, including age, size class, species composition, and structural components. Clumps and dispersed retention trees should include some of the largest, oldest live trees, decadent or leaning trees, and hard snags occurring in the unit.

D. VCUs where the Legacy Standard Applies

This standard is to be applied in VCUs where 33 percent or more of the productive old growth has been harvested from 1954 to 2005, or VCUs where less than 33 percent has been harvested but more than 67 percent of the productive old growth is projected to be harvested by the end of the Forest Plan planning horizon (see glossary). In 2008, there were 49 VCUs in this category; they are listed below by Ranger District:

Craig Ranger District	6100, 6200, 6210, 6240
Hoonah Ranger District	None
Juneau Ranger District	None
Ketchikan/Misty Ranger District	7360, 7380, 7560
Petersburg Ranger District	None
Thorne Bay Ranger District	5320, 5350, 5371, 5380, 5390, 5440, 5450, 5460, 5500, 5542, 5550, 5560, 5570, 5580, 5590, 5600, 5610, 5620, 5700, 5710, 5720, 5790, 5810, 5830, 5840, 5850, 5860, 5871, 5872, 5880, 5900, 5972
Wrangell Ranger District	4550, 4570

Sitka Ranger District	2930, 2990, 3070, 3120, 3130
Yakutat Ranger District	3620, 3640, 3670

Legacy Standards and Guidelines do not apply in other VCUs because they contain enough old-growth forest to provide habitat for old-growth associated species. See Appendix D in the 2008 FEIS. VCUs should be verified during project-specific planning and analysis to see if Legacy Standards and Guidelines apply based on the criteria above.

V. Reserve Tree/Cavity-Nesting Habitat

A. Provide habitat for cavity-nesting wildlife species. The legacy forest structure standard and guideline considers snags and replacement snag needs for those VCUs at risk for not providing sufficient snags within the watershed. Other VCUs will have snags retained within the development LUDs because habitat will be maintained in riparian buffers, the beach fringe, old-growth habitat reserves, and other Non-development LUDs within the VCU.

1. Retain reserve trees in all LUDs.
   a) Retain reserve trees (which may be soft or hard snags) with a reasonable assurance of windfirmness, while meeting management objectives and considering safety needs for people and equipment. Use the Reserve Tree Selection Guidelines (R10-MB-215) for guidance.
   b) Reserve trees do not need to be evenly distributed; clumped distributions are preferred.
   c) Favor saving reserve trees away from roads to reduce loss from firewood gathering activity.
   d) After timber harvest in an area, remaining reserve trees may be designated as wildlife trees and marked to make them illegal for cutting.
   e) Retain live trees for future reserve tree recruitment.

VI. Landscape Connectivity

A. Design projects to maintain landscape connectivity.

1. The objective is to maintain corridors of old-growth forest among large and medium old-growth reserves (Appendix K) and other forested Non-development LUDs at the landscape scale.
2. During the environmental analysis for projects proposing to harvest timber, construct roads, or otherwise significantly alter vegetative cover, conduct an analysis at the landscape scale to identify blocks of contiguous old-growth forest habitat within large and medium reserves and other Non-development LUDs to determine whether forest connectivity exists among old-growth blocks in large and medium reserves and natural setting LUDs. Consider existing features of the old-growth strategy such as the beach fringe, small old-growth reserves, riparian buffers, or other lands not suitable for timber production as contributing to maintaining connectivity among large and medium Old-growth Habitat reserves and Non-development LUDs. Use the following parameters to determine if a large or medium reserve is connected: a) only one connection is needed; b) the beach fringe serves as a connector; and c) the connection does not have to be the shortest distance between reserves. Where these features do not provide sufficient productive old-growth forest connectivity to meet the objective in 1 above, provide stands, where they exist, of productive old-growth forest or other forest that provides adequate wildlife habitat values (i.e., older young growth that provides adequate snow intercept for deer). Designed corridors should be of sufficient width to minimize edge effect and provide interior forest conditions. Consider elevation, natural movement corridors, length of corridor, tree heights, adjacent landscapes, and windthrow susceptibility in corridor design.

B. Forest-wide, within the beach fringe, riparian buffers, and other lands not suitable for timber production, consider designing young-growth treatments to accelerate old-growth characteristics in order to increase connectivity for wildlife.

VII. Sitka Black-tailed Deer

A. Consider Sitka black tailed deer habitat needs before or as part of project analysis.

B. Ensure interdisciplinary involvement and consideration of deer habitat in project planning and in the environmental analysis process.

VIII. Bald Eagle Habitat

A. The Bald and Golden Eagle Protection Act provides for special management for the bald eagle. Manage bald eagle habitat in accordance with the Interagency Agreement established with USFWS to maintain habitat to support the long-term nesting, perching, and winter roosting habitat capability for bald eagles. Coordinate with USFWS for bald eagle habitat management.

IX. Bear Habitat Management

A. Continue to implement strategies, in cooperation with the Alaska Department of Environmental Conservation, ADF&G, cities, and boroughs, that prevent habituation of bears to human foods/garbage and reduce chances of human/bear incidents. Strategies that can be used to reduce human/bear incidents include the following:

1. Phasing out and rehabilitating any remaining open garbage sites on National Forest System land. Establish timetables for phase out and rehabilitation in cooperation with appropriate state agencies. (Consult Lands Forest-wide Standards and Guidelines on sanitary landfills.)
2. Requiring incinerators and/or other bear-proof garbage disposal methods at work camps, recreation sites, administrative and research facilities, and special use authorizations in bear habitats.
3. Where feasible, locating seasonal and permanent work camps, recreation facilities, mineral exploration and operational facilities, LTFs, where allowed by the LUD, more than one mile from sites of important seasonal bear concentrations to reduce chances of human/bear confrontations.
4. On Forest Service-approved projects and special use authorizations in brown bear habitat, minimizing adverse impacts to the habitat and seeking to reduce human/bear conflicts. Specific plans could include seasonal restrictions on activities and other measures determined on a case-by-case basis.
5. Maintaining an aggressive public education program on bear behavior to reduce the number of human/bear incidents.
6. Requiring storage of human food in ways to make it unavailable to bears to reduce habituation of bears and reduce human/bear incidents.

B. During project planning, evaluate the need for additional protection of important brown bear foraging sites (e.g., waterfalls used as fishing sites) in addition to the buffers already provided by the Riparian and Beach and Estuary Fringe Forest-wide Standards and Guidelines, and the Old-growth Habitat and other Non-development LUDs. Consult with the ADF&G in identifying and managing important brown bear foraging sites. Establish forested buffers, where available, of approximately 500 feet from the stream at sites where, based upon the evaluation, additional protective measures are needed to provide cover among brown bears while feeding, or between brown bears and humans. This may be especially important on Class I anadromous fish streams within the Moderate Gradient/Mixed Control and Flood Plain Process Groups (see Appendix D) where a large amount of bear feeding activity on salmon occurs. Consider the combination of bear foraging behavior, stream channel types, and adjacent landform to help identify probable important feeding sites.

C. Manage human/bear interactions to limit brown bear mortality from both illegal kills and defense of life and property. Work with the ADF&G to develop and implement a bear management program that considers both access management and season and bag limits to manage bear mortality rates within sustainable levels.

D. Manage road use where concentrations of brown bear occur to minimize human/bear interactions and to help ensure the long-term productivity of brown bears. To meet this direction, develop and implement road management objectives through an interdisciplinary process. (Consult Transportation Forest-wide Standards and Guidelines.)

E. Cooperate with the state to develop sites for safe public bear viewing opportunities.

X. Marine Mammal Habitats

A. Provide for the protection and maintenance of harbor seal, Steller sea lion, and sea otter habitats.

1. Ensure that Forest Service authorized or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act (MMPA), Endangered Species Act, and NMFS guidelines for approaching seals and sea lions. Consult with the appropriate agency for identification of critical timing events, such as molting, parturition, etc., and recommended distances to avoid disturbances. "Taking" of marine mammals is prohibited; "taking" includes harassment (adverse disturbance), pursuit, or attempting any such activity.
2. Locate Forest Service authorized and approved facilities and concentrated human activities as far from known marine mammal haul outs, rookeries, and known concentration areas as feasible to meet MMPA. The following distances are provided as general guidelines for maintaining habitats and reducing human disturbance:
   a) Locate camps, LTFs, campgrounds, and other developments (where allowed by the LUD) one mile from known haul outs (farther if the development is large).
   b) Forest Service authorized or approved activities will not intentionally approach within 100 yards, or otherwise intentionally disturb or displace any hauled-out marine mammal.
   c) Dispose of waste oil and fuels off site as regulated by the Alaska Department of Environmental Conservation.
3. Cooperate with the state and other federal agencies to develop sites and opportunities for the safe viewing and observation of marine mammals by the public. Maintain a public education program explaining forest management activities related to marine mammals in cooperation with state and other federal agencies.

XI. Seabird Colonies

A. Provide for the protection and maintenance of seabird (marine bird) colonies.

1. Locate facilities and concentrated human activities requiring Forest Service approval as far from known seabird colonies as feasible consistent with the Migratory Bird Treaty Act. The following distances are provided as general guidelines for maintaining habitats and reducing human disturbance:
   a) For aircraft flights on Forest Service authorized or approved activities, when weather ceilings permit, maintain a constant flight direction and airspeed and a minimum flight elevation of 1,500 feet (458 meters) for helicopters and fixed-winged aircraft. If at all possible, avoid flying over seabird colonies.
   b) Regulate human use to maintain a 250 meter no-disturbance distance from seabird colonies on upland habitats.
2. The availability of garbage to gulls should be eliminated by requiring holders of special use authorizations to collect and dispose of their garbage.
3. Cooperate with state and other federal agencies to develop sites and opportunities for the safe public viewing of these species. Maintain a public education program explaining forest management activities related to these species in cooperation with state and other federal agencies.

XII. Waterfowl and Shorebird Habitats

A. Maintain or enhance wetland habitats that receive significant use by waterfowl and shorebirds. (The Tongass National Forest is a “Priority Forest” in the national Taking Wing Strategic Plan.) “Significant” is relative, but generally relates to use of a specific area by tens or hundreds of individuals of one or more species.

1. Support the international significance of wetland habitats on the Tongass National Forest by participating in partnerships such as the North American Waterfowl Management Plan and the Western Hemisphere Shorebird Reserve Network.

2. Identify during project analysis, in cooperation with the ADF&G and the USFWS, wetlands that receive concentrated waterfowl or shorebird use during fall/winter/spring concentrations or nesting, brood rearing, or molting habitats.
3. Locate facilities and concentrated human activities requiring Forest Service approval as far from known waterfowl or shorebird concentration and nesting areas as feasible. Minimize disturbance of waterfowl by restricting, when feasible, development activities to periods when waterfowl are absent from the area.
4. During project analysis, consider the need to rehabilitate waterfowl habitat following development activities if there is no feasible alternative to the habitat disturbance. (Consult the Wetlands Forest-wide Standards and Guidelines.)
5. Maintain habitat capability in coastal wetlands and intertidal areas that are important migratory staging areas and fall/winter/spring concentration areas, and wetlands that are important nesting and brood-rearing habitats, by avoiding, where feasible, all development activities that could fill wetlands, drain wetlands, or alter water levels resulting in loss of desirable vegetation, or direct loss of habitat. (Consult the Migratory Bird Treaty Act.)
6. Minimize human disturbance of habitats during important periods of the year (nesting and brood-rearing, molting, and winter) by managing human use (such as trails and off-highway vehicle use) in significant wetland areas. To reduce human disturbance, provide a minimum distance of 330 feet (100 meters) between human activities on the ground and significant areas being used by other waterfowl.
7. Develop waterfowl habitat improvement projects in cooperation with appropriate state, federal, and local agencies, partner organizations, and individuals.
8. For special use administration (non-recreation), issue only authorizations that meet the objectives of Executive Order 11990 (Protection of Wetlands). Issue authorizations that preserve, enhance, or aid in the management of the natural and beneficial values of wetlands.
9. Perform integrated logging system and transportation analysis to determine if other feasible routes avoiding areas where concentrated waterfowl use exists.
10. If the need to restrict road access is identified during project interdisciplinary review, roads will be closed either seasonally or year-long to minimize adverse effects on waterfowl.
11. Cooperate with state and other federal agencies to develop sites for safe-public viewing opportunities that do not adversely disturb wildlife. Maintain a public education program explaining forest management activities related to these species in cooperation with state and other federal agencies.

B. Conduct activities to avoid or minimize disturbance to habitats within the forest, riparian, and estuarine areas that are important nesting, brooding, rearing, and molting areas for Vancouver Canada geese, sandhill cranes, or trumpeter swans.

XIII. Heron and Raptor Nest Protection

A. Provide for the protection of raptor (hawk and owl) nesting habitat and great blue heron rookeries.
   1. Conduct project-level inventories to identify heron rookeries and raptor nesting habitat using the most recent inventory protocols.
   2. Protect active rookeries and raptor nests. Active nests will be protected with a forested 600-foot windfirm buffer, where available. Road construction through the buffer is discouraged. Prevent disturbance during the active nesting season (generally March 1 to July 31).
   3. Protection measures for the site may be removed if the nest is inactive after two consecutive years of monitoring.
   4. Bald eagle nest protection standards are outlined in WILD1 Section VIII.
   5. Northern goshawk and osprey nest protection standards are included under Threatened, Endangered, and Sensitive species Forest-wide Standards and Guidelines for wildlife (WILD4 Section II).

XIV. Alexander Archipelago Wolf

A. Implement a Forest-wide program, in cooperation with ADF&G and USFWS, to assist in maintaining long-term sustainable wolf populations.

1. Where wolf mortality concerns have been identified, develop and implement a Wolf Habitat Management Program in conjunction with ADF&G. To assist in managing legal and illegal wolf mortality rates to within sustainable levels, integrate the Wolf Habitat Management Program (including road access management) with season and harvest limit proposals submitted to federal and state boards.
   a) Participate in interagency monitoring of wolf populations on the Forest.
   b) Where wolf population data suggest that mortality exceeds sustainable levels, work with ADF&G and USFWS to identify probable sources of mortality. Examine the relationship among wolf mortality, human access, and hunter/trapper harvest. Conduct analyses for smaller islands (e.g., Mitkof Island), portions of larger islands, or among multiple wildlife analysis areas (WAAs).
   c) Where road access and associated human-caused mortality has been determined, through an interagency analysis, to be a significant contributing factor to locally unsustainable wolf mortality, incorporate this information into Travel Management planning and hunting/trapping regulatory planning. The objective is to reduce mortality risk and a range of options to reduce this risk should be considered. In these landscapes, both open and total road density should be considered. Total road densities of 0.7 to 1.0 mile per square mile or less may be necessary. Options shall likely include a combination of Travel Management regulations, establishing road closures, and promulgating hunting and trapping regulations to ensure locally viable wolf populations. Local knowledge of habitat conditions, spatial locations of roads, and other factors need to be considered by the interagency analysis rather than solely relying upon road densities. Road management objectives would be developed and implemented through an interdisciplinary Access and Travel Management or comparable process. (See Transportation Forest-wide Standards and Guidelines.) Suggested wolf hunting and trapping changes would be developed and forwarded to the Federal Subsistence Board and the Alaska Board of Game.
2. Provide, where possible, sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support 18 deer per square mile (using habitat capability model outputs) in biogeographic provinces where deer are the primary prey of wolves. Use the most recent version of the interagency deer habitat capability model and field validation of local deer habitat conditions to assess deer habitat, unless alternate analysis tools are developed. Local knowledge of habitat conditions, spatial location of habitat, and other factors need to be considered by the biologist rather than solely relying upon model outputs.
3. Design management activities to avoid abandonment of wolf dens.
   a) Maintain a 1,200-foot forested buffer, where available, around known active wolf dens. Road construction within the buffer is discouraged and alternative routes should be identified where feasible. No road construction is permitted within 600 feet of a den unless site-specific analysis indicates that local landform or other factors will alleviate potential adverse disturbance.
   b) If a den is monitored for two consecutive years and found to be inactive, buffers described in a), above, are no longer required. However, in the spring, prior to implementing on-the-ground management activities (timber harvest or road construction), check each known inactive den site to see if it has become active.

XV. Mountain Goat

A. Provide for the long-term productivity of mountain goat habitat and viability of mountain goat populations, both native and introduced.

1. Locate facilities and concentrated human activities as far from important wintering and kidding habitat as feasible.

a) Where feasible, locate facilities, camps, log transfer facilities, campgrounds, and other developments one mile or more from important wintering and kidding habitat.
b) If the one mile or more distance cannot be achieved, mitigate possible adverse impacts by seasonally restricting or regulating human use and other site-specific mitigation measures.

2. Forest Service and all other authorized or approved aircraft flights (fixed wing and helicopter), including helicopter yarding of timber, should maintain a 1,500-foot vertical or horizontal clearance from traditional summer and kidding habitat and animals whenever feasible. Where feasible, flight paths should avoid known mountain goat kidding areas from May 15 through June 15. Pilots will not compromise safety.
3. Where feasible, maintain mountain goat important winter habitat capability. During project planning, use the most recent version of the interagency mountain goat habitat capability model, which shows the most important habitat to generally be productive old-growth forest within 1,300 feet of escape terrain (greater than 50 degree slope or cliff). Travel corridors used by mountain goats between important seasonal sites should be identified and maintained, especially when they occur in forested areas.

XVI. Marbled Murrelet

A. Cooperate and coordinate with state and other federal agencies to better understand the life history requirements and distribution of the marbled murrelet. Nesting habitat relationships are poorly understood.
B. If nests are found during project implementation, maintain a 600-foot, generally circular, radius of undisturbed forest habitat surrounding identified murrelet nests, where available. Minimize disturbance activities within this buffer during the nesting season (May 1 to August 15). Maintain the buffer zone and monitor the site for nesting activity for not less than two nesting seasons after nest discovery. Maintain the buffer if the nest site is active during the monitoring period. Buffer protection may be removed if the site remains inactive for two consecutive nesting seasons.

XVII. Moose Habitat

A. Develop habitat management direction for moose habitats. Coordinate planning with ADF&G.
   1. During project planning, inventory vegetative conditions in moose habitat areas to help identify short- and long-term changes in habitat conditions, and to assess the effects of various management activities.
   2. Plan habitat improvement projects using a variety of techniques such as silvicultural treatments, young-growth management activities, prescribed burning, planting, and other vegetative manipulation techniques as appropriate.
   3. Coordinate other resource management activities to maintain or improve habitat conditions for moose. Where roads and human access are adversely affecting moose populations, incorporate this information into Travel Management planning objectives.

XVIII. American Marten

A. Implement a Forest-wide program, in cooperation with ADF&G, to assist in maintaining long-term sustainable marten populations.
   1. Where marten mortality concerns have been identified through interagency analysis, cooperate with ADF&G to assist in managing marten mortality rates to within sustainable levels. Both access management and hunter/trapper harvest regulations administered by the ADF&G shall be considered.
      a) Participate in interagency monitoring of marten populations on the Forest.
      b) Where marten harvest data suggest that mortality exceeds sustainable levels, work with ADF&G to identify probable sources of mortality. In an interagency analysis, examine the relationship between hunter/trapper marten harvest and human access.

c) Where road access and associated human-caused mortality has been determined, through this analysis to be the substantial contributing factor to unsustainable marten mortality, incorporate this information into Travel Management planning with the objective of reducing mortality risk. Local knowledge of habitat conditions, spatial location of roads, and other factors need to be considered by the biologist rather than solely relying upon road densities. Road management objectives would be developed and implemented through an interdisciplinary Access and Travel Management process or comparable process. (Consult Transportation Forest-wide Standards and Guidelines.)

XIX. Endemic Terrestrial Mammals

A. The objective is to maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges.

1. Use existing information on the distribution of endemic mammals to assess project-level effects. If existing information is lacking, surveys for endemic mammals may be necessary prior to any project that proposes to substantially alter vegetative cover (e.g., road construction, timber harvest, etc.). Surveys are necessary only where information is lacking to assess project-level effects.
   a) Survey islands smaller than 50,000 acres in total size (e.g., Heceta Island and smaller) that have productive old-growth forest on lands suitable for timber production. Conduct surveys on larger islands if there is a high likelihood that endemic taxa are present and a high likelihood that they would be affected by the proposed project.
   b) The extent and rigor of surveys will be commensurate with the degree of existing and proposed forest fragmentation, and potential risk to endemic mammals that may be present.
   c) Surveys should emphasize small (voles, mice, and shrews) and medium sized (ermine and squirrels) endemic mammals with limited dispersal capabilities that may exist within the project area.
   d) Use the most recent inventory protocols for surveys.
2. Assess the impacts of the proposed project relative to the distinctiveness of the taxa, population status, degree of isolation, island size, and habitat associations relative to the proposed management activity.
3. Where distinct taxa are located, design projects to provide for their long-term persistence on the island.

B. Consider habitat needs of endemic mammals in design of thinning treatments.

Wildlife Habitat Improvement: WILD2

I. Improvement Projects

A. Develop an aggressive young-growth management program to maintain, prolong, and/or improve understory forage production and to increase the development of old growth characteristics in young-growth timber stands for a variety of wildlife species (deer, moose, black bear, small mammals, birds, and other species of interest).

1. Consider stands for young-growth treatments that meet the following conditions:
   a) Historical deer winter range with high deer use.
   b) Historical or potential moose winter range.
   c) Areas with important and accessible consumptive and non-consumptive human uses of wildlife benefited by young-growth management.
   d) High risk VCUs and within beach fringe—these areas have significant young growth and are important habitat for a variety of wildlife species. Young-growth treatments may be used to accelerate development of old-growth characteristics and improve habitat conditions.
   e) Young-growth timber stands that have a relatively high tree stocking density that would result in early loss of understory forage. Plant associations containing

hemlock or spruce and Vaccinium or skunk cabbage on high site potential should be considered for treatment.

2. Consider the following for precommercial thinning:
   a) Time precommercial thinning before desirable forage species are shaded out by trees, although trees should fully occupy the site. Generally, highly productive sites will need to be thinned at a younger age (15 to 20 years) than moderate or low productive sites (20 to 25 years). Use site-specific conditions to determine the timing of precommercial thinning.
   b) Vary tree spacings according to site-specific information and dependent on a desired condition. Consider spacings from 16 feet by 16 feet to 24 feet by 24 feet. Site-specific objectives should be developed in conjunction with silvicultural staff, and should identify spacings to be used. Consider variable spacings and leaving some unthinned thickets and corridors to create future structural diversity.
   c) Generally, slash disposal treatments will not be necessary. In some site-specific areas, slash treatments may be needed to facilitate animal movements or increase forage production and availability. Slash treatments may include girdling trees, falling trees away from high forage areas, piling trees, or lopping and scattering of slash.
3. Consider the following for canopy gaps:
   a) It is generally recommended that canopy gaps be created at the same time as precommercial thinning activity.
   b) Generally, slash disposal treatments will not be necessary. In some site-specific areas, slash treatments may be needed to facilitate animal movements or increase forage production and availability. Slash treatments may include girdling trees, falling trees away from high forage areas, piling trees, or lopping and scattering of slash.
   c) Site-specific objectives and analysis should identify the gap sizes.

B. Coordinate habitat improvement projects with the ADF&G, the USFWS, and other appropriate agencies.

C. Coordinate the timing and location of habitat improvement projects with other resources so as to provide opportunities to decrease treatment costs and provide multi-resource benefit.

D. Coordinate any new projects to enhance the use of National Forest System lands with the recreation program managers.

Wildlife Habitat Maintenance: WILD3

I. Maintenance

A. Provide for the maintenance of wildlife habitat improvements.
   1. Fund maintenance of existing structures prior to the construction of new structures.
   2. Include funding for maintenance in planning and budgeting all structures.
   3. Maintain structures to ensure objectives of the original project are met.
   4. If the improvement becomes inefficient to operate or maintain, redesign or stop maintenance of that improvement.
   5. If a structure becomes inoperable, consider removal or reconstruction, as appropriate.

B. Develop a written agreement with project cooperators on maintenance responsibilities prior to project construction.

Threatened, Endangered, and Sensitive Wildlife Species: WILD4

Consult FSM 2670 for Threatened, Endangered, and Sensitive Species.

I. Threatened or Endangered Species

A. Steller Sea Lion[4]

[4] On November 4, 2013 the National Marine Fisheries Service issued a final rule (78 FR 66140) to remove the eastern distinct population segment (DPS) of Steller sea lion from the List of Endangered and Threatened Wildlife. A species removed from listing under the under the Endangered Species Act because recovery criteria have been met will automatically be added to the sensitive species list for at least five years (2009 Alaska Region Sensitive Species List). The western DPS remains endangered and may also occur within waters surrounding the Tongass National Forest.

1. Protect Steller sea lion habitats.
2. Ensure that Forest Service funded, permitted, or authorized activities are conducted in a manner consistent with the requirements, consultations, or advice received from the appropriate regulatory agencies for the Marine Mammal Protection Act, Endangered Species Act, and NMFS guidelines for approaching seals and sea lions. "Taking" of sea lions is prohibited; "taking" includes harassing or pursuing, or attempting any such activity.
3. Locate facilities, camps, log transfer facilities, campgrounds, and other developments one mile from known haulouts, and farther away if the development is large.
4. Cooperate with state and other federal agencies to develop sites and opportunities for the safe viewing and observation of sea lions by the public. Maintain a public education program explaining forest management activities related to sea lions in cooperation with state and other federal agencies.

B. Humpback Whale
1. Provide for the protection and maintenance of whale habitats.
2. Ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act, Endangered Species Act, and NMFS regulations for approaching whales, dolphins, and porpoise. "Taking" of whales is prohibited; "taking" includes harassing or pursuing, or attempting any such activity.

II. Sensitive Species[5]

A. Northern Goshawk (including the Queen Charlotte goshawk subspecies).
1. Preserve nesting habitat around all goshawk nest sites. Protection measures may be removed from probable nest stands if, after two consecutive years of monitoring, there is no further evidence of confirmed or probable nesting.
   a) Consider the following evidence for determining confirmed nest sites:
      (1) A goshawk observed on or near a nest;
      (2) Nestlings or branchers (young not able to fly) observed on or near a nest;
      (3) Goshawk feathers or eggs obtained from the nest;
      (4) One or more nest structures indicative of goshawk were found with goshawk prey remains, but without positive identified goshawk on the nest and without positive identified feathers from nest;
   b) Consider the following evidence for determining probable nest sites:
      (1) Aggressive, territorial breeding season adults vocalizing or attacking an observer (without locating a nest); or
      (2) Adults observed during the breeding season in a territory and recently fledged young were observed (without locating a nest).
   c) Nesting Habitat: Maintain an area of not less than 100 acres of productive old-growth (POG) forest if it exists, or the largest diameter young-growth forest if sufficient POG is not adjacent to the nest, generally centered over the nest tree or probable nest site to provide for prey handling areas, perches, roosts, alternate nests, hiding cover, and foraging opportunities for young goshawks. Vegetative structure should include, where available, multi-layered, closed (over 60 percent) canopy stands, a relatively open understory, with large trees (usually 20+ inches diameter at breast height) and low ground vegetation.
   d) Management: No commercial timber harvest is permitted Existing roads may be maintained. New road construction is permitted if no other reasonable roading alternatives outside the mapped nesting habitat exist. Permit no continuous disturbance likely to result in nest abandonment within the surrounding 600 feet from March 15 to August 15. Activity restrictions are removed for active nests that become inactive or unsuccessful. Other management activities that maintain the integrity of the forest stand structure are consistent with the objectives for this area. Activities such as cabin, trail, or campground construction should be consistent if designed with minimal vegetative manipulation.

[5] The Forest Service Alaska Region Sensitive Species List was updated in 2009 and supersedes previous lists.

e) Consider surrounding landscapes when managing for goshawk nest sites. Plans for an alternate nest management strategy to c) and d) above may be implemented if the rationale is documented.

f) Conduct inventories to determine the presence of nesting goshawks for proposed projects that affect goshawk habitat. Use the most current inventory protocols developed in cooperation with state and federal agencies.

B. American Peregrine Falcon (Removed from Alaska Region Sensitive Species List in 2009)

1. Provide for the protection and maintenance of habitats for migrating American peregrine falcons.
2. Obtain increased understanding and knowledge about the migration of American peregrine falcons through southeast Alaska (e.g., the timing of migrations, the length of stay in southeast Alaska, important foraging areas, important prey items, etc.).
3. Protect seabird rookeries and waterfowl concentration areas that provide important prey foraging habitat. (Consult Wildlife Forest-wide Standards and Guidelines.)

C. Peale's Peregrine Falcon (Removed from Alaska Region Sensitive Species List in 2009)

1. Provide for the protection and maintenance of Peale's peregrine falcon habitat.
2. Maintain nest site location data in cooperation with USFWS.
3. Plan project activities to avoid adverse impacts to the falcons and their habitats. Evaluate the effects of proposed projects within 2 miles of known falcon nests considering such items as a) human activities (aircraft, ground and water transportation, high noise levels, and permanent facilities) that could cause disturbance to nesting pairs and young during the nesting period April 15 to August 31; and b) activities or habitat alterations that could adversely affect prey availability. Coordinate all project activities that may affect known or potential nesting habitat with the USFWS.
4. Within 15 miles of all known or historical nest sites, prohibit all use of herbicides and pesticides.

D. Trumpeter Swan (Removed from Alaska Region Sensitive Species List in 2009)

1. Provide for the protection and maintenance of trumpeter swan habitats.
2. Avoid disturbance of trumpeter swans, particularly during nesting, brood-rearing, and wintering periods, to prevent abandonment of their nests, brood-rearing areas, and winter habitats. As a general guideline, limit developments within 0.5 mile (2,640 feet) of wetlands used by nesting, brood-rearing, and wintering trumpeter swans. The District Ranger will take feasible measures to minimize disturbance.
3. Avoid placement of overhead wires, fences, or other structures that could interfere with the flight paths of swans and cause injury or mortality.
4. Cooperate with state, federal, and local agencies, partner organizations, and individuals to develop sites and opportunities for the safe viewing of trumpeter swans by the public and maintain a public education program explaining Forest management activities related to trumpeter swans.

E. Osprey (Removed from Alaska Region Sensitive Species List in 2009)

1. Maintain and improve osprey populations and habitat.
2. Establish a minimum 330-foot radius habitat management zone around each existing osprey nest tree. Determine the exact boundary based on local topography, timber type, a reasonable assurance of windfirmness, and other factors.
3. Within the osprey nest zones, prohibit all land use activity which would likely disturb nesting osprey. Infringement may be acceptable depending on the nature of the project and timing of the activity.
4. Maintain the osprey nest zone even though the nest or nest tree becomes inactive.
5. Provide trees suitable for use by osprey for nesting, feeding and perching. Consider the following:
   a) Reserve trees and live trees that dominate or co-dominate a shoreline.
   b) Reserve trees with broken tops and live trees with branches large enough to support birds.
6. New nests will receive the same level of management protection as existing nests; however, osprey that select new nests in proximity to existing human activities will not cause those human activities to be modified.

F. Kittlitz's Murrelet[6]

1. Provide for the protection and maintenance of known Kittlitz's Murrelet nesting habitats.

[6] On May 4, 2004, the U.S. Fish and Wildlife Service (USFWS) published a candidate notice of review (CNOR) in the Federal Register (69 FR 24876) in which the Kittlitz's murrelet was included in the *Summary of New Candidates*. On October 3, 2013, the USFWS issued a final rule (78 FR 61764) that concluded listing the Kittlitz's murrelet as an endangered or threatened species under the Act is not warranted. Species identified as Candidates by the USFWS and/or the National Marine Fisheries Service (NMFS) will automatically be designated as sensitive species (2009 Alaska Region Sensitive Species List).

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CHAPTER 5
PLAN CONTENT DEVELOPED UNDER THE 2012 PLANNING RULE

CONTENTS

Introduction 5-1
Plan Components 5-1
Management Approaches 5-2
Young Growth Direction 5-2
Renewable Energy Direction 5-9
Transportation Systems Corridors Direction 5-10
Forest-wide Plan Components 5-13

Chapter 5

Plan Content Developed Under the 2012 Planning Rule

Introduction

Chapter 5 presents an amendment to the 2008 Forest Plan, and includes plan content[1] that was developed under the 2012 Planning Rule (36 Code of Federal Regulations [CFR] 219). A plan amendment is required to add, modify, or remove existing plan direction, or to change how or where one or more plan components apply to all or part of the plan area (including Land Use Designations [LUDs]) (36 CFR 219.13(a)). Direction in this chapter applies to the entire plan area (forest-wide) or to specific LUDs as explained in Chapter 3. The elements and priority of plan direction are explained in Chapter 1. Should a conflict or discrepancy in direction occur, the applicable plan direction in this chapter takes precedence over other plan direction. (See Priority of Direction in Chapter 1.)

Chapter 5 includes plan components that guide future project and activity decision-making, as well as management approaches that are used to carry out projects and activities developed under this Forest Plan.

Chapter 5 assumes all laws, regulations, and policy pertaining to management of National Forest resources will be followed. Ground-disturbing projects will use the approved best management practices (BMPs) (National Core BMP Technical Guide FS-990a and Alaska Region Soil and Water Conservation Handbook, Forest Service Handbook [FSH] 2509.22) to avoid, minimize, or mitigate environmental impacts. Therefore, direction from laws, regulations, or directives is not repeated in this chapter.

Plan Components

Plan components guide future project and activity decision making, and this plan amendment includes: desired conditions; objectives; standards; guidelines; and suitability of lands. Goals are optional plan components. The set of plan components integrates social, economic, cultural, and ecological considerations. The integration of plan components means that all plan components work together toward achieving or maintaining desired conditions.

Direction in Chapters 2, 3, and 4 of the plan includes goals, desired conditions, objectives, standards, and guidelines. The 2012 Planning Rule does not use these terms in the same way as they were developed under the 1982 Planning Rule. For example, the terms “standards and guidelines” is used but not defined in the 1982 Planning Rule. Under the 2012 Planning Rule, the definition of standards and guidelines have changed; both standards and guidelines are now mandatory constraints. A guideline is defined as a constraint on a project or activity decision-making that allows for departure from its terms, so long as the intent of the guideline is met. A standard is a mandatory constraint on project and activity decision-making, established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements. The 2012 Planning Rule also requires specific project and activity consistency requirements in relation to plan components. Every project and activity must be consistent with the applicable plan components. (See Chapter 6.)

[1] A broad term that refers to written material in a plan, including plan components, and other content in the plan. (See 36 CFR 219.7 (f).) Other content in the plan can be explanatory material that may be useful to Forest Service employees when designing projects and activities under the plan components, such as management approaches.

Specific plan components may apply forest-wide or to specific LUDs. Plan components have specific definitions and purposes in a plan and must be clearly identified and succinctly described. For definitions of plan content and plan components, refer to Chapter 7.

Management Approaches

Management approaches describe the principal strategies and program priorities the Responsible Official intends to employ to carry out projects and activities developed under the Plan. They are presented as a summary of the types of approaches that may occur to maintain or move the forest toward desired conditions. They relate to desired conditions and may indicate the future course or direction of change, recognizing budget trends, program demands and accomplishments.

A management approach is content in the plan (36 CFR 219.7(f)) and differs from plan components in that an amendment or revision would not be required for changes to be made to reflect new information or changed conditions. These may be updated at any time through an administrative change of the plan. (Consult Chapter 6.)

Young Growth Direction

The following plan components and management approaches are specific to young-growth management. The following young-growth plan direction applies to existing and future young-growth forest stands.

Desired Conditions (DC)

DC-YG-01: Young-growth forests produce desired resource values, products, services and conditions in ways that sustain the diversity and productivity of ecosystems. Lands suitable for timber production produce sawtimber and other wood products on an even-flow, long-term sustained yield basis; the timber yield contributes to the projected timber sale quantity (PTSQ). Timber and other ecosystem services from young-growth forest resources provide economical and sustainable opportunities that support Southeast Alaska communities.

DC-YG-02: Pre-commercial thinning treatment of young-growth timber stands approaching, or at, the stem-exclusion stage, increase stand growth and vigor (e.g., larger trees, small canopy gaps, diverse understory). Treatments occur where highest productivity, harvest operability and access is favorable.

DC-YG-03: Harvesting of young-growth stands provides opportunities to improve or maintain fish and wildlife habitat by accelerating old-growth characteristics.

DC-YG-04: Harvesting of young-growth stands in Riparian Management Areas (RMAs) and Beach Fringe provides opportunities to improve or maintain fish and wildlife habitat by accelerating old-growth characteristics.

DC-YG-05: At the end of the planned rotation for young growth, stands are in a condition whereby regeneration harvests using even-aged, two-aged or uneven-aged silvicultural systems are feasible and appropriate.

Suitability of Lands (SUIT)

SUIT-YG-01: Lands within Old-growth Habitat, Scenic Viewshed, Modified Landscape, and Timber Production LUDs are suitable for young-growth timber production, unless they do not meet the other suitability requirements (See Appendix A). Timber management within these LUDs is compatible with desired conditions for young-growth management.

Objectives (O)

O-YG-01: During the 15 years after plan approval, the amount of young-growth offered would gradually increase to exceed 50 percent of the timber offered annually.

O-YG-02: During the 15 years after plan approval, offer increasing annual volumes of economically viable[2] young-growth timber. Old-growth timber harvest would gradually be reduced to an average of 5 million board feet (MMBF) annually, to support Southeast Alaska mills.,

O-YG-03: Annually, pre-commercially thin 4,000 to 7,000 acres of young-growth stands.

Goals (GL)

GL-YG-01: Provide a stable young-growth timber supply that sustains long-term timber yields while maintaining or improving habitat conditions for wildlife and fish at the landscape level (see Appendix B).

GL-YG-02: Pre-commercially treat stands to reduce or eliminate stem exclusion, to decrease stand rotation time, and provide future silvicultural opportunities.

GL-YG-03: Create opportunities in young-growth management and the use of forest products in a manner that enhances the economic vitality of the region and the resilience of local communities.

GL-YG-04: Harvest of young-growth timber supports a variety of mill sizes and operators across the forest, including small and micro sales that support economic opportunities.

GL-YG-05: Make available a variety of potential forest products that support the development of an integrated industry based primarily upon young-growth timber harvest.

Standard (S)

S-YG-01: When harvesting trees prior to the culmination of mean annual increment (CMAI) of growth under the authority granted by Public Law (P.L.) 113–291, Sec. 3002, subsection (e)(4)(A), the limitation of subsection (e)(4)(B) shall be applied.

Management Approaches for Young Growth

The intent is to exercise flexibility to increase volume in these young-growth areas during the transition timeframe, and generally treat in priority of most economic return and least environmental risk:

1. Development LUDs outside of RMAs and beach fringe
2. Beach fringe
3. Old-growth Habitat LUD outside of RMAs
4. RMAs outside of the Tongass Timber Reform Act (TTRA) buffers

It is expected that priority stands would be in high and medium productivity sites with favorable logistical access.

If an assessment determines a need to plant trees, spruce and cedar would likely be favored and planted within two seasons of harvest to accelerate both establishment and growth of successive forest cover to meet habitat or scenic objectives. Before planting, it is our intent that interdisciplinary teams (IDTs) conduct a cost benefit analysis at the project-level to determine if replanting is cost-effective.

The intent is that responsible officials engage stakeholders (for example, conservation interests, timber operators, permitted user groups, and other interested parties) early and often to best design projects that meet ecological,

[2] On the Tongass, the Two-Log Rule was developed to better predict when stands reach a condition where economic harvest opportunities may exist prior to stands reaching culmination of mean annual increment (CMAI) of growth. The Two-Log Rule implies at least half of the merchantable volume within a stand is comprised of trees with two or more logs. A “two-log” tree is defined as a tree that is at least nine inches diameter at breast height, six inches in diameter at the small end and contains a minimum of two logs that are at least 34 feet long.

social, and economic interests. Such inclusion would surface and resolve differences, and minimize and avoid social, environmental, and natural resource conflicts. At the earliest possible time, IDTs would engage scientific and technical expertise, and knowledge of local resources to encourage creative thinking and enhance integration and coordination among jurisdictions.

The intent is that during project planning, IDTs identify other resource opportunities in the project area, and if approved by the responsible official integrate these opportunities into the project design. (See definition for Integrated Resource Management in Chapter 7.) When designing young-growth projects that would advance old-growth characteristics in the beach fringe, RMA, or an old-growth reserve (OGR), IDTs seek out stakeholders to encourage creative and innovative approaches for developing silvicultural treatments that imitate the natural scale and distribution of disturbance patterns on the Tongass (e.g., wind-thrown timber that creates gaps and patches; landslides that create corridors and gaps; mortality that naturally thins stand). The intent is that treatments in RMAs would address stream process group objectives. (Consult Appendix D, and Exhibit 2 in the Tongass Young Growth Management Strategy [USDA 2014].)

Where appropriate, line officers would use Stewardship Authority (FSH 2409.19, Chapter 60) and other authorities to help achieve land management goals while meeting regional and local community needs.

It is expected that by the end of the five year period after the signing of the Record of Decision (ROD) for this plan amendment, the Forest Service would conduct an internal scientific review in collaboration with a forest collaborative and other stakeholders to determine likely impacts to fish and wildlife habitat from young-growth timber projects that intersect with the following Tongass 77[3] (T77) Watersheds (Value Comparison Units):

Appleton Cove 2930
Fish Bay 2870
Irish Lakes 4290
Kadake Cr 4210
Mosman Inlet 4670
Bradfield River 5140
Nakwasina River 2990
Neka Bay 2010
Port Camden 4200
Rodman Bay 2920
Security Bay 4000
Sitkoh Bay 2430
Sitkoh Lake 2440
Situk River 3660
Sweetwater Lake 5730
Thoms Lake 4790

In addition, it is expected that at the end of five years and ten years following the signing of the ROD for this plan amendment, the Forest Service would conduct monitoring with stakeholders to determine if the young-growth goals are being achieved, and if not, adjust accordingly.

[3] The Tongass 77 (T77) refers to value comparison units (VCUs), which approximate major watersheds located on National Forest System lands that Trout Unlimited, Alaska Program identifies as priority salmon watersheds. As a result of the Sealaska Land Entitlement Finalization in the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act for Fiscal Year 2015 (Public Law 113-291), there was a net reduction in the T77. To provide clarity and consistency, the T77 nomenclature will continue to be used in this document when referring to these priority watersheds.

If the harvest of young growth does not adversely affect fish and wildlife populations, young growth in these areas will remain in the suitable timber base. If the review indicates that young-growth harvest does result in adverse effects on fish and wildlife populations, a review the T77 Watersheds and Audubon/The Nature Conservancy (TNC) Conservation Priority Areas will be conducted to determine whether a subsequent amendment is necessary.

At the end of five and ten years, assess whether any suitable young-growth acres should be removed from the suitable timber base, and if so, whether an equal number of acres should be added to the young-growth timber base. Changes made to suitability of lands require a plan amendment.

Beach and Estuary Fringe (BEACH)

Desired Condition (DC)

DC-YG-BEACH-01: Active management of young-growth stands within the beach and estuary fringe supports a range of social, economic and ecological needs. These areas provide habitat and connectivity for wildlife and opportunities for accelerating old-growth characteristics while also providing commercial timber byproducts.

Objective (O)

O-YG-BEACH-01: Offer about 3,500 acres of young-growth in the beach and estuary fringe to provide commercial timber during the 15 years after plan approval.

Suitability of Lands (SUIT)

SUIT-YG-BEACH-01: Young-growth stands within the beach and estuary fringe are suitable for timber production; timber management within these stands is compatible with desired condition DC-YG-BEACH-01.

See SUIT-YG-01 and Appendix A.

Standards (S)

S-YG-BEACH-01: Young-growth harvest in the beach and estuary fringe would be allowed only during the first 15 years after Plan approval. The maximum size of any created opening for commercial timber harvest in the beach fringe must not exceed 10 acres and a maximum removal of up to 35 percent of the acres of the original harvested stand is allowed. Commercial thinning is limited to 33 percent of the stand's basal area. A combination of the two treatments may be used, with no more than 35 percent of the total stand removed in either basal area and/or acres. TTRA and other administratively withdrawn areas do not count towards the stand's total acreage.

S-YG-BEACH-02: Harvest of commercial timber within young-growth stands in the beach fringe is limited to a one-time only entry and to the first 15 years unless best available scientific information shows that additional entries are: a) warranted, and b) meet the LUD objectives.

S-YG-BEACH-03: Commercial harvest within the beach and estuary fringe is not allowed within a minimum 200-foot forested buffer beginning at mean high tide (that is, a no commercial harvest buffer). This does not preclude wildlife enhancement projects and providing access to timber harvest units as long as process group objectives can be met in the RMA.

Management Approaches for Beach and Estuary Fringe

The intent is that determinations of prescriptions and opening sizes in the beach fringe consider spatial and temporal conditions of adjacent landscapes. It is expected that treatment prescriptions facilitate a more rapid recovery of the late-seral (successional) forest characteristics, while also producing commercial timber byproducts.

The intent is that the IDT assesses the fish and wildlife habitat found in estuaries to determine how to protect these important resources. Forest Plan Appendix D provides guidance for delineating RMAs associated with estuarine stream process group.

The intent is that the IDT consult and integrate permit holders, local users, and user groups in planning in the development of any management activity.

Facilities (FAC)

Standard (S)

S-YG-FAC-01: Authorize only those facilities (recreation and administrative) that are compatible with young-growth objectives O-YG-01 and O-YG-02.

Karst and Cave Resources (KC)

Desired Condition (DC)

DC-YG-KC-01: The karst and cave ecosystems (or landscapes) maintain natural processes and productivity, while providing for other land uses.

Standards (S)

S-YG-KC-01: Commercial timber harvest is not allowed on lands identified as high vulnerability karst lands. (Consult Appendix H.)

S-YG-KC-02: On lands identified as moderate vulnerability karst (see Appendix H), the maximum size of any created opening for commercial timber harvest must not exceed 10 acres with a maximum removal of 35 percent of the acres of the original harvested stand.

S-YG-KC-03: Even-aged management is allowed on lands identified as low vulnerability karst lands. (Consult Appendix H.)

Management Approach for Karst and Cave Resources

It is expected that karst resources be evaluated according to their vulnerability. (Consult Appendix H.)

Lands (LAND)

Standard (S)

S-YG-LAND-01: Authorize only those uses that are compatible with young-growth objectives O-YG-01 and O-YG-02.

Recreation and Tourism (REC)

Standard (S)

S-YG-REC-01: Authorize only those uses that are compatible with young-growth objectives O-YG-01 and O-YG-02.

Management Approaches for Recreation and Tourism

The intent is that the IDT consult and integrate permit holders, local users and user groups in planning in the development of any management activity.

The intent is that the project IDT seeks opportunities in young-growth projects that would increase accessibility for recreation and tourism.

Riparian (RIP)

Desired Condition (DC)

DC-YG-RIP-01: Active management of young-growth stands that are suitable for timber production within RMAs supports a range of social, economic and ecological needs. These areas are managed to accelerate old-growth characteristics in order to improve riparian functions for soil, water, fish, wildlife and other resources (see Appendix D), while also providing a commercial timber byproduct.

Suitability of Lands (SUIT)

SUIT-YG-RIP-01: Young-growth stands within RMAs (excluding Tongass Timber Reform Act buffers) are suitable for timber production; timber management within these stands is compatible with desired condition DC-YG-RIP-01.

See SUIT-YG -01 and Appendix A for Alternative 5.

Objective (O)

O-YG-RIP-01: During the 15 years after plan approval, treat about 900 acres of young-growth in RMAs to provide a commercial timber byproduct.

Standards (S)

S-YG-RIP-01: Young-growth harvest in RMAs outside of TTRA buffers would be allowed only during the first 15 years after Plan approval. The maximum size of any created opening for commercial timber harvest in the RMA must not exceed 10 acres and a maximum removal of up to 35 percent of the acres of the original harvested stand is allowed. Commercial thinning is limited to 33 percent of the stand's basal area. A combination of the two treatments may be used, with no more than 35 percent of the total stand removed in either basal area and/or acres. TTRA and other administratively withdrawn areas do not count toward the stand's total acreage.

S-YG-RIP-02: Harvest of commercial timber within young-growth stands in RMAs is limited to a one-time only entry and to the first 15 years unless best available scientific information shows that additional entries are: a) warranted and b) meet the LUD objectives.

Management Approaches for Riparian

The intent is that determinations of prescriptions and opening sizes consider spatial and temporal conditions of adjacent landscapes. The intent is that treatment prescriptions follow guidance from Exhibit 2 of the Tongass Young Growth Management Strategy (2014) and facilitate a more rapid recovery of the late successional forest characteristics, while also producing a commercial timber byproduct.

It is expected that young-growth treatments in the RMA (including estuary buffers) achieve stream process group objectives. (Consult Appendix D for guidance on delineating RMAs associated with stream process group.)

The intent is that BMPs are applied to all land-disturbing activities to protect the beneficial uses of riparian areas. Applicable BMPs are found in the National Core BMP Technical Guide FS-990a and the Alaska Region Soil and Water Conservation Handbook, FSH 2509.22. The intent is that the project IDT consider the Alaska Region Watershed and Air Management Manual, Forest Service Manual (FSM) 2530, U.S. Army Corps of Engineers Regulations (33 CFR 323.4) and the Clean Water Act.

The intent is that the IDT consults and integrates permit holders, local users and user groups in planning in the development of any management activity.

Scenery (SCENE)

Standard (S)

S-YG-SCENE-01: Apply the Very Low Scenery Integrity Objective (SIO) for young-growth harvest. (Consult Forest Plan Chapter 4, Scenery Preparation: SCENE2 section). For combined young-growth and old growth projects within the same viewshed, apply the Very Low SIO.

Management Approaches for Scenery

The intent is that harvest activities would be designed with irregular boundaries for Modified Landscape and Scenic Viewshed, such as feathering.

It is expected that scenery and recreation specialists assess visual priority routes (VPRs) related to the project as listed in Appendix F. Any changes to VPRs require a plan amendment, including public participation.

Soil and Water (SW)

Desired Condition (DC)

DC- YG-SW-01: Long-term soil quality and site productivity in the suitable land base is not impaired and is capable of supporting the regeneration, growth and successional pathways of naturally occurring plant communities. (Consult FSM 2554 Supplement No.: R-10 2500-2006-1.) Soil surface erosion and mass wasting from management activities is minimized.

Standard (S)

S-YG-SW-01: During timber harvest or vegetation treatment operations, dense slash and woody debris accumulations are not allowed.

Guideline (G)

G-YG-SW-02: Ground-based yarding should avoid creating ruts that are more than 12 inches deep

Management Approaches for Soil and Water

In young-growth stands, the evaluation of existing detrimental soil conditions may use historic and current air photos, informal field reviews, and/or formal soil disturbance measurements depending on project specific needs. See Region 10 Soil Quality Standards.

In young-growth stands, the slope stability analysis (see Watershed Resources Planning SW3 in Chapter 4) may use photography, slope, and soil maps or may require an on-site analysis.

Wildlife (WILD)

Desired Conditions (DC)

DC-YG-WILD-01: Active management of young-growth stands within the Old-growth Habitat LUD supports the integrated consideration of social, economic and ecological needs of regional and local communities. Young-growth stands within the Old-growth Habitat LUD maintain habitat and connectivity for wildlife and are managed to accelerate development of old-growth characteristics while also providing commercial timber byproducts.

DC-YG-WILD-02: In the Old-growth Habitat LUD, treated young-growth emulates the natural scale and distribution of disturbance patterns (for example, wind-thrown timber that creates gaps and patches; landslides that create corridors and gaps; and mortality that naturally thins stands).

Objective (O)

O-YG-WILD-01: During the 15 years after plan approval, treat about 1,800 acres of young-growth in the Old-growth Habitat LUD to promote the development of old-growth characteristics while also providing commercial byproducts.

Standards (S)

S-YG-WILD-01: Young-growth harvest in the Old-growth Habitat LUD would be allowed only during the first 15 years after Plan approval. The maximum size of any created opening for commercial timber harvest in the Old-growth Habitat LUD must not exceed 10 acres and a maximum removal of up to 35 percent of the acres of the original harvested stand is allowed. Commercial thinning is limited to 33 percent of the stand's original basal area. A combination of the two treatments may be used, with no more than 35 percent of the total stand removed in either basal area and/or acres. TTRA and other administratively withdrawn areas do not count towards the stand's total acreage.

S-YG-WILD-02: Commercial young-growth harvest within the Old-growth Habitat LUD is limited to a one-time only entry and to the first 15 years unless best available scientific information shows that additional entries are: a) warranted, and b) meet the LUD objectives.

Guideline (G)

G-YG-WILD-01: Road construction should be kept to the minimum necessary for the removal of young-growth timber within the Old-growth Habitat LUD.

Management Approaches for Wildlife

The intent is that determinations of prescriptions and opening sizes consider spatial and temporal conditions of adjacent landscapes. The intent is that treatment prescriptions in the Old-growth Habitat LUD would facilitate a more rapid recovery of the late successional forest characteristics, while creating commercial timber byproducts.

When young-growth harvest is proposed in the Old-growth Habitat LUD, it is expected that the project IDT and an interagency review team (USDA Forest Service, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game) would jointly work to determine by exchanging the young growth for old growth from adjacent landscapes outside the existing Old-growth Habitat LUD. Modifications to the Old-growth Habitat LUD would use the interagency process and review criteria outlined in Appendix K. The intent is for the resulting, modified

Old-growth Habitat LUD to maintain or enhance landscape connectivity and have a net gain of productive old-growth habitat.

Renewable Energy Direction

The direction in this amendment replaces the renewable energy direction in the Transportation and Utility System LUD in Chapter 3 of the 2008 Forest Plan, and removes that overlay LUD as part of the proposed amendment.

Apply these plan components to existing and proposed renewable energy developments. When a written proposal is submitted, beyond the initial stage, for a renewable energy project, the Chapter 5 plan components take precedence if there is a conflict with management direction in Chapters 3 and 4.

Timber cut incidental to renewable energy projects should be managed according to FSH 2409.18, Chapter 80, section 84, Timber Settlement.

Desired Conditions (DC)

DC-RE-01: Renewable energy resources (subject to applicable law) contribute to the economic well-being of Southeast Alaska communities.

DC-RE-02: Renewable energy resources are developed in a manner that would maintain and protect National Forest System (NFS) lands and resources.

Suitability of Lands (SUIT)

SUIT-RE-01: All NFS lands may be suitable for renewable energy sites on a case-by-case basis in consideration of the LUD, ecological and social values, and benefit to Southeast Alaska communities.

Management Approaches for Renewable Energy

Identifying renewable energy sites as suitable is not a commitment but only an indication that the use might be appropriate.

The addition of the Renewable Energy plan components do not change the need to ensure that resource protection measures are incorporated throughout project-level planning, construction, and operation of renewable energy sites.

Consult with the Pacific Northwest (PNW) Research Station Director regarding any proposed activities in the Experimental Forest LUD that may affect ongoing research in the Maybeso or Héen Latinee Experimental Forests. Consultation should take place as early in the planning process as feasible.

Objective (O)

O-RE-01: During the 15 years after plan approval, encourage renewable energy production. Our participation in responding to renewable energy projects would be in the priority order of whether they lead to:

1. A decrease in the number of Southeast Alaska rural communities powered by diesel generators,
2. An increase in energy capacity, efficiency, or storage at existing projects, or
3. An export of renewable energy resources without power benefitting Southeast Alaska communities~~.~~

Beach and Estuary Fringe (BEACH)

Suitability of Lands (SUIT)

SUIT-RE-BEACH-01: Beach and estuary fringe is suitable for renewable energy sites.

Facilities (FAC)

Guidelines (G)

G-RE-FAC-01: Utility lines should follow existing or planned transportation systems corridors, including those identified in the Logging Systems and Transportation Analysis (LSTA) and P.L. 109-59.

G-RE-FAC-02: An alternative route can be considered if it reduces or minimizes resource impacts.

Fish (FISH)

Standard (S)

S-RE-FISH-01: Assure that renewable energy projects continue the productivity of existing fish populations and habitat.

Lands (LAND)

Standard (S)

S-RE-LAND-01: Transportation and utility systems through conservation system units in Alaska, including designated wilderness, shall be considered under Title XI of the Alaska National Interest Lands Conservation Act (ANILCA).

Riparian (RIP)

Guideline (G)

G-RE-RIP-01: Where it is necessary to fall trees within an RMA, the cut trees should be left on site.

Scenery (SCENE)

Standard (S)

S-RE-SCENE-01: Apply the Low SIO to renewable energy sites. (Consult Forest Plan Chapter 4, Scenery Preparation: SCENE2 section.)

Management Approaches for Scenery

It is expected that renewable energy sites may dominate the seen area, and are designed with consideration for existing form, line, color, and texture found in the characteristic landscape.

It is expected that the responsible official will determine if a viewshed analysis is needed for renewable energy site development in relation to DC-RE-02.

Soil and Water (SW)

Standard (S)

S-RE-SW-01: Ensure that renewable energy projects provide for in-stream flows needed to support downstream riparian resources, channel conditions, and aquatic habitat.

Transportation (TRAN)

Suitability of Lands (SUIT)

SUIT-RE-TRAN-01: Lands within renewable energy sites are suitable for roads for access, construction, operation, maintenance, and support of renewable energy sites.

Standard (S)

S-RE-TRAN-01: Transportation and utility systems through conservation system units in Alaska, including designated wilderness shall be considered under Title XI of ANILCA.

Wildlife (WILD)

Management Approaches for Wildlife

It is expected that the IDT would consider current science, and methodologies (for example, Avian Power Line Interaction Committee guidelines) for all new and existing transmission lines and projects to minimize bird electrocution and collision potential, and to prevent road kill.

Transportation Systems Corridors Direction

The direction in this amendment replaces the transportation direction in the Transportation and Utility System LUD in Chapter 3 of the 2008 Forest Plan, and removes that LUD as part of the proposed amendment.

Timber cut incidental to transportation system corridors should be managed according to FSH 2409.18, Chapter 80, section 84, Timber Settlement.

The purpose of the plan direction is to facilitate the availability of NFS land for the development of existing and future transportation system corridors such as those identified by the State of Alaska in the Final Southeast Alaska Transportation Plan (2004) and applicable laws (for example, Section 4407 of P.L. 109-59, Title XI of ANILCA, P.L. 96-487). (See FEIS Chapter 3, Transportation section.)

Objectives (O)

O-TSC-01: Cooperate with other agencies in developing 35 miles of transportation corridors on NFS lands during the 15 years after plan approval.

O-TSC-02: Nominate a minimum of five projects, three to five years following Plan approval, consistent with implementation of the Federal Land Transportation Program Strategy, to provide for transportation facilities for Federal recreation sites associated with federally managed lands (such as a federally managed facility that supports local jobs and income).

Management Approach for Transportation Systems Corridors

Consult with the Pacific Northwest (PNW) Research Station Director regarding any proposed activities in the Experimental Forest LUD that may affect ongoing research in the Maybeso or Héen Latinee Experimental Forests. Consultation should take place as early in the planning process as feasible.

Facilities (FAC)

Standard (S)

S-TSC-FAC-01: Authorize only those facilities (for example, recreation, administrative) that are compatible with transportation system corridor objectives.

Fire (FIRE)

Standard (S)

S-TSC-FIRE-01: Prescribed natural fire is not allowed in transportation system corridors.

Guideline (G)

G-TSC-FIRE-01: Prescribed fire ignitions may be used as a means of fuels management as long as its use is compatible with the LUD objectives.

Fish (FISH)

Standards (S)

S-TSC-FISH-01: Design, construct, and maintain transportation system corridors to provide the continued productivity of existing fish populations and habitat.

S-TSC-FISH-02: Design, construct, and maintain aquatic organism passage across transportation system corridors.

Management Approach for Fish

It is expected that the project IDT would disclose impacts to fish habitat and, as appropriate, identify cost-effective methods to mitigate, rehabilitate, and monitor the potential impacts. The intent is that fish habitat would be protected to prevent the need for mitigation.

Forest Health (HEALTH)

Standard (S)

S-TSC-HEALTH-01: Allow timber sanitation and salvage that is compatible with present or proposed federal or state transportation system corridors, if they meet the desired conditions.

Management Approach for Forest Health

The intent is that the project IDT would identify cost effective insect and disease management activities to maintain or improve forest health in the transportation system corridors.

Lands (LAND)

Standards (S)

S-TSC-LAND-01: Allow only special uses that are compatible with Transportation Systems Corridors desired conditions.

S-TSC-LAND-02: Transportation and utility systems through conservation system units in Alaska, including designated wilderness, shall be considered under Title XI of ANILCA.

Recreation and Tourism (REC)

Standard (S)

S-TSC-REC-01: Allow only recreation uses that are compatible with Transportation Systems Corridors desired conditions.

Management Approach for Recreation and Tourism

The intent is that when development of transportation system corridors changes the Recreation Opportunity System (ROS) setting, recreation and tourism opportunities are managed consistent with the new setting.

Scenery (SCENE)

Standard (S)

S-TSC-SCENE-01: Apply the Low SIO for transportation system corridors. (Consult Forest Plan Chapter 4, Scenery Preparation: SCENE2 section.)

Management Approaches for Scenery

The intent is that when authorizing transportation system corridor construction, that transportation systems designers work with topographic and vegetative features to screen the transportation system development when seen from Visual Priority Travel Routes and Use Areas (see Appendix F).

The intent is to design transportation systems to attain the highest possible quality of landscape aesthetics and scenery commensurate with other appropriate public uses, costs, and benefits.

Guideline (G)

G-TSC-SCENE-01: For transportation system corridors that dominate the seen foreground area, design with consideration for existing form, line, color, and texture of the characteristic landscape.

Soil and Water (SW)

Desired Conditions (DC)

DC-TSC-SW-01: Undisturbed soils within the transportation system corridors are managed to maintain soil productivity. Under the road prism soils are compacted and are not maintained for soil productivity, but support a stable road base. In ditches, cut slopes, and other disturbed areas outside the road prism, soils support desired plant communities, typically native, non-invasive plants. Vegetative cover is maintained in these areas unless soil is absent. Soil erosion and sediment transport is minimized.

DC-TSC-SW-02: Water follows natural flow paths downhill and road ditches do not act as an extension of the stream network. Transportation systems corridors do not cause or contribute to non-attainment of State Water Quality Standards.

Guideline (G)

G-TSC-SW-01: Maintain soil cover to prevent soil erosion in ditches, on cut slopes and fill slopes, and other areas where native soil cover has been disturbed in the construction and maintenance of transportation systems.

Timber (TIM)

Management Approach for Timber

Timber cut incidental to the development of transportation systems may be available for personal use of sawtimber, firewood, and Christmas trees and that use is compatible with transportation system corridor desired condition (DC-03)

and objectives. Existing and future transportation system corridors may be used to access personal use products when consistent with the LUD objectives

Wildlife (WILD)

Standard (S)

S-TSC-WILD-01: Design and construct transportation systems to maintain wildlife habitat corridors between old-growth reserves (OGRs), RMAs, and beach and estuary fringe.

Guideline (G)

G-TSC-WILD-01: The ability for wildlife movement across transportation system corridors should be maintained.

Management Approach for Wildlife

It is expected that the project IDT would disclose impacts to wildlife habitat and movement corridors to maintain habitat connectivity across transportation infrastructure.

Forest-wide Plan Components

Forest Desired Conditions (Chapter 2)

DC-01: The Forest is characterized by extensive, unmodified natural environments. Old-growth forests are one of the predominant vegetation types on the Tongass and connections between patches of old growth are evident. Large areas of previously harvested stands now support young forests at different ages of succession. Stands in the natural setting Land Use Designations, within old-growth reserves, riparian management areas, and beach and estuary fringe would be at the climax-stage of forest stand composition and structure (e.g., old-growth conditions). Early seral stage stand composition and structure would be the desired condition in young-growth stands within the Development LUD Group. Insects and diseases native to southeast Alaska perform their natural role in the ecosystem.

DC-02: Transportation systems support community resilience, resource management, and provide for current and future land management needs, subject to applicable laws. Transportation systems avoid, minimize, or mitigate adverse effects to natural and cultural resources.

DC-03: Existing and future transportation system corridors provide community opportunities and support implementation of the Alaska Federal Lands Long Range Transportation Plan (LRTP) as identified through the Moving Ahead for Progress in the 21st Century Act (MAP-21).

DC-04: The minimum land area, consistent with an efficient, safe facility, is used for transportation sytems corridor development. Transportation routes with regional importance may offer new or improved developed recreation opportunities.

Forest-wide Multiple-use Goals and Objectives (Chapter 2)

Renewable Energy (Goal)

GL-RE-01: The Forest would proactively contribute to sustainable production of renewable energy and energy transmission and distribution across the Forest, on all lands and LUDs, after consideration of other resources and community benefits.

Timber (Objective)

O-TIM-01: Seeking to accelerate a transition to primarily young-growth harvest, offer an average of 46 MMBF annually in a combination of old growth and young growth. When young-growth offered is less than 41 MMBF, provide old growth to make up the difference and achieve the average annual projected timber sale quantity of 46 MMBF. After the transition, offer an average of 5 MMBF of old growth annually to support Southeast Alaska mills.

O-TIM-02: Seek to provide an economic timber supply sufficient to meet the annual market demand for Tongass National Forest timber, and the market demand for the planning cycle. The volume of young growth as part of the yearly offer will increase from an average of 9.2 MMBF annually in the first decade to an average of 25 MMBF annually in years 11-15 as the program nears full transition.

Management Approach for Timber

It is the Forest's intent to:

a) monitor harvest over the next five years, beginning at the effective date of the 2016 Amended Plan, and consider any constraints (such as litigation) on that harvest;

b) monitor data related to the assumptions relied on in the Daniels et al. (2016) report;

c) report on any different or unexpected information identified through monitoring than that considered in the analysis for the Plan Amendment EIS, and consider whether any differences are significant enough to warrant further review in another plan amendment; and

d) identify the timeframe for this report, and provide the opportunity for public and agency review of the information.

Update and post annually (by December 31 of each year) the five-year timber sale schedule to track and monitor timber sales.

Transportation (Goal)

GL-TRAN-01: During the 15 years after plan approval, manage and maintain roads to provide access for forest management, subsistence uses, and recreation, as well as public access to traditional use areas while protecting water, soil, fish, and wildlife resources.

Forest-wide Standards and Guidelines (Chapter 4)

Beach and Estuary Fringe (BEACH)

Standard (S)

S-BEACH-01: Harvest of old-growth timber within the beach and estuary fringe is not allowed, with the following exceptions that do not contribute to the PTSQ. Silvicultural prescriptions must address beach fringe management objectives:

a) Salvage harvest to include incidental amounts of standing green timber during operations for safety and operational considerations;

b) Administrative use (36 CFR 223.2);

c) By-products of habitat restoration treatments;

d) Free use to Alaskan settlers, miners, residents, and prospectors (36 CFR 223.10);

e) Landings and roads (only on the landward edges of the fringe); or

f) For accessing timber in adjacent lands suitable for timber production such as for landings for logical yarding settings or access roads, where there are no alternatives in project design.

Timber (TIM)

Standard (S)

S-TIM-01: Not including salvage or sanitation harvest, the quantity of timber sold in a decade may not exceed the sustained yield limit of 2480 million board feet (MMBF).[4]

[4] Forest Service Handbook 1909.12, Ch. 60, sec. 64.31

Wildlife (WILD)

Bald Eagle Habitat

Guideline (G) **G-WILD-02:** The National Bald Eagle Management Guidelines (USFWS 2007, or current) should be used when working or authorizing activities near eagle nests.

Aleutian Tern

Standard (S) **S-WILD-03:** Follow direction in *XI. Seabird Colonies* in Chapter 4.

Black oystercatcher

Standard (S) **S-WILD-04:** Provide a minimum distance of 330 feet from human activities on the ground and waterfowl or shorebird intertidal concentration or nesting areas.

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CHAPTER 6
IMPLEMENTATION

CONTENTS

Introduction 6-1
Project Consistency Requirements 6-2
Resolving Inconsistencies 6-2
Plan Amendments 6-2

Chapter 6

Implementation

Introduction

Forest Plan implementation accomplishes the management direction of the Forest Plan, and is necessary to meet public expectations of Forest Service actions and legal requirements. It is mainly accomplished through the identification of proposed actions (initiated by the Forest Service or external proposals) consistent with activities anticipated in the Forest Plan; the analysis and evaluation of such actions (and reasonable alternatives to them); related documentation and decision making; and project implementation and administration, in a manner that is consistent with the management direction of the Plan. (See Forest Plan Management Direction in Chapter 1.) Plan implementation also involves project consistency requirements, making necessary administrative changes (36 Code of Federal Regulations [CFR] 219.13), and amending the Plan to keep it current and adapt to new information or changing conditions.

Plan implementation is influenced by annual budget direction, fiscal limitations, and available personnel. Each year, upon approval of a budget, the Forest Supervisor develops an annual program of work. The accomplishment of the annual program results in the achievement of the Plan's management direction. Future budget requests are based on the management direction of this Forest Plan, and related project and activity scheduling.

Direction in the Forest Plan is implemented through an annual program of work. The Forest Plan is also responsive to several of the goals and objectives in the USDA Forest Service Strategic Plan: FY 2015-2020. This Strategic Plan contains the following strategic goals and objectives:

- Sustain our Nation's Forests and Grasslands
  - Objective A. Foster resilient, adaptive ecosystems to mitigate climate change.
  - Objective B. Mitigate wildfire risk.
  - Objective C. Conserve open space.
- Deliver Benefits to the Public
  - Objective D. Provide abundant clean water.
  - Objective E. Strengthen communities.
  - Objective F. Connect people to the outdoors.
- Apply Knowledge Globally
  - Objective G. Advance knowledge.
  - Objective H. Transfer technology and applications.
  - Objective I. Exchange natural resource expertise.

Project implementation, including location, quantities, and timing, is dependent on a variety of factors, such as budget availability, personnel, partnership

opportunities, and the timing and location of other Forest management activities. A short list of Tongass high priority projects is developed each year to guide project implementation.

External proposals (such as for the development of communications sites by private companies or restoration activities by partners) will also be considered for implementation and, if selected, evaluated for compliance with all applicable direction in this Plan, as well as applicable laws and Forest Service policy and regulations.

Project Consistency Requirements

The 2008 Forest Plan was developed under provisions in the1982 Planning Rule and the Forest Service interpretation under that Rule was that the consistency requirement applied to standards and guidelines but not to other parts of the plan. The 2012 Planning Rule applies a new interpretation, so that projects and activities must be consistent with all applicable plan components (goals, desired conditions, objectives, suitability of lands, and standards and guidelines). The source of the plan direction (1982 or 2012 Rule) dictates the consistency requirement as follows:

1. The 2012 Planning Rule consistency provisions at 36 CFR 219.15(d) apply only to plan component(s) in Chapter 5 that were written in conformance with, and as defined by, the 2012 Planning Rule. With respect to plan direction in Chapters 2, 3, and 4, projects need only be consistent with plan standards and guidelines since they were developed under the 1982 rule.
2. The Forest Service's prior interpretation of consistency under the 1982 rule, and not the 2012 Planning Rule consistency provisions, also applies when an amendment developed and approved under the 2012 Planning Rule does not change the text of the Plan direction, but simply applies existing plan direction to a different, or additional, area or areas within the plan area.

A project or activity decision document (Decision Memo, Decision Notice, or Record of Decision) must describe how the project or activity is consistent with applicable plan direction.

Resolving Inconsistencies

When a proposed project or activity would not be consistent with the applicable plan direction, the Responsible Official shall take, subject to valid existing rights, one of the following steps:

1. Modify the proposal to make it consistent with the approved plan direction;
2. Reject the proposal;
3. Amend the plan so that the proposal will be consistent with the plan. A plan amendment can be approved in the same decision document with a project. This amendment may apply only to the project or activity or to all future projects and activities.

Plan Amendments

The administrative review process for plan amendments varies based on whether the amendment applies to one project or to future projects as well. If the plan amendment applies only to a single project, the amendment would be subject to the project review process. If the plan amendment would apply to future projects as well, the objections process of the 2012 Planning Rule (36 CFR 219, Subpart B) would apply. The project itself will always be subject to the applicable project review process of 36 CFR 215 or 218 (see 36 CFR 219.59(b) as described in FSH 1909.12, chapter 50, section 51.1).

Plan amendments are intended to be an adaptive management tool to keep plans current, effective, and relevant between required plan revisions.

Amendments help the Responsible Official adapt the existing plan to new information keeping it current with changing conditions. Maintaining the plan through amendments may reduce the work needed for plan revisions.

Whether an amendment is proposed in response to changing conditions or in relation to a specific project, the scope and scale of the process, including analysis and public participation, should be commensurate with the scope of the plan amendment (36 CFR 219.13(b)(2)).

Plan amendments require an environmental impact statement, an environmental assessment, or could be categorically excluded from documentation, based on the significance of effects pursuant to NEPA.

When a plan amendment is approved in the same decision document with a project, the Responsible Official for both decisions must be the Forest Supervisor or higher-level official, regardless of whether the District Ranger could have authorized the project in the absence of a plan amendment. The decision document for the project and amendment must include the rationale for amending the plan.

Multiple or frequent project-specific plan amendments of the same type may suggest a need to change a plan component. The Responsible Official should recognize when there are multiple project-specific plan amendments and evaluate the presence of any systemic need to change the plan that should be addressed by a Forest-wide plan amendment.

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CHAPTER 7
GLOSSARY

Chapter 7

Glossary

These definitions apply to Forest Service land management and planning. Meanings may differ when used in another context. Glossary definitions are not legal unless otherwise noted. Some definitions were shortened, paraphrased, or adapted to conditions in Southeast Alaska or on the Tongass National Forest and for ease of understanding. Glossary terms that are new are distinguished by shading.

A

Accelerated windthrow

Increase in amount or extent of uprooting beyond that which may be found in the surrounding unharvested riparian management area (RMA) or under similar natural conditions.

Access

The opportunity to approach, enter, and make use of public lands.

Access management

Acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands (physical attributes).

Acquired land

Lands in federal ownership that were obtained by the Government through purchase, condemnation, gift, or by exchange.

Active channel

As defined for purposes of the Riparian Standards and Guidelines, includes stream channels*, secondary channels*, and braided channels*. For the Alluvial Fan Process Group, it also includes gravel outwash lobes. (Words marked by an * have further definitions within the glossary.)

Activity fuel loading

The amount of burnable debris left after logging.

Adaptive Management

The general framework encompassing the three phases of planning: assessment, plan development, and monitoring (36 CFR 219.5). This framework supports decision-making that meets management objectives while simultaneously accruing information to improve future management by adjusting the plan or plan implementation. Adaptive management is a structured, cyclical process for planning and decision-making in the face of uncertainty and changing conditions with feedback from monitoring, which includes using the planning process.

to actively test assumptions, track relevant conditions over time, and measure management effectiveness. (FSH 1909.12, Ch. Zero Code)

Adfluvial fish

Species or populations of fish that do not go to sea, but live in lakes, and enter streams to spawn.

Glossary 7

Adjacent

Objects or parcels of land that are not widely separated, though perhaps they are not actually touching.

Administrative site

Lands used as headquarters or administrative facility by a Federal agency.

Administrative unit

A National Forest, National Grassland, Purchase Unit, Land Utilization Project, Columbia River Gorge National Scenic Area, Land between the Lakes, Lake Tahoe Basin Management Unit, Midewin National Tallgrass Prairie, or other comparable unit of the National Forest System, such as the Tongass National Forest (36 CFR 212.1).

Administrative use (timber)

Trees, portions of trees, or other forest products in any amount on National Forest System lands may be disposed of for administrative use, by sale or without charge, as may be most advantageous to the United States, subject to the maximum cut fixed in accordance with established policies for management of the National Forests. (See 36 CFR 223.2.)

Aggradation

The process of building up a land surface by deposition.

Alaska Department of Fish and Game (ADF&G)

State of Alaska agency that manages fish and game populations throughout the state.

Alaska Heritage Resource Survey (AHRS)

The official list of cultural resources in the State of Alaska, maintained by the Office of History and Archaeology, Alaska Division of Parks and Outdoor Recreation.

Alaska Native Claims Settlement Act (ANCSA)

Act of December 18, 1971. Public Law 92-203, 92nd Congress, 85 Stat. 688-716.

Alaska National Interest Lands Conservation Act (ANILCA)

Act of December 2, 1980. Public Law 96 487, 96th Congress, 94 Stat. 2371-2551.

Alaska Native Corporation

One of the regional, urban, and village native corporations formed under the Alaska Native Claims Settlement Act of 1971.

Alliances (plant)

A grouping of [plant] associations with characteristics physiognomy and sharing one or more diagnostic species, which as a rule, are found in the uppermost or dominant stratum of the vegetation (Jennings et al. 2004). Also known as “plant series”.

Alluvial fan

A low, outspread, relatively flat to gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream at the place where it issues from a narrow mountain valley upon a plain or broad valley, or where a tributary stream is near or at its junction with the mainstream, or wherever a constriction in a valley abruptly ceases or the gradient of the stream suddenly decreases; it is steepest near the mouth of the valley where its apex points upstream and it slopes gently and conversely outward with gradually decreasing gradient (Haskins et. al. 1998).

Alluvium

Recent soil deposits resulting from modern rivers, including the sediment laid down in river beds, flood plains, lakes, and at the foot of mountain slopes and estuaries.

All sediment deposits resulting directly or indirectly from sediment transport within streams deposited in riverbeds, floodplains, lakes fans and estuaries (Helms 1998).

Alpine

Parts of mountains above tree growth.

Alternative

An option proposed for decision making.

Ambient air

The air, external to buildings, encompassing or surrounding a specific region.

Ambient Air Quality Standard

The prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

Amenity

Resource use, object, feature, quality, or experience that gives pleasure or is pleasing to the mind or senses. Amenity value typically describes those resource properties for which monetary values (or market values) are not or cannot be established.

Anadromous fish

Fish that mature and spend much of their adult life in the ocean, returning to inland waters to spawn. Salmon and steelhead are examples.

Anadromous Fish Habitat Assessment

An assessment conducted in 1994 within the Tongass National Forest (published in 1995) to study the effectiveness of current procedures for protecting anadromous fish habitat and to determine the need for any additional protection.

Annual demand

As used in this document, the amount of timber that buyers are willing to purchase each year. Estimates of annual timber demand are based on a number of factors, including Pacific Northwest projections, installed mill capacity, utilization rates and market trends.

Appropriation of land

The act of selecting, devoting, or setting apart land for a particular use or purpose, such as appropriating land for public buildings and military reservations or other public uses. Black's Law Dictionary (9th ed. 2009)

Aquaculture

Culture or husbandry of salmon or other aquatic fauna or flora.

Aquatic ecosystem

A stream channel, lake or estuary bed, the water itself, and the biotic communities that occur therein.

Aquatic farm (or Aquafarming)

Growing, farming, or cultivating aquatic products in captivity or under positive control. Current State of Alaska law (AS 16.40.100 - 16.40.199, 2014) does not allow the aquatic farming of finfish, but does allow the farming of shellfish.

ARCGIS

Geographic Information System (GIS) software used for the Amendment database.

Area of potential effects

In Heritage Resources, area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 CFR 800.16.d). The NEPA equivalent is at [40 CFR § 1502.15] the environment of the area(s) to be affected or created by the alternatives under consideration.

Available timberlands

Timberland not withdrawn from use in production of timber products as a result of administrative statue or regulation.

B

Background

The visible area greater than 5 miles and less than 15 miles from a visual priority route. (See the definitions for foreground and middleground.)

Bank

The continuous margin along a river or stream where all upland vegetation ceases.

Bankfull width

Distance from bank to bank at the elevation of bankfull streamflow. Bankfull streamflow occurs just before streamflow spills out of the channel into the flood plain.

Basal area

Tree area in square feet of the cross section at breast height of a single tree. When the basal areas of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Beach fringe

The area inland from salt water shorelines that is typically forested.

Beach log salvage

The salvage of logs that have been washed up on beaches.

Bedload

Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water. The particles of this material have a density or grain size that prevents movement far above or for a long distance out of contact with the stream bed under natural flow conditions.

Benchmark

An analysis of the supply potential of a particular resource, or set of resources, subject to specific management objectives or constraints

Benthic

Pertaining to the sea bottom or organisms that live on the sea bottom.

Best Management Practices (BMPs)

Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19). BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility. BMPs are found in the National Core BMP Technical Guide, FS-990a (USDA Forest Service 2012) and Forest Service Handbook 2509.22, Alaska Region Amendment.

Biogeographic provinces

Twenty-one ecological subdivisions of Southeast Alaska that are identified by generally similar physiogeography, climate, vegetation patterns and physical barriers such as mountains or saltwater (distinct ecological and biogeographic features). Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces. Historical events (such as glaciers, wind, and tectonic uplifting) are important to the nature of the province and to the barriers that distinguish each province (Martin and Alaback 1990).

Biological assessment

A "biological evaluation" conducted for major federal construction projects requiring an environmental impact statement, in accordance with legal requirements under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1536(c)). The purpose of the assessment and resulting document is to determine whether the proposed action is likely to affect an endangered, threatened, or proposed species. (FSM 2600, Ch. 2670)

Biological diversity

The variety of life forms and processes, including the complexity of species, communities, gene pools, and ecological functions, within the area covered by a land management plan.

The variety and abundance of life forms, processes, functions, and structures of plants, animals and other living organisms, including the relative complexity of species, communities, gene pools and ecosystems at the spatial scales that range from local through regional to global. 2. An index of richness in a community, ecosystem or landscape and the relative abundance of these species – Note: 1. There are commonly five levels of biodiversity: (a) genetic diversity, referring to the genetic variation within a species; (b) species diversity, referring to the variety of species in an area; (c) community or ecosystem diversity, referring to the variety of communities or ecosystems in and area; and (d) regional diversity, referring to the variety of species, communities, ecosystems or landscapes within a specific geographic region – Note: each level of biodiversity has three components: (a) compositional diversity or the number of parts or elements within a system, indicated by such measures as the number of species, genes, communities or ecosystems; (b) structural diversity or the variety of patterns or organizations within a system, such as habitat structure, population structure, or species morphology; and (c) functional diversity or the number of ecological processes within a system such as disturbance regimes, roles played by species within a community, and nutrient cycling within a forest (Helm 1998).

Biological evaluation

A documented Forest Service review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species. (FSM 2600, Ch. 2670)

Biomass

Organic matter available on a renewable basis; includes forest and mill residues, agricultural crops and wastes, wood and wood residues, animal wastes, livestock operation residues, aquatic plants, fast-growing trees and plants, and municipal waste and industrial residues; can be used to produce liquid transportation fuels, chemicals and other bioproducts, electric power, steam, and heat. Also refers to the total mass of living organisms in a given area or volume; recently dead plant material is often included as dead biomass.

Blowdown

See windthrow.

Board foot

A unit of timber measurement equaling the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

Bole

The trunk or main stem of a tree (seedlings and saplings have stems rather than boles).

Boulders

Rounded or angular rocks greater than 12 inches in size.

Braided streams or channels

A stream flowing in several dividing and reuniting channels resembling the strands of a braid, the cause of division being the obstruction by sediment deposited by the stream.

Branchers

Young goshawks not able to fly observed on or near a nest.

Bridge

A road or trail structure, including supports, erected over a depression or an obstruction, such as water, a road, a trail, or a railway, and having a deck for carrying traffic or other loads.

Buffer

An area of vegetation of varying size, shape, and character managed to mitigate effects on a particular resource.

C

Canopy gap

Natural openings created in the overstory of old-growth conifer forests from the loss of a single or small group of trees from windthrow, insects, or disease. Also, gaps created in young-growth conifer stands to increase light penetration to the understory by cutting all of the trees in a small area to maintain or increase the number of understory plant species.

Catastrophic event

Events resulting from a great and sudden calamity or disaster. In the case of forest stands, such events may include windstorms, wildfire, floods, snow slides, and insect outbreaks. Whether a disturbance event is called catastrophic is dependent on the context within which the event occurs, the scale of the event, and the effects of the event.

Capability

The potential of an area of land to produce resources, supply goods, and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity.

Capital investment cost

Costs generally associated with construction, such as trails, roads, and physical structures.

Carrying capacity

The estimated maximum number (or biomass) of organisms of a given species that can be sustained or survive on a long-term basis within an ecosystem.

Categorical exclusion

A category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a federal agency in implementation of these regulations [40 CFR 1507.3] and for which, therefore, neither an environmental assessment nor an environmental impact statement is required. An agency may decide in its procedures or otherwise, to prepare environmental assessments for the reasons stated in [40 CFR 1508.9] even though it is not required to do so. Any procedures under this section shall provide for extraordinary circumstances in which a normally excluded action may have a significant environmental effect (See 40 CFR 1508.4.)

Cave

Cave is legally defined under federal law as “any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or human-made. Such term shall include any natural pit, sinkhole or other feature which is an extension of the surface,” (Federal Cave Resource Protection Act of 1988). Speleologists use “cave” to refer to all parts, regardless of size, of an underground system that links openings and chambers and that may connect the system to the surface. Included in the term caves are tree molds and lava tubes associated with lava flows, erosional caves, and those formed by dissolution of bedrock.

Census designated place (CDP)

A concentration of population identified by the United States Census Bureau for statistical purposes. CDPs are delineated for each decennial census as the statistical counterparts of incorporated places, such as cities, towns, and villages.

Channel

A natural waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks that serve to confine the water.

The bed where a natural body of surface water flows or may flow; a natural passageway or depression of perceptible extent containing continuously or periodically flowing water, or forming a connecting link between two bodies of water, a water course (Haskins et al. 1998).

Channel migration

Movement of a stream or river channel within a flood plain area (or an alluvial fan) usually over an extended period of time.

Channel side-slope

The area from the stream channel to the side-slope break. See also Side-slope break.

Channel type

A means of distinguishing parts of a stream system into segments that have fairly consistent physical and biological characteristics. For descriptions, see “Channel Type Field Guide,” Forest Service publication R10-MB-6.

Class (streams)

See stream class.

Clearance

Certification by the Forest Supervisor documenting that the requirements of 36 CFR 800 Subpart B have been fully met for each undertaking.

A cultural resources term commonly used to refer to the completion of the Section 106 process as outlined in 36 CFR 800.3-13. The Section 106 process includes establishing an undertaking, evaluating potential to cause effects, coordinating with other reviews, and consulting with the State Historic Preservation Officer (SHPO) and other stakeholders, including tribes. Within the process determinations of national register eligibility are made, as is a determination of effect. The SHPO must concur with both determinations. “Clearance” is achieved when the SHPO concurs with a finding of “No Adverse Effect, or No Historic Properties Affected” or with the completion of a Memorandum of Agreement (MOA) for mitigation of Adverse Effects which is signed by the SHPO and the Agency Official. Depending on the complexity, the Advisory Council on Historic Preservation may also be involved.

Clearcutting

An even-aged regeneration method in which essentially all trees have been removed in one operation to create an even-aged stand that is composed of a single age class in which tree ages are usually +/- 20 percent of rotation. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class in planning.

Cluster initiative (Southeast Alaska)

The Southeast Alaska Cluster Initiative is an “industry cluster” made up of a set of businesses, in the same or related field and co-located in the region, which are linked by service or supplier relationships, common customers and supporting institutions or other relationships. This cluster initiative supports implementation of the USDA Forest Service and Rural Development unified regional "Transition Framework" economic development plan for Southeast Alaska that focuses on four industry sectors: Visitor Products, Ocean Products, Forest Products, and Renewable Energy.

Coarse filter

An approach used for wildlife conservation management and analysis which focuses on the characteristics of entire ecosystems and landscapes. (Also see the definition for fine filter.)

Colluvial

Soil and material produced by the disintegration and weathering of rocks, including cliff debris, material of avalanches, and alluvium. This material accumulates at the foot of a slope.

Pertaining to material or processes associated with transportation or deposition by mass movement (direct gravitational action) and local, unconcentrated runoff on side slopes or at the base of slopes (Helm 1998).

Code of Federal Regulations (CFR)

The codification of the general and permanent rules published in the Federal Register by the departments and agencies of the Federal Government. It is divided into 50 titles that represent broad areas subject to Federal regulation. The 50 subject matter titles contain one or more individual volumes, which are updated once each calendar year, on a staggered basis. Each title is divided into chapters, which usually bear the name of the issuing agency. Each chapter is further subdivided into parts that cover specific

regulatory areas. Large parts may be subdivided into subparts. All parts are organized in sections, and most citations to the CFR refer to material at the section level.

Collaboration or collaborative process

A structured manner in which a collection of people with diverse interests, share knowledge, ideas, and resources, while working together in an inclusive and cooperative manner toward a common purpose. Collaboration, in the context of 36 CFR 219 subpart A, falls within the full spectrum of public engagement described in the Council on Environmental Quality's publication of October, 2007: Collaboration in NEPA— A Handbook for NEPA Practitioners. (36 CFR 219.19)

Commercial forest land (CFL)

Forest land that is producing or is capable of producing crops of industrial wood and (a) has not been withdrawn by Congress, the Secretary, or the Chief; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; and (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be attained within 5 years after final harvesting.

Commercial thinning

See thinning.

Commercial timber

Trees, portions of trees, and other forest products on National Forest System lands may be sold for the purpose of achieving the policies set forth in the Multiple-Use Sustained-Yield Act of 1960, as amended (74 Stat. 215; 16 U.S.C. 528-531), the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended (88 Stat. 476; as amended, 16 U.S.C. 1600-161), and the Program thereunder. (See 36 CFR 223.1 Authority to sell timber.)

Commodities

Resources with monetary (market) or commercial value; all resource products that are articles of commerce, such as timber and minerals.

Community Water Systems

As defined by the State of Alaska, a community water system is a public water system that expects to serve, year round, at least 25 individuals; or expects to serve, year round, at least 15 residential service connections. The Municipal Watershed LUDs are associated with a subset of community water systems in the vicinity of the Tongass National Forest. Compare to public water systems and municipal watersheds.

Confined streams

Streams that are confined within their channel banks; they are controlled by stream incision, geomorphic landform characteristics, and local geological conditions.

Confluence

The point where two streams meet.

Connectivity (landscape)

A measure of the extent that forest areas between or outside Old-growth habitat reserves (Appendix K) and other Non-development LUDs provide habitat for breeding, feeding, dispersal, and movement.

Connectivity (ecosystem)

Ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the exchange of flow, sediments and nutrients; the daily and seasonal movements of animals

within home ranges; the dispersal and genetic interchange between populations; and the long distance range shifts of species, such as in response to climate change (FSM 1909.12, Ch. 10; 36 CFR 219.19).

Conservation strategy

See old-growth habitat conservation strategy.

Contributed funds

Funds used to pay for a portion of the work or materials needed to construct a road only to the standard needed for a timber sale, which could have properly been paid for by purchaser credits, if available.

Convey

To pass or transmit the title to property from one to another.

Conveyance

An instrument by which some estate or interest in lands is transferred from one person to another (Black 1979); a transfer of legal title to land.

Corridor (transportation)

A linear strip of land defined for the present or future location of transportation rights-of-way within its boundaries. **Corridor (wildlife)**

Habitats, often linear, that facilitate dispersal and movement of wildlife between patches of suitable habitat. (Also see the definition for connectivity.)

Corridor (Wild and Scenic Rivers)

Wild, scenic, and recreational river corridors are generally comprised of the area within 0.25 mile either side of the ordinary high water mark of the river. River corridor boundaries may be changed as a result of specific river planning following inclusion of the River in the National Wild and Scenic Rivers system.

Cost efficiency

The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs, including environmental, economic, or social impacts, are not assigned monetary values, but are achieved at specified levels in the least cost manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and rates-of-return may be appropriate.

Created opening

Openings in the forest canopy created by silvicultural practices, including shelterwood regeneration cutting, clearcutting, seed tree cutting, or group selection cutting.

Critical habitat

Specific areas designated as critical by the Secretary of Interior or Commerce for the survival and recovery of species listed as Threatened or Endangered pursuant to the Endangered Species Act.

For a threatened or endangered species, (1) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provision of section 4 of the Endangered Species Act (ESA) (16 USC 1533), on which are found those physical or biological features (a) essential to the conservation of the species, and (b) which may require special management considerations or protections; and (2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA (16 USC 1533), upon a determination by the Secretary that such areas are essential for the conservation of the species. ESA, sec. 3 (5) (A), (16 USC 1532 (3) (5) (A). Critical habitat is designated through rulemaking by the Secretary of Interior or Commerce. ESA, sec. 4 (a) (3) and (b) (2) (16 USC 1533 (a)(3) and (b)(2)).

Crown
The part of a tree or woody plant bearing live branches and foliage.

Cull logs
Logs that do not meet merchantability specifications.

Culmination of Mean Annual Increment (CMAI)
The age in the growth cycle of a tree or stand at which the mean annual increment (MAI) for height, diameter, basal area, or volume is at a maximum

Cultural resources
See heritage resources.

Culvert
A conduit or passageway under a road, trail, or other obstruction. A culvert differs from a bridge in that is usually constructed entirely below the elevation of the traveled way.

Cumulative effects
See the definition for effects.

Cumulative watershed effects (CWE)
The effects on a watershed's streams and lakes that result from the incremental impact of individual actions within a watershed when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative watershed effects can result from individually minor but collectively significant actions taking place over a period of time.

D

Debris avalanches
The rapid downslope movement of a mixture of soil, rock, and forest litter with or without a relatively high water content. Also known as debris flows.

The very rapid and usually sudden sliding and flowage of incoherent, unsorted mixtures of soil and weathered bedrock (Haskins et. al 1998).

Debris flow
A moving mass of rock fragments, soil and mud, more than half of the particles being larger than sand size. Slow debris flows may move less than 1 meter per year; rapid ones reach 160 kilometer per hour (Haskins et al. 1998).

Debris torrents
Landslides that occur as a result of debris; avalanche materials that either dam a channel temporarily or accumulate behind temporary obstructions such as logs and forest debris. Debris torrents are usually confined within the stream channel until they reach the valley floor where the debris spreads out, inundating vegetation and forming a broad surface deposit.

Decision criteria
The rules, standards, or guidelines used to evaluate alternatives. They are measurements or indicators that are designed to assist a decision maker in identifying a preferred choice from an array of possible alternatives.

Degradation

The general lowering of the surface of the land by erosive processes, especially by the removal of material through erosion and transportation by flowing water.

The erosion of stream beds or banks that occurs when instream sediment loads do not meet a stream's capacity (tractive force) to transport sediment – note: degradation commonly occurs below reservoirs that trap sediments when flow rates are increase or when watershed erosion and sediment delivery rates to stream are significantly reduced (Helm 1998).

Demand

The quantity of a commodity or service that buyers are willing to purchase at a given price over a specific time period.

Demographic

Pertaining to the study of the characteristics of populations, such as size, growth, density, distribution, and vital statistics.

Dense Slash and woody debris accumulations

Accumulations of multiple layers of slash that are dense enough to adversely affect the growth of the desired vegetation (soil respiration and soil water movement are affected). Dense slash accumulation can occur at landings and on equipment trails. The soil standard is specifically written for equipment trails where slash is used to support multiple passes of equipment over soils that would otherwise be rutted by equipment use. Dense slash mats occur with multiple layers of slash and multiple passes of the equipment. Dense slash mats on equipment trails can easily be broken up by equipment using the grapple to fluff the slash mat on the last pass over the equipment trail. Soil respiration and water movement can be difficult to measure under a dense slash mat. As a practical guideline slash mats more than 20 inches thick with more than 10 equipment passes will meet the definition of dense slash and woody debris accumulation.

Designated road, trail, or area

A National Forest System (NFS) road, a NFS trail, or an area on NFS lands that is designated for motor vehicle use pursuant to 36 CFR 212.51 on a motor vehicle use map (36 CFR 212.1).

Desired Condition

A description of specific social, economic, and/or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates (36 CFR 219.7(e)(1)(i)). Desired conditions are achievable, and may reflect social, economic, or ecological attributes, including ecosystem processes and functions.

Detrimental soil disturbance

The condition where established threshold values of soil properties are exceeded and result in significant change or impairment to long-term soil productivity. (Also see the definitions for significant change and significant impairment.)

Detritus

Material, produced by the disintegration and weathering of rocks, that has been moved from its site of origin. Also, pieces of dead or decomposing plant or animal material. In streams, detritus is the accumulation of leaves, needles, twigs, and other organic material that falls from overhead vegetation.

Developed recreation

The type of recreation that occurs where modifications (improvements) enhance recreation opportunities and accommodate intensive recreation activities in a defined area.

Development LUDs

Land use designations that permit commercial timber harvest and other commercial activities (Timber Production, Modified Landscape, Scenic Viewshed, and Experimental Forest) and convert some of the old-growth forest to early-to mid-successional, regulated forests.

Diameter at breast height (DBH)

The diameter of the stem of a tree measured at breast height (4 feet, 6 inches from ground level).

Discharge

The volume of water moving past a given point on a stream or river over a given period of time, often expressed as cubic feet per second (CFS) in hydrology, or as millions of gallons per day (MGD) in engineering.

Discount rate

The rate used to adjust future benefits or costs to their present value.

Dispersal

The movement, usually one way, of plants and animals from their point of origin to another location where they subsequently produce offspring.

Dispersed recreation

The type of recreation use that requires few, if any, improvements and may occur over a wide area. This type of recreation involves activities related to roads, trails, and undeveloped waterways and beaches. The activities do not necessarily take place on or adjacent to a road, trail, or waterway, only in conjunction with it. Activities are often day-use oriented and include hunting, fishing, boating, off-highway vehicle use, hiking, and others.

Dissected landforms

A physical, recognizable form or feature of the earth's surface such as a mountain, hill, or valley, having a characteristic shape, that in part is the result of several shallow or deeply incised drainage channels.

Dissolved oxygen

The amount of free (not chemically combined) oxygen in water.

Distance zone

Areas of landscapes denoted by specified distances from the observer (foreground, middleground, or background). Used as a frame of reference in which to discuss landscape characteristics of management activities. (Also see the definitions for foreground, middleground, and background.)

Distinct population segment (DPS)

A DPS, or a distinct population segment, is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The Endangered Species Act provides for listing species, subspecies, or distinct population segments of vertebrate species.

Disturbance

A force that results in changes in the structure and composition through natural events such as wind, fire, flood, avalanche, or mortality caused by insect or disease outbreaks, or by human caused events (e.g., timber harvest).

Any relatively discrete event in time that disrupts ecosystem, watershed, community, or species population structure and/or function and changes resources, substrate availability, or the physical environment (36 CFR 219.19).

Diversity

See biological diversity.

Draft Environmental Impact Statement (DEIS)

The version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA) and released to the public and other agencies for review and comment.

E

Easement

An interest or right in land owned by another that entitles its holder to a specific limited use.

Easement (special uses)

A type of special use authorization (usually granted for linear rights-of-way) that is used in those situations where a conveyance of a limited and transferable interest in National Forest System land is necessary or desirable to serve or facilitate authorized long-term uses, and that may be compensable according to its terms (36 CFR 251.51).

Ecological integrity

The quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence (36 CFR 219.19).

Ecological provinces

See biogeographic provinces.

Ecological sections

Ecosystems may be subdivided into ecological sections that consist of ecological subsections (see “Ecological Subsection”). There are 14 ecological sections on the Tongass National Forest.

One mapping level of the National Hierarchical Framework of Ecological Units which delimits areas of different biological and physical potentials at varying geographical scales ranging from global to local. Ecological sections areas delimited at the sub regional scale and are characterized by combinations of climate, geomorphic processes, topography and stratigraphy that influence moisture availability and exposure to radiant solar energy, which in turn directly control hydrologic function, soil forming processes, and potential plant community distributions. Sections and subsections are the two ecological units mapped at this scale. Sections are broad areas of similar geomorphic process, stratigraphy, geologic origin, drainage networks, topography and regional climate. Such areas are often inferred by relating geologic maps to potential natural vegetation (series) groups as mapped by Kuchler (1964). The Tongass is divided into 14 ecological subsections, which are smaller areas of sections having similar surficial geology, lithology geomorphic processes; soil groups sub regional climate and potential natural communities (USDA 1993).

Ecological sustainability

See sustainability.

Economic sustainability

See sustainability.

Economically viable young-growth timber

On the Tongass National Forest, the Two-Log Rule was developed to better predict when stands reach a condition where economic harvest opportunities may exist prior to stands reaching culmination of mean annual increment (CMAI) of growth. The Two-Log Rule implies at least half of the merchantable volume within a stand is comprised of trees with two or more logs. A “two-log” tree is defined as trees that are at least nine inches diameter at breast height, six inches in diameter at the small end and contains a minimum of two logs that are at least 34 feet long.

Ecosystem

A spatially explicit, relatively homogenous area that includes all interacting organisms and the abiotic environment components. An ecosystem can be of various sizes (e.g., a log, a pond, a forest, or the earth’s biosphere).

An ecosystem is commonly described in terms of its:

1. Composition. The biological elements within the different levels of biological organization, from genes and species to communities and ecosystems.

2. Structure. The organization and physical arrangement of biological elements such as, snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity.

3. Function. Ecological processes that sustain composition and structure, such as energy flow, nutrient cycling and retention, soil development and retention, predation and herbivory, and natural disturbances such as wind, fire, and floods.

4. Connectivity. See connectivity (ecosystem) above.

Ecosystem management

Management guided by explicit goals, executed by policies, protocols, and practices and adapted through monitoring and research to sustain the composition, structure, and function over the long term.

Ecosystem services

Ecosystem services include the full suite of goods and services that are vital to human health and livelihood provided by ecosystems—in this case, ecosystems on the Tongass National Forest.

Benefits people obtain from ecosystems, including:

1. Provisioning services, such as clean air and fresh water, energy, food, fuel, forage, wood products or fiber, and minerals;

2. Regulating services, such as long-term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood and drought control; and disease regulation;

3. Supporting services, such as pollination, seed dispersal, soil formation, and nutrient cycling; and

4. Cultural services, such as educational, aesthetic, spiritual, and cultural heritage values, recreational experiences, and tourism opportunities.

Ecotone

A transition or junction zone between two or more naturally occurring diverse plant communities (ecosystems).

An edge habitat (Helms 1998).

Edge effect

The effect of adjoining vegetative communities on the population structure along the margin, which provides for greater numbers of species and higher population densities than either adjoining community. Edge may also result in negative effects, since habitat along the edge is different than within the patch, reducing the effective area of the habitat patch.

The modified environmental conditions or habitat along the margins (edges) of forest stands or patches (Helms 1998).

Effect

In Cultural Resources, the potential of an undertaking to alter the characteristics that may qualify a property for inclusion in the National Register of Historic Places.

Heritage Resources: An "effect" means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register of Historic Places. [36 CFR § 800.16(i)] Adverse effects may include direct, indirect, or cumulative effects.

Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. [36 CFR § 800.5(a)(1)] Indirect effects may change the character of the property's use or physical features within the property's setting that contribute to its historic significance; are often audible, atmospheric, and visual effects; and may relate to viewshed issues.

A direct effect to a historic property would include demolition of a historic building, major disturbance of an archaeological site, or any other actions that occur to the property itself.

Effects

Environmental effects and impacts as used in the Council on Environmental Quality's (CEQ) regulations (40 CFR parts 1508.7 and 1508.8) implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. parts 4321 *et seq.*) are synonymous and include:

Direct effects, which are caused by the action and occur at the same time and place;

Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable; and

Cumulative impact, which is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

Emergent

A plant rooted in shallow water and having most of its vegetation above water (e.g., cattails).

Encumbrance

A claim, lien, charge, or liability attached to and binding real property (Black 1979).

Endangered species

Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Any species that the Secretary of the Interior or the Secretary of Commerce has determined is in danger of extinction throughout all or a significant portion of its range. Endangered species are listed at 50 CFR sections 17.11, 17.12, and 224.101 (FSM 1090.12).

Endemic

Living in or restricted to a particular locality. In this document the term endemic is used in two ways. First, it is used to describe plant and animal species, subspecies, or lineages that are native and restricted in their distribution to an island, a portion of Southeast Alaska, or Southeast Alaska. Second, it is used to describe a type of windthrow event that is a very localized windthrow event, where individual trees are blown over (see the definition for Windthrow in this Glossary).

Indigenous to (native) or characteristic of a particular restricted geographical area (Helms 1998).

Endemism

The ecological state of a species being unique to a defined geographic location, such as an island or other defined zone or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.

Enhance

To improve, reinforce, enrich, or strengthen the existing condition, value, or beauty of a resource.

Entitlement

Right to benefits, income, or property that may not be abridged without due process.

Environment

All the conditions, circumstances, and influences surrounding and affecting the development of an organism, or group of organisms.

Environmental analysis

An analysis of alternative actions and their predictable short- and long-term environmental effects, incorporating the physical, biological, economic, social, and environmental design arts and their interactions.

Environmental assessment (EA)

A concise public document that provides sufficient evidence and analysis for determining whether to prepare an, environmental impact statement (EIS) or a finding of no significant impact, aids an agency's compliance with the NEPA when no EIS is necessary, and facilitates preparation of a statement when one is necessary (40 CFR 1508.9; FSH 1909.15, chapter 40). (36 CFR 219.62).

Environmental document

An environmental assessment, environmental impact statement, finding of no significant impact, categorical exclusion, and notice of intent to prepare an environmental impact statement. (36 CFR 219.19)

Environmental impact

Used interchangeably with environmental consequence or effect.

Environmental Impact Statement (EIS)

A document prepared by a federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. A federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form, and then in a final form. An impact statement includes the following points: 1) the environmental impact

of the proposed action, 2) any adverse impacts that cannot be avoided by the action, 3) the alternative courses of actions, 4) the relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity, and 5) a description of the irreversible and irretrievable commitment of resources that would occur if the action were accomplished.

A detailed written statement as required by section 102(2)(C) of the National Environmental Policy Act of 1969 (40 CFR 1508.11; 36 CFR 220) (36 CFR 219.62).

Epikarst

The upper surface of karst, consisting of a network of intersecting fissures and cavities that collect and transport surface water and nutrients underground; epikarst depth can range from a few centimeters to tens of meters.

Ephemeral stream

A stream, or a portion of a stream, that does not flow year round, but only when (a) it receives base flow during wet periods, or (b) when it receives groundwater discharge or protracted contributions from melting snow or other erratic surface or subsurface sources.

A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all other times above the zone of saturation.

Erosion

The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities.

Escapement

Adult anadromous fish that escape from all causes of mortality (natural or human-caused) to return to streams to spawn.

Essential fish habitat (EFH)

Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity for federally managed species as per 50 CFR 600, “Magnuson-Stevens Act Provisions.” For the purpose of interpreting the definition of essential fish habitat: “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities, “necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and “spawning, breeding, feeding growth to maturity” covers a species full life cycle.

Estuary

An ecological system at the mouth of a stream where fresh water and salt water mix, and where salt marshes and intertidal mudflats are present. The landward extent of an estuary is the limit of salt-intolerant vegetation, and the seaward extent is a stream’s delta at mean low water.

The seaward end or the widened funnel-shaped tidal mouth of a river or stream where fresh water comes into contact with seawater and where tidal effects are evident; e.g. a tidal river, or a partially enclosed coastal body of water where the tide meets the current of a stream (Haskins 1998).

Evapotranspiration

The sum total of water lost from the land by evaporation and plant transpiration. Transpiration is loss of water in vapor form from a plant.

The conversion of water, whether surface water, soil moisture (both by evaporation), or within plants (by transpiration) into water vapor that is released into the atmosphere – note: potential evapotranspiration can be estimated from simplified heat energy considerations of readily measured meteorological

phenomena; actual evapotranspiration may be the result of various factors, e.g., restricted water supplies or plant physiological processes modifying that potential (Helms 1998).

Even-aged management

A regeneration method that result in the creation of stands comprised of a single age class in which tree ages are usually +/- 20 percent of rotation. Clear cut, shelterwood, or seed tree cutting methods produce even-aged stands.

Exchange

See Land Exchange

Executive Order

An order or regulation issued by the President or some administrative authority under his direction.

Existing data search

A systematic check and evaluation of available records, documents, and informant sources to gather information pertinent to cultural resources within a given area.

Existing scenic integrity (ESI)

Current state of the landscape, considering previous human alterations. ESI levels are as follows:

Very High. Landscapes where the landscape character is intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.

High. Landscapes where the landscape character "appears" intact. Deviations may be present but repeat form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.

Moderate. Landscapes where the landscape character "appears slightly altered." Noticeable deviations remain visually subordinate to the landscape being viewed.

Low. Landscapes where the landscape character "appears moderately altered." Deviations begin to dominate the landscape character being viewed, but borrow attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed.

Very Low. Landscapes where the landscape character "appears heavily altered." Deviations may strongly dominate the landscape character. They do not borrow from attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed.

Unacceptably Low. Landscapes where the landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little, if any, form, line, color, texture, pattern, or scale from the landscape character.

F

Facility

Structures needed to support the management, protection, and use of the National Forests, including buildings, utility systems, dams, and other construction features. There are three types of facilities: recreation, administrative and authorized.

Falldown

The difference between the number of acres planned for timber harvest and those actually harvested, usually experienced as a reduction in acres. Falldown results from many factors, including unmapped

unsuitable timber land, newly available information, and project-level consideration of site-specific issues and non-timber resource needs. (Also see the definition for Management Implementation Reduction Factor.)

Federal Advisory Committee Act (FACA)

A law (Public Law 92-463) passed by Congress on October 6, 1972 to create an orderly procedure by which Federal agencies may seek advice and assistance from citizens and experts, and to promote meaningful public participation in government decisions. A federal agency must comply with FACA when it: establishes, utilizes, controls, or manages a group with non-federal members that provides the agency with consensus advice or recommendations.

Federally recognized Indian tribe

An Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a.

An Indian tribe, band, nation, or other organized group or community, including a native village, regional corporation or village corporation, as those terms are defined in Section 3 of the Alaska Native Claims Settlement Act (43 U.S.C. 1602)(ANCSA), which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

Fen

A nutrient medium peatland ecosystem dominated by sedges and brown mosses, where mineral-bearing groundwater is within the rooting zone and meneratrophic plant species are common.

A peat-accumulating wetland that receives some drainage from surrounding mineral soils and usually supports marsh-like vegetation including sedges, rushes, shrubs and trees – note: fens are less acidic than bogs and derive most of their water from groundwater rich in calcium and magnesium as well as other nutrient rich water sources (Helms 1998).

Fine filter

An approach used for wildlife conservation management and analysis which focuses on individual species and their habitat needs. (Also see the definition for coarse filter.)

Fire suppression

All work and activities connected with fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fiscal Year (FY)

October 1 to September 30. The Fiscal Year is referred to by the calendar year, which begins on January 1. For example, October 1, 1996, to September 30, 1997, is referred to as Fiscal Year 1997.

Fish passage

The ability of both adult and juvenile fish to move both up and down stream.

Flash flooding

A very rapid responding, relatively high streamflow overtopping the banks in any reach of a stream.

Flood plain

The level or nearly level land with alluvial soils on either or both sides of a stream or river that is subject to overflow flooding during periods of high water.

Fluvial

1. Of, or pertaining to, streams and rivers.
2. Growing or living in streams or ponds.
3. Produced by river or stream action, as a fluvial plain (Helms 1998).

Foodfish

Fish consumed by humans.

Footslope

The inner, gently inclined surface at the base of a hill or mountain slope. The surface profile is dominantly concave, and is the transition zone between upslope erosional sites and downslope depositional sites.

Forbs

A grouping/category of broad-leaved herbaceous plants that are not included in the grass, shrub, or tree groupings/categories; generally smaller flowering plants.

Foreground

The visible area within 0.5 mile of a visual priority route.. (See the definitions for background and middleground.)

Forest development road

See the definition for National Forest System road.

Forest Facility Master Plan

The plan that depicts the development and management of the Forest's facilities. This includes current volume of business and projections for the future, locations for needed skills to perform program work, existing administrative sites and proposed locations of new sites, and management strategies concerning consolidation or sharing services between units (FSM 7312.1).

Forest health

The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance.

Forest Plan

Source of management direction for an individual forest, specifying activity and output levels for a period of 10 to 15 years. Management direction in the Forest Plan is based on the issues identified at the time of the plan's development.

Forest road or trail

A road or trail wholly or partly within or adjacent to and serving the National Forest System (NFS) that the Forest Service determines is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources (36 CFR 212.1).

Forest transportation atlas

A display of the system of roads, trails, and airfields of an administrative unit (36 CFR 212.1).

Forest transportation facility

A forest road, trail, or airfield that is displayed in a forest transportation atlas, including bridges, culverts, parking lots, marine access facilities, safety devices, and other improvements appurtenant to the forest transportation system (36 CFR 212.1).

Forest transportation system

The system of National Forest System (NFS) roads, trails, and airfields on NFS lands (36 CFR 212.1).

Forest transportation system management

The travel planning, analysis, designation of roads, trails, and areas for motor vehicle use, recordkeeping, scheduling, construction, reconstruction, maintenance, decommissioning, and other operations undertaken to achieve environmentally sound, safe, cost-effective, access for use, enjoyment, protection, administration, and management of NFS lands.

Forested land

Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest uses. Lands developed for non-forest use include areas for crops, improved pasture, residential or administrative areas, improved roads of any width and adjoining road clearing, and power line clearings of any width (36 CFR 219.19).

Forested wetland

A wetland whose vegetation is characterized by an overstory of trees at least 10 percent occupied by forest trees, which are 20 feet or taller.

Forest Service Handbook (FSH)

Handbooks are the principal source of specialized guidance and instruction for carrying out the direction issued in the Forest Service Manual (FSM). Specialists and technicians are the primary audience of Handbook direction. However, some FSHs include significant procedural direction needed by line officers and/or primary staff officers; examples include Handbooks on land management planning, appeals, litigation, and environmental analysis. Handbooks may also incorporate external directives (such as the Federal Property Management Regulations in FSH 6409.31) with related USDA and Forest Service directive supplements.

Forest Service Manual (FSM)

Manuals contain legal authorities, objectives, policies, responsibilities, instructions, and guidance needed on a continuing basis by Forest Service line officers and primary staff in more than one unit to plan and execute assigned programs and activities.

Fragmentation

The process by which a landscape is broken into smaller patches of forest within a mosaic of other forms of land use or ownership.

Free use permit

A permit that allows the removal of timber or other resources from public lands free of charge.

Fuel

The organic materials that will support the start and spread of a fire: duff, litter, grass, weeds, forbs, brush, trees, dead woody materials.

Function

A term in ecology referring to the interactions and influences between plant and animal species within an area (how each species uses its environment), and to natural processes of change or disturbance (such as wind or aging).

One of the three components used to define and describe Ecosystems (see definition above). An ecosystem function is an ecological process that sustains composition and structure, such as energy flow, nutrient cycling and retention, soil development and retention, predation and herbivory and natural disturbances such as wind, fire, and floods (FSM 1909.12).

G

Game Management Unit

Geographical areas defined by the Alaska Department of Fish and Game to manage wildlife populations. Legal hunting and trapping regulations govern each unit.

Genetic descendant

A person known or reliably assumed to have a genetic relationship to a deceased person.

Glacial refugia

The areas of Southeast Alaska that were not covered by glaciers during the last ice age.

Glacial rivers and streams

Rivers and streams that receive their main flow characteristics from the presence and activities of ice and glaciers and their meltwater.

Glide or placid streams

Grouping of channel types that have fairly consistent physical characteristics occurring on lowland landforms and are mostly associated with bogs, marshes, or lakes.

Goal

A concise statement that describes a desired future condition normally expressed in broad, general terms that are timeless, in that there is no specific date by which the goal is to be achieved.

Optional plan components that are broad statements of intent, other than desired conditions, usually related to process or interaction with the public. Goals are expressed in broad, general terms, but do not include completion dates (36 CFR 219.7(e)(2)).

Goods and services

The various outputs and on-site uses produced from forest resources.

Groundwater

Water within the earth that supplies wells and springs. Specifically, water in the zone of saturation where all openings in soils and rocks are filled; the upper surface level forms the water table.

The subsurface water in both phreatic (saturated) and vadose (unsaturated) zone water at a pressure equal to or greater than atmospheric that is free to move under the influence of gravity. Note: ground water is recharged by infiltration and enters streams through seepage and springs (Helms 1998).

Group selection

An uneven aged regeneration method in which trees are removed and new age classes are established in small groups where the widths of groups are commonly approximately twice the height of the mature

trees. Note: the management unit or stand in which regeneration growth and yield are regulated consists of an aggregation of groups.

Growing stock

All trees growing in a forest or in a specified part of it, usually commercial species, meeting specified standards of size, quality, and vigor, and generally expressed in terms of trees per acre, density, or volume.

Guideline

A preferred or advisable course of action or level of attainment designed to promote achievement of goals and objectives.

A constraint on project and activity decision-making that allows for departure from its terms, so long as the purpose of the guideline is met (36 CFR 219.15(d)(3)). Guidelines are established to help achieve or maintain a desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

H

Habitat

The sum total of environmental conditions of a specific place occupied by wildlife or plant species or a population of each species.

1. A unit area of environment. 2. The place, natural or otherwise, (including climate, food, cover and water) where animal, plant, or populations naturally or normally lives and develops (Helms 1998).

Habitat capability

The estimated maximum number of fish or wildlife that can be supported by the amount and distribution of suitable habitat in an area.

Hard snags/soft snags

Terminology used to describe the state of the decay process in dead trees. Hard snags are dead trees that have little decay and are generally still merchantable. Soft snags are dead trees that have a considerable amount of decay and are generally soft, broken, non-merchantable wood.

Haul out

Areas used by marine mammals for resting and other social/biological activities that occur in the intertidal zone.

Heritage resources

The physical remains of districts, sites, structures, buildings, networks, events, or objects used by humans in the past. They may be historic, prehistoric, architectural, or archival in nature. Heritage resources are non-renewable aspects of our national heritage.

Also referred to as Cultural Resources. Heritage resources are associated with sites of human activities or events. According to the Glossary of National Register Terms in National Register Bulletin No. 16A, site means "location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archaeological value regardless of any existing structure." Heritage resources include archaeological features, sites and districts, artifacts, historic structures and buildings, cultural and ethnographic landscapes, sacred sites and cemeteries, and traditional cultural properties, and may have both tangible and intangible qualities. Effects considered under NEPA include cultural resources and historic [40 CFR 1508.8] without regard to their National Register eligibility.

Highway legal vehicle

Any motor vehicle that is licensed or certified for general operation on public roads within the State of Alaska.

Historic property

Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. The term includes artifacts, records, and remains that are related to and located within such properties.

Properties of religious and cultural significance to Indian tribes and Native Hawaiian organizations may be determined to be eligible for inclusion in the National Register. [16 U.S.C. 470a(d)(6)(A)] See also Heritage Resources.

Horizontal distance

Distance measured in a flat (horizontal) manner at zero angle.

Human remains

The physical remains of human bodies.

Humus

Black or brown organic material of complex composition that is the end-product of microbial breakdown of plant and animal residues at the soil surface.

Hunter day

One hunter day is equivalent to one person hunting for any length of time during a 24-hour period.

Hydrologic cycle

The complete cycle through which water passes, commencing as atmospheric water vapor, passing into liquid and solid form as precipitation, thence along or into the ground surface, and finally again returning to the form of atmospheric water vapor by means of evaporation and transpiration. Also called Water Cycle.

Impacts

See effects.

Improvements

Includes any structures of a permanent nature placed upon the land that tend to increase its value.

Incision Depth

Stream channel incision depth is the vertical distance between the channel bottom at the thalweg and the first significant slope break occurring above the bankfull stage point.

Intermittent stream

A stream, or a portion of a stream, that flows only in direct response to precipitation, receiving little or no water from springs and no long continuous supply from snow or other sources, an whose channel is at all times above the water table. See ephemeral stream.

Indian religious practitioner

In Southeast Alaska, a Shaman or religious leader, or specific elder, that is identified by the appropriate tribal authority (tribal government or council) as the appropriate knowledgeable or authoritative person regarding the sacredness of a location.

Industrial wood

All commercial roundwood products, except fuelwood.

Infrastructure

The facilities, utilities, and transportation systems needed to meet public and administrative needs.

Inherent capability

Recreation capability for the physical, social, and managerial setting for recreation, based on remoteness from modern human development and activity, modification of the land, and social factors such as crowding.

The ecological capacity or ecological potential of an area characterized by the interrelationship of its physical elements, its climatic regime, and natural disturbances (36 CFR 219.19).

Integrated pest management (IPM)

Integrated pest management, or IPM, is a long-standing, science-based, decision-making process that identifies and reduces risks from pests and pest management related strategies. It coordinates the use of pest biology, environmental information, and available technology to prevent unacceptable levels of pest damage by the most economical means, while posing the least possible risk to people, property, resources, and the environment. IPM provides an effective strategy for managing pests in all arenas from developed residential and public areas to wild lands. IPM serves as an umbrella to provide an effective, all encompassing, low-risk approach to protect resources and people from pests.

Integrated resource management

Multiple use management that recognizes the interdependence of ecological resources, and is based on the need for integrated consideration of ecological, social, and economic factors. (36 CFR 219.19)

Inter

To place in a grave or tomb.

Interception

The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrubs, and other vegetation, and lost by evaporation, never reaching the surface of the ground. Interception equals the precipitation on the vegetation minus stemflow and through fall.

Interdisciplinary Team (IDT)

A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view and a broader range of expertise to bear on the problem.

Interest

A general term to denote a right, claim, title, or legal share in real estate (Black 2015).

Interior old-growth forest

The region of a forested stand that has a stable microclimate relative to light, wind, humidity, moisture regime, etc. Natural forest ecotones (see definition for ecotone) “seal” a forest’s edge and stabilize these microclimate features. Ecotones created by management such as the old growth, clearcut edge may have “edge” effects that extend into a forest for several hundred feet (estimated 2 to 3 tree heights) before stable “interior forest” conditions are achieved and microclimatic effects of the edge are no longer evident.

Invasive species

A species that is non-native (or alien) to the habitat under consideration and 2) whose purposeful or accidental introduction causes, or is likely to cause, economic or environmental harm or harm to human health (Executive Order 13112).

An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. A species that causes, or is likely to cause, harm and that is exotic to the ecosystem it has infested. Invasive species infest both aquatic and terrestrial areas and can be identified within any of the following four taxonomic categories: Plants, Vertebrates, Invertebrates, and Pathogens (Executive Order 13112).

Inventoried roadless area (IRA)

An undeveloped area typically exceeding 5,000 acres that meets the minimum criteria for Wilderness consideration under the Wilderness Act.

Areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps. (36 CFR 294.11).

Invertebrates

Animals without backbones. Land invertebrates include insects, snails, and slugs; freshwater invertebrates include aquatic insects; and marine invertebrates include crab, shrimp, and clams.

Irretrievable commitments

A term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible commitments

A term that describes the loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time.

Issue

A point, matter, or section of public discussion or interest to be addressed or decided.

J

Jurisdiction over a forest transportation facility

The legal right to control or regulate use of a forest transportation facility derived from title, an easement, an agreement, or other similar source.

K

Karst

A type of topography that develops in areas underlain by soluble rocks, primarily limestone. Dissolution of the subsurface strata results in areas of well-developed, surface drainage that are sinkholes, collapsed channels, or caves.

L

Lacustrine wetland

Includes permanently flooded lakes and reservoirs, intermittent lakes, and tidal lakes with ocean-derived salinities of less than 0.5 percent. Typically, there are extensive areas of deep water and there is considerable wave action.

Land allocation

The decision to use land for various resource management objectives to best satisfy the issues, concerns, and opportunities, and meet assigned forest output targets.

Land exchange

The conveyance of non-federal land or interests to the United States in exchange for National Forest System land or interests in land.

A land adjustment transaction whereby the United States trades federal land, interests in land, and/or timber for not less than equal value of non-Federal land and/or interests in land needed for National Forest purposes, or programs. Some exchanges provide for cash equalization to equalize values.

Land Use Designation (LUD)

A defined area of land specific to which management direction is applied.

Defined areas of the Forest that are allocated for different uses or activities and have the same set of applicable plan components, but do not have to be spatially contiguous. (36 CFR 219.19)

Landform

Any physical, recognizable form or feature of the earth's surface, having a characteristic shape, and produced by natural causes. Major forms included are plains, plateaus, and mountains; minor forms are hills, valleys, slopes, eskers, and dunes.

Landing

A cleared area to which logs or trees are transported for loading onto trucks for transport to a mill or log transfer facility. Barges are sometimes used for landings in Southeast Alaska.

Landscape

A heterogeneous land area with interacting ecosystems that are repeated in similar form throughout [Forest Ecosystem Management Assessment Team (FEMAT)].

A defined area irrespective of ownership or other artificial boundaries, such as a spatial mosaic of terrestrial and aquatic ecosystems, landforms, and plant communities, repeated in similar form throughout such a defined area (36 CFR 219.19).

A cultural landscape is defined as an area which includes both cultural and natural resources associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

Landslides

The moderately rapid to rapid downslope movement of soil and rock materials that may or may not be water-saturated.

Large woody debris (LWD)

Any piece of relatively stable woody material, having a diameter of 4 inches or greater and a length greater than 3 feet, that intrudes into a stream channel. Formerly called large organic debris.

A term used to describe logs, tree boles, rootwads, and limbs that are in, on or near the stream channel, having a diameter of 4 inches or greater and a length equal to or greater than 3 feet, that intrudes into a stream channel.

Leasable minerals

Generally includes minerals such as coal, oil, gas, phosphate, sodium, potassium, oil shale, sulfur, and geothermal steam.

Lease

A type of special use authorization (usually granted for uses other than linear rights-of-way) that is used when substantial capital investment is required and when conveyance of a conditional and transferable interest in National Forest System lands is necessary or desirable to serve or facilitate authorized long-term uses, and that may be revocable and compensable according to its terms.

Leave strips

A narrow band of forest trees left between cutting units.

Legacy trees

A tree, usually mature or old growth that is retained on a site after harvesting or natural disturbance to provide a biological legacy.

Locatable minerals

Includes minerals such as gold, silver, lead, zinc, copper, and mercury.

Log transfer facilities (LTF)

Log transfer facilities include the site and structures used for moving logs and timber products from land-based transportation forms to water-based transportation forms (or vice versa).

Logging residue (logging slash)

The unused portion of trees cut during logging and left in the woods.

Logging systems

Ground Based. A system of log transportation in which logs are pulled from the woods to a landing by means of a crawler tractor, skidder, or similar ground-based equipment.

High-lead. A system of cable logging in which the working lines are elevated at the landing area by a rigged wooden tree or portable steel spar.

Skyline. A system of cable logging in which all or part of the weight of the logs is supported during yarding by a suspended cable.

Helicopter. A system of transporting logs from the woods to a landing as an external load on a helicopter.

Long-term sustained yield (LTSY) timber capacity

The highest uniform wood yield that may be sustained under specific management intensity consistent with multiple use objectives on lands being managed for timber production.

M

Macrophytes

Any plant species that can be readily observed without the aid of optical magnification.

Major culvert

A culvert that provides an opening of more than 35 square feet in a single installation or in a multiple installation in which the smallest opening is more than 19 square feet.

Managed stand

A forested stand whose natural structure has been purposely altered through some regeneration or stocking control treatment.

Management action

A set of management activities applied to a land area to produce a desired output.

Management approach

Optional content in the Forest Plan that describes the principal strategies and program priorities the Responsible Official intends to employ to carry out projects and activities developed under the plan. The management approaches can convey a sense of priority and focus among objectives and the likely management emphasis. Management approaches should relate to desired conditions and may indicate the future course or direction of change, recognizing budget trends, program demands and accomplishments. Management approaches may discuss potential processes such as analysis, assessment, inventory, project planning, or monitoring.

Management area

Combinations of adjacent Value Comparison Units having common management direction, as defined in the 1979 Tongass Land Management Plan.

A land area identified within the planning area that has the same set of applicable plan components. A management area does not have to be spatially contiguous (36 CFR 219.19).

Management concern

An issue, problem, or condition that constrains the range of management practices identified by the Forest Service in the planning process.

Management direction

A statement of multiple-use and other goals and objectives, the associated land use prescriptions, and standards and guidelines for attaining them.

A document or set of documents that provide management direction for an administrative unit of the National Forest System developed under the requirements of the land management planning regulation at 36 CFR part 219 or a prior planning rule (36 CFR 219.19).

Management Indicator Species

Plant or animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation to assess the effects of management activities on their populations and the populations of other species with similar habitat needs that they may represent.

Management practices

The activities applied to a defined area of land (land use designation as defined in the Forest Plan) to attain multiple-use and other goals and objectives.

Management prescription

Management practices and intensity selected and scheduled for application on a specific area (e.g., a land use designation) to attain multiple-use and other goals and objectives.

Mariculture

The cultivation of plants and animals in saltwater, with no freshwater component. Mariculture does not include anadromous fish farming.

Marine access facility (MAF)

An area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, log transfer facility, boat ramp, or a combination of these.

Marine access point

An area that is used by humans to transfer items to saltwater generally where there is a trail that leads to saltwater and that has no associated structures.

Maritime climate

Weather conditions controlled by an oceanic environment characterized by small annual temperature ranges and high precipitation.

Mass-wasting

A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly from one place to another. Also, mass movement.

Matrix

A term used in the Old-growth habitat conservation strategy that refers to the lands with LUD allocations where commercial timber harvest may occur.

Mean annual increment (MAI)

The total increment of a tree or stand, up to a given age in years, divided by that age.

Mean high tide

The average of all high tides, especially over a period of 18.6 years. (Black's Law Dictionary, 7th ed.)

Memorandum of Agreement (MOA)

Under the authority of 36 CFR 800 an MOA with the State Historic Preservation Office (SHPO) is required if historic properties that are eligible for the National Register of Historic Places are to be adversely affected by an undertaking. An MOA created under 36 CFR 800 is not a fund obligating document.

Memorandum of Understanding (MOU)

An agreement between the Forest Service and other agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project. A memorandum of understanding is not a fund obligating document.

Microclimate

The temperature, moisture, wind, pressure, and evaporation (climate) of a very small area that differs from the general climate of the larger surrounding area.

Microsale

A microsale is a timber sale proposed by a prospective purchaser consisting of dead or down timber of approximately 50 thousand board feet (MBF) or less and the District Ranger agrees to offer for bidding.

Middleground

The visible area between foreground and background of a visual priority route. (See the definitions for foreground and background.)

Million board feet (MMBF)

One million board feet of timber (see the definition for board foot).

A measurement of the number of millions of board feet of timber. The letter "M" is borrowed from Roman numerals, but instead of "MM" representing the value 2,000, the industry treats them as variables in algebra and interprets them based on the rules of mathematics (where two adjacent variables are multiplied), thus the product is 1 million (1,000 times 1,000) board feet of timber.

Mineral development

The activities and facilities associated with extracting mineral deposits.

Mineral entry

Filing a mining claim on public land to obtain the right to mine any minerals it may contain. Also the filing for a mill site on federal land for the purpose of processing off-site minerals.

Mineral exploration

The search for valuable minerals on lands open to mineral entry.

Mineral lease

A lease that authorizes the development and production of leasable minerals from public lands.

Mineral production

The extraction of mineral deposits.

Mineral rights

The rights of one who owns the mineral estate (subsurface).

Mineral soils

Soils consisting predominantly of, and having its properties determined by, mineral matter. These soils usually contain less than 20 percent organic matter, but can contain an organic surface layer up to within 20 inches of the surface.

Mineral withdrawal

A formal designation by the Secretary of Interior that precludes entry or disposal of mineral commodities under the mining and/or mineral leasing laws.

Mining claims

A geographic area of the public lands held under the general mining laws in which the right of exclusive possession is vested in the locator of a valuable mineral deposit.

Mitigate

Take action to alleviate potential adverse effects of natural or human caused disturbances. For example, to lessen or minimize an adverse effect upon a cultural resource listed on or eligible for the National Register of Historic Places. The two categories of mitigation most often used for cultural resources are project modification and data recovery. Also to lessen or minimize an adverse effect upon a listed plant and animal species or on any resource.

To avoid, minimize, rectify, reduce, or compensate the adverse environmental impacts associated with an action.

Mixed conifer

In Southeast Alaska, mixed conifer stands usually consist of the following species: western hemlock, mountain hemlock, and yellow-cedar, redcedar, and Sitka spruce. Shorepine may occasionally be present depending on individual sites. Redcedar is not usually in mixed conifer stands on the central and northern portions of the Tongass. Mixed conifer sites indicate poor drainage and/or shallow soils.

Model

An idealized representation of reality developed to describe, analyze, or understand it; a mathematical representation of the relationships under study (e.g., Woodstock, wildlife habitat capability models).

Model Implementation Reduction Factor (MIRF)

An adjustment made to the timber outputs of the computer model to account for anticipated effects on timber availability that cannot be accounted for in the computer model. (Also see the definition for falldown.)

Moderately well-drained soil

Water in these soils is removed from them somewhat slowly, so that the profile is wet for a small, but significant, part of the time.

Moisture regime

The variation of moisture content in a specified portion of soil during the year.

Monitoring

Gathering information and observing results of management activities to provide a basis for the periodic evaluation of the Forest Plan.

A systematic process of collecting information to evaluate effects of actions or changes in conditions or relationships (36 CFR 219.19).

Motor vehicle

Any vehicle that is propelled by a motor, other than:

a. A vehicle operated on rails; and

b. Any wheelchair or mobility device, including one that is battery-powered, designed solely for use by a mobility-impaired person for locomotion, and suitable for use in an indoor pedestrian area (36 CFR 212.1).

Motor vehicle use map (MVUM)

A map reflecting designated roads, trails, and other areas for motorized use on an administrative unit or a Ranger District of the National Forest System (36 CFR 212.1).

Motorized mixed use

Designation of a National Forest System road for use by both highway-legal and non-highway-legal motor vehicles.

Multi-aged (multi-cohort) stands

A stand with two or more age classes or cohorts.

Multiple use

The management of all the various renewable surface resources of the National Forest System so that they are used in the combination that will best meet the needs of the American people; harmonious and

coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources.

The management of all the various renewable surface resources of the National Forest System so that they are used in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output, consistent with the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528–531) (36 CFR 219.19).

Municipal Watershed

A watershed, designated on the Forest Plan Land Use Designation Map, which provides municipal water supplies. On the Tongass these include the municipal watersheds for Ketchikan, Petersburg, Sitka, Juneau, Wrangell, Kake, Klawock, Craig, and Hydaburg. Compare to public water supply definition.

Muskeg

Algonquin term for peatland. Usually applied to areas with sphagnum mosses, tussocky sedges, and an open growth of scrubby trees.

N

National Cooperative Soil Survey (NCSS)

A program consisting of a joint effort of cooperating Federal agencies, land-grant universities, and other state and local agencies to map soils, collect soil data, interpret the maps and data, and promote their use. Federal leadership is provided by the National Resource Conservation Service.

National Environmental Policy Act of 1969 (NEPA)

An act declaring a national policy to encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

National Forest Management Act (NFMA)

A law passed in 1976 that amends the Forest and Rangeland Renewable Resources Planning Act and requires the preparation of Forest Plans.

National Forest System (NFS) land

Federal lands that have been designated by Executive Order or statute as National Forests, National Grasslands, or Purchase Units, or other lands under the administration of the Forest Service.

National Forest System road

A forest road other than a road which has been authorized by a legally documented right-of-way held by a state, county, or local public road authority (36 CFR 212.1). The term “National Forest System road” is synonymous with the term “forest development road” as used in 23 U.S.C. 205.

National Forest System trail

A forest trail other than a trail which has been authorized by a legally documented right-of-way held by a state, county, or local public road authority (36 CFR 212.1).

National Historic Preservation Act

The National Historic Preservation Act (NHPA), 54 U.S.C. § 300101 et seq., is the primary federal law governing the preservation of cultural and historic resources in the United States.

National Marine Fisheries Service

An office of the National Oceanic and Atmospheric Administration that is responsible for the stewardship of the nation's ocean resources and their habitat with authorities under the Marine Mammal Protection Act and the Endangered Species Act.

National Register of Historic Places

A register of cultural resources of national, state, or local significance, maintained by the U.S. Department of the Interior.

Eligibility to the National Register requires certain criteria to be met. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: A. That are associated with events that have made a significant contribution to the broad patterns of our history; or B. That are associated with the lives of significant persons in or past; or C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D. That have yielded or may be likely to yield, information important in history or prehistory.

National Wild and Scenic River System

Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

Native selection

Application by Native corporations formed under authority of the Alaska Native Claims Settlement Act of 1971 (ANCSA - Public Law 92–203, 85 Stat. 688) and by Native individuals (under Section 14(h)(5), ANCSA) to the USDI Bureau of Land Management (BLM) for conveyance of a portion of lands withdrawn under ANCSA in fulfillment of Native entitlements established under ANCSA. Native village corporations had three years from the date of ANCSA (December 18, 1971) to make their selections and regional corporations had four years. Native individuals who met the criteria had two years from the date of ANCSA to make application under Section 14(h)(5). BLM regulations allowed Native corporations formed under ANCSA to select in excess of their entitlements to ensure sufficient land would be available to meet full entitlement. Remaining lands in excess of entitlement, which have been selected but not conveyed, will revert back to unencumbered National Forest System land status after full entitlement is reached.

Net public benefit

The overall long-term value to the Nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index.

Net sawlog volume

Trees suitable in size and quality for producing logs that can be processed into lumber.

Net willingness-to-pay

The amount that a person would have paid for an activity above and beyond what the person actually did pay for that activity.

Niche market

A small but profitable segment of a market suitable for focused attention by a marketer. Market niches do not exist by themselves, but are created by identifying needs and by offering products that satisfy them.

No-Action Alternative

The most likely condition expected to exist in the future if current management direction were to continue unchanged. There are two distinct interpretations of "no action" depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed.

The second interpretation of "no action" is illustrated in instances involving federal decisions on proposals for projects. "No action" in such cases would mean the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.

No adverse effect

A term used for cultural resources indicating the effect on a cultural resource would not be considered harmful to those characteristics that qualify the property for inclusion in the National Register.

See Effect

No effect

A term used in a Biological Assessment indicating there would be no effect whatsoever, either positive or negative, or any effects are highly improbable or insignificant.

Noncommercial species

Tree species that have no economic values at this time or anticipated timber value within the near future.

Non-declining even flow

A flow of goods or services from a forest that does not decrease in successive periods.

Non-development LUDs

Land use designations that do not permit commercial timber harvest.

Wilderness and Natural Setting LUDs make up the non-development LUDs. These LUDs are:

- Wilderness
- Wilderness National Monument
- Non-wilderness National Monument
- LUD II
- Remote Recreation
- Semi-Remote Recreation
- Old-Growth Habitat (except young-growth as allowed by Chapter 5 plan content)
- Municipal Watershed
- Research Natural Area
- Special Interest Area
- Wild River
- Scenic River
- Recreational River

Nonforest land

Land that has never supported forests and lands formerly forested but now developed for such non-forest uses as crops, improved pasture, etc. (see the definition for forestland).

Nonforest lands are lands that do not meet the definition of forest lands contained in 36 CFR 219.19. Thus, nonforest lands are less than 10 percent occupied by forest trees of any size or that formerly had such tree cover and are currently developed for nonforest uses. Land developed for nonforest uses

includes areas for agricultural crops, improved pasture, residential or administrative areas, improved roads of any width and adjoining road clearing, and powerline clearing of any width. Lands that were formerly occupied by tree cover, but do not presently have tree cover, should be identified as nonforest unless the land will be naturally or artificially regenerated into forest cover in the near future (example: clearcut lands).

Non-highway legal vehicle

Any motor vehicle that is not licensed or certified for general operation on public roads within the State of Alaska.

Non-interchangeable components (NIC)

Non-interchangeable components (NICs) are defined as increments of the suitable land base and their contribution to the Allowable Sale Quantity (ASQ) that are established to meet Forest Plan objectives. NICs are identified as parcels of land and the type of timber thereon, which are differentiated for the purpose of Forest Plan implementation. The total ASQ is derived from the sum of the timber volumes from all NICs. NICs cannot be substituted for each other in the timber sale program.

NIC I. Normal Operability: This is volume scheduled from suitable lands using existing logging systems. Most of these lands are expected to be economic under projected market conditions. On average, sales from these lands have the highest probability of offering a reasonable opportunity for a purchaser to gain a profit from his/her investment and labor. This is the best operable ground.

Normal operability includes those systems most frequently used on the Tongass. These systems are tractor, shovel, standard cable, and some helicopter.

Tractor. Tractor logging includes all ground wheel or track system used for skidding logs to a landing. Shovel yarding is included; however, tractor or rubber-tire skidding used in conjunction with swing operations are not included.

Standard Cable. The most typical logging systems used on the Tongass. Included in the standard cable system component are highlead uphill, highlead downhill, slackline, running skyline, and flyer.

Standard Helicopter. Helicopter yarding with yarding distances up to 0.75 mile.

NIC II. Difficult and Isolated Operability: This is volume scheduled from suitable lands that are available for harvest using logging systems not in common use in Southeast Alaska. Most of these lands are presently considered economically and technologically marginal.

Difficult operability includes those systems used on the Tongass that have significantly higher cost. These may include balloon, long-span skyline, multi-span, or helicopter with yarding distances greater than 0.75 mile. This category also includes lands that have limited access as a result of being isolated by prior harvest activities or other management activities.

Long Span Cable. Cable systems that require longer than average yarding distances. Typical long-span cable systems considered are standing skylines and multispan.

Helicopter. Helicopter yarding with distances between 0.75 mile and 2 miles.

Isolated Operability. This class is comprised entirely of isolated stands. These are small stands of isolated timber that are extremely difficult to harvest. The harvest system could vary, but would be more costly due to the location of the stand. Typical harvest systems are helicopter with average yarding distances greater than 2 miles.

Nonmarket value

Products derived from National Forest System resources that do not have a well-established monetary (market) value (e.g., wilderness and wildlife). (Noncash economic benefits.)

Nonpoint source (pollution)

Unlike point sources of water pollution, nonpoint sources are diffuse and can come from any land area. Nonpoint sources of water pollution originate from many undefinable sources such as agricultural and urban runoff, runoff from construction activities, and runoff from forestry practices. Nonpoint source pollutants are generally carried over or through the soil and ground cover via storm flow processes. The following activities are potential nonpoint sources of pollution: reforestation and subsequent silvicultural treatment, thinning, prescribed burning, pest and fire control, harvest operations, surface drainage, and road construction and maintenance from which there is natural runoff. Best Management Practices are recognized as control mechanisms for nonpoint source pollution.

Non-timber forest products

All forest products except timber, including resins, oils, leaves, bark, plants other than trees, fungi, and animals or animal products. Previously called special forest products.

Notice of intent to operate

A notice of intent to operate is required from any person proposing to conduct operations which might cause significant disturbance of surface resources. Such notice of intent to operate shall be submitted to the District Ranger having jurisdiction over the area in which the operations will be conducted. Each notice of intent to operate shall provide information sufficient to identify the area involved, the nature of the proposed operations, the route of access to the area of operations, and the method of transport. (36 CFR 228.4)

Nunataks

The mountain peaks between glaciers.

O

Objectives

The steps to be taken and the resources to be used in achieving goals.

A concise, measurable, and time-specific statement of a desired rate of progress toward a desired condition or conditions. Objectives should be based on reasonably foreseeable budgets (36 CFR 219.7(e)(1)(ii)).

Off-highway vehicle (OHV)

Any motor vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain (36 CFR 212.1).

Old-growth associated species

Plant and animal species with habitat relationships that exhibit a strong association with old-growth forests.

Old-growth forest

The (usually) late successional stage of forest development. Old-growth forests are defined in many ways; generally, structural characteristics used to describe old-growth forests include a) live trees: number and minimum size of both seral and climax dominants; b) canopy conditions: commonly including multi-layering; c) snags: minimum number and specific size; and d) logs and large (coarse) woody debris.

Old-growth habitat conservation strategy

An integrated science-based old-growth forest habitat conservation strategy developed and adopted during the 1997 Forest Plan Revision process. The old-growth strategy has two basic components: 1) a forest-wide reserve network that protects the integrity of the old-growth forest by retaining blocks of intact,

largely undisturbed habitat; and 2) management of the matrix (that is, lands that are suitable for timber harvest). (See Appendix D of the EIS.)

Old-growth reserve (OGR)

A contiguous unit of old-growth forest habitat to be managed to maintain the integrity of the old-growth forest ecosystem.

Open road density

The length of forest development roads open for public access and use per unit area of land; usually expressed as miles of open road per square mile of land. "Open" roads include roads managed to Maintenance Levels 2, 3, 4, and 5.

Operability

See the definition for non-interchangeable components.

Operation and maintenance costs

Costs associated with operating and maintaining facilities, program management, and support costs associated with management of other resources.

Order three inventory

A level of soil surveys made for extensive land uses that do not require precise knowledge of small areas or detailed soils information. Such survey areas are usually dominated by a single land use and have few subordinate uses. This information can be used in planning for range, forest, recreational areas, and similarly extensive land uses, and in community planning.

Order four inventory

A soil survey level made for extensive land uses that require general information for broad statements concerning land-use potential and general land management. This information can be used in locating, comparing, and selecting suitable areas for major kinds of land use in regional land-use planning, and in selecting areas for more intensive study and investigation.

Ordinary high water mark

The mark along the bank or shore up to which the presence and action of the nontidal water are common and usual, and so long continued in all ordinary years, as to leave a natural line impressed on the bank or shore and indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics. (Consult 11 AAC 53.900 — Alaska Code.)

Organic soils

Soils that contain a high percentage (greater than 15 percent) of organic matter throughout the soil depth.

Original harvested stand

The stand as mapped before the initial harvest.

ORV

Abbreviation for off-road vehicle. (See the definition for off-highway vehicle.)

Output

The measurable goods, end products, or services resulting from management activities that are purchased, consumed, or used directly by people.

Overflow

High runoff that overflows natural stream and river banks. Also known as flooding.

Overmature

A tree or an even-aged stand that has reached that stage of development when it is declining in vigor and health and reaching the end of its natural life span.

Overselection

Unconveyed lands selected in excess of entitlement. Overselections by the State of Alaska are authorized in Section 906 (f) of ANILCA. They are authorized for Native corporations organized under ANCSA in Federal Regulations (43 CFR 2650).

Over-snow vehicle

A motor vehicle that is designed for use over snow and that runs on a track or tracks and/or a ski or skis, while in use over snow (36 CFR 212.1).

Overstory

The portion of trees in a forest that forms the uppermost canopy layer.

Overstory removal

The cutting of trees constituting an upper canopy layer to release trees or other vegetation in an understory.

P

Palustrine

Pertaining to low velocity, ponded environments. Examples are backwater sloughs, swamps, bogs, and muskeg ponds, as well as their outlet streams or any ponded environment. “Ponded” describes a condition in which free water covers the soil surface and is removed only by percolation, evaporation, or transpiration.

Palustrine wetland

Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 percent.

Parent material

The unconsolidated, and more or less chemically weathered, mineral or organic matter from which soils develop.

Partial cut (cutting)

Removal of only part of a stand for purposes other than regeneration of a new age class. Partial cutting is not considered a regeneration method and is a layman’s term for uneven-aged management.

Parts per million (PPM)

A measurement of concentration indicating the quantity of a substance per unit volume of a solution.

Peak flow

The highest discharge of water recorded over a specified period of time at a given stream location. Often thought of in terms of spring snowmelt, summer, fall, or winter rainy season flows. Also called maximum flow.

Peatland

A generic term including all types of peat-covered terrain. Many peatlands are a complex of swamps, bogs, and fens.

Perennial Stream

A stream channel that flows continuously, year round. Compare to the definitions provided for ephemeral stream and intermittent stream.

A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream. These streams are identified as solid blue on the USGS 7 1/2-inch quadrangle maps.

Permit

A special use authorization which provides permission, without conveying an interest in land, to occupy and use National Forest System land or facilities for specified purposes, and which is both revocable and terminable.

Persistence

Continued existence

Personal use (free use)

Bona fide settlers, miners, residents, and prospectors for minerals in Alaska may take free of charge green or dried timber from the National Forests in Alaska for personal use but not for sale. Permits will be required for green saw timber. Other material may be taken without permit. The amount of material granted to any one person in one year shall not exceed 10,000 board feet of saw timber and 25 cords of wood, or an equivalent volume in other forms. Persons obtaining materials shall, on demand, forward to the supervisor a statement of the quantity taken and the location from which it was removed (36 CFR 223.10).

Persons-at-one-time (PAOT)

Used to measure how many people can use a recreation facility at one time.

pH

The degree of soil acidity or alkalinity.

Plan area

The National Forest System lands covered by a plan. (36 CFR 219.19)

Plan components

The parts of a land management plan that guide future project and activity decision-making. Specific plan components may apply to the entire plan area, to specific management areas or geographic areas, or to other areas as identified in the plan. Every plan must include the following plan components: desired conditions, objectives, standards, guidelines, and suitability of lands. A plan may also include goals as an optional component. Plan components can only be changed through plan amendment or revision.

Plan content

A broad term that refers to written material in a plan, including plan components, and other content in the plan. (See 36 CFR 219.7 (f).) Other content in the plan can be explanatory material that may be useful to Forest Service employees when designing projects and activities under the plan components, such as management approaches.

Plan implementation

To carry out or fulfill Standards and Guidelines contained in the Land and Resource Management Plan (Forest Plan).

Plan of Operations

A Plan of Operations is required from anyone who proposed operations, under the 1872 Mining Law, would cause, "significant surface disturbance." See 36 CFR 228, Subpart A.

Plan period

The period of time a Forest Plan is in effect, typically 10 years, but no longer than 15 years.

Planning area

All the lands addressed in a land management plan. For this document, it is the Tongass National Forest.

Planning cycle demand

As used in this document, the amount of timber that buyers are estimated to be willing to purchase over the next 10 to 15 years. Also see the definition for annual demand.

Planning horizon

The overall time period considered in the planning process that spans all activities covered in the analysis or plan, and all future conditions and effects of proposed actions that would influence the planning decisions more than 100 years.

Planning period

Generally a 10- to 15-year period. The time interval within the planning horizon that is used to show incremental changes to yields, costs, effects, and benefits.

Planning record

A system that records decisions and activities that result from the process of developing a forest plan, revision, or significant amendment.

Plant association

A plant community type based on land management potential, successional patterns, and species composition.

Plant communities

An assemblage of plants that, in general, occur together on similar site conditions.

Point source (pollution)

A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

Pole

A tree of a size between a sapling and a mature tree. On the Tongass, an immature tree between 5 and 9 inches diameter at breast height.

Pollution

The presence of matter or energy whose nature, location, or quantity produces undesired environmental effects.

Pond log value

Selling value minus manufacturing costs. Pond log values are the price a timber buyer would pay for a log at the mill site.

Pool

The portion of a stream with reduced current, often with deeper water than surrounding areas and with a smooth surface.

Poorly drained soils

Water in these soils is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year.

Population

The actual number of animals or plants present in an area at a certain time that share a common gene pool.

Population viability

Probability that a population will persist for a specified period of time across its range despite normal fluctuations in population and environmental conditions.

Practicable

Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Precommercial Thinning

See the definition for thinning.

Present Net Value (PNV)

The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

Prescribed fire

A wildland fire burning under planned conditions to accomplish specific land and resource objectives. It may result from either a management or natural ignition.

Prescribed natural fire

Naturally ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Preservation

A technique of conservation that maintains the resource in or on the ground in perpetuity.

In cultural resources, “preservation” is the first treatment option under the Secretary of the Interior Standards for the Treatment of Historic Properties. It focuses on the maintenance and repair of existing historic materials and retention of a property's form as it has evolved over time.

Primary succession

Vegetation development initiated on newly formed soils or upon surfaces exposed for the first time (as by landslides or retreating glaciers), which have, as a consequence, never borne vegetation before. Any succession beginning on a bare area not previously occupied by plants or animals.

Priority use

A Forest Service commitment to the holder of a permit for outfitting and guiding to give priority consideration to granting the holder a specific amount of available future use.

Authorization of use for up to 10-years, based on the holder's past use and performance and applicable programmatic or project decisions to allocate use. Except as provided in 36 CFR 251, Subpart E, authorizations providing for priority use are subject to renewal (FSH 2709.14, section 53.1m).

Private road

A road under private ownership authorized by an easement, or a road that provides access pursuant to a reserved or outstanding right.

Process Group

A combination of similar channel types based on major differences in landform, gradient, and channel shapes. (A full description of process groups is located in Appendix D of the Forest Plan.)

Productive old growth (POG)

Old-growth forest capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8,000 board feet per acre.

Programmatic Environmental Impact Statement (PEIS)

The document disclosing the environmental consequences of a program or plan that guides or prescribes the use of resources, allocates resources, or establishes rules and policies in contrast to disclosure of the environmental consequences of a site-specific project.

Programmed timber harvest

Timber harvest that occurs on suitable forested lands and that contributes to the allowable sale quantity.

Project

One or more site-specific activities designed to accomplish a specific on-the-ground purpose or result.

An organized effort to achieve an outcome on National Forest System lands identified by location, tasks, outputs, effects, times, and responsibilities for execution (36 CFR 219.19).

Projected Timber Sale Quantity (PTSQ)

A subset of the projected wood sale quantity and is an estimate of the quantity of timber expected to be sold during the plan period. The volume in the projected timber sale quantity is the volume that meets utilization standards (FSH 1909.12, Chapter 60, section 64.34). Except as provided in section 64.33 of FSH1909.12 (departure from sustained yield limit), the projected timber sale quantity must be equal to or below the sustained yield limit for each decade of the plan.

PTSQ must take into account the fiscal capability of the planning unit and be consistent with all plan components. Estimates of the projected timber sale quantity do not include any volumes anticipated from salvage or sanitation harvests.

Projected Wood Sale Quantity (PWSQ)

An estimate of the volume of all timber and other wood products that is expected to be sold during the plan period from expected harvests for any purpose (except salvage harvest or sanitation harvest) on all lands in the plan area. The projected wood sale quantity includes all woody material likely to be sold from these harvests whether or not the woody material meets the utilization standards (FSH 1909.12, Chapter 60, section 64.34).

PWSQ must take into account the fiscal capability of the planning unit and be consistent with all plan components. Estimates of the projected wood sale quantity do not include any volumes anticipated from salvage or sanitation harvests.

Proponent

Any individual or entity applying to perform an activity on National Forest System lands under authority of a mining plan of operations, contract, license, special use authorization, or other agreement.

Public issue

A subject or question of widespread public interest relating to management of the National Forest System.

Public participation

Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service planning.

Public Lands

Any land and interest in land owned by the United States within the several States and administered by the Secretary of the Interior through the Bureau of Land Management, National Park Service, Bureau of Reclamation, or the Fish and Wildlife Service; or by the Secretary of Agriculture through the Forest Service; or the Department of Commerce through the National Oceanic and Atmospheric Administration; or the Department of Defense through the Army Corps of Engineers without regard to how the United States acquired ownership, except: (1) lands located on the Outer Continental Shelf; and (2) lands held for the benefit of Indians, Aleuts, and Eskimos.

Public road

A road under the jurisdiction of and maintained by a public road authority and open to public travel (23 U.S.C. 101(a)).

Public Water System

Public water supplies, or systems, include only state-designated Class A or Class B systems. These are defined by the State of Alaska's Drinking Water Regulations in 18 AAC 80.1990: "Class A public water system" means a public water system that (a) is expected to serve, year-round, at least 25 individuals, (b) is expected to serve, year-round, at least 15 residential service connections; or (c) regularly serves the same 25 or more individuals for at least 6 months of the year. "Class B public water system" means a public water system that is not a Class A public water system and regularly serves at least 25 individuals each day for at least 60 days of the year. A list of public water supplies is available from the Alaska Department of Environmental Conservation.

A public water system supplies water to consumers and is not a private water system. The State of Alaska designates and classifies public water systems that are subject to the State of Alaska's Drinking Water Regulations in 18 AAC 80 in accordance with the Federal Safe Drinking Water Act. Community water systems are one type of public water system.

Public water system protection area

The State of Alaska maintains an inventory of source water protection areas for each designated public water system. Some of these areas are outside of the Forest Plan Municipal Watershed Land Use Designation. Protection of these areas is addressed in the Forest-wide Soil and Water Standards and Guidelines.

Purchase unit

A unit designated by the Secretary of Agriculture or previously approved by the National Forest Reservation Commission for purposes of Weeks Law acquisition (USDA Forest Service, undated, Land Areas of the National Forest System).

Q

Qualified Engineer

An engineer who by experience, certification, education, or license is technically trained and experienced to perform the engineering tasks specified, and is designated by the Director of Engineering, Regional Office.

R

Rare plants

Rare plants are those with potential conservation concerns on the Tongass National Forest. They may be common elsewhere; however, the edge of their range is known or suspected to be on the Tongass National Forest, or disjunct populations of the plant species occur on the Tongass National Forest. The Alaska Natural Heritage Program tracks rare plant species, and gives them a state ranking of S1 to S5. This database will be the basis of the rare plant list for the Tongass National Forest. See the Alaska Natural Heritage plant list for guidance on rare plants known or suspected to occur on the Tongass National Forest.

Rare plants include plant species identified on the Alaska Natural Heritage Program (ANHP) Rare Vascular Plant Tracking List that are known to occur on the Tongass (ANHP, 2008), is considered globally rare (G1/T1, G2/T2) and/or rare in the State (S1, S2 and some S3 are considered); or is considered rare because of a range extension or disjunct populations on the Tongass but not yet given a state ranking on the ANHP list.

Rare plant populations

Individual rare plants of the same species within one kilometer (0.6 mile) of each other together are considered a population.

RAW

See the definition for Reasonable Assurance of Windfirmness.

Real dollar value

A monetary value that compensates for the effects of inflation.

Reasonable Assurance of Windfirmness (RAW) Buffer

A managed area designed to contain windthrow within the area where timber harvest is allowed. It is use to protect Riparian Management Areas and adjacent stands. Also see the definition for Windthrow Management Area.

Reburial and reinterment

The replacement of disinterred human remains into the ground or otherwise disposing of such remains in a manner likely to approximate the wishes of the deceased (e.g., placement in burial caves, legal cemeteries, surface mortuary structures, or cremation where traditionally practiced).

Reclamation

Returning disturbed land to as near to its natural condition as is reasonably practical.

Recreation capacity

The number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources.

Recreation Opportunity Spectrum (ROS)

A system for planning and managing recreation resources that categorizes recreation opportunities into seven classes. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The seven classes are:

Primitive. An unmodified environment generally greater than 5,000 acres in size and located generally at least 3 miles from all roads and other motorized travel routes. A very low interaction between users (generally less than 3 group encounters per day) results in a very high probability of experiencing solitude, freedom, closeness to nature, tranquility, self-reliance, challenge, and risk. Evidence of other users is low. Restrictions and controls are not evident after entering the land unit. Motorized use is rare.

Semi-Primitive Non-Motorized. A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located at least 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) but not further than 3 miles from all roads and other motorized travel routes. Concentration of users is low (generally less than 10 group encounters per day), but there is often evidence of other users. There is a high probability of experiencing solitude, freedom, closeness of nature, tranquility, self-reliance, challenge, and risk. There is a minimum of subtle on-site controls. No roads are present in the area.

Semi-Primitive Motorized. A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located within 0.5 mile of primitive roads and other motorized travel routes used by motor vehicles; but not closer than 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) from better-than-primitive roads and other motored travel routes. Concentration of users is low (generally less than 10 group encounters per day), but there is often evidence of other users. There is a moderate probability of experiencing solitude, closeness to nature, and tranquility along with a high degree of self-reliance, challenge, and risk in using motorized equipment. Local roads may be present, or along saltwater shorelines there may be extensive boat traffic.

Roaded Natural. Resource modification and utilization are evident, in a predominantly naturally-appearing environment generally occurring within 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) from better-than-primitive roads and other motorized travel routes. Interactions between users may be moderate to high (generally less than 20 group encounters per day), with evidence of other users prevalent. There is an opportunity to affiliate with other users in developed sites but with some chance for privacy. Self-reliance on outdoor skills is only of moderate importance with little opportunity for challenge and risk. Motorized use is allowed.

Roaded Modified. Vegetative and landform alterations typically dominate the landscape. There is little on-site control of users except for gated roads. There is moderate evidence of other users on roads (generally less than 20 group encounters per day), and little evidence of others or interactions at campsites. There is opportunity to get away from others but with easy access. Some self-reliance

is required in building campsites and use of motorized equipment. A feeling of independence and freedom exists with little challenge and risk. Recreation users will likely encounter timber management activities.

Rural. The natural environment is substantially modified by land use activities. Opportunity to observe and affiliate with other users is important as is convenience of facilities. There is little opportunity for challenge and risk and self-reliance on outdoor skills is of little importance. Recreation facilities designed for group use are compatible. Users may have more than 20 group encounters per day.

Urban. Urbanized environment with dominant structures, traffic lights and paved streets. May have natural appearing backdrop. Recreation places may be city parks and large resorts. Opportunity to observe and affiliate with other users is very important as is convenience of facilities and recreation opportunities. Interaction between large numbers of users is high. Outdoor skills, risk, and challenge are unimportant except for competitive sports. Intensive on-site controls are numerous.

The social, managerial, and physical attributes of a place that, when combined, provides a distinct set of recreation opportunities. The Forest Service uses the recreation opportunity spectrum to define recreation settings and categorize them into seven distinct classes: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, roaded modified, rural, and urban. (See 36 CFR 219.19.).

Recreation places

Identified geographical areas having one or more physical characteristics that are particularly attractive to people engaging in recreation activities. They may be beaches, streamside or roadside areas, trail corridors, hunting areas of the immediate area surrounding a lake, cabin site, or campground.

Recreation visitor day (RVD)

A measure of recreation use of an area. One recreation visitor day consists of 12 hours of recreation use of a site or area. Recreation visitor days are used to measure recreation production or output capacity.

Reducing soil condition

An environment in the soil conducive to the removal of oxygen and chemical reduction of ions caused by saturated soil conditions.

Reforestation

The re-establishment of forest cover either naturally (natural seeding, coppice, or root suckers) or artificially (direct seeding or planting).

Regeneration Method

A cutting procedure by which a new age class is created through methods of coppice, clear cutting, seed tree, shelter wood, and selection. Regeneration methods are grouped into four categories: coppice (stump sprouts not practiced in Southeast Alaska forests), even-aged, two-aged, and uneven-aged.

Rehabilitation

Actions taken to restore site productivity, water quality, or other resource values.

In cultural resources "rehabilitation" is the second treatment option under the Secretary of the Interior Standards for the Treatment of Historic Properties and is defined as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values." (See 36 CFR 67.)

Renewable Energy

Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include: biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Renewable Energy Site

A renewable energy site consists of all related facilities, including access roads, utility lines for the transmission and distribution of electric energy, ancillary equipment sites and areas required for construction and maintenance of the project.

Research design

A statement of work to be done toward a particular goal. The research design details what will be done, how it will be done, what is required to do it, and why it is important or useful to do the work.

Research Natural Area (RNA)

An area in as near a natural condition as possible, which exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. The area is set aside to preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and most public uses are not allowed.

Reserve

A general term for an area of land recognized for, and managed to preserve or maintain, specific natural features. Wilderness is one common example. In the context of wildlife or fish habitat management, or biological diversity, an area set aside for the maintenance and perpetuation of its habitat or ecosystem features. (Also see the definitions for old-growth habitat reserve and non-development LUDs.)

Reserve trees

Trees that remain after timber harvest, for a variety of purposes other than regeneration (e.g., to provide wildlife habitat or to mitigate effects on scenery).

Resident fish

Fish that are not migratory and complete their entire life cycle in fresh water.

Residual basal area

The basal area (per square feet per acre) of acceptable trees left standing after harvest.

Resource values

The tangible and intangible worth of forest resources.

Responsible official

The Forest Service employee who has the delegated authority to make a specific decision.

Restoration

Ecology: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. The concept of ecological restoration is forward-looking. Restoration focuses on reestablishing composition, structure, and ecological processes to maintain or increase resilience of terrestrial and aquatic ecosystems in a dynamic, continually evolving world.

Ecological: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience, and health under current and future conditions (36 CFR 219.19).

Functional: Restoration of abiotic and biotic processes in degraded ecosystems. Functional restoration focuses on the underlying processes that may be degraded, regardless of the structural condition of the ecosystem. Functionally restored ecosystem may have a different structure and composition than the historical reference condition. As contrasted with ecological restoration that tends to seek historical reference condition, the functional restoration focuses on the dynamic processes that drive structural and compositional patterns. Functional restoration is the manipulation of interactions among process, structure, and composition in a degraded ecosystem to improve its operations. Functional restoration aims to restore functions and improve structures with a long-term goal of restoring interactions between function and structure. It may be, however, that a functionally restored system will look quite different than the reference condition in terms of structure and composition and these disparities cannot be easily corrected because some threshold of degradation has been crossed or the environmental drivers, such as climate, that influenced structural and (especially) compositional development have changed.

Recreation: The removal of non-historic elements from a historic structure and the replacement of missing elements.

Heritage: Restoration is the third treatment option under the Secretary of the Interior Standards for the Treatment of Historic Properties. It focuses on the retention of materials from the most significant time in a property's history, while permitting the removal of materials from other periods. Historic elements may be removed if they are not considered part of the structure's "period of significance".

Retention

The amount of commercial forest land removed from the timber base to protect other resource values.

Revegetation

The re-establishment and development of vegetation.

Riffles

Shallow rapids in an open stream, where the water surface is broken by waves caused by wholly or partially submerged obstructions.

Right-of-way

Land authorized to be used or occupied for the construction, operation, maintenance and termination of a project or facility passing over, upon, under or through such land (36 CFR 251.51).

Rill

A very small channel.

Riparian area

Riparian areas encompass the zone of interaction between aquatic and terrestrial environments associated with streamsides, lakeshores, and floodplains, and display distinctive ecological conditions characterized by high species diversity, wildlife value, and resource productivity.

Three-dimensional ecotones [the transition zone between two adjoining communities] of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at variable widths (36 CFR 219.19).

Riparian corridor

The floodplain and associated riparian soils, vegetation, and wetlands.

Riparian ecosystem

Land next to water where plants that are dependent on a perpetual source of water occur.

Riparian management area (RMA)

Land areas delineated in the Forest Plan to provide for the management of riparian resources. Specific standards and guidelines, by stream process group, are associated with riparian management areas. Riparian management areas standards and guidelines may be modified by watershed analysis.

Portions of a watershed where riparian-dependent resources receive primary emphasis, and for which plans include plan components to maintain or restore riparian functions and ecological functions (36 CFR 219.19).

Riverine wetland

A category in wetland classification that includes all wetlands and deep-water habitats contained within a channel, with two exceptions: 1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and 2) habitats with water containing ocean-derived salts in excess of 0.5 percent.

Road

A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36 CFR 212.1).

Road construction or reconstruction

Supervising, inspecting, actual building of the subgrade, base course or surfacing coarse of a roadway, and incurrence of all costs incidental to the construction or reconstruction of a road (36 CFR 212.1).

Road reconditioning

Work consisting of blading the surface of an existing road to remove potholes and wash boarding, and re-establish an adequate crown. (Standard Specifications for Construction of Roads and Bridges of Federal Highway Projects FP 03)

Road decommissioning

Activities that result in the restoration of unneeded roads to a more natural state (FSM 7734).

Road density

The number of road miles per square mile of land area.

Roaded roadless

Portions of inventoried roadless areas (IRAs) that were roaded before the 2001 Roadless Rule and during the 2001 Roadless Rule exemption period for theTongass. .

Roadless area

An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use. For purposes of the Forest Plan environmental impact statement analysis, this is a generic term that includes inventoried roadless areas and unroaded areas (see these definitions).

Road Maintenance

The ongoing upkeep of a road necessary to retain or restore the road in accordance with its road management objective (FSM 7714).

Road Maintenance Level

Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria (FSH 7709.58, section 12.3).

Maintenance Level 1. Assigned to intermittent service roads during the time they are closed to vehicular traffic. Appropriate traffic management strategies are "prohibit" and "eliminate" all traffic. The closure period is 1 year or longer. Basic custodial maintenance is performed.

Maintenance Level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.

Maintenance Level 3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.

Maintenance Level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.

Maintenance Level 5. Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-lane and paved, or aggregate surfaced with dust abatement.

Road management objectives

Define the intended purpose of an individual road based on management area direction and access management objectives. Road management objectives contain design criteria, operation criteria, and maintenance criteria.

Road subject to the Highway Safety Act

An National Forest System road that is open to public use in a standard passenger car. This includes a road with access restricted on a seasonal basis and a road closed during extreme weather conditions or for emergencies, but is otherwise open to public travel.

Recreation Opportunity Setting (ROS) existing

The ROS setting in place, regardless of the official inventory.

Recreation Opportunity Setting (ROS) inventoried

A general inventory of the physical, social, and managerial setting for recreation, based on remoteness from modern human development and activity, modification of the land, and social factors such as crowding. (See the definition for Recreation Opportunity Spectrum.)

Rotation

In even-age systems, the period between regeneration establishment and final cutting.

Rotation age

The age at which final cutting occurs.

RPA

Forest and Rangeland Renewable Resources Planning Act.

The Forest and Rangeland Renewable Resources Planning Act of 1974 (or RPA) (PL. 93-378) is a federal law which authorizes long-range planning by the Forest Service to ensure the future supply of forest resources while maintaining a quality environment. (16 U.S.C. 1600)

RPA Assessment and Program

The RPA Assessment is prepared every 10 years and describes the potential of the nation's forests and rangelands to provide a sustained flow of goods and services. The RPA Program is prepared every five years to chart the long-term course of Forest Service management of the National Forests, assistance to state and private landowners, and research. They are prepared in response to Sections 3 and 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) (16 U.S.C. 1601).

Rubble

All accumulations of loose angular rock fragments, commonly overlying outcropping rock.

Rural development

The management of human, natural, technical, and financial resources needed to improve living conditions, provide employment opportunities, enrich the cultural life, and enhance the environment of rural America. In the National Forest System, rural development is accomplished through partnerships.

S

Sacred sites

A place that has traditional spiritual values for Alaska Native people, reverently dedicated to a person or object or event or activity, and secured against violation or infringement or interference.

Executive Order 13007 defines a sacred site as "any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." See also Traditional Cultural Properties and Heritage Resources.

Saleable minerals

Include common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. In general, these minerals are of wide-spread occurrence and are of relatively low unit value. They are generally used for construction materials and road building purposes.

Salmonid

Any fish belonging to the family *Salmonidae*, which includes salmon and trout.

Salvage cutting

The removal of dead trees or trees damaged or dying because of injurious agents other than competition to recover economic value that would otherwise be lost.

Saturated soils

Soil condition where all the spaces between soil particles are filled with water.

Sawlogs (Sawtimber)

The portion of a tree that is suitable in size and quality for the production of dimension lumber, collectively known as sawtimber.

Scenic Integrity Objective (SIO)

A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape. The adopted SIO is the SIO to be achieved as a result of management direction identified in the approved Forest Plan. SIOs are described below:

Very High: Landscapes where the landscape character is intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.

High: Landscapes where the landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.

Moderate: Landscapes where the landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape being viewed.

Low: Landscapes where the landscape character "appears moderately altered." Deviations begin to dominate the landscape character being viewed but borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

Very Low: Landscapes where the landscape character "appears heavily altered." Deviations may strongly dominate the landscape character. They may not borrow from attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Unacceptably Low: Landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character. Landscapes at this level of integrity need rehabilitation.

Scoping

Determination of the significant issues to be addressed in an environmental impact statement through public involvement.

The issues for consideration in the planning phase are identified in the NEPA document through public and governmental participation opportunities provided in the early stages of the planning process. Governments, agencies, and the public may submit any additional or new scientific information for consideration in the planning process, and the Responsible Official shall determine whether any such information is the best available scientific information.

Scree

An accumulation of loose stones or rock debris lying on a slope or at the base of a cliff.

Scrub-shrub wetland

Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. In Southeast Alaska this includes forested lands where trees are stunted because of poor soil drainage.

Second growth forest

Trees that cover an area after the removal of the original stand, as by cutting or fire. (American Heritage Dictionary of the English Language, Fifth Edition 2011)

Also referred to as young-growth forest and used interchangeability in places within the 1997 Forest Plan revision, as amended.

Secondary channel

Lateral channel with an axis of flow roughly parallel to the mainstem and fed by the mainstem.

Secondary stream production

Results from consumption by animals of materials produced in primary production in streams; this includes production of macroinvertebrates and some fish species.

Secondary succession

The process of re-establishing vegetation after normal succession is disrupted by fire, cultivation, lumbering, windthrow, or any similar disturbance.

Sediment

Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Seed tree cutting

The cutting of all trees except for a small number of widely dispersed trees retained for seed production to naturally regenerate a new age class. Seed trees are usually removed after regeneration is established.

Selection cutting

A silvicultural system used to create or maintain uneven-aged stands, usually by the periodic removal of groups of trees or individual trees. It is undertaken to provide periodic harvests, while maintaining full residual stand growth rates. It attempts to develop a balanced uneven-aged stand structure, including the encouragement of regeneration by providing the cultural measures needed for tree growth and seedling establishment. The selection system refers to the programs used to create or maintain the stand, while the selection method refers to the way in which the stand is regenerated. The cutting usually involves a mixture of regeneration and improvement cuts. Note that selection cutting is not the same thing as selective cutting (logging). Also see the definition for selective cutting.

Selective cutting

A cutting that removes only a portion of trees in a stand (see partial cutting). Note: Selective cutting is a general term that should not be confused with cutting done in accordance with the selection method.

Sensitive species

Plant or animal species that are susceptible or vulnerable to habitat alterations or management activities resulting in a viability concern for the species long-term persistence. Sensitive species may be those species under consideration for official listing as endangered or threatened species, are on an official state list, or are recognized by the Regional Forester as needing special consideration to ensure viable populations and to prevent their being placed on federal or state lists.

Sensitive travel route

A road system or marine water way that receives a moderate to high degree of use by the public, both Alaskan residents and tourists.

Sensitivity zone

A body of land that has been classified on the basis of cultural and environmental data, as having a high, medium, or low likelihood for containing cultural resources.

Settlement sale

The disposition of timber or other National Forest products, cut, damaged, or destroyed in conjunction with an authorized occupancy of National Forest System (NFS) land. For example, timber removed from an inholding access road or privately developed hatchery site. Also, the compensation to the United States for property taken or rendered unusable for other purposes incidental to some lawful use of NFS lands. When timber has a value, clearing the land for some use other than growing timber constitutes a settlement sale.

Shelterwood

An even-aged regeneration method that removes most of the trees in a stand, except for those needed to produce sufficient shade to produce a new age class in a moderated microenvironment. The trees are removed in a series of cuts where the last removal cut releases the established regeneration from competition with the over wood.

SHPO

See the definition for State Historic Preservation Officer.

Side-slope break

The abrupt change (usually decreases) in slope gradient defining the upper limit of channel incision.

Significant change

Under NEPA, refers to the severity of the impact (i.e., the extent of harm on public health, historic resources, wetlands, or ecologically critical areas) and the extent of the impact (i.e., local, regional, or national). Refer to 40 CFR Part 1508.27.

As used in the Soils section, it refers to change in productivity of the land as indicated by changes in soil properties that are expected to result in a reduced productive capacity over the planning horizon. Based on available research and current technology, a guideline of 15 percent reduction in inherent soil productivity potential is used as a basis for setting threshold values for measurable or observable soil properties or conditions. The threshold values, along with areal extent limits, will serve as an early warning signal of reduced productive capacity. A more stringent basis than 15 percent can be used where appropriate and documented.

Significant effect

Significance is defined as effects of sufficient context and intensity that an environmental impact statement is required. The Council on Environmental Quality (CEQ) regulations refer to both significant effects and significant issues (for example, 40 CFR 1502.2(b)). The meaning of significance should not be interpreted differently for issues than for effects: significant issues are those issues that are related to significant or potentially significant effects.

Significant impairment

Changes in the productivity of the land as indicated by changes in soil properties that would result in significant changes in the inherent productive capacity that last beyond the planning horizon.

Significant surface disturbance

Changing the aboveground environment so much that returning that site to the condition it was in before the change is difficult or impossible. Road construction, use of mechanical earthmoving equipment, including backhoes and bulldozers, construction of buildings, and cutting of timber are all examples of activities that are considered to cause significant disturbance to surface resources. An evaluation of proposed operations must be made on a case-by-case basis to determine if disturbance is considered significant. For example, a mining activity in an alpine area may result in significant disturbance that takes years to reclaim, while the same activity conducted at a lower elevation where natural conditions are not as severe may result in a disturbance that would take only a few months to successfully reclaim.

Silvicultural system

A planned series of treatments for tending, harvesting, and re-establishing a stand. Note: The individual system name is based on the number of age classes (even-aged, two-aged, uneven-aged) or the regeneration method (clearcutting, seed tree, shelterwood, selection) used.

Silviculture

The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

Single-tree selection

A regeneration method used to develop and maintain uneven-aged stands by removing individual trees of all sizes more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration.

Site index

A species-specific measure of actual or potential forest productivity (site quality, usually for even-aged stands), expressed in terms of the average height of trees included in a specified stand component (defined as a certain number of dominants, codominants, or the largest and tallest trees per unit area) at a specified index or base age. Note: Site index is used as an indicator of site quality.

Site preparation

Hand or mechanized manipulation of a site designed to enhance the success of regeneration.

Site-potential tree height

The average height of a given species of tree when mature on a given site.

Site productivity class

A species-specific classification of forest land in terms of inherent capacity to grow crops of industrial, commercial wood.

Skyline logging

See the definition for logging systems.

Slash

The residue (e.g., treetops and branches) left on the ground after logging or accumulating as a result of storm, fire, girdling, or delimbing.

Slope distance

Distance measured along the contour of the ground.

Slough

A creek in a marsh or tide flat. The water level fluctuates with the tide.

Small sale

Timber sales that are generally less than 10 million board feet (MMBF).

Smolt

A young silvery-colored salmon or trout that has undergone physiological changes to move from freshwater environment to saltwater.

Snag

A dead standing tree usually greater than 5 feet tall and 6 inches in diameter at breast height. The interior of the snag may be sound or rotted.

Social sustainability

See sustainability.

Soil conservation practices

Practices that are mechanisms used to protect soil quality while managing for other resource goals and objectives. They can be administrative, preventive, or corrective measures. They are identified during project planning and design.

Soil drainage

The rapidity and extent of the removal of water from the soil, in relation to additions especially by surface runoff and by flow through the soil to underground spaces.

Soil mass movement

See the definition for mass-wasting.

Soil productivity

The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

Soil quality standards

Standards that are a combination of 1) “threshold” values for severity of soil property alteration, or significant change in soil properties conditions; and 2) areal extent of disturbance.

Soil Resource Inventory (SRI)

An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Somewhat poorly drained soil

Water in the soil is removed from the soil slowly enough to keep it wet for significant periods but not all of the time.

Special Interest Areas (SIA)

A designation for areas possessing unique or unusual scenic, historic, prehistoric, geodesic scientific or other characteristics.

Special use authorization

A written permit, term permit, lease, or easement that authorizes use or occupancy of National Forest System lands and specifies the terms and conditions under which the use or occupancy may occur. (36 CFR 251.51)

Special use permit

See permit.

SPECTRUM

The Forest planning model. A linear programming software package used for the 2008 Plan Amendment to analyze management alternatives for land use patterns and timber harvest scheduling and out puts.

Speleothem

Any secondary mineral deposit or cave formation that is formed by the action of water. Examples are stalagmites, stalactites, flow stone, bacon rind drapery, helictites, soda straws, and crystal growths.

Split lines

The process of separating the direction of timber harvest yarding into opposite directions.

SRI

See the definition for Soil Resource Inventory.

Stabilization

The process of arresting the deterioration of a damaged cultural resource in order to prevent further damage from occurring. Stabilization may include reconstructing portions of the cultural resource.

Stand

A contiguous group of trees sufficiently uniform in composition, age class distribution, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

Standard

A course of action or level of attainment required by the Forest Plan to promote achievement of goals and objectives.

A mandatory constraint on project and activity decision-making, established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements. (36 CFR 219.12)

Stand density

A quantitative measure of stocking expressed either absolutely per unit of land in terms of number of trees, basal area, volume per unit area, or relative to some standard condition.

Size Density Model (SDM)

A forest-mapping model based on average tree size (quadratic mean diameter) and average tree density (stand density index), used to describe stand structural characteristics. SDM uses timber volume class, hydric soil class, and aspect to characterize forest structure.

State Historic Preservation Officer (SHPO)

The official appointed or designated pursuant to Section 101(b)(1) of the National Historic Preservation Act of 1966, as amended, to administer the State Historic Preservation Program.

State selection (from National Forest System lands)

Application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000 acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under authority of Section 6(a) of the Alaska Statehood Act of 1959 (Public Law 85-508, 72 Stat. 340). For lands to be conveyed, State selections must be approved by the USDA Forest Service, Regional Forester, Alaska Region under criteria of the Statehood Act. Until approved by the Regional Forester, the State application is not considered a valid selection. The State can select up to 25 percent in excess of its remaining entitlement.

Stocking

An indication of growing space occupancy of trees relative to plan-defined desired conditions for the stand or area. Common indices of stocking include the number of trees by size and spacing, percent occupancy, basal area, relative density or crown completion factor.

Strata

See the definition for volume strata.

Stratigraphic

Depositional units or layers of sediment distinguished by composition or appearance that are associated with archaeological and historic sites.

Stream bed

The substrate plane bounded by the stream banks, over which the water column moves. Also called the stream bottom.

Stream bank

The portion of the channel cross section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank.

Stream class

A means to categorize stream channels based on their fish production values. There are four stream classes on the Tongass National Forest *(FSH 2090.21 (2001) Chapter 10, Section 12)*, including:

Class I: Streams and lakes with anadromous or adfluvial fish or fish habitat, or high quality resident fish waters or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

Class II: Streams and lakes with resident fish or fish habitat—generally steep channels 6 to 25 percent or higher gradient—where no anadromous fish occur, and otherwise do not meet Class I criteria.

Class III: Perennial and intermittent streams with no fish populations but which have sufficient flow, or transport sufficient sediment and debris, to have an immediate influence on downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.

A stream segment is designated Class III if the following conditions are met for the majority of its length: Bankfull stream width greater than 1.5 meters (5 feet) and channel incision (or entrenchment) greater than 5 meters (15 feet).

Streams that do not meet both the width and incision criteria may be classified as Class III streams based on a professional interpretation of stream characteristics for the stream segment being assessed. The following characteristics **could** indicate a Class III stream:

a. Steep side-slopes containing mobile fine sediments, sand deposits, or deep soils that can provide an abundant source area for sedimentation.

b. Very steep gradient channels (greater than 35 percent slope).

c. Recently transported bedload or woody debris wedges (especially if deposited outside high water mark).

d. High water indicators (scour lines, drift lines, etc.) that greatly exceed observed wetted stream width.

e. Large sediment deposits stored amongst debris that could be readily transported if debris shifts.

Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capacity to directly influence downstream water quality or fish habitat capability. Class IV streams do not meet the criterion used to define Class I, II, or III streams. Class IV streams must have bankfull width of at least 0.3 meter (1 foot) over the majority of the stream segment. For perennial streams, with average channel gradients less than 30 percent, special care is needed to determine if resident fish are present (resident fish presence dictates a Class II designation).

Non-streams: Rills and other watercourses, generally intermittent and less than 1 foot in width, little or no incision into the surrounding hillslope, and with little or no evidence of channel scour. (Note: These micro-drainage features are not mapped in GIS hydrography layers.)

Streamflow

The discharge of water from a watershed that occurs in a natural stream channel.

Stream order

First order streams are the smallest unbranched tributaries; second order streams are initiated by the point where two first order streams meet; third order streams are initiated by the point where two second order streams meet, and so on.

Stream simulation

Installing culverts that mimic and retain the natural stream characteristics of stream width, gradient, substrate and pool depth and spacing. Stream simulation assumes that if a culvert is installed in a manner that mimics that of the stream channel the ability for fish movement will be no less or greater at the road crossing than in the natural channel .

Structure

A term in ecology referring to the arrangement of plant communities or ecosystems across a landscape and how they are connected, and to variations in tree heights and diameters within a stand or between stands.

Subsistence

Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence use as, “the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.”

Subspecies

An aggregate of similar populations of a species generally inhabiting a geographic subdivision of the range of the species and differing taxonomically (e.g., different size or color) from other populations of the species.

Substrate

The size of rock in the bed (bottom) of rivers and streams.

Suitability of Lands

A determination that specific lands within a plan area may be used, or not, for various multiple uses or activities, based on the desired conditions applicable to those lands. The suitability of lands determinations need not be made for every use or activity, but every plan must identify those lands that are not suitable for timber production (FSH 1909.12 chapter 20, section 22.15). (See FSH 1909.12 chapter 60 for timber production suitability.)

Supplemental funds

Funds or materials used to finance the additional cost of a road to a higher standard than is needed for a timber sale.

Suppression

Fire: The act of extinguishing or confining a fire.

Silviculture: The process whereby a tree or other vegetation loses vigor and may die when growing space is not sufficient to provide photosynthate or moisture to support adequate growth.

Surface rights

All rights in the surface of the land except oil, gas, and other mineral or subsurface rights.

Suspended sediment

The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

Sustainability

The capability to meet the needs of the present generation without compromising the ability of future generations to meet their needs. For purposes of 36 CFR 219.19, "ecological sustainability'' refers to the capability of ecosystems to maintain ecological integrity; "economic sustainability'' refers to the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits; and ''social sustainability'' refers to the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another, and support vibrant communities.

Sustained yield

The yield that a forest can continuously produce at a given intensity of management.

Sustained Yield Limit (SYL)

The amount of timber, meeting applicable utilization standards, "which can be removed from [a] forest annually in perpetuity on a sustained-yield basis" (NFMA at section 11, 16 USC 1611; 36 CFR 219.11(d)(6))). It is the volume that could be produced in perpetuity on lands that may be suitable for timber production. Calculation of the limit includes volume from lands that may be deemed not suitable for timber production after further analysis during the planning process. The calculation of the SYL is not limited by land management plan desired condition, other plan components, or the planning unit's fiscal capability and organizational capacity. The SYL is not a target but is a limitation on harvest, except when the plan allows for a departure.

Swale

A slight, marshy depression in generally level land. A depression in glacial ground moraine.

Symbol

Inclusive of all rock art, totemic, and clan symbols.

T

Taxa

For the purposes of this Plan and FEIS, taxa are animal species or sub-species.

Temporary facility

Any structure or other human-made improvement that can be readily and completely dismantled and removed from the site when the authorized use terminates.

Temporary roads

Roads authorized by contract, permit, lease, or emergency operation, not intended to be part of the forest transportation system and not necessary for long-term resource management.

Thinning

A silvicultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality. Thinning may also be done to manipulate stand characteristics to improve wildlife or riparian habitat, or to enhance scenery. Types of thinning include:

Precommercial (PCT). The removal of trees not for immediate financial return but to reduce stocking to concentrate growth on the more desirable trees.

Commercial (CT). Any type of thinning producing merchantable material at least equal to the value of the direct costs of harvesting.

Threatened species

A plant or animal species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Any species that the Secretary of the Interior or the Secretary of Commerce has determined is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are listed at 50 CFR sections 17.11, 17.12, and 223.102.

Threshold

The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

Tiering

Elimination of repetitive discussions of the same issue by incorporating, by reference, the general discussion in an environmental impact statement (EIS) of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

Timber

Wood, other than fuelwood, potentially useable for lumber.

Timber classification

Forested land is classified under each of the land management alternatives according to how it relates to the management of the timber resource. The following are definitions of timber classifications used for this purpose:

Non-Forest. Land that has never supported forests, and land formerly forested where use for timber production is precluded by development or other uses.

Forest. Land at least 10 percent stocked (based on crown cover) by forest trees of any size, or formerly having had such tree cover and not currently developed for non-forest use.

Suitable. Land to be managed for timber production on a regulated basis.

Unsuitable. Land withdrawn from timber utilization by statute or administrative regulation (e.g., Wilderness), or identified as inappropriate for timber production in the Forest planning process.

Commercial Forest. Land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.

Timber production

The purposeful growing, tending, harvesting, and regeneration of trees for industrial or consumer use.

The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. (36 CFR 219.19)

Timber production suitability (lands suited and not suited for timber production)

A forest plan must identify the lands that are suited and not suited for timber production. (FSH 1909.12, chapter 60).

Timber sanitation

Harvesting of timber stands which are substantially damaged by fire, wind throw, or other catastrophe, or which are in imminent danger from insect or disease attack.

Timber stand

A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands.

Timber Stand Improvement

An intermediate treatment made to improve the composition, structure, condition, health, and growth of even or uneven aged stands.

Timed meander

A proven floristic survey method where the surveyor enters the field, records the time, and records all species, while moving through the unit in a meandering search path covering all habitat variations. If after a certain time no new species are found, the survey is considered complete.

Tongass Conservation Strategy

See Old-growth habitat conservation strategy

Tongass Resource Use Cooperative Survey (TRUCS)

A study done to gather information on subsistence uses of the Forest.

Topography

The configuration of a land surface including its relief, elevation, and the position of its natural and human-made features.

Total stream discharge

Total water outflow from stream or river.

Traditional Cultural Property (TCP)

A traditional cultural property is generally one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. Examples include a rural community whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents; or a location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice. See also Sacred Sites and Heritage Resources.

Traffic Service Level (TSL)

Describes a road's significant traffic characteristics and operating conditions. The levels reflect a number of factors, such as speed, travel time, traffic interruptions, freedom to maneuver, safety driver comfort, convenience, and operating costs. These factors, in turn, affect design elements such as number of lanes, turnout pacing, lane widths, type of driving surface, sight distances, design speed, clearance, horizontal and vertical alignment, curve widening, and turnarounds.

TSL A. Reflects transportation efficiency and mobility with few interruptions to flow and a stable smooth driving surface.

TSL B. Generally would have alignment more influenced by topography and more interruptions, but still usually a stable smooth driving surface.

TSL C. One could expect much more sinuous alignment to reduce construction costs with a surface that may not be stable under all traffic or weather conditions.

TSL D. Generally constructed for a single purpose, and traffic is discouraged for other purposes; surface and alignment is rough and irregular; very low speeds are anticipated to be able to safely negotiate the road.

Transmission (electric)

An interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for delivery to customers or is delivered to other electric systems.

Transportation system

See forest transportation system.

Transportation Systems Corridors (TSC)

Existing and future transportation systems such as those identified by the State of Alaska in the current version of the Southeast Alaska Transportation Plan (SATP) and applicable laws (for example, Section 4407 of Public Law 109-59, Title XI of the Alaska National Interest Lands Conservation Act (Public Law 96-487).

Transportation/Utility corridor

A linear strip of land identified for the present location of transportation or utility rights-of-way within its boundaries.

Travel management

Providing for the safe, environmentally responsible, and customer responsive movement of vehicles and people to and through public lands (social attributes).

Travel Management Plan

The plan for the system of access roads, trails, and airfields needed for the protection, administration, and utilization of the National Forests and other lands administered by the Forest Service, or the development and use of resources upon which communities within or adjacent to the National Forests are dependent (36 CFR 212.1). The plan also addresses permanent or temporary road closures necessary for resource protection or public safety.

Trust

A right of property, real or personal, held by one party for the benefit of another (Black 1979).

Turbidity

An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample; turbidity in water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms.

Two-aged management

A regeneration method that regenerates and maintains a stand with two-age classes where the reserved trees are distributed somewhat evenly as individual or clumps and represent 15 percent or more of the stand's pre-treatment basal area. The resulting stand may be two-aged or trend towards an uneven-aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserved trees that may represent one or more age classes. Two-aged stands are created using these regeneration methods:

1. Clearcutting with reserves
2. Seed tree with reserves
3. Shelterwood with reserves.

The reserved trees are not harvested to attain goals other than regeneration.

Two-Log Rule

See economically viable young-growth timber.

Type conversion

The act of converting a plant community from one vegetative type to another. In forestry, it is the act of changing the existing dominant tree species from one type to another.

U

Unconfined streams

Streams that, due to lack of stream incision, and effects of geomorphic landform characteristics and local geologic conditions, result in streams overflowing their banks, changing flows to other channels, and establishing new channels during flood conditions.

Understory vegetation

All forest vegetation growing under an overstory.

Undertaking

In cultural resources, any project, activity, or program that can result in changes in the character or use of historic properties, if any such properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a federal agency or be licensed or assisted by a federal agency. Undertakings include new and continuing projects, activities, or programs and any of their elements not previously considered under Section 106, National Historic Preservation Act of 1966, as amended.

In cultural resources, an undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval. (See 36 CFR 800 (16)(y))

Uneven-aged management

A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes.

Unproductive forest land

Forest land incapable of yielding crops of industrial wood because of adverse site conditions.

Unprogrammed timber harvest

Timber harvest that occurs on unsuitable forested lands and does not contribute to the allowable sale quantity.

Unroaded area

An undeveloped area typically less than 5,000 acres but of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition.

Unsuitable lands

Forest land not managed for timber production because: 1) Congress, the Secretary, or the Chief has withdrawn it; 2) it is not producing or capable of producing industrial wood; 3) technology is not available to prevent irreversible damage to soils productivity or watershed conditions; 4) there is no reasonable assurance, based on existing technology and knowledge, that it is possible to restock lands within 5 years after final harvest; 5) there is, at present, a lack of adequate information about responses to timber management activities; or 6) timber management is inconsistent with or not cost efficient in meeting the management requirements and multiple-use objectives specified in the Forest Plan.

Upland

Areas that do not classify as wetlands or riparian areas.

Utility lines

Utility lines may include lines for telecommunication, electricity distribution, natural gas, cable television, fiber optics, traffic lights, street lights, storm drains, water mains, and wastewater pipes.

Utilization standards

Standards guiding the use and removal of timber.

Utility volume

Logs that do not meet minimum requirements for sawtimber but are suitable for the production of usable chips. They are measured in terms of diameter at breast height (DBH), top of the tree inside the bark (top DIB), and the percentages of “soundness” of the wood.

V

Valley

An elongated, relatively large, externally drained depression of the earth’s surface that is primarily developed by stream erosion.

Valley bottom

A general term for the nearly level to gently sloping part of a valley. Also referred to as the valley floor.

Value Comparison Unit (VCU)

First developed for the 1979 Tongass Land Management Plan as distinct geographic areas that generally encompass a drainage basin containing one or more large stream systems. Boundaries usually follow easily recognizable watershed divides. There are 926 units established to provide a common set of areas for which resource inventories could be conducted and resource value interpretations made.

Veneer log

A log considered suitable in size and quality for producing veneer that is a thin sheet of wood of uniform thickness.

Very poorly drained soils

Water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage class usually occupy level or depressed sites and are frequently ponded.

Viable population

For forest planning purposes, a fish or wildlife population that has the estimated number and distribution of reproductive individuals to insure its continued existence is well distributed in the National Forest.

A population of a species that continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future environments. (36 CFR 219.19)

Viewshed

An expansive landscape or panoramic vista seen from a road, marine waterway, or specific viewpoint.

The area that is potentially seen from a specific viewing point using a planimetric approach.

Visual absorption capability (VAC)

The capability of the landscape to visually absorb management activities. Landscapes are rated with high, intermediate, or low abilities to absorb management activities. These ratings reflect the degree of landscape variety in an area, viewing distance and topographic characteristics. As an example, steep, evenly sloped landscapes viewed in the foreground to middleground are typically given a low VAC rating.

V-Notches

A deeply incised valley along some waterways that would look like a “V” from a frontal view. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Volume strata

Divisions of old-growth timber volume derived from the interpreted timber type data layer (TIMTYP) and the common land unit data layer (CLU). Three volume strata (low, medium, and high) are recognized in the Forest Plan. These have been further subdivided in the size density model.

W

Watershed

The area that contributes water to a drainage or stream. Portion of the forest in which all surface water drains to a common point. Watersheds can range from tens of acres that drain a single small intermittent stream to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams.

Third order watershed. A watershed where there are (generally) two major branches to the mainstream of the watershed. (Also see the definition for stream order.)

Fourth order watershed. A watershed that contains at least two third order watersheds.

A region or land area drained by a single stream, river, or drainage network; a drainage basin (36 CFR 219.19).

Typically, watersheds are delineated as hierarchical Hydrologic Units in the national Watershed Boundary Dataset, cooperatively managed by state and federal agencies. In the context of the Forest Plan, watersheds may correspond to VCU or LUD boundaries which may or may not correspond to the boundaries delineated in the Watershed Boundary Dataset.

Watershed analysis

A systematic procedure for characterizing and evaluating ecological processes within a watershed to meet specific management and social objectives. Forest Plan Appendix C explains the process for watershed analysis on the Tongass.

In the context of the Forest Plan, watershed analysis is very narrowly defined as a procedure required only in specific circumstances: before making site specific adjustments to Forest-wide Riparian Standards and Guidelines, before authorizing management activities in public water system source water protection areas, or any other time a line officer determines that it is necessary to make an informed decision. Compare to cumulative effects analysis.

Water table

The upper surface of the ground water or that level below which the soil is saturated with water.

Well-drained soils

Water is removed from the soil readily, but not rapidly.

Wetlands

Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wild and Scenic Rivers

Rivers or sections of rivers designated by congressional actions under the 1968 Wild and Scenic Rivers Act. Wild and scenic rivers may be classified and administered under one or more of the following categories:

Wild river areas. Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic river areas. Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational river areas. Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

A river designated by Congress as part of the National Wild and Scenic Rivers System that was established in the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 (note), 1271–1287) (36 CFR 219.19).

Wilderness

Areas designated by congressional action under the 1964 Wilderness Act or subsequent Acts. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historic value as well as ecologic and geologic interest. On the Tongass National Forest, Wilderness has been designated by the Alaska National Interest Lands Conservation Act of 1980 and Tongass Timber Reform Act of 1990.

Any area of land designated by Congress as part of the National Wilderness Preservation System that was established in the Wilderness Act of 1964 (16 U.S.C. 1131–1136) (36 CFR 219.19).

Wildfire

Any wildland fire not designated and managed as a prescribed fire within an approved prescription. All wildfires will be given an appropriate suppression action.

Wildlife Analysis Area

A division of land used by the Alaska Department of Fish and Game for wildlife analysis (WAA).

Wildlife Reserve Trees

Dead, dying, defective, or damaged trees left standing after harvest to provide wildlife habitat.

Windfirm

Trees not likely to be blown over by the wind. These are usually trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features or other trees.

Windthrow

The act of trees being uprooted by the wind. In Southeast Alaska, Sitka spruce and hemlock trees are shallow rooted and susceptible to windthrow. There are generally three types of windthrow—endemic where individual trees are blown over; catastrophic where a major windstorm can destroy hundreds of acres; and management related, where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Windthrow management area

A managed area designed to minimize windthrow within an adjacent no-harvest area.

Winter range

An area, usually at lower elevation, used by a variety of wildlife species during the winter months; usually smaller and better-defined than summer ranges.

Withdrawal

The withholding of an area of federal land from settlement, sale, location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain other public values in the area.

Woodstock

A forest modeling system that can be used to perform a wide variety of analyses, including harvest scheduling and wood supply analysis, wildlife management and simulation of forest ecosystems. Woodstock was used in the Forest Plan analysis to determine Projected Timber Sale Quantity (PTSQ) and Sustained Yield Limit (SYL).

Y

Yarding

To convey logs or trees to a landing by cable, helicopter or other systems. Shovel- yarding is also used in Southeast Alaska.

Young growth

Forest growth that has regenerated naturally or has been planted after some disturbance (e.g., clearcut harvest, serious fire, catastrophic windthrow, or insect attack) to the previous forest growth.

The term young growth is synonymous with second growth.

Young-growth forest

A relatively young forest that has been regenerated naturally or artificially after some drastic interference such as extensive cutting, wildfire, insect or disease attack, or blowdown (Helms 1998). On the Tongass a forest younger than 150 years is considered young-growth forest.

APPENDIX A
IDENTIFICATION OF LANDS SUITABLE FOR TIMBER PRODUCTION AND LIMITATIONS ON TIMBER HARVEST

Appendix A

Identification of Lands Suitable for Timber Production and Limitations on Timber Harvest

Introduction

This appendix presents the review of lands within the plan area to identify their suitability for timber production. During forest land and resource management planning, the Forest Service is required to identify lands suited and not suited for timber production (36 Code of Federal Regulations [CFR] 219.11).

The process used in the 1997 Forest Plan was consistent with the 1982 National Forest Management Act (NFMA) Regulations (36 CFR 219.14 (a)(1) through (4)). The appendix from the 1997 plan was brought forward and used in the 2008 Forest Plan with minor updates. Appendix A is updated to comply with the 2012 Planning Rule.

Suitable lands in this Forest Plan constitute the land base for determining vegetation management practices associated with timber production.

The status of land as suitable for timber production does not mean that timber production is the primary purpose of management on those lands. It means that timber production is compatible with the achievement of desired conditions and objectives established by the plan for those lands (36 CFR 219.11(a)(1)(iii)), and some regular flow of timber products may be expected.

Suitability of Lands

Suitability of lands is a determination made regarding the appropriateness of various lands within a plan area for various uses or activities, based on the desired conditions applicable to those lands. Identifying lands not suited for timber production is accomplished in two steps (see Process for Identifying Suitability below):

1. Identify lands that are **not suited** based on legal and technical factors at 36 CFR 219.11 (a) (i), (ii), (iv), (v), and (vi), further described in FSH 1909.12, Sections 61.11 to 61.14. If any of these factors apply to the land, the land is not suited for timber production.

   Subtract the lands that are not suited from the total of National Forest System lands. The remaining lands are lands that **may be suited** for timber production, and are considered in step 2.

2. From the lands that may be suited for timber production (the remaining lands from step 1), identify lands that are **suited for timber production**, based on the compatibility of timber production with the desired conditions and objectives for those lands. (Consult FSH 1909.12, Section 61.2.)

The process is defined for the preferred alternative. Lands suitable for timber production based on multiple-use objectives were identified for each of the

alternatives analyzed in detail in the FEIS for the plan amendment. Table A-1 displays the results of the suitability process, and lists the acreage for each step.

Table A-1
Timber Production Suitability Classification

Land Classification Category	Acres[1]
A. Total National Forest System lands within the plan area	16,755,685
B. Lands not suited for timber production due to legal or technical reasons	15,794,004
C. Lands that *may* be suited for timber production (A-B)	961,681
D. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan	393,648
E. Total lands not suited for timber production (B+D)	16,187,652
F. Total lands suited for timber production (mapped suitable) because timber production is compatible with the desired conditions and objectives established by the plan (C-D)	568,033
G. Model Implementation Reduction Factor (MIRF) Acreage	90,138
H. Estimated actual suitable acreage for timber production (F-G)	477,895
I. Scheduled suitable acreage (based on modeling)	326,623

[1] Based on GIS database

Refinement of Suitable Land Acreage: The suitable lands estimated following the process below and identified in Table A-1 represent a first attempt at estimating the acreage of suitable forest land. However, this estimate overestimates the actual suitable acreage because it is based on the available Forest-wide mapping, which because of the size an inaccessibility of many lands has limitations.

When projects are implemented on the Tongass National Forest typically more streams, karst or other factors are found that reduce the acreage of suitable lands. In order to account for this reduction during modeling, the Tongass has included a correction factor called the Model Implementation Reduction Factor or MIRF. How this correction factor is determined is documented in Appendix B of the FEIS and in the planning record.

Thus, in Table A-1 two estimates of suitable are given. The mapped suitable (Row F) is the estimated suitable using available mapping and based on the above process. The estimated actual suitable (Row H) is the mapped suitable minus the MIRF acres (Row G). The final number in Table A-1 represents the scheduled suitable (Row I). This acreage is based on Forest Plan modeling and represents the acreage that is scheduled for harvest by the model over the long term (i.e., 100 years).

Process for Identifying Suitability (Two Steps)

Step 1 – Lands Not Suitable for Timber Production based on Legal and Technical Factors (FSH 1909.12, Section 61.1)

Timber production may be prohibited on certain lands by statute, Executive order, regulation, or where the Secretary of Agriculture or the Chief of the Forest Service has withdrawn the land from timber production (36 CFR 219.11(a)(1)(i) and (ii), and FSM 1921.12). The lands not suitable for timber production due to legal or technical reasons (Row B in Table A-1) include the following:

Lands on which Timber Production is Prohibited or Withdrawn from Timber Production (FSH 1909.12, Section 61.11)

1. Designated Areas
    A. Statutorily Designated Areas
        1) Wilderness
        2) National Monument
        3) Nonwilderness National Monument
        4) Land Use Designation (LUD II) areas
        5) Stream buffers under Section 103 of the Tongass Timber Reform Act
    B. Administratively Designated Areas
        1) Inventoried Roadless Areas
        2) Research Natural Areas
        3) Municipal Watersheds
        4) Experimental Forests

Land that Is Not Forest Land (Nonforest) (FSH 1909.12, Section 61.14)

Nonforest lands are lands that do not meet the definition of forest lands contained in 36 CFR 219.19. Thus, nonforest lands are less than 10 percent occupied by forest trees of any size or that formerly had such tree cover and are currently developed for nonforest uses.

1. Land developed for nonforest uses includes areas for agricultural crops, improved pasture, residential or administrative areas, improved roads of any width and adjoining road clearing, and powerline clearing of any width; and

2. Lands that were formerly occupied by tree cover, but do not presently have tree cover, should be identified as nonforest unless the land will be naturally or artificially regenerated into forest cover in the near future (example: clearcut lands.

Lands for which Adequate Response Information is Not Currently Available

Forest land shall be classified as not suited for timber production, if there is not adequate information available, based on current research and experience, to project response to timber management practices. These lands shall be identified as needing further inventory, research, or information and shall not be considered as part of the suitable land base, until such time those adequate response data are available. Give special attention to lands classified as incapable of producing 20 cubic feet/acre/year. Lands meeting this criterion are generally mapped as forested lands with low productivity in the Forest Productivity attribute of Cover Type in the Forest Plan GIS Database.

Lands Not Capable of Producing Industrial Wood

Lands that are not capable of producing crops of industrial wood are, by definition, to be classified as not suited for timber production. Species of trees that are not currently utilized or not expected to be utilized within the next 10 years, constitute the primary criterion for assigning lands to this category (e.g., black cottonwood, lodgepole pine, and alder).

Lands on which Technology to Harvest Timber is Not Currently Available without Causing Irreversible Damage (FSH 1909.12, Section 61.12)

Lands on which technology to harvest timber is not currently available without causing irreversible damage include the following:

1. High vulnerability karst lands as described in Appendix H; and
2. Soils that occur on slopes over 72 percent gradient and soils on slopes less than 72 percent gradient that have a mass movement index (MMI) of 4. (Consult Chapter 4 Soil and Water direction.)

Lands on Which There is No Reasonable Assurance that Lands Can be Adequately Restocked within Five Years of Final Regeneration Harvest (FSH 1909.12, Section 61.13)

If there is no reasonable assurance that lands can be adequately restocked within five years after final regeneration harvest, those lands must be identified as not suitable for timber production. Criteria for restocking is found in FSH 2409.17, Region 10 Supplement No. 2409.17-99-3, chapter 2.

Step 2 – Lands Suited and Not Suited for Timber Production Based on Compatibility with Desired Conditions and Objectives (FSH 1909.12, Section 61.2)

Lands that may be suitable for timber production (described in Step 1 and shown in Row C of Table A-1) are identified as suited for timber production if they are compatible with desired conditions and objectives. Lands that are not compatible with desired conditions and objectives are not suited for timber production (shown in Row D of Table A-1).

Timber production is compatible with the desired conditions and objectives of the following LUDs, including specific areas (e.g., beach fringe, riparian management areas) within these LUDs:

1. Non-Development LUDs
    A. Forest land in non-development LUDs are identified as **not suited** for timber production, except for young-growth stands in the Old-growth Habitat LUD.
2. Old-growth Habitat LUD (specific areas)
    A. Young-growth stands that meet all the other suitable criteria in the Old-growth Habitat LUD are identified as suitable for timber production. See Chapter 5, Young Growth Direction in the Wildlife (WILD) section.
    B. Young-growth stands in the beach buffer are identified as suitable for timber production, except for those areas within 200 feet of the mean high tide line. See Chapter 5, Young Growth Direction in the Beach and Estuary Fringe (BEACH) section.
    C. Young-growth stands in RMAs outside of TTRA buffers are considered suitable for timber production. See Chapter 5, Young Growth Direction in the Riparian (RIP) section.

3. Development LUDs (and specific areas)

    A. Forest lands that meet all the other suitable criteria in the Development LUDs (Scenic Viewshed LUD, Modified Landscape LUD, and Timber Production LUD) are identified as suitable for timber production (with the exception described in item 3B).

    B. Old-growth forest located within Phases 2 and 3 of the Tongass Timber Sale Program Adaptive Management Strategy (refer to the December 2016 Tongass National Forest Timber Sale Program Adaptive Management Strategy map), or within the T77[1] Watersheds and The Nature Conservancy / Audubon conservation priority areas (refer to the June 2016 Final EIS Alternative 5 Suitable Land map) is identified as not suitable for timber production. However, young-growth stands located within Phases 1, 2, and 3 in the T77 Watersheds and The Nature Conservancy / Audubon conservation priority areas are identified as suitable for timber production.

    C. Young-growth stands in the beach buffer are identified as suitable for timber production, except for those areas within 200 feet of the mean high tide line. See Chapter 5, Young Growth Direction in the Beach and Estuary Fringe (BEACH) section.

    D. Young-growth stands in RMAs outside of TTRA buffers are considered suitable for timber production. See Chapter 5, Young Growth Direction in the Riparian (RIP) section.

Planned Timber Sale Program

The sustained yield limit (SYL) is the amount of timber that could be produced on all land that *may be suitable* for timber production, assuming all of these lands were managed to produce timber without considering other multiple uses or fiscal or organizational capability. The SYL for the Tongass National Forest is estimated to be 55 million cubic feet (MMCF) or 248 million board feet (MMBF) per year (Table A-2).

The projected wood sale quantity (PWSQ), is an estimate of the volume of all timber and other wood products that is expected to be sold during the plan period from expected harvests for any purpose (except salvage harvest or sanitation harvest) on all lands in the plan area. The projected wood sale quantity includes all woody material likely to be sold from these harvests whether or not the woody material meets the utilization standards. The PWSQ for the Tongass National Forest is estimated at 10.8 MMCF per year for the first decade and 17.0 MMCF per year for the second decade (Table A-2).

Projected timber sale quantity (PTSQ) is the estimated quantity of timber meeting applicable utilization standards that is expected to be sold during the plan period. As a subset of the PWSQ, the PTSQ includes volume from timber harvest for any purpose from all lands in the plan area based on expected harvests that would be consistent with the plan components. The PTSQ is also based on the planning unit's fiscal capability and organizational capacity. PTSQ is not a target

[1] The Tongass 77 (T77) refers to value comparison units (VCUs), which approximate major watersheds located on National Forest System lands that Trout Unlimited, Alaska Program identifies as priority salmon watersheds. As a result of the Sealaska Land Entitlement Finalization in the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act for Fiscal Year 2015 (Public Law 113-291), there was a net reduction in the T77. To provide clarity and consistency, the T77 nomenclature will continue to be used in this document when referring to these priority watersheds.

nor a limitation on harvest, and is not an objective unless the responsible official chooses to make it an objective in the plan. The PTSQ for the Tongass National Forest is estimated to be 46.0 MMBF or 10.3 MMCF per year for the first decade, increasing to 71.8 MMBF or 16.0 MMCF per year for the second decade, due to more young growth reaching harvestable age (Table A-2).

Table A-2
Planned Timber Sale Program, Tongass National Forest, including Annual Average Volume Outputs for 1st and 2nd Decade

Sustained Yield Limit (SYL):	248 MMBF or 55 MMCF[1] per year			
	First Decade		Second Decade	
Timber Products				
	MMCF	MMBF	MMCF	MMBF
Lands suitable for timber production				
Sawtimber	10.3	46.0	16.0	71.8
Other products				
Lands not suitable for timber production				
Sawtimber				
Other products				
Projected Timber Sale Quantity (PTSQ)	10.3	46.0	16.0	71.8
Other Estimated Wood Products[2]				
	MMCF	Tons	MMCF	Tons
Fuelwood	0.5	10,000	1.0	20,000
Projected Wood Sale Quantity (PWSQ)	10.8		17.0	

[1] MMCF: Millions of cubic feet
MMBF: Millions of board feet
[2] Does not include wood provided through the Tongass personal use firewood or free use timber programs.

APPENDIX B
FINAL
TONGASS ADVISORY COMMITTEE RECOMMENDATIONS

Tongass Advisory Committee Final Recommendations

December 2015

Acknowledgements

The TAC received guidance and support from:

Jason Anderson – Designated Federal Official and Deputy Forest Supervisor, Tongass National Forest

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Cover Photo Credit: Sitka Conservation Society

Executive Summary

The Tongass Advisory Committee (TAC) was federally chartered in the winter of 2014 to advise the Secretary of Agriculture on developing an ecologically, socially, and economically sustainable forest management strategy for the Tongass National Forest. They were specifically tasked with developing recommendations about how to transition within 10 to 15 years from old growth to predominantly young growth timber management in a way that is economically viable for the existing industry, while recognizing and balancing the other unique and equally important resource values of the Tongass.

The TAC was comprised of fifteen members from the timber industry, conservation community, Native interests, government, and "other" interests. The TAC members were selected because of their deep knowledge and their willingness to work collaboratively on new approaches, practices, and responses to historically contentious management challenges. They did so with diligence, respect, and honesty during nine meetings between August 2014 and December 2015. (All meeting materials, summaries, and background documents are available on the Committee website: www.merid.org/tongassadvisorycommittee.) Early in the process, they all agreed on a common vision:

"Southeast Alaska is comprised of prosperous, resilient communities that have the opportunity to predictably use and benefit from the diversity of forest resources to achieve the cultural, social, economic, and ecological health of the region for current and future generations."

With that vision in mind, and through extensive modeling of young growth availability, literature review, and consideration of public comments, the TAC achieved consensus on a comprehensive package of recommendations for analysis purposes. Following release of the Draft Environmental Impact Statement and proposed Forest Plan, the TAC reviewed the analysis finalized its recommendations with very few substantive changes. Their work offers the possibility of a regionally focused, collaborative path toward an innovative opportunity for a viable young growth timber industry while honoring the suite of economic, ecological, social, and cultural values inherent in the Forest.

Forest Plan Amendment Recommendations

The TAC's analysis revealed that the current Forest Plan would most likely not achieve the transition to young growth within the 10-15 year timeframe set out in their Charter. Recognizing that a different approach is required, the TAC recommended employing a "co-intent" mandate in the Forest Plan Amendment to improve habitat conditions and long–term ecological function in young growth stands while producing timber volume from those areas. This will enable the Forest to move out of old growth as quickly as possible and accelerate the transition while sustaining an economically viable timber industry.

To implement the co-intent approach, the TAC recommends that the Forest Service:

a) **Maximize the use of flexibilities designed to replace old growth harvest with young growth harvest on a one-to-one volumetric basis**. For the purposes of the recommended flexibilities in young growth management, the overall transition period is defined by the TAC as a period not to exceed 15 years from the date of the Amendment's Record of Decision (ROD). The TAC is making these recommendations to apply to young growth timber only and would not apply them to old growth timber.
b) **Provide more flexibility and opportunities in the existing timber management areas for young growth.**
c) **Use specific treatments for young growth harvest in areas that are not currently designated as "suitable" for harvest during the transition period, provided the original objective of the particular Land Use Designation (LUD) and/or standards and guidelines (S&Gs) is respected**. The TAC recognized the high ecological value of the non-suitable lands. However, many of those stands of young growth forest do not provide the full ecological function that they would have in the un-harvested state. Habitat treatments that improve ecological conditions will benefit wildlife and game populations while also improving the ecological functioning of the larger landscape, and will increase the understanding of effective habitat restoration treatments and allow operators to become more effective at habitat restoration activities.
d) **Aggressively monitor the outcomes of management activities resulting from the transition and apply adaptive management to improve outcomes**. Review the recommended flexibilities made by the TAC for all LUDs and S&Gs at least every five years. At the conclusion of the transition, a full review process should be conducted to evaluate continuity in whole, part, or expanded form.
e) **Fully utilize currently allowed prescriptions in beach buffer, Old Growth Reserves, and Riparian Management Areas (outside of Tongass Timber Reform Act buffers) that improve fish and wildlife habitat and create a commercial byproduct.** Further, the TAC believes that young growth volume produced from these treatments should be counted towards the Potential Timber Sale Quantity.
f) **Identify where young growth timber projects, during the period of the transition, intersect with certain high-value fish watersheds.** In these areas of intersection, conduct a timely scientific review to determine likely impacts to fish and wildlife habitat from timber harvest. If harvest is proposed in one of these watersheds, the Forest Service may apply additional standards or guidelines to mitigate risk to fish habitat.
g) **Maintain the existing suitable land base for young growth timber (i.e., no net loss of young growth acres).** If suitable young growth acres are removed from the timber base as a result of review, an equal number of acres should be added to the young growth timber base.
h) **Engage stakeholders, such as conservation interests, timber operations, permitted user groups, and other interested parties in multi-party planning using an integrated resource management planning framework** to: best design and

implement projects to meet ecological, social, and economic goals; provide best practices for producing timber volume from treatments; and develop management prescriptions and identify areas where co-intent prescriptions are best applied. Monitor the response of the timber industry and assist in their transition by investing in infrastructure and market development.

i) **Overhaul administrative practices for timber sales to improve timeliness, lower costs, and strengthen supply consistency** required in an industry dependent on predominantly young growth.

Old Growth Bridge Strategy

By bringing more young growth forward sooner in the transition period, the Forest can reduce old growth harvest earlier. For every unit of young growth volume brought forward into the transition solution, there should be an equal unit less of old growth. Ultimately this will result in transitioning from old growth to young growth in less than 15 years by making more young growth available for harvest and substituting young growth for old growth on a one-to-one volumetric basis, using the annual timber demand, which will be held constant during the transition period.

To provide a more accurate prediction of available young growth during the transition, the TAC recommends a thorough analysis of young growth inventory at the stand level in the first three years of the transition. Based on this information, the Forest should plan and produce sufficient young growth volume to ensure the required volume through the transition that meets the determined demand. Because the young growth volume is not sufficient to meet demand during the transition period, the Forest should develop a unit pool[1] for bridge timber volume within a specified timeframe to meet the volume demand that cannot be met by young growth during the transition.

Following the transition period, the TAC recommends that the Forest maintain a post-transition annual old growth timber harvest that will meet the long-term demand of small- and micro-sale programs.

Implementing the Transition

The TAC concluded that cultural and operational changes in how the Forest conducts its business are mandatory for the success of the transition. The Forest Service must play a pivotal role in leading, fostering, and supporting the societal and institutional learning the transition will require. Openness, transparency, and collaboration both within the Forest and with external parties will be essential. The TAC's detailed implementation recommendations provide guidance on crucial elements for success and identify critical opportunities by which the TAC,

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[1] A unit pool refers to a stand or polygon within a project area, within which landscape objectives could be considered.

Agency, and greater community will share ownership of the transition strategy and embrace its successful implementation.

The recommendations include the following transformative steps:

- Pursue partnerships and collaboration;
- Improve internal Forest Service coordination;
- Support and encourage leadership at the District Ranger level;
- Revamp the sale planning and assessment process;
- Maximize the use of stewardship contracts and agreements; and
- Address incentives and feasibility for operators, and domestic processing and consumption.

In addition, the transition to young growth must provide economically and financially viable opportunities for industry, and meaningful economic and employment benefits to local communities. The TAC provided detailed recommendations for targeted investment, financial assistance, and financing mechanisms for stand inventory, research, infrastructure, and retooling. These investments are intended to help communities and businesses successfully transition to, and thrive within, a new young growth economy.

Monitoring and Research

The TAC's commitment to creating conditions for Tongass communities to thrive is reflected in recommendations for robust and active monitoring and adaptive management:

a) **Convene a Forest-wide collaborative group** as the mechanism by which stakeholders support and help hold themselves and the Forest accountable to the goals of the transition.
b) **Contract an appropriate organization to conduct a baseline socioeconomic benefits analysis** as soon as possible. Key "dashboard" metrics to be included in the analysis are listed in the recommendations report.
c) **Conduct ongoing benefits analyses** at regular intervals for the life of the current plan to demonstrate changes over time in the relationship between planning and implementation of timber and stewardship work and community wellbeing.

In summary, the TAC's recommended actions represent a new paradigm for the Tongass National Forest, and situate the Forest at the leading edge of forest management in the United States. We look forward to the Agency and stakeholders taking on the challenge together of adopting and implementing this paradigm.

Table of Contents

Acknowledgements 1

Executive Summary 2

Forest Plan Amendment Recommendations 2

Old Growth Bridge Strategy 4

Implementing the Transition 4

Monitoring and Research 5

Table of Contents 6

Introduction 1

Background 1

Purpose 3

Vision 3

Recommendations and Action Plan 4

Rationale 4

Overarching Principles 4

Approach 5

Recommendations for Land Use Designations and Standards and Guidelines 6

Timber Management (TM) 8

Modified Landscape & Scenic Viewshed 9

Currently Non-suitable Lands 10

Old Growth Reserves, Riparian Mangagement Areas Outside of TTRA, and Beach Buffers 11

Old Growth Bridge Strategy 13

Implementation Strategy 14

Purpose 14

Essentials of the Transformation: 14

Leadership and a Culture of Collaboration and Transparency 14

Implementation Recommendations 15

Transition Economics and Investment 23

Introduction 23

Investment Recommendations 24

Monitoring and Research 27

Monitoring Principals (*Why*) 27

Monitoring Recommendations (*How*) 27

Dashboard Metrics (*What*) 29

Appendix A: Tongass Advisory Committee Members 31

Appendix B: TAC Charter 32

Appendix C: High-Value Fish Watersheds 37

Appendix D: Map of Phase 1 Lands, T77 Watersheds, and TNC/Audubon Core Conservation Areas 38

Appendix E: *Suggested Draft* Memorandum of Understanding Between Forest Collaborative Stakeholder Group Representatives And The U.S. Forest Service Tongass National Forest 39

Appendix F: Outline for Socioeconomic Analyses 43

Acronyms and Abbreviations 46

Introduction

Background

The Tongass National Forest (Tongass or Forest) is the largest National Forest in the Nation. The Tongass is comprised of 16.7 million acres and covers the great majority of Southeast Alaska, with the Forest Service (USFS) by far the largest landowner in this part of Alaska. There are 3.4 million acres of Development Land Use Designations (LUDs) allowing commercial timber harvesting, with the remaining 13.3 million acres designated as Wilderness (5.9 million acres) and Natural Setting (7.4 million acres).[2] Only a little over 400,000 acres of timber has actually been harvested to date. This proposal focuses on the 360,000 acres of young growth available to meet the goals of the transition.

There are dozens of communities, including many longstanding Native villages, that exist within the region covered by the Tongass. These communities use and depend on the resources of the Tongass. As a consequence, management decisions and actions of the Tongass National Forest have a great deal of influence on these communities. A multitude of resources and activities produced from the Forest fuel the economies, livelihoods, and way-of-life for the people who live there. The Tongass is also one of the largest temperate rainforests in the world, containing large tracts of intact ecosystems critical to preserving biodiversity and capturing carbon to help mitigate the effects of climate change.

The Tongass is a Native place, home of the Tlingit, Haida, and Tsimshian people, whose cultural identities and traditional way of life are rooted in and tied to the land and waters of Southeast Alaska. Alaska Natives have continuously inhabited the Forest for more than 10,000 years and today are dependent on subsistence hunting and fishing, and utilization of all Tongass resources to sustain their bodies, as well as their traditions, cultures, and livelihoods.

The Forest is a productive landscape that sustains robust fish stocks for subsistence, personal use, and commercial and sport fisheries. Maintaining the habitat diversity and connections among watersheds is essential to the continued productivity of the Forest's salmon fisheries. Land managers are increasingly aware of the economic and social contributions of activities that sustain all these important fisheries.

The Tongass is also home to a vibrant and growing tourism industry. Tourism, from large cruise ships to small and independent tours, plays an important role in the economies of

[2] A chart of acreages is located within the Tongass National Forest 2008 Land and Resource Management Plan, available at: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5367422.pdf.

communities throughout Southeast Alaska. Additionally, the Tongass provides many communities with lake-tap hydropower and presents many opportunities for renewable energy. Then, of course, the Tongass is home to a variety of wildlife and birds; all of which enrich the lives of those who live in and/or visit the Tongass.

The Tongass has a renewable timber resource that is managed on a sustainable basis. During the second half of the 20th century, two fifty-year contracts spurred investments and year round jobs in Southeast Alaska. The region experienced a timber boom with Tongass timber supplying two large regional pulp mills, several large sawmills, and numerous small mills and manufacturing businesses. During that time, several hundred thousand acres were harvested. Many of those stands have continued to be managed for various purposes including future timber production. These stands are now known as young growth and constitute the primary focus of this report for purposes of future harvest.

Contentious debate over Tongass management has overshadowed the opportunities for local solutions. The establishment of the Tongass Advisory Committee (TAC) represents a turning point in Tongass management, seeking new approaches, practices, and responses. The TAC offers a regionally focused, collaborative path toward an innovative opportunity for a viable young growth timber industry, while honoring the suite of values – economic, ecological, social and cultural – inherent in the Forest. (See Appendix A, pg. 31, for a list of TAC members.)

This Plan Amendment is being drafted in a time marked by transition. It is the transition away from predominantly old growth timber harvest to young growth harvest. The Secretary of Agriculture has specifically spelled out the terms of this transition when he set up the Charter for the TAC (see Appendix B, pg. 32). This Charter is narrow in scope and does *not* charge the TAC with making overall recommendations in regard to fisheries, recreation, wildlife management, or tourism. This does not mean these values are overlooked. It does mean that the recommendations of the TAC will be timber-centric in accordance to the Charter issued by Secretary Vilsack. It is important to note that these timber-centric recommendations do not comprise the sole direction of the Tongass National Forest and the TAC encourages the USFS to continue and expand their management and investment in other important sectors of Tongass, such as fisheries, the visitor industry, and renewable energy.

In regards to the management of young growth forest-land, the principles of vegetation management for wildlife, patch cuts and ecological restoration will be relied upon. In regards to the harvest of old growth trees, the principle employed is to replace old growth harvest with young growth harvest within 10-15 years, except for small operators dependent on low-volume, niche markets. The 2016 Plan Amendment should provide the flexibility for USFS staff, partners, and collaborators to succeed in transitioning the Southeast Alaska timber industry from predominantly old growth to young growth. Additionally, the TAC aims to encourage local processing and other economic benefits for local communities and villages.

A critical component for this Plan Amendment to succeed is USFS management embracing the concept of co-intent as outlined in the recommendations of the TAC on page 6.[3] The TAC believes that co-intent creates the space for the USFS to be flexible, adaptive, creative, transparent, and innovative. These traits will be necessary to implement balanced recommendations that foster community well-being, and recognize the priorities of the larger American public.

Purpose

The purpose and need for this Forest Plan Amendment is to respond to the Secretary of Agriculture's July 2nd, 2013 memorandum that directs the USFS to transition timber harvest on the Tongass away from a predominately old growth timber harvest to the utilization of young growth timber resources.[4] This Plan is being amended specifically to accommodate a strategy for the transition that creates opportunities in young growth management and the utilization of forest products in a manner that enhances the economic vitality of the region and the resilience of local communities. The Amendment will evaluate the lands available for young growth timber harvest and provide the guidance for young growth land management activities on the Tongass. This Amendment also considers maximizing the opportunities for social and economic returns from other economic sectors that depend on the Forest.

Vision

Early in the process, the members of the TAC all agreed on a common vision to serve as a touchstone for their deliberations and to help guide the development of the recommendations that follow.

"Southeast Alaska is comprised of prosperous, resilient communities that have the opportunity to predictably use and benefit from the diversity of forest resources to achieve the cultural, social, economic, and ecological health of the region for current and future generations."

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[3] The TAC defines co-intent as: A mandate to maintain the primary intent and objectives of each Land Use Designation and standard and guideline while developing and applying forest management activities that will accelerate the transition to young growth management in the Tongass National Forest.

[4] *Secretary's Memorandum 1044-009: Addressing Sustainable Forestry in Southeast Alaska* is available online through the following link: http://www.merid.org/en/TongassAdvisoryCommittee/~/media/Files/Projects/tongass/August%20meeting/Secretarys%20Directive.pdf.

Recommendations and Action Plan

Rationale

The TAC learned that the current Tongass Land & Resource Management Plan (Forest Plan) would most likely not achieve the transition to young growth within the 10-15 year time frame set out in the Charter as defined by the Secretary of Agriculture. In order to reach the ultimate goal to move out of old growth as quickly as possible and accelerate the transition while sustaining an economically viable timber industry, the TAC recognized that changes in the Forest Plan will be necessary. The TAC discovered that there were opportunities to accelerate the transition to young growth, reduce the commensurate harvest of old growth, and maintain a more reliable timber supply in Southeast Alaska through the transition period. The most effective way to meet these goals is to bring forward and provide advanced age young growth through some time-limited relaxations in standards and guidelines (S&Gs).

The TAC recognizes the high ecological value of the non-suitable lands. However, many of those stands of young growth forest do not provide the full ecological function that they would have in the un-harvested state. Habitat treatments that improve ecological conditions will benefit wildlife and game populations while also improving the ecological functioning of the larger landscape. This work will increase our understanding of effective habitat restoration treatments and will allow operators to become more effective at habitat restoration activities.

Overarching Principles

Throughout the discussion, the TAC returned to several overarching principles that permeated throughout all the recommendations that follow:

1. During the transition, young growth in the suitable land base is not sufficient for a viable timber industry. Therefore, the TAC included recommendations for approaches in non-suitable lands, and suggested changes to S&Gs, for young growth during the transition period.
2. By bringing more young growth forward sooner in the transition period, the USFS can reduce old growth earlier. For every unit of young growth volume brought forward into the transition solution, there should be an equal unit less of old growth.
3. Due to uncertainties in young growth inventory data and often significant differences in on the ground operational outcomes, independent monitoring is essential to achieve the dual objective of reducing old growth sooner and providing for a viable timber industry.
4. Co-intent occurs on all suitable and non-suitable acres, and with proper S&Gs can work to meet multiple uses associated with the Forest.
5. Bringing multi-disciplinary input and stakeholder involvement forward into the project planning process is essential to the success of co-intent.

6. Change in the culture of the USFS is mandatory.
7. The establishment of a forest collaborative is critical to the success of the recommendations.[5] (See Monitoring and Research, pg. 27). Reviews will be conducted at the end of five and ten years to measure the effectiveness of the flexibilities in meeting co-intent goals.
8. In order to maintain a viable young growth timber industry in the future, the existing suitable land base for young growth timber should be maintained (i.e., no net loss of young growth acres). If suitable young growth acres are removed from the timber base as a result of the review process, an equal number of acres should be added to the young growth timber base. Operational and geographic considerations (i.e., close proximity to other young growth acres) should be given priority. The process for this acreage replacement will be determined at the ten year review by a forest collaborative, through consultation at Gate 1, Initial Planning of a Timber Sale Project, and beyond, with a focus on comparable achievement[6].
9. At five and ten year reviews, the USFS, with a forest collaborative and other stakeholders, shall study, identify, and adopt methodology for supply that is tied to future sustained yield from the young growth land base. This new orientation will provide opportunities for the growth and development of an integrated industry focused on community and ecosystem health.

Approach

The TAC approached its work in the following order:

1. Prioritized LUDs and S&Gs where it believed the opportunity to capture more young growth volume in the near-term is the greatest and the risk to the environment would be least.
2. Quantified opportunities and social acceptability of adding additional young growth volume into the transition period, within each LUD and S&G by running several modeling scenarios through Tetra-Tech and Mason, Bruce & Girard (contractors for the Forest Plan Amendment options analysis work).
3. Reviewed and incorporated literature and science related to young growth timber and all public comments provided to the Committee.

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[5] The TAC defines a "forest collaborative" as a balanced, multi-stakeholder group formed and operating to support the USFS in completing a successful transition from old growth to young growth harvest on the Tongass National Forest. Typically, the USFS or other agencies' staff join forest collaboratives as equal members. See Appendix E for a draft memorandum of understanding that provides an example of how the Forest Service might interact with such a forest collaborative.

[6] The current Forest Plan uses the approach of comparable achievement to adjust Old Growth Reserves, provided that alternative reserves provide comparable achievement of the old growth habitat goals and objectives. The Tongass National Forest 2008 Land and Resource Management Plan is available at: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5367422.pdf. See Appendix K of the Forest Plan for additional information.

4. Indexed the social and ecological sensitivity of each LUD and S&G identified in activity 2 above.
5. Defined the concept of co-intent for both suitable and non-suitable lands. Developed goals and potential operating actions within specific and identified LUDs and S&Gs to achieve co-intent, which emphasizes recognizing and balancing the other unique and important resource values on the Forest.
6. Conducted thorough discussions on social acceptance pertaining to the modification of LUDs and S&Gs to fine-tune its Amendment option alternative and prepare a recommendation to include with USFS alternatives for review in draft in later meetings.
7. Emphasized and identified key implementation, investment, monitoring, and research elements required of the USFS in parallel with developing recommended treatment options.

Recommendations for Land Use Designations and Standards and Guidelines

The primary objective of the TAC was to reduce the amount of old growth timber harvest on the Tongass National Forest and accelerate the transition to a young growth based timber program. After evaluating the sensitivity of various LUDs, the TAC recommends the USFS does *not* seek young growth volume or change S&Gs in the following areas:

- Roadless Areas;
- Tongass Timber Reform Act (TTRA) Buffers;
- High vulnerability karst;
- Steep slopes;
- Municipal Watersheds;
- Wild, Scenic, and Recreational Rivers;
- Semi-Remote Recreation;
- Remote Recreation;
- Special Interest Areas;
- Wilderness Areas and National Monuments;
- LUD II; and
- Special Interest Areas.

Further, the TAC recommends the USFS identify where young growth timber projects, during the period of the transition, intersect with certain "high-value fish watersheds" (identified in Appendix C, pg. 37). In these areas of intersection, conduct a timely (during the first five years after the Record of Decision (ROD)) internal scientific review in collaboration with a forest collaborative and other stakeholders to determine likely impacts to fish and wildlife habitat from timber harvest. If harvest is proposed in one of these watersheds, the USFS may apply additional standards or guidelines to mitigate risk to fish habitat, or apply the "no net loss" concept outlined in the TAC's overarching principals.

The following Plan adjustments are considered with the co-intent of shifting harvest activities away from old growth harvest, providing alternative young growth volume, and improving habitat conditions for wildlife and fish and stand function in places that would benefit from restoration work. The TAC defines the broad concept of co-intent as follows:

A mandate to maintain the primary intent and objectives of each LUD and S&G while developing and applying forest management activities that will accelerate the transition to young growth management in the Tongass National Forest.

For the purposes of the recommended flexibilities in young growth management, the overall transition period is defined by the TAC as a period not to exceed 15 years from the date of this Amendment's ROD.

Recommendations

The TAC recommends that in order to achieve these objectives, the USFS:

a) Strive to maximize the volume of young growth timber in planning and ultimately offered for sale.
b) Maximize the use of flexibilities designed to replace old growth harvest with young growth harvest on a one-to-one volumetric basis.
c) Provide more flexibility and opportunities in the existing timber management areas for young growth.
d) Use specific treatments, designed for a one-time entry, for young growth harvest in specified areas that are not currently designated as suitable for harvest during the transition period, provided the original objectives of the particular LUD and/or S&Gs are respected.
e) Aggressively monitor the outcomes of management activities resulting from the transition and apply adaptive management to improve outcomes. Follow the aforementioned review process for the recommended flexibilities made by the TAC for all LUDs and S&Gs. At the culmination of the transition, a full review process should be conducted to evaluate continuity in whole, part, or expanded form to perpetuate and refine prescriptions that improve habitat while providing timber volume where they successfully meet the co-intent objectives. (See Monitoring and Research, pg. 27.)
f) Fully utilize currently allowed prescriptions in beach buffer, Old Growth Reserves, and Riparian Management Areas (RMAs)(outside of TTRA) that improve fish and wildlife habitat and create a commercial by-product. Further, young growth volume produced from these treatments should be counted toward the Projected Timber Sale Quantity (PTSQ).
g) Engage stakeholders, such as conservation interests, timber operations, permitted user groups, and other interested parties, in multi-party planning using an integrated resource management (IRM) planning framework to best design and implement projects to meet ecological, social, and economic goals; to provide best practices for producing timber volume from treatments; and to develop management prescriptions and identify areas where co-intent prescriptions are best applied.

h) Monitor the response of the timber industry and assist in their transition by investing in infrastructure and market development. (See Transition Economics and Investment, pg. 23.)
i) Overhaul administrative practices for timber sales to improve timeliness, lower costs and strengthen supply consistency required in an industry dependent on predominantly young growth. (See Implementation Strategy, pg. 14.)

The TAC is making these recommendations to apply to young growth timber only and would not apply them to old growth timber. (See Old Growth Bridge Strategy, pg. 13.) The TAC recommends that the USFS exercise flexibility within the following areas, LUDs, and S&Gs to increase young growth volumes for the period of the transition as defined above. These areas are listed in order of priority of most return and least environmental risk:

1. Timber management;
2. Modified landscape;
3. Scenic viewshed;
4. Beach buffer;
5. Old Growth Reserves (OGRs); and
6. RMAs outside of TTRA buffers.

Currently Suitable Land Base

The suitable land base refers to the LUDs in the current Plan specifically zoned for timber production: the Timber Management LUD (TM), Modified Landscape LUD (ML), and Scenic Viewshed LUD (SV). These LUDs form the core areas of land management where the bulk of timber harvest will occur during and following the transition on the Tongass. The suitable land base contains 273,000 acres out of the total 435,000 acres on which a second generation of timber is growing within the Tongass National Forest. During the transition period, the TAC's recommendations will bring forward young growth timber volume and support an enhanced timber sale program.

Under the suitable land base and associated S&Gs identified below, the objective of co-intent is to maintain emphasis on the production of young growth timber, while actively managing for concurrent values through treatments that enhance timber establishment and growth within viewsheds and habitat corridors. This definition includes active and progressive treatments that will address stem excluded, growth and undergrowth stagnant stands that inhibit forest habitat, as well as negate any timber values. The goal is to bring those lands back into productive forest and fish and wildlife habitat conditions.

Timber Management (TM)

The Timber Management LUD currently contains approximately 186,000 acres of young growth.

Recommendations

a) Maximize young growth harvest and management on the Timber Management LUD with particular emphasis on stands where culmination of mean annual increment (CMAI) relief, from accelerated establishment, and growth and restart prescriptions can make both short- and long-term contributions to the stability of long term young growth supply.
b) Utilize the full authorities provided under the Sealaska Lands Entitlement Act CMAI language in this LUD for even-aged management of young growth stands.
c) The TAC defined the rotation age under CMAI relaxation for the purposes of modeling as when 50% of a stand volume consists of trees that contain two 34-foot logs. This does not preclude market or site opportunities that occur where CMAI relaxation can be defined in a different manner.
d) Consider using flexibility under the Stewardship Contracting Authority to allow longer sale terms (e.g., five to ten years) to provide more certainty, reduce risk, and encourage investment in infrastructure for all timber sales (young growth and old growth).
e) Continue emphasis on additional opportunities for the small and micro-sale programs and show continuity in small old growth sales for these programs beyond the transition period.
f) Integrate methods to maximize timber establishment and growth (e.g., planting, thinning, fertilizing, etc.) to increase volume, species mix, and/or product value with priority on high productivity sites with favorable logistical access options in the region.
g) Consider a measured pace, scale, and variety of projects to match workforce and capacity. (See Implementation Recommendations, pg. 15.)
h) Prioritize pre-commercial thinning (PCT) projects and regimes on stands in this LUD where highest productivity and highest feasibility of operation.
i) Consider projects that could improve wildlife habitat by rehabilitating young growth stands that are in stem exclusion and will have limited contribution to young growth management. Priority stands will be high and/or medium sites with favorable logistical access.
j) Areas that have been previously harvested should be subject to larger landscape Environmental Assessments (EAs) rather than Environmental Impact Statements (EISs), where appropriate.

Modified Landscape & Scenic Viewshed

The Modified Landscape (ML) LUD currently contains approximately 60,000 acres of young growth. The Scenic Viewshed (SV) LUD currently contains approximately 12,000 acres of young growth.

Recommendations

The TAC recommends that young growth on the ML and SV LUDs, be managed in the same way during the transition period under the S&Gs of the ML LUD:

a) Manage using the Very Low Scenery Integrity Objective (SIO), as described by the Scenery Management System.[7]
b) Re-evaluate some of the existing visual priority routes in a multi-party, community-based review process.
c) Consult early and throughout the project planning process with other users to mitigate impacts in higher value scenic watersheds and/or routes, and encourage transparency throughout the process.
d) Areas of harvest may be replanted favoring spruce and cedar to enhance establishment, green-up, and scenic values.
e) Within the 15 year transition period, on a project-by-project basis and where acceptable, allow a second entry. If the second entry impacts SIOs to Unacceptable levels, seek appropriate relief to implement. Encourage leaving lower value timber to improve scenic and wildlife values.
f) Design cutting units with irregular boundaries (i.e., feathering).
g) Emphasize additional opportunities for the small and micro-sale programs (young growth and old growth).
h) Prioritize PCT projects and regimes on stands in this LUD where highest productivity and highest feasibility of operation.

Currently Non-suitable Lands

The non-suitable land base comprises over 120,000 acres of the total 435,000 acres on which young growth timber is growing within the Tongass National Forest. These lands represent areas of high ecological value; however, many of these stands are in stem exclusion, and do not provide their full potential of ecological values. These lands also tend to have a high level of use for subsistence, tourism, recreation, and guided hunting, and are among the most likely areas to have culturally significant historic sites.

The transition to young growth timber and away from old growth can be accelerated by applying co-intent management. With co-intent as a guide, young growth volume from these areas will count towards the PTSQ while fully meeting the existing intent and objectives of the LUDs and S&Gs. Under the non-suitable land base associated S&Gs identified below, the objective of co-intent is to maintain/improve habitat conditions and long-term ecological

[7] For more information, see *Landscape Aesthetics: A Handbook for Scenery Management*, available online at: http://www.fs.fed.us/cdt/carrying_capacity/landscape_aesthetics_handbook_701_no_append.pdf.

function in young growth stands, while producing timber volume that will count towards the PTSQ, and fully meeting the intent and objectives of the existing LUDs and S&Gs.

The TAC believes the greatest positive impact to both improving fish and wildlife habitat and to increasing the short-term young growth timber supply in the non-suitable lands will be realized by using a one-time only entry into each of the young growth stands that warrant management actions. Additional entries are supported where best available science and active review by a forest collaborative agree that two or more entries are (a) warranted; and (b) meet the LUD objectives. Significant habitat improvement and the total allowed young growth removal would be accomplished in one pass while keeping within the full intent of the LUDs and/or S&G. As a general principle, the TAC recommends providing discretion and flexibility to land managers in order to meet the goal of speeding the shift to young growth and using the co-intent mandate in these areas during the transition period.

It is important to note that the TAC is *not* recommending harvest of any old growth in non-suitable lands and it fully recognizes the importance of these lands for the overall Tongass conservation strategy. Further, the non-suitable lands will not become part of the long-term timber base and are being accessed for a limited period of time to ensure a successful transition.

Old Growth Reserves, Riparian Management Areas Outside of TTRA, and Beach Buffers

Recommendations

The TAC recommends the following activities during the transition period for young growth management in OGRs, RMAs outside of TTRA buffers, and beach buffers:

a) Examine young growth within those OGRs, RMAs, and beach buffers that are now in young growth (early seral stage) and are of sufficient maturity to advance the transition to determine the opportunities for habitat improvement. If active adaptive management would likely facilitate a more rapid recovery of late successional forest characteristics than would leaving it alone, the TAC recommends co-intent management activities that advance the seral stages toward Tongass old growth conditions, while creating commercial timber by-products.
b) Treatments in any of the non-suitable lands would include a maximum opening size of 10 acres and maximum removal of up to 35% of acres. Treatments should be designed on a project-by-project basis with the co-intent objectives listed in (a).

c) The USFS should prioritize utilizing OGR modification processes to capture additional young growth acres within OGRs, putting particular emphasis on adjacent landscapes, where a net gain of productive old growth habitat is possible, while maintaining and enhancing landscape connectivity.[8]
d) Where OGR boundaries cannot be modified, the USFS should use the co-intent mandate on young growth stands in OGRs and implement treatments where non-timber values are not compromised, and particularly where adjacent stands of young growth exist and can be integrated into the project scope.
e) The USFS and involved stakeholders are encouraged to be creative and innovative in developing projects that advance old growth characteristics in young growth stands within non-suitable lands. Emphasis should be on emulating the natural scale and distribution of disturbance patterns on the Tongass (e.g., wind-thrown timber that creates gaps and patches, landslides that create corridors and gaps, mortality that naturally thins stand, etc.) that correspond with silvicultural treatments such as gaps, corridors, variable retention harvest, and variable density thinning.
f) Treatments within beach buffers must maintain a minimum 200 foot buffer starting at the high tide line. USFS staff may consider expanding the buffer in sensitive areas, (e.g., such as in proximity to estuaries). Wildlife treatment enhancements and openings for access purposes may be allowed within those 200 foot buffers.
g) The USFS should prioritize projects that improve habitat and forest function, increase accessibility for recreation and tourism, and provide young growth volume in support of transition goals.
h) The USFS should consider prescriptively planting within two seasons of harvest to accelerate both establishment and growth of successive forest cover to meet the habitat and/or scenic objectives.
i) The USFS should review permits and current usages within proposed project areas in the non-suitable lands (including operators who hold tourism and guiding permits) to avoid conflict (analyze impacts) and seek mutually beneficial opportunities. Permit holders, local users, and user groups should be consulted and integrated in planning in the development of any management activity.
j) To the extent possible, these projects should also provide outputs such as recreational infrastructure and improved access.

[8] The current Forest Plan uses the approach of comparable achievement to adjust Old Growth Reserves, provided that alternative reserves provide comparable achievement of the old growth habitat goals and objectives. The Tongass National Forest 2008 Land and Resource Management Plan is available at: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5367422.pdf. See Appendix K of the Forest Plan for additional information.

Old Growth Bridge Strategy

The TAC agrees that the USFS should:

- Complete a thorough analysis of young growth inventory at the stand level in the first three years of the transition to more accurately predict the young growth timing and supply to complete the transition;
- Develop the unit pool for bridge timber volume to meet the timeline goals set below (1 and 2);
- Plan and produce sufficient young growth volume to ensure the required volume through the transition meets the determined demand;
- Transition from old growth to young growth in less than 15 years by making more young growth available for harvest and substituting young growth for old growth on a one to one volumetric basis, using the annual timber demand;
- During the transition period, hold the timber demand number constant. (Subject to review of the DEIS, the TAC will recommend a number to hold consistent through transition period.[9]);
- Maintain a post transition annual old growth timber harvest that will meet the long term demand of the small and micro-sale programs; and
- Limit the old growth timber base to the current definition of Phase 1 lands outside of The Nature Conservancy (TNC)/Audubon conservation priority areas, Tongass 77 (T77) watersheds and Inventoried Roadless Areas. (See Appendix D, pg. 38, for a map of the conservation priority areas and T77 watersheds.)

Goals for planning the unit pool for the old growth bridge timber volume from the defined land base development:

1. All timber pool volume is through Gate 1 by year two through extensive collaboration with other landowners and stakeholders.
2. All timber pool volume is through Gate 2 (National Environmental Policy Act (NEPA) cleared) by end of year five.

At the end of five years from the ROD of this Plan Amendment, there will be more experience and knowledge because:

- A forest collaborative will have completed a review of USFS performance on planning timber sales;
- There will be five years of experience in planning young growth timber sales aligned with the TAC recommendations that will improve the understanding of actual project net-downs and allow for more accurate predictions of young growth harvest timing and flow; and

[9] The TAC expected to see an analysis by the USFS of the effects of two different annual volume targets. After reviewing the DEIS, which did not include an analysis of two volume targets, the TAC was unable to reach consensus on an annual volume target. The range of annual volumes supported by individual TAC members for analysis remains at 46MMBF – 70MMBF. The TAC did *not* agree to a specific annual target.

- The improved inventory information will be available and integrated into the forecast of both the timing and volume of young growth during the remaining period of the transition and set a target timeline for old growth harvest to complete the transition.

Implementation Strategy

Purpose

The Forest Plan Amendment is but one piece of the transition to a young growth forest management program. The other major piece is for the USFS to transition to a more flexible, responsive timber program tooled for young growth. The recommendations above should increase the certainty of young growth supply. The implementation steps below will ensure that projects are available and delivered in a manner that leads to a viable industry while not diminishing other values of the forest.

These implementation recommendations provide guidance on crucial elements for success. They also identify critical opportunities by which the Committee, Agency, and greater community will share ownership of the transition strategy and embrace its successful implementation. While much of the economic success of the transition will depend upon the willingness and ability of communities, businesses, other landowners, and the forest products industry to learn, adapt, and innovate, the TAC believes that the USFS must play a pivotal role in leading, fostering, and supporting the societal and institutional learning a successful transition will require. The USFS will, of necessity, be in transition itself.

In the absence of Agency transformation, the TAC remains extremely concerned that the collaborative efforts of the TAC will be in vain.

Essentials of the Transformation: Leadership and a Culture of Collaboration and Transparency

Agency Leadership

Any and all transitions come with risk and uncertainty. Agency leadership will be challenged to provide clarity of purpose and consistency of direction to all staff of the Tongass National Forest. Likewise, all stakeholders, users, and user groups will look to Agency leadership for clear commitments in terms of budgets, staffing, planning, and implementation in order to make their own adjustments to changing conditions. The next 15 years will be a learning process, but action must take place immediately. Leadership must foster a culture of flexibility, transparency, creativity, and innovation, as well as new institutional practices to successfully meet the Secretary's young growth direction, institutionalize learning, and manage risk throughout the transition period, while still meeting the high demands of accountability and compliance with existing laws and regulations.

Recommendation

a) The TAC expects Forest Service line officers and leadership at every level to encourage and support the development of a multi-stakeholder forest collaborative to help maintain the vision of the Amendment, provide resources to the Agency for the implementation steps described herein, and improve and compliment the monitoring efforts necessary for accountability and learning. (See Monitoring and Research, pg. 27). The agency's support for such a group should include both participation and funding. (A suggested draft memorandum of understanding (MOU) can be found in Appendix E, pg. 39.)

It is the intent of the TAC that stakeholders, stakeholder groups, and the Forest Service seek to increase efficiency and effectiveness during and beyond the transition period. We acknowledge the tension caused by the need for collaboration and the pressing desire for action. We consider this a mutual challenge.

Collaboration and Transparency

The TAC has succeeded because its members agreed at the outset to collaborate (i.e., to work together towards a common goal) and to do so with respect, honesty, and transparency. The TAC has taken great pains to access the knowledge base and values of many stakeholders, explain the process used to reach decisions, and detail the rationale for those decisions. We likewise went to lengths to explain the innovative concepts of co-intent and co-products expected from young growth management. This agreement to manage for multiple purposes, including fish and wildlife enhancement while developing timber supply, is challenging. It brings opportunity for new styles of conservation and silviculture to the Tongass which will require the utmost collaboration and transparency. The Forest needs to commit to these values in implementing the transition if the hard won agreements we have achieved are to endure.

Collaboration and transparency mean frequent engagement *and* taking action with partners, sometimes with risks where all parties learn. Risk *management*, as opposed to risk *aversion*, by Agency leadership will create the space for flexibility, creativity, and innovation among the Forest staff and stakeholders. Collaboration and transparency are the best risk mitigation tools the Agency has at its disposal to navigate what will be a difficult period and to take advantage of new opportunities. Risk sharing by all stakeholders, and most importantly the Agency, will speed the transition and make sure the private sector is not assuming a disproportionate degree of risk.

Implementation Recommendations

The USFS has already expressed its commitment and made important investments in the shift to a young growth-based forest management program and an IRM approach.

Building on that commitment and those investments, the TAC recommends the following transformative steps for successful future young growth forest management:

1. Pursue partnerships and collaboration;
2. Support internal USFS Coordination;
3. Encourage leadership at the District Ranger level commensurate with their authority;
4. Revamp the sale planning and assessment process;
5. Maximize the use of stewardship contracts and agreements; and
6. Address incentives and feasibility for operators and domestic processing/consumption.

Partnerships and Collaboration

Community-based partners and stakeholders can lead and support creative work by building mutually beneficial agreements and working relationships, facilitating collaborative processes, and ensuring projects achieve local benefits.

Recommendation

a) Line officer performance evaluation must include metrics for partnerships, collaboration, and transparency (self-reported and stakeholder-reported).

Partnerships will be needed to achieve the social and economic outcomes envisioned by the TAC and enabled by the 2016 Amendment. These include:

Planning for Young Growth Projects
The TAC expects the Agency to move to true collaborative planning for young growth projects. Collaborative planning has the advantage of using the knowledge of industry to design projects that will work economically, and the knowledge of the scientific and conservation communities to design projects that will achieve the desired habitat objectives, and of local communities and/or user groups to identify areas critical to community development. It provides the opportunity for mutual learning through the assessment and analysis stages of planning. It produces the commitment of willing partners in the implementation of the Amendment ROD.

Recommendation

a) Give clear direction to staff that collaborating early and often in the Gate 1 process and in other ways, with stakeholders, including industry, is expected for all projects in the Five Year Plan.

Workforce Training and Development
There is an opportunity to work with local governments, tribes, non-profits, businesses, and the State to create a local, multi-skilled, cross-trained workforce to perform all facets of young growth forest management, habitat restoration, and local utilization.

Recommendations

a) Utilize the Alaska National Interest Lands Conservation Act (ANILCA) or similar hiring authorities, and agreements or MOUs with partners, adjacent landowners,

and business owners, to provide training opportunities and continuity of work for a local workforce.

b) Implement vocational-technical training programs in coordination with local high schools and regional universities. Integrate training with current vocational-technical training in marine services and fisheries. With local partners, consider a program to develop USFS internships for local students, to complement the youth conservation corps and other existing programs.

c) In response to a directive in the recent Farm Bill addressing disease and infestation, the USFS is seeking new methods of utilizing yellow cedar. Explore the opportunity to work with local Native carvers who use the wood for their products.

Coordination with Other Landowners

There are unrealized opportunities for cost savings through coordination among adjacent or nearby landowners. These include: sharing the costs of road building crews, log transfer facilities, ships or shipping companies, helicopter logging companies, survey contractors, thinning crews, marketing experts, and/or other strategies. In addition, project-level cumulative effects analyses conducted for watershed and island-to-island linkages should be improved through coordination with adjacent landowners.

It will require an intentional effort by the USFS to initiate dialogue with other landowners when creating future silviculture and harvest plans to encourage coordination across ownership boundaries. This will incentivize mobilization, create economies of scale, and help ensure continuity of supply for existing and emerging businesses.

Recommendations

a) Increase participation in the All Lands Council and/or establish a new group with similar objectives.
b) Collaborate and/or consult with area landowners on the Five Year Plan.
c) Execute agreements for shared infrastructure among landowners.
d) Provide shared database access to young growth models for other landowners.
e) Work with researchers to take an all-lands approach to research projects in the region.
f) Begin working together on the Kosciusko landscape.

Improved Public Outreach and Messaging

In addition to planning, an emergent forest collaborative and other stakeholders can help with public outreach, messaging, transparency, monitoring, and shared learning.

Recommendations

a) Utilize the networks established by local and regional forest and landscape collaboratives, Communicate with the greater public through national and local media and via regular community briefings, open houses, and non-NEPA required

meetings. Use existing public forums to engage in dialogue regarding the progress of the transition.

b) Working with stakeholders and working group(s) that emerge from forest collaborative(s), prepare pre- and post-project reports to the public about what was planned and what happened with the project or activity. Highlight positive results, such as collaborative planning, restoration, workforce development, jobs, and injection of capital into the economy, and identify areas not meeting expected outcomes in order to address options through future efforts.

Inclusion, Transparency, and Shared Learning

As mentioned, the TAC expects the Agency to move to true collaborative planning for all timber projects.

Recommendations

a) Give clear direction to staff that collaborating early and often with stakeholders, including industry, is expected for all projects in the Five Year Plan.

b) Design and implement a simple after-action review with project collaborators for the purpose of identifying opportunities to make the projects achieve better outcomes in terms of efficiency and effectiveness. Document and share. (See Monitoring and Research, pg. 27.)

Internal USFS Coordination

Collaboration across the Forest is an essential ingredient for a successful transition, starting with clear direction from leadership that internal collaboration and cross-district communication is the expected norm. At times in the past, some attempts at internal coordination have lost their impact because of the inability of staff to escape the traditional programmatic areas, budgets, and targets. The current primary purpose approach to resource allocation, which constrains already limited resources to achieving a single objective, is one of the barriers. The co-intent concept the TAC recommends necessitates resource allocation across internal boundaries and requires very different internal budget and target systems. Interdisciplinary teams (IDTs) on co-intent projects will be collectively resourced and held to clear processes and timelines on deliverables by the Tongass Leadership Team (TLT) and a forest collaborative if present. These conditions make each team member equally responsible, balances power, and leads to IRM as envisioned.

Recommendations

a) Explore the use of Integrated Resource Restoration-like budgeting.

b) Create an internal environment that invites collaboration among USFS staff and team members – including office space, co-location, etc.

Support and Encouragement for District-Level Leadership

The TAC has taken risks in suggesting more proactive adaptive treatments to accommodate a quicker transition, including reduction of old growth harvest. If the TAC's recommendations are to have any value or impact, District Rangers must be empowered to use all their existing authorities to expedite projects and collaboration in order to generate additional young growth timber sales. This runs counter to the current culture in which District Rangers, in order to be safe and not take any risk, simply layer on IDT suggestions for protection, without paying attention to redundancies. This pattern too often leads to a collision of restrictions that result in low volume and non-economic projects without any real additional resource protection, or extinguishes projects altogether.

Recommendations

a) Give District Rangers strong direction and support from above to fully exercise their authority to implement projects that are balanced, timely, effective, and efficient.
b) Give District Rangers strong direction and support to take into account collaborative partner input in designing and implementing projects. Partner work should be considered a value to the process, rather than an imposition.
c) Give District Rangers clear performance measures that include not only accomplishments but also multi-party evaluations of the skill sets associated with successful internal and external collaboration.
d) Define entry points for collaborative input and engagement pre-and post-season and pre-NEPA.

Sale Planning and Assessment Process

The Five Year Timber Plan

The Five Year Plan should become a reliable strategic document which allows stakeholders to understand the projected ramp-down of old growth and the ramp-up of young growth sales, including the small and micro-sales of both old growth and young growth. These projections must become credible and reliable through a deliberate process by the Agency. Credibility is established through 1) strict adherence to schedules; and 2) continuity of supply insured by a "pipeline" or inventory of shovel-ready projects to allow for unexpected interruptions.

Recommendations

a) To help with transparency and clarity, the Five Year Plan must differentiate between old growth, young growth, small sales, and micro-sales.
b) Provide a clear definition of small and micro-sales, and if there is a difference in implementation of old growth versus young growth small and micro-sales, this needs to be clearly outlined and communicated.

c) Provide inventory analysis and reliable volume and harvest data for each project to provide industry with some certainty.
d) Involve industry in consultation, up-front and early, without precluding ability to bid.

Supply/Demand Planning Methodologies

At present, demand and target numbers (MMBF) are calculated through a few different political, regulatory, and legal processes. This layered authority creates uncertainty for stakeholders.

Recommendation

a) At five and ten year reviews, the USFS with a forest collaborative, if present, and other stakeholders shall study, identify, and adopt methodology for supply that is tied to future sustained yield from the young growth land base. This new orientation will provide opportunities for the growth and development of an integrated industry focused on community and ecosystem health.

Cross-District Coordination and Strategic Planning

Young growth timber that will be available in the near-term is scattered across the Forest; yet a scattershot approach to planning sales is not cost effective. Stronger coordination across districts, and between districts and programs, will be critical to meeting young growth benchmarks.

Recommendation

a) Implement a strategic process for the scale, size, and scheduling of projects – for both young growth and old growth – to assist businesses struggling with small profit margins so they have time and incentive to invest in new markets and products.

Small Sale Program

The purpose of small sales is to provide opportunity for small operators to access timber for local product manufacturing. Often, small operations represent the best opportunity to encourage more value-added production and local consumption of wood products. However, following the initial NEPA review and pooling, small sales often get lost or delayed, leaving businesses that depend on those sales with limited or no supply. There is a need for more dedicated staff involvement in the timber sale preparation process for small sales from existing NEPA pools.

Recommendation

a) Establish one or more dedicated small-sale teams, specifically tasked with small sales, micro-sales, salvage sales, personal use, and other non-traditional timber sale opportunities, where this is its only function. This will sustain small businesses, and foster and encourage innovation. The team must be provided with the requisite

resources and support, able and encouraged to do NEPA and/or pre-sale work as needed, and be subject to accountability mechanisms and incentives.

Programmatic Environmental Assessments

Recommendation

a) Sales of young growth in areas that have been previously harvested should be subject to larger landscape Environmental Assessments (EAs) rather than Environmental Impact Statements (EISs), which are appropriate for the size and scope of these projects.

Maximize Stewardship Contracts and Agreements including Tribal Stewardship Authority

In many cases, especially in the projects designed with co-intent, stewardship contracts and agreements will be the best tool available to ensure co-intent is met. The requirements and opportunities of stewardship contracts and agreements are particularly useful, and include:

- The requirement for collaboratively planned projects, allowing the Agency to continue to avail themselves of the knowledge of conservation and scientific communities, industry, local communities, traditional communities, and other stakeholders at the project-level.
- The authority to use "designation by description" and "designation by prescription" allows the Agency to lower costs and encourages the development of a highly skilled private sector workforce to meet the intent of the Amendment.
- The authority to award a stewardship contract up to 10 years in length can give industry the continuity of work it needs to justify investment in retooling.
- The opportunity for pooled "retained receipts" (as piloted by the Tongass Collaborative Stewardship Group) allows the Agency to provide dedicated funds for off-project stewardship and restoration work.
- The emphasis on "Best Value" criteria for awarding contracts (as opposed to low-bid) allows the Agency and stewardship collaborative to define best value and set scoring – in terms of the goals of the Amendment (e.g., meeting co-intent, maximizing local benefit, providing job training, etc.).
- The authority to allow a stewardship collaborative representative to be on IDTs and review teams for contract award deepens collaborative relationships.
- The monitoring requirement will help the Agency and collaborators institutionalize learning.

Recommendations

a) Take full advantage of the stewardship contracting authority for all the preceding reasons.

b) The TAC requests that a special dedicated Fish and Wildlife Habitat Enhancement Fund be established within the retained receipts pool, to be used for projects sponsored by non-governmental organizations (NGOs), identified and prioritized through a collaborative process. We further recommend that the 20 percent match required by current USFS agreements be waived, or significantly reduced, for this body of work.

Incentives and Feasibility for Timber Operators

Risks, Costs, and Process

This section provides recommendations for reducing risk, reducing costs, and simplifying processes in order to incentivize the participation of timber operators and increase the economic feasibility of the young growth program.

In order to effectively utilize various tools (whether grants, agreements, or contract provisions), a shared vision and clarity of purpose across the Agency, and with partners, will be key. It is essential that Agency leadership and staff communicate and understand the range of authorities available, and interpret and implement with consistency across the Forest.

Recommendations

a) In year one of the transition, meet with a forest collaborative, or working group thereof, to develop effective collaborative practices and procedures for the Gate 1 process and old growth timber pool volume.
b) Consider changes to reduce cost in scaling and harvesting of young growth stands.
c) Revise the residual-value appraisal system through a Forest-wide, multi-stakeholder evaluation process to establish stumpage rates that accurately reflect the profit and risk margins in young growth sales.
d) Remove bid bonds for predominantly young growth small and medium-sized sales, and consider reducing bid bonds for small old growth sales.
e) Consider reducing performance bonds for small and medium sized sales that are predominantly young growth.
f) Coordinate with road engineers, planners, and transport planners on open roads to avoid closures before all sales are complete, as well as with other landowners.
g) Use the knowledge of potential contractors in initial sale design for projects with restoration intent in order to maximize economic feasibility and communicate desired restoration outcomes.
h) Meet at least annually with collaborative members and contractors to identify additional strategies to reduce costs.

Incentives and Feasibility for Increased Domestic Processing and Consumption

Recommendations

a) Increase the use of local processing credits in young growth sales, regardless of size or location, to capture as much economic opportunity as possible and reduce economic leakage.
b) Award some long-term stewardship contracts to provide continuity of supply to reduce retooling investment risk.
c) Offer sales with volumes appropriate to the scale of existing and emerging local processors.
d) Encourage the USFS to look first at locally produced Tongass forest products for all USFS projects in the region.[10] Work with USFS engineering and design personnel, as well as procurement, to set up the process. Engage the USFS Forest Products Lab in any questions regarding grade and quality.

Transition Economics and Investment

Introduction

The transition to young growth must provide economically and financially viable opportunities for industry, and meaningful economic and employment benefits to local communities. Targeted investment, financial assistance, and financing mechanisms are needed to help the communities and businesses successfully transition to and thrive within a new young growth economy.

The TAC categorized the investment recommendations into the following five categories:

1. Inventory;
2. Research;
3. Infrastructure;
4. Retooling; and
5. Financing Mechanisms.

[10] In Ketchikan, local bus shelters were constructed using locally sourced wood. Similarly, in Sitka, the University of Alaska Southeast (UAS) used local wood products to build a visitors' kiosk for the Convention and Visitors' Bureau. Young growth wood has also been sourced for a bike shelter, high school vocational training projects, and local home construction projects. While these examples are not specific to USFS projects, they offer example of local consumption of Tongass timber.

Investment Recommendations

Inventory Investment

Young growth resource data evaluated by the TAC carries a very high margin of uncertainty in regard to the reliability and accuracy of information. The TAC recommends investment in stand-level field work to: 1) ground-proof and refine inventory and growth data; 2) improve inventory accuracy; and 3) increase reliability of forecast projections for future resource management and investment activities.

Recommendations:
Improve Stand Level Young Growth Forest Inventory:

a) Update and expand stand exams and inventory.
b) Update and expand growth and yield studies.
c) Provide additional focus on information for cedar and alder.
d) Include integrated resource inventory.

USFS, State, and private sector forestry experts believe a budget of $5,000,000 would be necessary to improve accuracy of data and geographic information system (GIS) layers to levels needed to support responsible resource management decision-making.

Research Investments

There is limited information available on growing, managing, harvesting, processing, manufacturing, and marketing of young growth timber within Southeast Alaska. Additional research regarding young growth silviculture and operability is necessary to support a viable transition. Research activities should include significant and meaningful private sector engagement, guidance, and leadership to assure that deliverables are beneficial to industry.

Recommendations:

a) Invest strategically in the following research areas:
    i. New harvest techniques
    ii. Small log manufacturing processes
    iii. Site-specific use of wood biomass
    iv. Silviculture
        - Consider tree planting for species manipulation and speeding harvest rotations.
        - Evaluate effectiveness of different stand thinning treatments.
        - For stem excluded, stagnant stands consider, conversion to a new stand.
        - Evaluate site preparation (e.g., slash treatments, mounding, etc.)
        - Review current forest research on fertilization and genetics and determine applicability to Southeast Alaska.
    v. Product and market development

- Transitioning to a young growth resource requires existing businesses to adapt their business model and develop new products and markets. As part of the USFS commitment to the transition and commitment to provide assistance to communities and businesses, world market analysis and products demand analysis may help encourage business transition, enhance local livelihoods, and maintain economically viable communities.

b) The USFS should fully utilize local wood products in their own projects thereby providing a showcase for local businesses and Tongass wood.

Infrastructure Development Investments

Affordable planning, harvesting, transportation and manufacturing will be critical to establishing an economically viable and globally competitive young growth timber industry in Southeast Alaska. At present, the region is significantly disadvantaged due to lack of critical infrastructure, including roads, affordable energy sources, and marine infrastructure.

Recommendations:

a) Connect critical road systems (e.g., Ketchikan Saddle Lakes), and designate utility corridors for future renewable energy and hydropower infrastructure.
b) Establish adequate docks and log transfer facilities within five logistic "working circle" areas: Hoonah, Kake, Wrangell, Klawock, and Ketchikan.
c) Establish adequate land- and water-based log storage facilities within these five "working circles."
d) Assure adequate marine logistical service infrastructure (e.g., ship and barge moorage systems), within these five "working circles."
e) Assure affordable energy in "working circle" communities:
   - Ensure that access to renewable energy, including hydropower, is assured via the Forest Plan.
   - Provide loan or grant funding mechanisms.
   - Provide energy subsidies, tax credits, and/or other cost offsets for young growth manufacturers.

Retooling Investments

Businesses have expressed interest in opportunities created through increased availability of young growth. However, retooling costs associated with transitioning to a young growth-based timber economy are significant, and beyond the means of most of the limited, remaining industry. Strategic investments that enable businesses to retool could make the difference between prosperity and business closure.

Recommendations:

a) Manufacturing facilities for small logs.
b) New harvesting equipment:
   - Small log cable yarding systems; and
   - Low ground pressure logging machines.
c) Biomass facilities utilizing young growth.

Financing Mechanisms

Uncertainty associated with supply of older-age young growth and old growth timber supplied by the USFS is a tremendous impediment to raising capital for timber sector business activities. There will likely be lower profit margins associated with young growth, as industry transitions through trial and error, and as market demand for young growth projects is gradually created. The following financing mechanisms and incentives will help mitigate those factors, and make it possible for businesses to survive through the transition and beyond.

Recommendations:

a) **Federal loan guarantees,** which will ensure repayment of lenders in the event the USFS is unable to provide suitable volumes of timber. This will ensure that private sector businesses and lenders are protected and can recover their investment in the event that a business fails due to reasons associated with the USFS.
b) **Federally-purchased risk insurance**, which will assure repayment of lenders in the event the USFS is unable to provide suitable volumes of timber. This will ensure that private sector businesses and lenders are protected and can recover their investment in the event that a business fails due to reasons associated with the USFS.
c) **Increased profitability:** Increase the allowable profit percentage in the young growth appraisal process. This will help encourage, incentivize, and reward new investment in the young growth industry, while providing addition room for trial and error, which will surely occur throughout the transition process.
d) **Cost Recovery Relief ("Buy-out")**: It is anticipated that the changes created through new federal policy within the Tongass may prevent some harvesting and manufacturing operations from maintaining economically viable operations, and from recovering their existing investment. The federal government should offer an option to buy-out these businesses' existing assets at fair market value, as a means of compensating these businesses for the new economic hardship and obsolescence imposed upon them. This manner of economic relief has precedence under ANILCA. The TAC recognizes this type of relief as a last resort; however, it will likely be necessary to offset the economic harm associated with new federal policy within the Tongass.

- **Economic Hardship Relief:** Loss of businesses and associated employment will cause economic harm to Southeast Alaska communities. Communities should be compensated for direct and indirect economic harm which they may be subject to due to the federal government's new young growth strategy within the Tongass (e.g., lost employment, tax revenue, population out-migration, etc.). This could be achieved through a formula-based funding mechanism.
- **Hardship Relief and Increased Competitiveness through Access to Renewables.** Relief to communities can also be provided by ensuring that the Forest Plan guarantees increased access to new renewable energy and hydropower resources within the Tongass. This will allow communities to enjoy more affordable energy for current purposes and future growth, while also supporting the growth and prosperity of a new young growth manufacturing industry through more affordable renewable energy.

Monitoring and Research

Monitoring Principals (*Why*)

- The TAC's commitment to creating conditions for Tongass communities to thrive is reflected in its recommendations toward robust and active monitoring and adaptive management.
- The following monitoring recommendations are designed to improve and complement with existing monitoring efforts and those under development in spring 2016.
- Measuring and telling the story of socioeconomic impacts of Forest policy and practice can build support for sustained investments on the Tongass.
- The recommended actions represent a new paradigm for monitoring on the Tongass, and situate the forest at the leading edge of active and adaptive management in the U.S. The TAC expects the Agency and stakeholders to take on the challenge of adopting this paradigm.

Monitoring Recommendations (*How*)

Recommendations

a) **Support an emergent forest collaborative:** The TAC recommends that the USFS encourage and support the development of a multi-stakeholder collaborative to help maintain the vision of the Amendment. The TAC further recommends that the Tongass National Forest and the emergent collaborative enter into an MOU to formalize their exchange of information and sense of responsibility to a successful transition. (A suggested draft MOU can be found in Appendix E.)

The TAC believes a useful emergent forest collaborative will, for the duration of the transition:

- Embody, and help the USFS fulfill responsibility to, the types of shared learning and feedback required by the 2012 Planning Rule (36 CFR 219.4(a), 219.5(a), and 219.12(c)(3));
- Improve and complement traditional, implementation, and effectiveness monitoring at project- and Forest-levels (see recommendations (b) and (c) in this section);
- Be available to the USFS to provide recommendations on project-level decisions (with a focus on innovation, risk, and benefits to local communities), especially through after-action reviews and Gate 1 consultations on important or precedent-setting projects;[11]
    - All multi-stakeholder after-action reviews should:
        - Identify what worked well;
        - Identify what worked poorly; and
        - Develop a plan for how to transfer these learning outcomes to future projects. Transfer must happen across ranger districts, must have individual point people identified, and should identify what future projects are targeted, where possible.
- Have the resources to support social science and applied research activities necessary to conduct implementation and effectiveness monitoring that complements the agency's, and facilitate collaboration in low-capacity communities;
- Develop a practice of regular, formalized check-ins with the full TLT, RLT, and WO; and
- Steward the values associated with action items of the transition, including but not limited to, co-intent projects on non-suitable lands, support of a viable forest products industry, and USFS transformation and leadership.

b) **Vastly improve metrics tracking the flow of benefits to communities in the TNF monitoring plan:** The TAC recommends the USFS integrate the key metrics identified as "dashboard" (listed below) and full social benefits metrics (outlined and described in Appendix F) into the monitoring plan under development in spring 2016, and change other Agency practices as needed to fully engage these metrics. Any contracts for monitoring should be awarded in-region, in-state, or relocated to an in-state institution after expert development. The TAC understands this

[11] Post-project effectiveness monitoring on the Heceta project, where State and the USFS conducted second growth commercial thinning and harvest using a range of techniques and approaches, could offer an insightful case study. For example, effectiveness monitoring could explore: how did this work and how could a similar project work better? The group should examine contracts, operability, soils, deer browse, other habitat needs, coordination between landowners, impact on workers' communities, and other values.

recommendation dovetails with the requirements of the 2012 Planning Rule, 219.12(c)(3).

c) **Maintain a transparent and timely exchange of information about monitoring and implementation with an emergent forest collaborative and the public:** The TAC recommends that the Agency maintain open and transparent planning, implementation, and monitoring practices to facilitate complementary implementation and effectiveness monitoring by a forest collaborative. Ongoing monitoring by the Agency and any external groups should demonstrate changes over time in the relationship between (x) planning and implementation of timber and stewardship work on the Tongass, and (y) community well-being. The TAC understands this recommendation dovetails with the requirements of the 2012 Planning Rule, 219.12(c)(3).

Dashboard Metrics (*What*)

Arrows reflect the direction of change the TAC expects to see during the transition; some metrics do not have expected trends. The Forest and a forest collaborative should coordinate reporting to keep the RLT and WO up to date on progress of the transition and make information public in a timely and accessible way.

- Number and volume of timber sales planned, offered, and sold; split out to show the following at each project stage or gate:
  - Number and volume of young growth ↑;
  - Number and volume of old growth ↓; and
  - Number and volume of small and micro-sales ↑.
- Number and outputs of co-intent projects planned, offered, and under contract; split out to show quantity and quality of projects on suitable versus non-suitable lands, and including:
  - Type, scale, and quality/effectiveness of habitat improvement, including understory vegetation response, deer populations, connectivity effects for key species, and additional biophysical metrics as needed, to be decided by multi-party planning at the project level ↑;
  - Volume of commercial wood products;
  - Use of commercial wood products;
  - Cost of habitat improvement planning and implementation; and
  - Number and names of parties monitoring project(s) for socioeconomic and ecological effectiveness.
- Number and value of private sector jobs (direct, indirect, and induced) associated with the transition—publicly or privately employed or contracted—and percentage of those jobs hired or held by local (census area or borough) residents; split out to show,
  - Number and value associated with timber sale preparation;
  - Number and value associated with harvest;
  - Number and value associated with wood products processing; and
  - Number and value associated with co-intent projects.

- Number of public construction and maintenance projects using Tongass wood products and estimated value contribution of the wood. Includes USFS, local governments, and special districts (e.g., school districts, soil and water conservation district etc.).↑
- Number and scale of biomass projects in Southeast Alaska (operating and newly constructed). Consult with appropriate agencies or organizations already tracking this metric.
- Number and value contribution (cash and in-kind) of stakeholders involved in transition and habitat improvement planning, implementation, and monitoring; split out to show:
    - Collaborative planning processes, including but not limited to, stewardship contract design and award ↑;
    - Grants and agreements;
    - Project implementation;
    - After-action reviews ↑;
    - Multi-party monitoring ↑; and
    - Pooled receipts application and awards process, and project implementation ↑.

Appendix A: Tongass Advisory Committee Members

Federally Recognized Tribes, Alaska Native Organizations, and/or Alaska Native Corporation representatives

Jaeleen Araujo – Juneau, AK

Richard Peterson – Kasaan, AK

Woody Widmark – Sitka, AK

Alternate: Robert Mills – Kake, AK

National or regional environmental and/or conservation organization representatives

Brian McNitt – Sitka, AK

Keith Rush – Juneau, AK

Andrew Thoms – Sitka, AK

Alternate: Chris Rose – Sutton, AK

Timber industry representatives

Les Cronk – Ketchikan, AK

Eric Nichols – Ketchikan, AK

Wade Zammit – East Sound, WA

Resigned: Philip Hyatt – Thorne Bay, AK

Federal, State, and local government representatives

Chris Maisch – Fairbanks, AK

Carol Rushmore – Wrangell, AK

Kate Troll – Juneau, AK

Resigned: Wayne Benner – Thorne Bay, AK

Other commercial users, those holding land use permits, or the public at large

Lynn Jungwirth – Hayfork, CA

Kirk Hardcastle – Juneau, AK

Erin Steinkruger – Portland, OR and Coffman Cove, AK

Alternate: Jason Custer – Ketchikan, AK

Appendix B: TAC Charter

United States Department of Agriculture

USFS, Tongass National Forest

Alaska Region

CHARTER

1. Committee's Official Designation

Tongass Advisory Committee

2. Authority

The Charter for the Tongass Advisory Committee (Committee) is hereby established under the authority of the Secretary of Agriculture in accordance with the provisions of the Federal Advisory Committee Act (FACA) as amended, 5 U.S.C. App. 2.

3. Objectives and Scope of Activities

The Committee will advise the Secretary of Agriculture, through the Chief of the USFS, by providing advice and recommendations for developing an ecologically, socially, and economically sustainable forest management strategy on the Tongass National Forest. Recommendations and advice may inform the modification of the 2008 Tongass Land Management Plan.

This forest management strategy will emphasize a shift to young growth management. The rationale for shifting to a predominantly young growth-based forest management program is explained in the January, 2013 Leader's Intent Paper, providing overall direction for the Committee. The 5-Year Tongass Integrated Plan (TIP), released in May 2013, identified old growth timber sales that can provide a bridge to support a transition within 10 to 15 years in a way that is economically viable for the existing industry. The Secretary's July 2, 2013 Memorandum Addressing Sustainable Forestry in Southeast Alaska also directed the identification of young growth and restoration projects that could be completed over the next five years, as well as shifts in staff and financial resources towards young growth management. Planning, integration and funding of that program of work will be driven and guided by work on key projects with collaborative partners.

4. Description of Duties

The Committee will be solely advisory in nature. All activities of the Committee will be conducted in an open, transparent, and accessible manner. The Committee will be

asked to perform the following duties or other requests made by the Secretary or Chief:

a) As necessary and appropriate, identify the key elements to be considered for a potential Forest Plan modification assuming young growth is the focus of vegetation management in the future, while recognizing and balancing the other unique and equally important resource values of the Tongass, such as tourism, recreation, fishing, subsistence, and renewable energy.
b) Offer recommendations on the suitable and available land base for developing an ecologically, socially and economically sustainable forest management program on the Tongass National Forest with emphasis on young growth management. Considerations include standards and guides and land use designations for a future modification of the Tongass Land Management Plan.
c) Provide advice on how to speed the shift from predominately old growth management to predominately young growth management, in a way that is economically viable for the existing industry. This may include consideration of options for managing stands.
d) Offer advice on opportunities to work cooperatively with other landowners on an all lands young growth forest management strategy.

5. Agency or Official to Whom the Committee Reports

The Committee will report to the Secretary of Agriculture, through the Chief of the USFS.

6. Support

Clerical and administrative support will be provided by the USFS. The Tongass National Forest and Alaska Region will also provide significant technical support to the committee to ensure members have access to appropriate and relevant data as needed.

7. Estimated Annual Operating Costs and Staff Years

Members of the Committee will serve without compensation. In performance of their duties away from the homes or regular places of business, Committee members may be allowed reimbursement for travel expenses in accordance with Federal per diem rates for attendance at meetings as authorized by 5 U.S.C. 5703. All expenses will be subject to approval of the Designated Federal Officer (DFO).

Estimated annual operating costs for the committee is $980,000 including; travel, lodging and per diem, committee facilitation, administrative support expenses, and Federal staff support (estimated as four full time equivalents staff per year). Committee expenses will be covered through the annual budget of the USDA USFS.

8. Designated Federal Officer

A permanent Federal employee will be appointed in accordance with agency procedures and will serve as the Designated Federal Officer (DFO). The DFO will approve or call the advisory committee and subcommittees' meetings, prepare and approve all meeting agendas, attend all committee and subcommittee meetings, adjourn any meeting when the DFO determines adjournment to be in the public interest, and chair meetings when directed to do so by the official to whom the advisory committee reports.

The Forest Supervisor for the Tongass National Forest will serve as the DFO. The Deputy Forest Supervisor for the Tongass National Forest will serve as the Acting DFO.

9. Number and Frequency of Meetings

The Committee will meet as often as necessary to complete its work, perhaps as frequently as every month. A quorum of 10 members of the 15 member committee must be present to constitute an official meeting. The committee shall not hold any meetings except at the call of, or with the advance approval of, the DFO. Attendance may be in-person, by telephone, or by other electronic means.

10. Duration

Continuing.

The Committee will be up to 2 years in duration, but the majority of the work is expected to be accomplished between March 1, 2014 and December 30, 2014.

11. Termination

The Committee will expire 2 years after the date of filing unless prior to that date, it is renewed accordance with FACA, Section 14. The Committee will not meet or take any action without a valid current charter.

12. Membership and Designation

12a. The Committee will be fairly balanced in its membership in terms of the points of view represented and the functions to be performed. The Committee will be comprised of not more than 15 members. The members appointed to the Committee will be knowledgeable of ecological, social, and economic issues impacting Southeast Alaska, while providing a balanced and broad representation within the following interests:

i. Federally Recognized Tribes, Alaska Native Organizations and/or Alaska Native Corporation representatives;
ii. National or regional environmental and/or conservation organizations;
iii. Timber industry representatives

iv. Federal, State and local government representatives; and
v. Other commercial users, those holding land use permits or the public at large.

Committee members must have a demonstrated commitment to working collaboratively and finding solutions that meet multiple stakeholder values.

Committee advice and recommendations must be approved by consensus of the groups represented (2 out of 3 within each interest group) but not consensus of all participants.

One substitute (alternate) will be selected for each interest group.

Nominees will be sought through an open and public process that includes, but is not limited to, nominees submitted by Alaska Native Organizations, local and State governments, community based/non-governmental organizations, environmental and conservation groups, and individuals who represent the interests of the public served by National Forest System programs and land resources.

12b. Equal opportunity practices in accordance with USDA policies will be followed in all appointments to the Committee. To ensure that the recommendations of the Committee have taken into account the needs of the diverse groups served by USDA, membership will include to the extent possible, individuals with demonstrated ability to represent minorities, women and persons with disabilities.

12c. The USDA prohibits discrimination in all of its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program.

12d. Of these members, one person who is recognized for his or her ability to lead a group in a fair and focused manner, and who has been briefed on the mission of this Committee will be designated by the Secretary to be the Chairperson. A co-Chairperson may be assigned, especially to facilitate his or her transition to become the Chairperson in the future.

12e. Ethics Statement

To maintain the highest levels of honesty, integrity and ethical conduct, no Committee or subcommittee member shall participate in any “specific party matters” (i.e., matters are narrowly focused and typically involve specific transactions between identified parties) such as a lease, license, permit, contract, claim, grant, agreement, or related litigation with the Department in which the member has a direct or indirect financial interest. This includes the requirement for Committee or Subcommittee members to immediately disclose to the DFO (for discussion with USDA’s Office of Ethics) any specific party matter in which the member’s immediate family, relatives, business partners or employer would be directly seeking

to financially benefit from the Committee's recommendations. Members of the Committee shall be required to disclose their direct or indirect interest in leases, licenses, permits, contracts, claims, grants, or agreements that involve lands or resources administered by the USFS, or in any litigation related thereto. For purposes of this paragraph, indirect interest includes holdings of a spouse or a dependent child.

All members will receive ethics training to identify and avoid any actions that would cause the public to question the integrity of the Committee's advice and recommendations. Members who are appointed as "Representatives" are not subject to Federal ethics laws because such appointment allows them to represent the point(s) of view of a particular group, business sector, or segment of the public.

Members appointed as "Special Government Employees" (SGEs) are considered intermittent Federal employees and are subject to Federal ethics laws. SGE's are appointed due to their personal knowledge, academic scholarship, background or expertise. No SGE may participate in any activity in which the member has a prohibited financial interest. Appointees who are SGEs are required to complete and submit a Confidential Financial Disclosure Report (OGE-450 form) and, upon request, USDA will assist SGEs in preparing these financial reports. To ensure the highest level of compliance with applicable ethical standards USDA will provide ethics training to SGEs on an annual basis. The provisions of these paragraphs are not meant to exhaustively cover all Federal ethics laws and do not affect any other statutory or regulatory obligations to which advisory committee members are subject.

13. Subcommittees

The USFS has the authority to create subcommittees. Subcommittees must report back to the parent committee, and must not provide advice or work products directly to the Agency.

14. Recordkeeping

The records of this Committee, formally and informally established subcommittees, or other subgroups of the committee, shall be handled in accordance with General Records Schedule 26, Item 2 or other approved agency records disposition schedule. These records shall be available for public inspection and copying, subject to the Freedom of Information Act, 5 U.S.C. 552.

15. Filing Date

FEB 10 2014

Appendix C: High-Value Fish Watersheds

Watershed Name	VCU #
Appleton Cove	2930
Fish Bay	2870
Irish Lakes	4290
Kadake Cr	4210
Mosman Inlet	4670
Bradfield River	5140
Nakwasina River	2990
Neka Bay	2010
Port Camden	4200
Rodman Bay	2920
Security Bay	4000
Sitkoh Bay	2430
Sitkoh Lake	2440
Situk River	3660
Sweetwater Lake	5730
Thoms Lake	4790

Appendix D: Map of Phase 1 Lands, T77 Watersheds, and TNC/Audubon Core Conservation Areas

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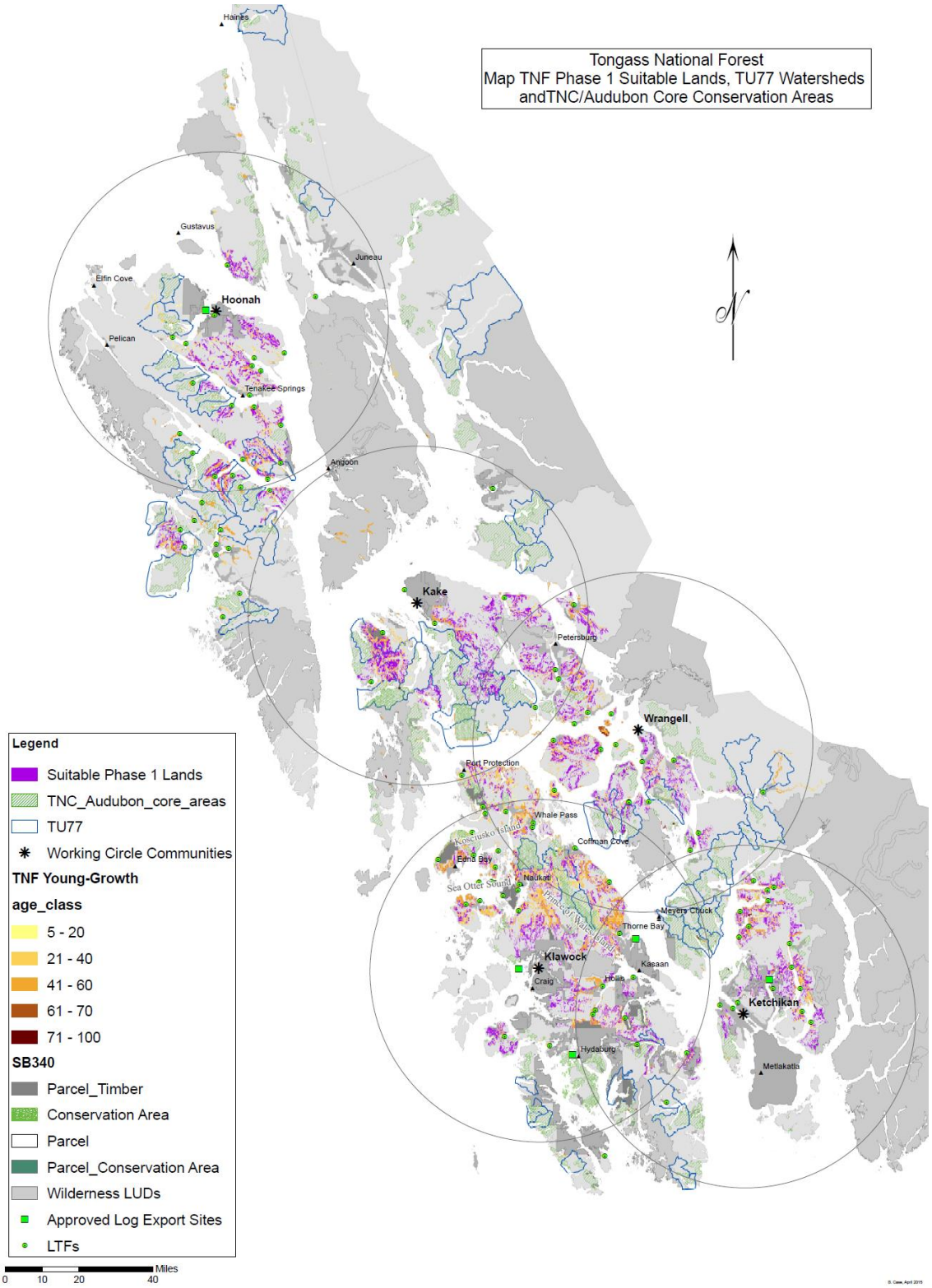

Appendix E: *Suggested Draft* Memorandum of Understanding Between Forest Collaborative Stakeholder Group Representatives And The U.S. Forest Service Tongass National Forest

Suggested Draft
Memorandum of Understanding
Between Forest Collaborative
Stakeholder Group Representatives
And The
U.S. Forest Service
Tongass National Forest

This Memorandum of Understanding (MOU) is hereby made and entered into by and between a Forest Collaborative (Collaborative) and the U.S. Forest Service, Tongass National Forest (TNF).

Whereas, the 16.7 million acre Tongass National Forest is managed for a variety of interests, with management directive to transition its timber program from old growth to predominantly young growth harvest;

Whereas, the 2016 Plan Amendment is being drafted—and will be implemented—in a time marked by transition. The Tongass Advisory Committee (TAC) has paved a path for multi-stakeholder collaboration in the region by reaching consensus within the sideboards of its 2014 Charter. This Charter was narrow in scope and did *not* charge the TAC with making overall recommendations in regard to fisheries, recreation, wildlife management, or tourism. This does not mean these values are overlooked. It is necessary, however, to recognize the full suite of challenges and opportunities associated with implementing a successful transition, and the range of forest values that will be positively affected by successful implementation;

Whereas, the Collaborative shares the following vision: *"Southeast Alaska is comprised of prosperous, resilient communities that have the opportunity to predictably use and benefit from the diversity of forest resources to achieve the cultural, social, economic, and ecological health of the region for current and future generations";*

Whereas, the consensus recommendations by the TAC for the Forest Plan Amendment and transition more generally represent an unprecedented opportunity that must be acted upon more comprehensively and as soon as possible;

Whereas, innovative collaboration can provide the U.S. Forest Service with better information, a more comprehensive and science-based planning process, better planning integration, conflict mitigation, improved fact-finding, increased social capitol, more effective implementation, enhanced environmental stewardship, and reduced litigation. The Council on Environmental

Quality (CEQ) 2007 publication, "Collaboration in NEPA: A Handbook for NEPA Practitioners," provides instructive guidance for collaboration throughout the NEPA process;

Whereas, transition implementation can and should occur in an ecologically sustainable, resilient manner that is economically and socially viable. This document describes the intentions of the U.S. Forest Service and members of the Collaborative as they work together towards transition implementation and monitoring on the Forest;

Whereas, members of the Collaborative have entered into an agreement (the Collaborative Stakeholder Charter) describing their mutual participation in a collaborative group with the goal of reaching consensus recommendations to guide implementation and monitoring of the Tongass transition;

Whereas, *(mediation and staffing clause)*;

Whereas, a great deal of effort has been invested in accelerating the transition on the ground to meet the Secretary's directive, via innovative planning and stakeholder deliberation. The TAC's recommendations represent a foundational document for comprehensive transition that genuinely supports forest-dependent communities adjacent to the Tongass. The U.S. Forest Service recognizes the importance of the TAC's deliberative work to guide the transition and will consider the recommendations document, finalized December 2015, along with all other public comments and recommendations in a public process before reaching a particular decision. TAC members and other stakeholders feel a sense of responsibility to steward the values associated with the transition well beyond the life of the 2016 Amendment planning process;

Whereas, implementation of the transition is embodied by the following goals: 1) to actively model the types of sharing and feedback required by the 2012 Planning Rule; 2) to improve and complement monitoring at project and Forest levels; 3) to facilitate collaboration in low-capacity, forest-dependent communities; and 4) to steward the values associated with the TAC's transition recommendations.

Now therefore, the U.S. Forest Service and members of the Collaborative agree to work together towards appropriate and timely implementation and monitoring on the Tongass transition;

I. PURPOSE

The purpose of this MOU is to document a framework of collaboration by all parties involved and interested in the implementation and monitoring of the Tongass transition directive, and the cooperative relationship among the parties to complete a successful transition.

The MOU defines the relationship between the U.S. Forest Service and the Collaborative. These Parties, along with the public at large, will work together at multiple stages prior to, during, and following the NEPA process to actively implement and monitor transition-related

management actions, subject to/consistent with applicable federal laws, regulations, land management plans, and other management direction.

II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS

The U.S. Forest Service and the Collaborative enter this MOU to learn and work together to steward the values associated with the TAC's transition recommendations. The Parties expect that implementation, monitoring, and active adaptive management of the TAC's recommendations will support prosperity and resiliency in forest-dependent communities adjacent to the Tongass National Forest.

In consideration of the above premises, the parties agree as follows:

III. THE COLLABORATIVE SHALL

a. Steward the values associated with the TAC's transition recommendations, using this focus as its north star when determining where to direct its resources;
b. Develop agreement-based recommendations that are intended to inform and express diverse support for transition-related implementation and monitoring activities;
c. Provide input to the U.S. Forest Service in a timely manner that matches the needs of an efficient NEPA and implementation timeline;
d. Maintain communication with the U.S. Forest Service in order to track ongoing processes and upcoming scoping so that the group can provide timely input;
e. Maintain capacity to discuss, evaluate, and support implementation and monitoring of innovative planning, project planning and implementation, administration, science integration, and adaptive management strategies;
f. Support agreement-based recommendations in the face of external challenges;
g. Develop, share, and apply scientific and technical information intended to significantly bolster adaptive transition implementation;

IV. THE U.S. FOREST SERVICE SHALL

a. Work directly with parties at all phases of the NEPA process, seeking their input and agreement on: the purpose and need statement, alternatives, collection and use of data, impact analysis, development of a preferred alternative, and/or recommendations regarding mitigation of environmental impacts (CEQ Handbook, p. 13);
b. Work directly with parties to develop and/or amend optional plan components, including the TNF Monitoring Plan pursuant to the 2012 Planning Rule;
c. Strive to accommodate the agreement-based outcomes and products of the collaborative process within the Collaborative, recognizing that translation of such agreement greatly enhances chances for success, and reduces the risk of conflict;
d. Communicate with the Collaborative and the general public the Agency decisions and management direction that are pending, both before and after development of associated timelines, as soon as possible;

e. Line and/or Staff Officers or their designee will participate in Collaborative meetings, consistent with requirements in federal law;

V. IT IS MUTALLY UNDERSTOOD AND AGREED BY AND BETWEEN THE PARTIES THAT

a. The Collaborative is inclusive; new members may join at any time, and the public at large has the same rights and opportunities for access to information and input into the process whether a member or not of the Collaborative;
b. This MOU does not grant cooperating agency status to any member of the Collaborative;
c. The U.S. Forest Service and the Collaborative will work together through all phases of the NEPA process potentially including the framing of the issues, the development of a range of reasonable alternatives, the analysis of impacts, and the identification of the preferred alternative—up to, not including, the agency's final decisions made by the relevant Line Officer (CEQ Handbook, p. 13);
d. The U.S. Forest Service and the Collaborative will work together to develop, discuss, evaluate, and implement innovative planning, project preparation, treatment, science integration, monitoring and adaptive management strategies;
e. The U.S. Forest Service and the Collaborative will work together to identify strategies for implementation, monitoring, and adaptive management that are efficient and effective, toward prosperous and resilient local communities and a more socially, ecologically, and economically viable transition;
f. The U.S. Forest Service and the Collaborative will work together to develop a regular process and means to keep the Alaskan Congressional Delegation, appropriate state officials, and high-level Forest Service or USDA officials informed of activities that occur under this MOU;
g. The U.S. Forest Service and the Collaborative will work together to identify efficiencies in utilization and contracting strategies, grants and agreements, and use of volunteers. This is exclusive of the contracting design, awarding, and administration processes;
h. All documents developed and submitted to the U.S. Forest Service from the Collaborative will become public documents;
i. Once the U.S. Forest Service formally initiates the NEPA process, specific timelines for advancing that analysis will be established. The Collaborative will provide input to the U.S. Forest Service in accordance to these timelines in order to be considered;

(this section also includes technical components to be developed by Grants and Agreements; see similar Memorandums for model)

Appendix F: Outline for Socioeconomic Analyses

The recommended analyses address the Forest Plan Amendment and transition strategy, including old and young growth timber sales, co-intent projects, restoration and stewardship projects, workforce and business capacity development efforts, and other key transition components. The recommended plan is nested geographically, with measures by borough/census area (correlated with ranger districts and working circles as possible) and Forest-wide. [12]

A range of types, scales, and levels of participation in monitoring are possible (see Figure1). Most notably, the Agency's 2016 monitoring plan, developed pursuant to the 2012 planning rule, presents a robust approach to implementation monitoring (i.e., did we do what we said we were going to do?). [13, 14] The TAC's recommendations supplement ongoing implementation monitoring with verification/validation and effectiveness monitoring, which ask if (1) completed actions led to expected outcomes; and (2) if completed actions are contributing to objectives. In order to help our communities thrive, monitoring must measure outcomes as well as outputs.

Figure 1: Types, Scales, and Levels of Participation in Monitoring[15]

		Focus
Types	Biophysical; economic; social/cultural; legal/administrative	Input; output; outcome
Scales	Project; program; community, island, or ranger district; region; state/country	Implementation; verification/validation; effectiveness
Participation	Single-party; third-party; multiparty	

[12] For census area/borough boundaries, visit the Alaska Department of Labor and workforce Development Research and Analysis, available at: http://labor.alaska.gov/research/census/maps.htm

[13] Tongass National Forest Draft Plan Monitoring Program, available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3827408.pdf.

[14] Monitoring Requirements under the 2012 Planning Rule are listed on the Tongass National Forest Monitoring Reports page, available at: http://www.fs.usda.gov/detail/tongass/landmanagement/planning/. The full text of the 2012 Planning Rule is available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5362536.pdf.

[15] Adapted from Multiparty Monitoring for Sustainable Natural Resource Management, available through the University of Oregon Ecosystem Workforce Program at: http://ewp.uoregon.edu/resources/community-guidebook/.

The recommended analyses should have four (or more) thematic emphases and eight (or more) questions; Figure 2 outlines the monitoring questions and measures.

Figure 2: Monitoring questions and measures [16]

Theme	*Question addressed*	*Measures/metrics*	*Scale reported*
A. Context and trends	a. What are the socioeconomic conditions and context in the borough/census area in which the transition is being implemented?	Employment by sector	Census area or borough
		Unemployment	Census area or borough
		Poverty	Census area or borough
		Number of students eligible for free and reduced lunch	Census area or borough and school
		School enrollment	Census area or borough
		Median age	Census area or borough
B. Employment and economic impacts	a. What are the employment effects in the communities around National Forests from co-intent projects, restoration projects, and timber sales?	Private sector jobs (direct, indirect, induced) associated with: • Restoration service contracts and stewardship • Timber sale harvesting and processing and transport of wood products	Ranger District or zone and Forest-wide
	b. What are the personal income effects in the communities around National Forests from co-intent projects, restoration projects, and timber sales?	Private sector labor income (direct, indirect, induced) associated with: • Restoration service contracts and stewardship • Timber sale harvesting and processing and transport of wood products	Ranger District or zone and Forest-wide
	c. What is the	Business output (direct,	Ranger District or

[16] Adapted from Ecosystem Workforce Program Working Paper Number 52: Socioeconomic Monitoring Plan for the U.S. Forest Service's Eastside Restoration Efforts, available at: http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_52.pdf

	economic activity resulting, in the communities around National Forests from co-intent projects, restoration projects, and timber sales?	indirect, and induced) associated with: • Restoration service contracts and stewardship • Timber sale harvesting and processing and transport of wood products	zone and Forest-wide
C. Business health and impacts	a. What are the effects of transition implementation on the health of wood products *businesses*?	Businesses reporting good health as indicated by: • Workforce maintained or hired	Ranger District or zone and Forest-wide
	b. What are the effects of transition implementation on the health of the regional wood products *industry*?	Proportion of business type and workforce maintained or hired	Ranger District or zone and region-wide
	c. How much co-intent work/sales, restoration work, and timber sales are local and regional businesses capturing?	• Percent of service contracts and timber sales captured by businesses local to a Forest annually • Total value of contracts and timber sales captured locally annually • Primary types of work captured locally/not captured locally	Ranger District or zone and region-wide
D. Collaborative capacity	a. What is the capacity of collaborative groups to undertake an accelerated transition via co-intent projects in both suitable and non-suitable LUDs?	Guided self-evaluation rankings for: • Spatial scales at which they are working • Timelines at which they are working • Levels of ecological/social complexity of projects • Level of trust	Ranger District or zone, across Districts/zones (by group), and region-wide
		Number of matching funds and in-kind contributions from non-Agency partners for project planning, implementation, and monitoring	Ranger District or zone, across Districts/zones (by project), and region-wide

Acronyms and Abbreviations

Agency	United States Forest Service
CMAI	Culmination of Mean Annual Increment
Committee	Tongass Advisory Committee
DEIS	Draft Environmental Impact Statement
Department	United States Department of Agriculture
FEIS	Final Environmental Impact Statement
Forest	Tongass National Forest
Forest Plan	Tongass Land & Resource Management Plan
GIS	Geographic Information System
IDT	Interdisciplinary Team
IRM	Integrated Resource Management
LUD	Land Use Designation
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
PCT	Pre-commercial Thinning
PTSQ	Projected Timber Sale Quantity
RLT	Regional Leadership Team
ROD	Record of Decision
RMA	Riparian Management Area
S&Gs	Standards and Guidelines
SIO	Scenery Integrity Objective
TAC	Tongass Advisory Committee
TLT	Tongass Leadership Team
Tongass	Tongass National Forest
TTRA	Tongass Timber Reform Act
USDA	United States Department of Agriculture
USFS	United States Forest Service
WO	Washington Office

About Meridian Institute

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APPENDIX C
WATERSHED ANALYSIS

Appendix C

Watershed Analysis

Applicability

In this Forest Plan, the term "watershed analysis" is very narrowly defined. Cumulative watershed effects analysis should not be confused with watershed analysis as described in this appendix. The Forest-wide Soil and Water Standards and Guidelines (Chapter 4) and plan components (Chapter 5) provide direction to evaluate and minimize cumulative effects during project planning and analysis.

Watershed analysis is required *only* in the following circumstances:

1. Before making site-specific adjustments to Forest-wide Riparian Standards and Guidelines (including commercial young-growth harvest or timber salvage in riparian management areas), ensure adjustments will achieve channel process group objectives described in the Riparian Standards and Guidelines (Appendix D). [In accordance with the Tongass Timber Reform Act [Section 103. Fisheries Protection. (a) Section 705 (16 U.S.C. 539d) of ANILCA], maintain a buffer zone of no less than one hundred feet in width on each side of all Class I streams in the Tongass National Forest, and on those Class II streams which flow directly into a Class I stream, within which commercial timber harvesting shall be prohibited. Therefore adjustments cannot be made for commercial timber harvest within this zone.]
2. Before authorizing management activities in public water system source watersheds, to ensure activities are not authorized that create or maintain a condition that has a significant potential to cause or allow the pollution or contamination of a public water system (in compliance with Alaska's Drinking Water Regulations, 18 AAC 80).
3. Any other time the Responsible Official determines that a watershed analysis is necessary to make an informed decision.

A watershed analysis must be documented as part of the National Environmental Policy Act (NEPA) decision *in these circumstances.* If none of these circumstances exist, a watershed analysis (as described in this appendix) is otherwise not required. The watershed analysis is not used to propose actions or make decisions.

Introduction

Watershed analysis is a procedure for assessing important riparian and aquatic values and processes in a watershed context. It is designed to:

1. Help set the stage for project-level planning and decisions
2. Strengthen the project NEPA analysis and decision
3. Focus interdisciplinary discussion on key watershed resources

Approach

When watershed analysis is required, it must occur prior to or during NEPA analysis for a specific project or projects. The scope and intensity of watershed analysis should be commensurate with the level of risk associated with the NEPA decision, and the information necessary to support the decision.

A journey-level watershed or fisheries specialist will determine the scope and intensity of the watershed analysis in consultation with the Responsible Official.

Watershed Analysis

A primary consideration is the scale of the proposed activity. For example, a one-time, isolated activity in a 1st order tributary, such as salvage of one or two down trees from within a single Class III riparian area, is not expected to require an expensive, lengthy watershed analysis. In this example, if this activity will achieve process group objectives, it is expected that the procedures (described below) could be quickly and concisely documented in a few paragraphs to justify the activity.

On the other hand, adjustment of Riparian Standards and Guidelines at many sites, or repeatedly, within a 3rd or 4th order watershed will require more time and effort in order to demonstrate that the adjustment will achieve process group objectives.

When determining the scope and intensity of a watershed analysis to justify site-specific adjustments to Forest-wide Riparian Standards and Guidelines (including timber salvage in riparian areas), consider risks associated with not achieving the channel process group objectives that are described in the Riparian Standards and Guidelines.

When determining the scope and intensity of a watershed analysis to support authorizing management activities in public water system source watersheds, consider risks associated with polluting a public water supply and effects on public health.

Procedures

Watershed analysis requires field-based site evaluations. There is a wide array of analytical tools and procedures that may be used. At a minimum, follow the procedures listed below.

1. Before making site-specific adjustments to Forest-wide Riparian Standards and Guidelines (including timber salvage in riparian areas):
   a. Conduct field inventory of all affected stream reaches, including downstream reaches connecting to fish habitat, to verify fish presence, stream classes, and channel types (Tier I survey as described in the Alaska Region's Aquatic Habitat Management Handbook, FSH 2090.21).
   b. Consult with logging systems personnel; document the site-specific adjustments, rationale, and trade-offs between logging systems and riparian objectives.
   c. Evaluate site specific windthrow risk (Landwehr 2007, Stathers et.al. 1994).
   d. Consider cumulative effects of past practices such as riparian harvest and roads, and natural disturbances such as landslides.
   e. Assess current condition and trend of channel process group objectives (refer to Process Group information in Forest-wide Riparian Standards and Guidelines and fish habitat objectives in Forest-wide Fish Standards and Guidelines).
   f. Explain how adjustments to Riparian Standards and Guidelines will achieve channel process group objectives.

2. Before authorizing management activities in public water system source watersheds:
   a. Consult with Alaska Department of Environmental Conservation (ADEC), affected municipality, and/or owner/operator of water system.
   b. Refer to Forest Service Manual (FSM) Guidance for Municipal Watersheds (FSM 2542) and the Code of Federal Regulations for management of municipal watersheds (36 CFR 251.9) for guidance. Refer to Alaska's Drinking Water Regulations, specifically 18 AAC 80.620(c)(3), for systems that seek to avoid filtration.
   c. Review completed Source Water Assessment for the watershed, available from ADEC.

d. Consider cumulative effects of past practices such as riparian harvest, road condition, potential pollution sources and natural disturbances such as landslides, without regard to landownership.
e. Develop site-specific Best Management Practices (BMPs) for any authorized activity. Consider, at a minimum, BMPs that limit ground disturbance, restrict public access (in consultation with landowners), and restrict hazardous materials and hazardous waste.
f. Explain how proposed management activities will not create or maintain a condition that has a significant potential to cause or allow the pollution or contamination of a public water system.

Documentation

Complete a watershed analysis report. The report documents each of the items listed above. The report will provide a summary of the analysis and recommendations that respond to the key management issues. Include the watershed analysis report in any subsequent or concurrent documentation of project-level decisions.

Literature Cited

Landwehr, D.J. 2007. Reasonable Assurance of Windfirmness Guidelines Version 2.0 Tongass National Forest, May 2, 2007.

Stathers, R.J, T.P. Rollerson, and S.J. Mitchell. 1994. Windthrow Handbook for British Columbia Forests. Ministry of Forests Research Program Working paper 9401.

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APPENDIX D
RIPARIAN MANAGEMENT AREA STANDARDS AND GUIDELINES

Appendix D

Riparian Management Area Standards and Guidelines

Introduction

Riparian areas encompass the zone of interaction between aquatic and terrestrial environments associated with streamsides, lakeshores, and floodplains, and display distinctive ecological conditions characterized by high species diversity, wildlife value, and resource productivity. The Riparian section of Chapter 4 contains Forest-wide Standards and Guidelines for managing riparian areas. The desired conditions, objectives, and management direction for each channel type and process group contained in this appendix are an important component of the Forest-wide Standards and Guidelines. In this Plan, channel types and process groups are central to the direction for riparian area management (see the Riparian Forest-wide Standards and Guidelines in Chapter 4). Appendix D applies to all riparian areas in the Tongass National Forest, including young-growth stands. The Tongass Young Growth Management Strategy (2014) Exhibit 2 includes management goals and objectives, and descriptions of existing and desired conditions of young growth stands in riparian areas.

Channel types and process groups are used for guiding land management activities and predicting the effects of those activities along all stream and river systems of the Tongass National Forest. For more information on riparian management considerations for each of the channel types, consult the Region 10 Channel Type Revision (Paustian et al. 1992 as amended in 2010) available online at http://www.fs.usda.gov/detail/tongass/maps-pubs/?cid=stelprdb5413798.

In the early 1980s, a method of inventorying channel types was developed for the Tongass National Forest to identify, classify, and map the distinguishing parts of stream and river (fluvial) systems. This inventory system, which was finalized for the Tongass National Forest in 1992 (Paustian et al. 1992, as amended in 2010), allows for the logical categorization of fluvial channels and provides a process for predicting channel response to management- or naturally-caused changes.

Process Groups

The inventory groups channels into nine basic fluvial process groups (Table D-1) as well as one additional group covering lakes and ponds. These process groups describe streams and rivers with similar physical "processes," that are with similar interrelationships between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition.

Each process group includes a number of channel types. Channel types represent a finer delineation than process groups. They more precisely characterize a channel and help predict the probable responses to natural and human influences. Like process groups, channel types are defined by physical attributes, but channel types also incorporate other aspects of channel gradient, channel pattern, stream bank incision and containment, and riparian community composition. A description of each channel type is listed in Table D-2.

Beginning on page D-5 is a discussion of each process group, including a listing of the channel types that are incorporated within the process group. A summary of process group characteristics can be found in Table D-3. An illustration of the

typical setting of each of the process groups, and their relationship within a watershed, is provided in Figure D-1.

Table D-1
Stream Classification and Stream Length by Process Group

Stream Process Groups	Channel Type Classification	Miles[1]
Flood Plain	FPO, FPB, FPE, FPB, FPE, FPS, FPM, FPL	3,955
Glacial Outwash	GSC, GOL, GOB, GAF, GSC, GOS, GOM, GOL, GOB, GOC, GES	1,152
Alluvial Fan	AFO, AFM, AFH	1,516
Low Gradient Contained	LCO, LCS, LCM, LCL	461
Moderate Gradient, Mixed Control	MMO, MMS, MMM, MML	3,753
Moderate Gradient Contained	MCO, MCS, MCM, MCL	2,934
High Gradient Contained	HCO, HCL HCM, HCD, HCV	28,727
Palustrine	PAO, PAS, PAM, PAL, PAH, PAG, PAB	2,632
Estuarine	ESO, ESS, ESM, ESL	310

[1] Miles are only those currently mapped and in the GIS database excluding lake miles, unverified connectors, and channels on all non-Forest Service lands. Additional unmapped streams are present, but have not been located through on-the-ground surveys, especially Class III and IV streams that are greatly underrepresented in the database.

Source: Paustian et al. (1992) and Revision (2010); GIS Database (2016). Miles are adjusted for estimates of channels missed in the inventories.

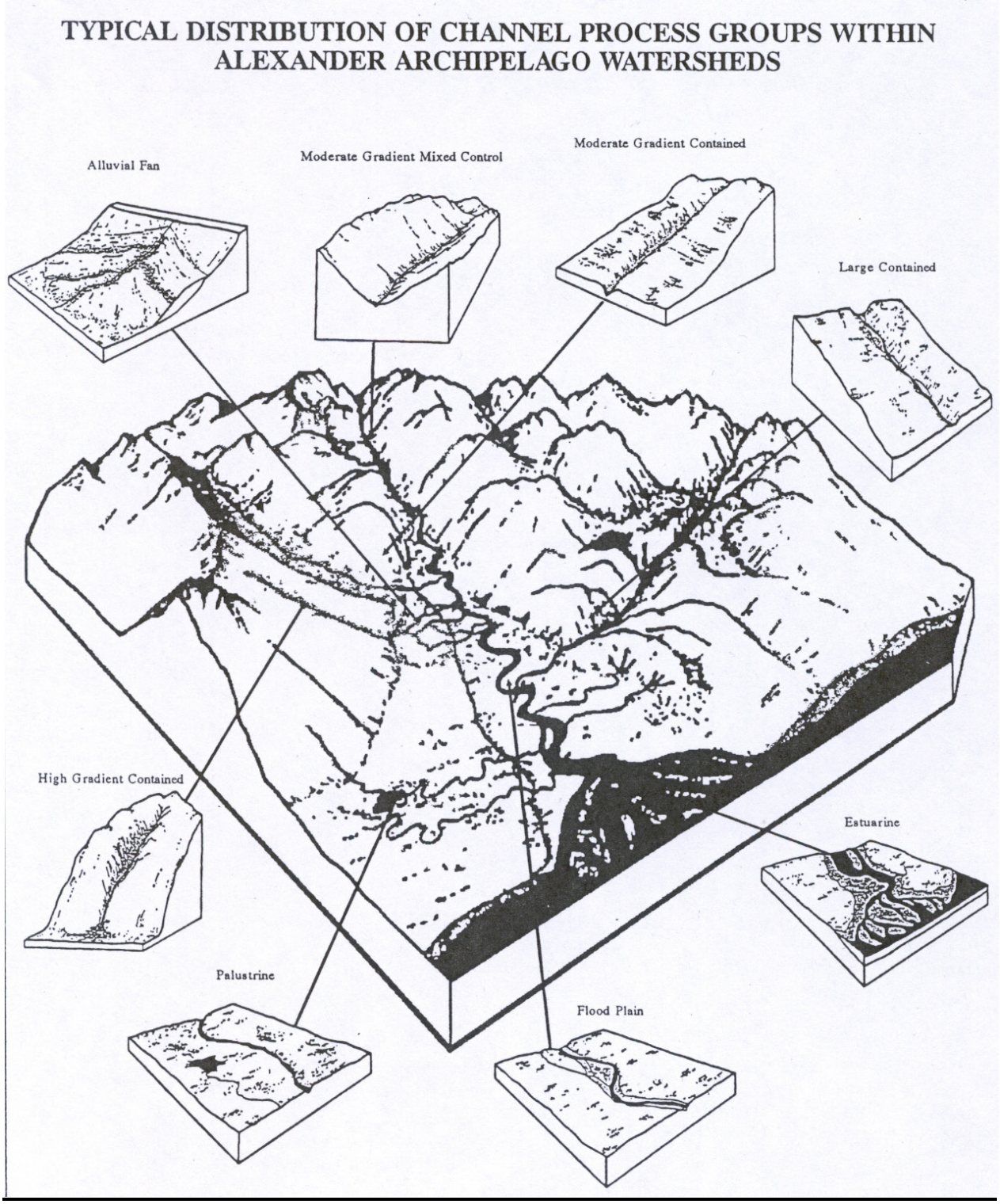
Table D-2
Channel Type Descriptions

Channel Type	Description
AFO	Micro Alluvial Fan Channel
AFM	Moderate Gradient Alluvial Fan Channel
AFH	High Gradient Alluvial Cone Channel
ESO	Micro Estuarine Channel
ESS	Small Estuarine Channel
ESM	Medium Estuarine Channel
ESL	Large Estuarine Channel
FPO	Micro Flood Plain Channel
FPB	Foreland Uplifted Beach Channel
FPE	Foreland Uplifted Estuarine Channel
FPS	Small Flood Plain Channel
FPM	Medium Flood Plain Channel
FPL	Large Flood Plain Channel
GAF	Glacial Alluvial Fan Channel
GSC	Glacial Outwash Flood Plain Side Channel
GOS	Small Glacial Outwash Side Channel
GOM	Medium Glacial Outwash Channel
GOL	Large Meandering Glacial Outwash Channel
GOB	Large Braided Glacial Outwash Channel
GOC	Cirque Channel
GES	Glacial Outwash Estuarine Channel
HCO	Micro High Gradient Contained Channel
HCL	High Gradient Upper Valley Channel

Table D-2 (continued)
Channel Type Descriptions

Channel Type	Description
HCM	High Gradient Moderate Incision Channel
HCD	High Gradient Deep Incision Channel
HCV	Deeply Incised Muskeg Channel
LCO	Micro Low Gradient Contained Channel
LCS	Low Gradient Contained Channel
LCM	Moderate Gradient Contained Channel
LCL	Large Low Gradient Contained Channel
MCO	Micro Moderate Gradient Contained Channel
MCS	Small Moderate Gradient Contained Channel
MCM	Medium Moderate Gradient Contained Channel
MCL	Large Moderate Gradient Contained Channel
MMO	Micro Moderate Gradient Contained
MMS	Small Moderate Gradient Mixed Control Channel
MMM	Medium Moderate Gradient Mixed Control Channel
MML	Large Moderate Gradient Mixed Control Channel
PA0	Micro Palustrine Channel
PAS	Small Palustrine Channel
PAM	Medium Palustrine Channel
PAL	Large Palustrine Channel
PAH	Backwater or Groundwater Fed Slough
PAG	Backwater glacial Side channel
PAB	Beaver Dam/Pond Channel

Figure D-1
Typical Distribution of Channel Process Groups within Alexander Archipelago Watersheds



Flood Plain and Glacial Outwash

Channel Types: FPO, FPB, FPE, FPS, FPM, FPL, GSC, GOL, GOB, GOS

Description: Flood plain and glacial outwash channels are associated with the valley bottom flood plain landform. These two process groups contain low gradient sinuous singular or anabranched channels. Braided channels are more prevalent in the glacial outwash process group. Mountain slope runoff and groundwater discharge control stream flow in the flood plain process group, while glacial melt controls flow in the glacial outwash group. Peak flows occur in the spring and fall in the flood plain process group, while in summer for the glacial outwash group. Sediment deposition is the dominant process in both groups. Substrate material ranges from sand to cobble size material in both groups.

Flood plains commonly support standing old-growth spruce with heights of up to 130 feet. Downed wood provides nurse logs for regeneration, sediment retention, and infiltration. Flood plain width may exceed 200 feet on FPM and FPL channels, but are generally less than 200 feet on FPS channels. These areas are typically highly productive for fish. Beaver ponds, sloughs, ephemeral side channels, commonly referred to as “off channel areas,” are of particular significance as flood plain and glacial outwash habitat features. Early successional forest species, such as black cottonwood, are common in the glacial outwash process group.

Stream channels in the flood plain process group include FPO (micro flood plain) FPB (uplifted beach), FPE (uplifted estuary) foreland channel types, and FPS, FPM, and FPL (narrow to wide) flood plain channel types. Generally, alluvial deposition is prevalent in these low gradient (less than 2 percent gradient) channels. High stream flows often are not contained within channel banks resulting in flood plain development.

Flood plain streams are relatively efficient at trapping nutrients from riparian forest detritus and inorganic sediment delivered from headwater areas. These streams also buffer against flood disturbances by spreading runoff across densely vegetated flood plains and into numerous side channels and sloughs. Shallow alluvial aquifers associated with these streams store runoff from flood flows and hillslope tributaries and slowly release groundwater to surface channels during periods of low rainfall. The ability of flood plain channels to dampen the effects of runoff extremes and to store nutrients are primary factors contributing to productive aquatic communities found in these streams.

Channel materials are composed of fine sediments, small boulders, and cobble, which are deposited by the stream. Stream banks consist of unconsolidated materials such as sand, gravel, or organic materials and are often unstable. Channel migration and braiding may occur. Root networks of trees and shrubs have an important role in holding unconsolidated stream banks together. Large woody debris (LWD) also plays a role in controlling streambed and bank stability by regulating the stream's energy dissipation. Pools and cover from LWD provide good fish habitat.

Glacial outwash channel types are alluvial channels with stream gradients usually less than 3 percent. This process group includes GSC (side channel), GOL (large meandering), and GOB (large braided) glacial outwash channel types. These are generally valley or lowland streams. Because mountain glacier meltwater is the source of runoff to these streams, they carry extremely high sediment loads and have very turbid water. Riparian areas are wide and may extend for many hundred feet in large braided river systems.

Glacial outwash channel types share many of the attributes of the flood plain process group. However, glacial streams tend to have larger seasonal variations

in stream flow and large sediment loads that result in more dynamic or unstable channels and flood plains. These factors, along with colder water temperatures, tend to limit overall aquatic productivity.

Desired condition: Flood plains are highly productive as fish and wildlife habitat. Natural flood plain functions occur, such as flood mitigation, surface-groundwater exchange, water temperature moderation, and the formation of streams providing off-channel fish habitat. Large wood is distributed across the flood plain, except where non-forest or early successional species naturally occur. Old-growth habitat provides high-quality habitat for riparian-associated wildlife species.

Glacial outwash plains range from low to highly productive fish and wildlife habitat. Fine sediments may limit spawning. Natural flood plain functions such as flood mitigation, surface groundwater exchange, water temperature moderation, and stream formation provide off-channel fish habitat. Areas of off-channel spawning and rearing may be highly productive where areas of upwelling occur. Large wood is distributed across the flood plain, except where non-Forest or early successional species dominate naturally.

Objectives: Maintain near-natural quantities of large wood by assessing the site's old-growth type and managing for the natural frequency and size distribution for large, downed wood and standing trees on the flood plain. (Consult Ecological Definitions for Old-growth Forest Types in Southeast Alaska, Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution, pool size and frequency, and channel morphometry. (Consult the Alaska Anadromous Fisheries Habitat Assessment, Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives.)

Minimize soil disturbance and the formation of new channels (BMP 13.9). Maintain fish access to entire range of habitat. Avoid diverting surface drainage channels.

Minimize damage to large standing trees from yarding activities.

Implement riparian vegetation improvement projects in young-growth stands, where appropriate, to help in attaining desired future condition.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (refer to Appendix C) in NEPA documents that make site-specific adjustments to process group direction, including commercial harvest of young-growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I, II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. Although not required by the Tongass Timber Reform Act, no commercial timber harvest in the flood plain until the completion of watershed analysis. No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils, riparian associated wetland fens, or 130 feet [the height of one site-potential tree]). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct), III/Timber Harvest

No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils, riparian associated wetland fens, or 130 feet [the height of one site-potential tree]). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

I, II, and III/Harvest Controls

Yard in a manner to minimize baring of mineral soil (less than 5 percent) and such that new channelization does not occur across the flood plain. The objective is to minimize alder growth and formation of new channels (BMP 13.9).

I, II, and III/Roads, Borrow Pits, Drainage Structures

Locate roads only when other feasible routes do not exist (BMP 14.2). Develop stream course protection plans when stream crossings are necessary. Do not develop borrow pits within the active flood plain (BMP 14.9). The objective is to maintain fish passage and access to all available habitats and avoid diverting surface drainage channels.

Channel Types: AFO, AFM, AFH, GAF

Alluvial Fan

Description: Alluvial fan channels flow directly over the alluvial fan landform. These are dynamic multi-branched channels that periodically change course within the landform. Stream gradient ranges from 1 to 3 percent on the lower half of the alluvial fan and increases toward the fan apex. The alluvial fan channel is associated with high-gradient contained channels; therefore, streamflow is dependent on mountain slope runoff. Groundwater discharge is also significant. Surface flow may be intermittent as substrate consists of sand to cobble size material. During low flow periods, stream flow may run subsurface due to infiltration of water into coarse gravel substrate in the middle section of the alluvial fan and emerge on the lower section. Aggradation of material is the dominant process on the alluvial fan, and fine sediment may be deposited in the low gradient section. The active channels on alluvial fans often include multiple high flow channels and unvegetated gravel or cobble outwash lobes with ill-defined channel banks. Alluvial fans typically support large spruce with diameters (diameters at breast height [DBH]) of 30 inches and have average site-potential tree heights of 140 feet. Downed wood serves as nurse logs for regeneration.

This process group includes AFO (micro), AFM (moderate gradient), AFH (high gradient), and GAF (glacial) alluvial fan/cone channel types. These are generally tributary streams that are located on footslope landforms in a transitional area between valley flood plains and steep mountain slopes. Alluvial fans are formed by the rapid change in sediment transport capacity as the high energy mountain slope stream segments spill onto the valley bottoms. Stream channels change course frequently, resulting in a multi-branch stream network. Sediment deposition tends to create elongated islands of bare cobbles and gravel between these multi-branched channels. Alluvial fan stream channels are often unstable. Riparian areas commonly associated with these poorly contained streams are very narrow at the top of the fans and become wider as the fan spreads out. Due to the complex stream network, riparian areas for alluvial fan channels may be extensive.

LWD can play a major role in trapping sediment on the fan surface and within stream channels. Scour and dam pools formed by LWD can be very important for fish rearing habitat in alluvial fan streams. Gravel aquifers associated with alluvial fan drainages are commonly an important source of groundwater discharge to adjacent valley bottom streams.

Desired condition: Stream systems relocate naturally in an unpredictable pattern across the alluvial fan. Large wood occurs across the fan, and is important for the retention and metering of sediment into stream systems, and to create pools for fish rearing habitat. Some amount of large wood is available to the stream wherever the stream may be located on the fan. Wood may be excavated by fluvial processes on the fan.

Objectives: Maintain near-natural quantities of large wood by assessing the site's old-growth type and managing for the natural frequency and size distribution for large, downed wood and standing trees on the fan. (Consult Ecological Definitions for Old-growth Forest Types in Southeast Alaska, Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution described in the Alaska Anadromous Fisheries Habitat Assessment (Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives).

Implement BMP 13.9. Provide for natural fish migration. Do not divert stream channels.

Implement riparian vegetation improvement projects in young-growth stands, where appropriate, to help in attaining desired future condition.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (refer to Appendix C) in NEPA documents that make site-specific adjustments to process group direction, including commercial harvest of young-growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I, II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed within the RMA, which is the greater of the active portion of the alluvial fan or 140 feet (the height of one site-potential tree) from the current channel(s). Manage across the remainder of the fan (no more than 10 percent of the fan harvested in a 30-year period) with the objective of leaving large trees within the stand for future recruitment to stream channels.

II (non-direct), III/Timber Harvest

No commercial timber harvest is allowed within the RMA, which is the greater of the active portion of the alluvial fan or 140 feet (the height of one site-potential tree) from the current channel(s).

I, II, and III/Harvest Controls

Yard in a manner to minimize baring of mineral soil and such that new human-caused channelization does not occur across the entire alluvial fan. The objective is to minimize alder growth and formation of new channels (refer to BMP 13.9). Where trees are removed, utility/cull logs should be left distributed across the alluvial fan.

I, II, and III/Roads, Borrow Pits, Drainage Structures
Recognize that alluvial fans are places of inherent instability where roads, borrow pits, or structures will be continually threatened by migrating stream channels.

Moderate Gradient/Mixed Control

Channel Types: MMO, MMS, MMM, MML, GOM

Description: These channels are commonly found in transition zones between high gradient contained streams and flood plain channels. They are located in narrow valleys, footslopes, or sloping and rolling lowlands. Stream channel gradients range from 2 to 6 percent. Channel containment is variable as structural control may be intermittent or only along one bank. Overall channel pattern is straight. Stream flow is dependent upon mountain slope runoff and the sediment regime is balanced (input equals output). Channel substrate ranges from coarse gravel to boulder size material. Typical site potential tree is 120 feet.

This process group includes MMO (micro), MMS (narrow) and MMM (moderate width) and MML (large width) channel types that are a mixture of stream channel containment. This process group also includes GOM (moderate width glacial channel). These channel types are moderate gradient (2 to 6 percent) streams where sediment deposition processes are limited. Some segments are constrained by bedrock outcrop or the valley walls, while other areas develop narrow flood plains. Stream banks are dominated by coarse alluvium (boulders, cobbles) or bedrock. Riparian vegetation is important in regulating stream energy losses through LWD input. LWD forms such water energy dissipaters as log step pools and lateral scour pools. LWD can strongly influence channel form, sediment storage, and pool and cover habitat in streams with minor bedrock control. Riparian areas seldom extend beyond 100 feet from stream banks.

Desired condition: Large wood is recruited and retained in the stream channel. Riparian vegetation provides shade, is a source of organic inputs to the stream, and maintains dynamic flood plain processes. Large wood is distributed across the flood plain. Old-growth habitat provides high quality habitat for riparian-associated wildlife species.

Objectives: Maintain near-natural quantities of large wood by assessing the site's old-growth type and managing for the natural frequency and size distribution for large, downed wood and standing trees. (Consult Ecological Definitions for Old-growth Forest Types in Southeast Alaska, Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution, pool size and frequency and channel morphometry. (Consult the Alaska Anadromous Fisheries Habitat Assessment, Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives.)

Minimize soil disturbance and the formation of new channels (BMP 13.9). Maintain fish migration where needed and maintain natural surface drainage patterns for flood plain areas.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Implement riparian vegetation improvement projects in young-growth stands, where appropriate, to help in attaining desired future condition.

Stream Class/Activity

I, II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils, riparian associated wetland fens, or 120 feet [the height of one site-potential tree]). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct), III/Timber Harvest

No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils, riparian associated wetland fens, or 120 feet [the height of one site-potential tree]). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

I, II, and III/Harvest Controls

Fully suspend trees over the bankfull width of the stream when yarding. Minimize yarding corridors within the RMA. Yard in a manner to minimize baring of mineral soil (less than 5 percent) and such that new channelization does not occur across the entire flood plain. The objective is to minimize surface soil disturbance and formation of new channels (BMP 13.9).

I, II, and III/ Roads, Borrow Pits, Drainage Structures

Borrow pits are generally not appropriate. Special road construction techniques may be required to ensure fish passage. Maintain fish migration where needed and avoid diverting surface drainage channels.

Channel Types: LCS, LCM, and LCL

Description: Low gradient contained channels are associated with canyons or sloping lowlands. These are low gradient (less than 3 percent), singular, straight, and entrenched channels with gravel to bedrock substrate. Sediment regime balances input with output. Stream flow is dependent upon mountain slope or lowland runoff. Habitat is often limited by a scarcity of stable large wood structure. Riparian vegetation communities are varied. Riparian width, including flood plain and sideslope breaks, is generally less than 150 feet. A site potential tree reaches an average height of 100 feet.

Low Gradient Contained

Stream flow in channels in this process group are well contained by adjacent landforms. Bedrock outcrops that constrain or control channel migration and downcutting are common. This process group includes LCS (small), LCM (medium width), and LCL (large width) low gradient contained channel types. The riparian influence zone often extends up channel side slopes on these entrenched streams. Channel side slope vegetation plays a major role in controlling the rate of downslope soil movement and LWD into stream channels. LWD accumulations also dissipate stream energy (slow its velocity) and store sediment within the stream channel. The larger valley and lowland streams often have narrow alluvial terraces within the river gorge. Streambed and banks are dominantly composed of coarse alluvium (cobble to boulder size) and occasional bedrock outcrops. These streams generally have a balance between sediment

transport and deposition. Waterfalls and cascades that form at bedrock knick points can be barriers to upstream anadromous fish migration.

Desired condition: Natural integrity of channel sideslopes is maintained. Large wood is recruited and retained in the stream channel. Riparian vegetation provides shade and is a source of organic inputs to the stream. Old-growth habitat provides high-quality habitat for riparian-associated wildlife species.

Objectives: Maintain near-natural quantities of large wood by assessing the site's old-growth type and managing for the natural frequency and size distribution for large, downed wood and standing trees. (Consult Ecological Definitions for Old-growth Forest Types in Southeast Alaska, Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution, and pool size and frequency. (Consult the Alaska Anadromous Fisheries Habitat Assessment, Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives.)

Allow no increase over natural rates of channel sideslope surface erosion or mass wasting.

Minimize changes to the natural rates of sediment transport. Ensure fish passage for all Class I and II streams.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young-growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I and II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed within the RMA, defined as within the channel sideslope break. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct)/Timber Harvest

No commercial timber harvest is allowed within the RMA, defined as within 100 feet of the stream or to the top of the side-slope break, whichever is greater. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

III/Timber Harvest

No commercial timber harvest is allowed within the RMA, defined as the side-slope break. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

I and II/Harvest Controls

Fully suspend trees over the bankfull stream when yarding. Minimize yarding corridors within the RMA. Yard in a manner to

ensure no delivery of sediment from channel sideslopes; baring of mineral soil is minimized (less than 5 percent); and new channelization does not occur across the flood plain.

I, II, and III/Roads, Borrow Pits, Drainage Structures

Do not develop borrow pits within the active flood plain (BMP 14.9). Where road crossings are required, minimize erosion and sedimentation associated with road crossing approaches within inner gorge. Fish migration should not be impeded by road crossings.

Channel Types: MCS, MCM, and MCL

Moderate Gradient Contained

Description: Moderate gradient contained channels are associated with sloping or rolling lowlands. Stream gradient ranges from 2 to 6 percent for these singular, straight, and entrenched channels. Stream flow is dependent upon mountain slope runoff. Sediment is transported through these channels. Substrate is dominated by cobble, boulder, and bedrock material. Habitat is often limited by stable large wood structures. Riparian vegetation communities are varied. Riparian width, including flood plain and sideslope breaks, reach 60 to 70 feet. A site potential tree height is 100 feet.

This process group includes MCS (small), MCM (medium), and MCL (large) moderate gradient contained channel types. Stream flow in this process group is completely contained by adjacent landforms and channel side slopes. Stream bank and streambed erosion are frequently controlled by bedrock outcrops. Gravel bars are infrequent channel features (plain bed channels). LWD within the wetted channel provide localized sediment storage sites and habitat diversity. Riparian areas are limited to the bank influence zone and generally less than 100 feet.

Desired condition: Natural integrity of channel sideslopes is maintained. Large wood is recruited and retained in the stream channel. Riparian vegetation provides shade and is a source of organic inputs to the stream.

Objectives: Maintain near-natural quantities of large wood by assessing the site's old-growth type and managing for the natural frequency and size distribution for large, downed wood and standing trees. (Consult Ecological Definitions for Old-growth Forest Types in Southeast Alaska, Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution, and pool size and frequency. (Consult the Alaska Anadromous Fisheries Habitat Assessment, Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives).

Allow no increase over natural rates of channel sideslope surface erosion or mass wasting.

Minimize changes to the natural rates of sediment transport. Ensure fish passage for all Class I and II streams.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young-growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I and II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed within the remainder of the RMA, defined as within the channel sideslope break. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct)/Timber Harvest

No commercial timber harvest is allowed within 100 feet or within the channel side-slope break, whichever is greater. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

III/Timber Harvest

No commercial timber harvest is allowed within the RMA, defined as the side-slope break. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

I, II, and III/Harvest Controls

Fully suspend trees over the bankfull stream when yarding. Minimize yarding corridors within the Riparian Management Area. Yard in a manner to minimize delivery of sediment from channel sideslopes.

I, II, and III/Roads, Borrow Pits, Drainage Structures

Borrow pits are generally not appropriate. Where road crossings are required, minimize erosion and sedimentation associated with road crossing approaches within inner gorge. Maintain fish passage at road crossings and avoid diverting surface drainage channels.

High Gradient Contained

Channel Types: HCO, HCL, HCM, HCD, and HCV

Description: High gradient contained channels are located on mountain slopes. These are singular straight incised channels with steep slopes and channel gradients greater than 6 percent. Stream flow is dependent upon mountain slope runoff and may be intermittent. Channel substrate is mostly comprised of large material, either bedrock or well-packed boulders and cobbles.. RMAs include incised channel sideslopes. Hemlock series dominate vegetation although spruce is also common. Some streams have intermittent flows. Steep gradients (greater than 6 percent) limit fish capability. Typical site-potential tree height is 120 feet.

These steep, headwater streams are important source areas for runoff, organic and inorganic sediment transported to downstream riparian and fish habitats. Stream channels are well contained within the narrow valley bottoms or ravines. High stream energy enables these streams to transport large sediment loads during spring and fall flood events. Riparian areas generally extend to the upper stream side slope break. Riparian vegetation consists of narrow strips (often less than 50 feet wide) of alder, salmonberry, devil's club, or currant/shrub communities. Spruce and hemlock forests are also present on ravine side slopes. These channels are predominantly influenced by hillslope erosion processes. Soils in the adjacent upland area are shallow and subject to mass wasting. Although these are dominantly transport or erosive channels, significant amounts of forest litter and sediment can be trapped and stored temporarily behind woody debris jams.

Desired condition: Natural integrity of channel sideslopes is maintained. Sediment is "metered out" to downstream reaches by large wood structure. Over the long term, high gradient contained streams act as conduits to move large wood and gravel into downstream fish bearing streams during debris flow events.

Objectives: Activities should not accelerate sideslope surface erosion or mass wasting. Maintain some instream large wood structure over the long term where important for downslope channel processes that require wood as a component of natural debris torrents.

Retain natural drainage patterns and minimize changes to the natural rates of sediment transport.

Design, install, and maintain stream crossings to pass flow, bedload, and wood debris from peak events with minimal impacts to stream channel and road integrity.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I, II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed within the RMA, defined as within 100 feet of the stream or to the top of the V-notch (side-slope break), whichever is greater. Manage an appropriate distance beyond the no-harvest zone to provide for a

reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct)/Timber Harvest

No commercial timber harvest is allowed within the RMA, defined as within 100 feet of the stream or to the top of the V-notch (side-slope break), whichever is greater. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

III/Timber Harvest

No commercial timber harvest is allowed within the RMA, defined as the V-notch (side-slope break). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

IV/Timber Harvest

Protect Class IV streams using the following techniques, depending on the situation:
a) Directional felling along streams and full suspension of logs yarded across streams, immediate cleanout of logging debris. May include partial retention of standing trees along stream courses or.
b) Split yarding when practicable, partial log suspension when yarding across channels and stream cleanout once logging is completed. Use stream protection measures most amenable to local site conditions: (refer to “b” and “c” stream protection measures, FSH 2409.18).

I, II, III, and IV/Harvest Controls

Minimize yarding corridors within the RMAs.

I, II, III, and IV/Roads, Borrow Pits, Drainage Structures

Borrow pits are generally not appropriate. Road and road crossings should be designed and constructed to minimize soil runoff to the channel, retain natural drainage patterns, and minimize changes to the natural rates of sediment transport.

Channel Types: PAO, PAS, PAM, PAL, PAG, PAH, and PAB

Palustrine

Description: Palustrine channels are associated with lowland landforms and wetlands. Channel gradients are less than 1 percent. Palustrine channels are singular and sinuous. Stream flow is dependent on peatland and lowland runoff. Sediment storage is the dominant process. Substrate material ranges from fine organic material to coarse gravel.

Riparian vegetation includes mixed conifer, shore pine, and non-forest. Site-potential tree height is generally less than 85 feet.

Streams within this process group are associated with low relief landforms dominated by wetlands. Water movement and sediment transport rates are low. Stream banks are composed of dense organic root mats that are resistant to bank erosion. Streambeds consist of fine alluvial gravel and sand, and organics. Flood waters spread out across adjacent wetlands to buffer against downstream flooding. Another important function of these channels is to sustain streamflows during dry periods. Slow flowing palustrine streams can have elevated water

temperatures that can be detrimental to some aquatic species during summer months. Riparian areas are usually wider than 100 feet and can be very wide in peatland landscapes.

Desired condition: Highly complex stream and riparian systems provide canopy shading, instream organic recruitment for food and cover, and habitat diversity for rearing salmonids. Undercut banks are often present. Old-growth habitat provides high quality habitat for riparian-associated wildlife species.

Objectives: Maintain near-natural quantities of large wood (primarily for cover habitat) by assessing the site's vegetation type and managing for the natural frequency and size distribution for large, downed wood and standing trees. (Consult "Ecological Definitions for Old-growth Forest Types in Southeast Alaska," Forest Service publication R10-TP-28.) In the stream channel, meet the natural range of aquatic habitat features for large wood size and distribution, and channel morphometry. (Consult the Alaska Anadromous Fisheries Habitat Assessment, Forest Service publication R10-MB-279, Appendix C.1. on fish habitat objectives.)

Maintain streambank structure and wetland functions and values.

Apply the following management direction at the project level to streams in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Stream Class/Activity

I and II (direct)/Timber Harvest

No commercial timber harvest within 100 feet of Class I streams and Class II streams that flow directly into Class I streams. No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils or riparian associated wetland fens). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

II (non-direct)/Timber Harvest

No commercial timber harvest is allowed in the RMA (greatest of flood plain, riparian vegetation or soils, or riparian associated wetland fens). Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of the RMA (pay special attention to the area within one site-potential tree height of the RMA).

III/Timber Harvest

Consider no harvest (or limited harvest) areas to benefit water quality or palustrine-associated wildlife species.

I, II, and III/Harvest Controls

Fully suspend trees over the bankfull stream when yarding. Minimize width and number of yarding corridors within the RMA. Yard in a manner to minimize delivery of sediment from channel sideslopes. Follow Forest-wide Wetland Standards and Guidelines.

I, II, and III/Roads, Borrow Pits, Drainage Structures

Wetland functions and fish passage receive special attention in locating roads.

Description: Lakes and ponds can be located throughout a watershed from near sea level to the alpine. Very high elevation lakes (over 1,000 feet) are often frozen much of the year. Low elevation lakes are often high quality fish rearing habitat, and provide for many species of wildlife (especially beaver, loons, eagles, swans, and other water birds). Lakes and ponds function to mitigate downstream flooding during large precipitation events, and are important for surface-groundwater exchange and moderating water temperatures. Low elevation, fish-abundant lakes, are commonly used for customary and traditional subsistence harvests, sport fishing, and recreational camping. Small ponds, particularly beaver ponds, can be highly productive for fish on a per unit area basis.

Riparian and near-lake vegetation can often be mixed and a mosaic. It can include old-growth forests, hardwoods (e.g., alder or cottonwood), shore pine, and non-forest.

Desired condition: Low elevation lakes and ponds provide high quality fish rearing, wildlife habitat, and recreation. In forested areas, adjacent riparian areas provide the lake or pond canopy shading, organic recruitment for food and cover, and habitat diversity for fish. Old-growth habitat surrounding the lakes and ponds provides high quality habitat for lake and riparian-associated wildlife species. Lakes offer scenic diversity and attract recreationists for both consumptive and non-consumptive pursuits.

Objectives: In forested areas, maintain near-natural quantities of large wood for near-shore lake habitat and lake and riparian-associated wildlife.

Maintain lake shore character, including vegetation, bank conditions, and near-shore substrate (except occasionally for localized areas developed for recreation or other conforming uses); maintain hydrologic and wetland function and values.

(Note: Because lakes and ponds are so variable in their physical and biological characteristics, additional objectives should be set on a project basis.)

Apply the following management direction at the project level to lakes in this process group. Include a watershed analysis (see Appendix C) in NEPA documents that make site-specific adjustments to process group direction including commercial harvest of young-growth stands. Adjustments to the direction may be made only if the objectives of the process group can be met.

Lake Class/Activity

Lakes and Ponds

I (lakes with anadromous fish or with high value resident fisheries) and II (lakes with lower value resident fisheries)/Timber Harvest

No commercial timber harvest is allowed within 100 horizontal feet of the lake margin or within the RMA (greatest of the riparian vegetation or soils, riparian associated wetland fens, or the height of one-site potential tree [to be determined at the project level]). Consider an additional no harvest (or limited harvest) area beyond the no commercial timber harvest area to benefit lake-associated scenic quality, wildlife species (e.g., spotted frogs, Vancouver Canada geese, tree nesting ducks), and recreation, subsistence, and visitor uses. Typically, larger lakes in non-development LUDs

should have wider buffers than smaller lakes in the development LUDs. Manage an appropriate distance beyond any no-harvest zone to provide for a reasonable assurance of windfirmness of the desired standing timber (pay special attention to the area within one site-potential tree height of the no-harvest zone).

III/Timber Harvest

Consider no harvest (or limited harvest) areas to benefit lake-associated scenic quality, wildlife species and recreation, subsistence, and tourism uses.

I and II Harvest Controls

Yard in a manner to minimize baring of mineral soil (less than 1 percent) and such that new channelization does not occur in areas that would drain into a lake, pond, or wetland.

I, II, and III/Roads, Borrow Pits, Drainage Structures, Facilities

Special attention shall be given to wetland/riparian functions and values. Normally, locate roads and borrow pits outside the no commercial timber harvest area. Roads, trails, and other facilities that are dependent on, or make specific use of, the lake or pond may be located to the lake edge.

Estuarine

Channel Types: ESO, ESS, ESM, ESL, and GES

Description: This process group includes ESO (micro) ESS (small), ESM (medium), ESL (large), and GES (glacial outwash) estuarine channel types. These channel types occur at the mouths of watersheds with estuarine landforms (located along inlets and deltas at the head of bays). Water level fluctuations, channel morphology, sediment transport, and water chemistry are influenced to some degree by saltwater inundation in these channel types. Riparian areas consist of saltwater marches, meadows, mudflats, and gravel deltas that are depositional environments. Estuarine channels are usually single to multiple thread channels, shallowly entrenched, and poorly constrained. Stream substrate is fine textured alluvium that is easily eroded by currents and wave action. Much of the sediment produced from any given watershed is ultimately deposited in or along the estuarine channel types; consequently, these channels are highly sensitive to upstream disturbances. Sedge and grass communities dominate the riparian vegetation. The amount of stream migration and channel braiding vary, depending on bank and bed materials and upstream erosion and sediment transport regimes. Riparian areas are normally more than 100 feet wide and are often several hundreds of feet wide on large river deltas.

Desired condition: Natural processes dominated by diurnal and seasonal tidal flooding and fluvial sediment deposition sustain estuary wetland functions and habitat. Streambank condition and function and substrate composition exist within natural ranges. Upstream and riparian input of allochthonous organic material and large woody debris are maintained at natural rates. Channel condition (width to depth ratio, pool frequency, and depth) and large woody debris (density, recruitment rate, and size distributions) meet process group habitat objectives.

Objectives: Maintain near-natural rates of sediment deposition and quantities of large wood by assessing the condition of the watershed for the natural rates of erosion and the size distribution for large, downed wood and standing trees in the riparian management area.

Minimize increases in deposition of fine sediments by applying BMP 13.16 (channel protection) and BMP 14.17 (bridge design and implementation). Minimize impacts to stream channels (BMP 14.14).

Maintain intertidal wetland functions associated with these channels including sediment retention, shoreline stabilization, nutrient cycling, and wildlife and fish habitats. The natural rates of sediment deposition and volume and frequency of freshwater and tidal flooding are key processes that maintain these estuarine functions.

Maintain the integrity and structure of sensitive streambanks. Keep stream substrate particle size distributions within the natural range for channel types in similar geophysical areas.

Estuarine associated riparian management areas have high values for many wildlife species and are important for rearing marine fishes.

Maintain streambank structure and wetland functions and values.

Apply the following management direction at the project level to streams in this process group. Complete a watershed analysis (see Appendix C) before making project site-specific adjustments to process group direction including commercial harvest of young growth stands. Deviate from this direction only if the objectives of the process group can be met.

Stream Class/Activity

Timber Harvest

No commercial timber harvest may occur within 1,000 feet slope distance around the estuary, defined as the landward extent of salt tolerant vegetation. Where estuarine channels occur other than in association with a defined estuary, no commercial timber harvest is allowed in the riparian management area.

Manage beyond the no harvest zone to provide for a reasonable assurance of a windfirm boundary along the riparian management area, with special attention given to the area within one site-potential tree height of the riparian management area.

Harvest Controls

Consider no-harvest (or limited harvest) areas to benefit water quality or estuarine associated wildlife species.

Roads, Borrow Pits, and Drainage Structures

Give special attention to wetland functions and fish passage when locating roads. Road design and construction should minimize erosion and sedimentation and ensure that lateral channel migration patterns are maintained. Borrow pits are not appropriate for this channel process group.

Table D-3
Stream Process Group Characteristics, Alaska Region (Paustian et al. 1992, as amended in 2010)

	Glacial Outwash	Palustrine	Estuarine	Flood Plain and Alluvial Fan	Low Gradient Contained	Moderate Gradient Mixed Control	Moderate Gradient Contained	High Gradient Contained
Landform	Glacial River Flood Plain	Lowland/ Wetlands	Estuary/Delta	Flood Plain/ Alluvial Fan-Cone	Canyon or Entrenched in Lowlands	Footslope/ Narrow Valleys	Entrenched in Hills or Lowlands	Mountain Slope
Flood Plain Width	>2 times Channel Width	>2 times Channel Width	>2 times Channel Width	>2 times Channel Width	<1.5 times Channel Width	1 to 2 times Channel Width	<1 times Channel Width	<1 times Channel Width
Stream Gradient	Variable	<1%	0.5 to 1%	0.5 to 2% (fans can be steeper)	1 to 2%	2 to 6%	2 to 6%	>6%
Channel Form	Meandering/ Braided	Meandering (high sinuosity)	Meandering/ Anabranch	Meandering/ Multi-branch	Straight, Single Thread	Straight	Straight, Single Thread	Straight, Single Thread
Water Source	Glacial Meltwater	Peatland Runoff/ Groundwater	Mountain slope source area runoff dominates in these stream segments. Groundwater discharge is also significant in flood plain and alluvial fan segments.					
Sediment Regime	Deposition/ Aggrading	Deposition	Deposition/ Aggrading	Deposition/ Aggrading	Balanced	Balanced	Erosive	Erosive
Stream Class	Class I, II and III	Class I and II	Class I	Class I, II and IV	Class I and II	Class I and II	Class I and II	Class I, II, III, and IV

APPENDIX E
COMMUNICATIONS SITES

Appendix E

Communications Sites

Appendix E lists approved communications sites on the Tongass National Forest (Table E-1).

A communications site is an area of National Forest System land designated for telecommunication uses in a Land Management Plan or separate NEPA decision document, a communications site may be limited to a single communications facility, but most often includes more than one facility and is identified by name, usually featuring a local prominent landmark, such as “Mt. Furuhelm Communications Site.”

Sites approved for telecommunication facilities are characterized by antennas, electronic transmitters, equipment shelters, and a wide variety of electronic communication support equipment such as those listed in Forest Service Handbook (FSH) 2709.11, Chapter 90.

Proposals for new communications uses on the Tongass National Forest will be encouraged to co-locate on an approved communications site, unless the proponent demonstrates that communication sites approved in the Forest Plan are not technically feasible due to geographic location, or are incompatible with the requested use.

The analysis for new site designation and new proposals for communication sites will adhere to the direction for processing new special use proposals found in Title 36, Code of Federal Regulations, part 251, Subpart B, the direction in FSH 2709.11, Chapter 10, and the Forest Service Communication Sites Management Handbook (FSH 2709.11, Chapter 90).

Communications Sites

Table E-1
Approved Communications Sites on the Tongass National Forest

District	Site Name	Site Location	Site Size (acres)	Elevation (feet)
Admiralty National Monument (NM)	Angoon Admin. Site	SW4, Sec. 31, T50S, R68E, CRM 57° 30´ 02" N, 134° 34´ 44" W	1	100
Admiralty NM	Greens Creek #1	SE4, Sec. 11, T44S, R65E, CRM 58° 03´ 28" N, 134° 44´ 15" W	17	1,550
Admiralty NM	Greens Creek #2	SW4, Sec. 4, T44S, R66E, CRM 59° 05´ 05" N, 134° 37´ 54" W	100 sq.ft.	1,550
Admiralty NM	Washburn Peak	NE4SW4, Sec. 14, T46S, R70E, CRM 57° 49´ 51" N, 133° 56´ 52" W	1	1,400
Admiralty NM	Wheeler Creek	NW4, Sec. 28, T44S, R65E, CRM 58° 01´ 58" N, 134° 41´ 49" W	1	100
Admiralty NM	Windfall Harbor	SW4NW4, Sec. 34, T47S, R69E, CRM 57° 45´ 15" N, 134° 13´ 30" W	1	2,920
Craig	Hill 1400	Sec. 31, T75S, R82E, CRM 55° 19´ 25" N, 133° 00´ 21" W	1.25	1,399
Craig	Sukkwan Island	NE4NW4 Sec. 21, T78S, R82E, CRM 55° 06´ 36" N, 132° 46´ 22" W	2	2,160
Hoonah	Adolphus	NE4NE4, Sec. 6, T49S, R59E, CRM 58° 15´ 06" N, 135° 48´ 42" W	0.43	1,670
Hoonah	Neka Mtn.	SW4NW4NW4, Sec. 33, T43S, R59E, CRM 58° 06´ 11" N, 135° 47´ 15" W	1	3,139
Hoonah	Pelican	SE4SE4, Sec. 26, T44S, R55E, CRM 58° 01´ 08" N, 136° 22´ 04" W	1	2,095
Hoonah	Point Althorp	E2, Sec. 33, T44S, R55E, CRM 58° 05´ 36" N, 136° 24´ 46" W	2	2,393
Hoonah	Sisters Island	E2NW4, Sec. 3, T43S, R62E, CRM 58° 10´ 20" N, 135° 15´ 24" W	42	30
Juneau	Auke Mtn. #1	NW4NE4, Sec. 20, T40S, R65E, CRM 58° 23´ 26" N, 134° 42´ 37 W	0.7	1,870
Juneau	Beezer Mtn.	SE4, Sec. 13, T49S, R74E, CRM 57° 37´ 06" N, 133° 27´ 25" W	1	4,100
Juneau	Bessie Mtn.	SW4, Sec. 16, T38S, R64E, CRM 58° 34´ 43" N, 134° 51´ 16" W	0.9	2,850
Juneau	Endicott Ridge	NW4SW4, Sec. 9, T36S, R61E, CRM 58° 45´ 34" N, 135° 15´ 36" W	0.5	1,849
Juneau	Heintzleman Ridge	SW4, Sec. 29, T40S, R66E, CRM 58° 22´ 12" N, 134° 32´ 54" W	1	1,400
Juneau	Mt. Robert Barron	SE4, Sec. 18, T42S, R65E, CRM 58° 13´ 38" N, 134° 50´ 21" W	1	3,475
Juneau	Point Bishop	NW4, Sec. 28, T42S, R69E, CRM 58° 12´ 12" N, 134° 08´ 36" W	0.1	20
Juneau	Point Howard	E2, Sec. 3, T41S, R63E, CRM 58° 20´ 23" N, 135° 04´ 38" W	1.3	1,748
Juneau	Salisbury Ridge	SE4SE4, Sec. 5, T42S, R69E, CRM	0.25	3,000
Juneau	Speel Point	NW4, Sec. 19, T43S, R72E, CRM	0.1	1,400
Juneau	Sullivan River	NE4, Sec. 23, T34S, R60E, CRM 58° 54´ 31” N, 135° 21´ 18” W	0.9	182
Juneau	William Henry Peak	SE4SW4, Sec. 17, T36S, R61E, CRM 58° 44´ 50” N, 135° 17´ 00”W	1	3,458

Table E-1 (continued)
Approved Communications Sites on the Tongass National Forest

District	Site Name	Site Location	Site Size (acres)	Elevation (feet)
Juneau	Williams Mtn.	SW4, Sec. 7, T43S, R70E, CRM 58° 09´ 09” N, 134° 01´ 55” W	1	3,336
Ketchikan – Misty Fiords NM	Bell Island	SE4, Sec. 11, T68S, R89E, CRM 55° 54´ 30” N, 131° 42´ 05” W	0.5	2,000
Ketchikan – Misty Fiords NM	Betton Head	SE4, Sec. 25, T73S, R89E, CRM 55° 30´ 32” N, 131° 49´ 21” W	0.46	1,138
Ketchikan – Misty Fiords NM	Black Mountain #1	NW4, Sec. 14, T75S, R92E, CRM 55° 17´ 30” N, 131° 22´ 00” W	0.25	2,052
Ketchikan – Misty Fiords NM	High Mtn. (Gravina Island)	SW4, Sec. 18, T75S, R90E, CRM 55° 21´ 45” N, 131° 45´ 15” W	0.01	2,506
Ketchikan – Misty Fiords NM	High Mtn. (Revillagigedo Island)	NE4, Sec. 19, T80S, R97E, CRM 54° 55´ 05” N, 130° 50´ 26” W	0.459	1,976
Ketchikan – Misty Fiords NM	Mt. Dolly	NE4, Sec. 18, T68S, R100E, CRM 55° 58´ 16” N, 130° 00´ 30” W	0.5	5,475
Ketchikan – Misty Fiords NM	Mt. Lazaro (Duke Island)	S2, Sec. 35, T80S, R93E, CRM 54° 52´ 40” N, 131° 22´ 35” W	.01	1,720
Ketchikan – Misty Fiords NM	Quartz Hill	SE4, Sec. 35, T74S, R98E, CRM 55° 18´ 10” N, 130° 32´ 10” W	0.1	3,800
Ketchikan – Misty Fiords NM	Saw Ridge	NE4, Sec. 25, T76S, R93E, CRM 55° 15´ 25” N, 131° 12´ 22” W	1	2,250
Ketchikan – Misty Fiords NM	Shoal Cove	Secs. 22 and 23, T74S, R93E, CRM 55° 26´ 26” N, 131° 15´ 25” W	241	300
Petersburg	Cape Fanshaw	NE4, Sec. 10, T54S, R75E, CRM 57° 12´ 17” N, 133° 27´ 55” W	2	2,100
Petersburg	Crystal Mountain	SW4NW4, Sec. 13, T61S, R80E, CRM 56° 35´ 05” N, 132° 51´ 55” W	0.25	3,317
Petersburg	Duncan Canal	SW4NW4, Sec. 17, T59S, R78E, CRM 56° 45´ 12” N, 133° 09´ 50” W	2	2,606
Petersburg	Farragut Peak	NE4, Sec. 8, T55S, R78E, CRM 57° 07´ 22” N, 133° 02´ 35” W	1	3,810
Petersburg	Kah Sheets	NW4SW4, Sec. 20, T61S, R78E, CRM; 56° 33’ 57” N, 133° 16’ 50” W	0.5	1,880
Petersburg	Kuiu Mtn. #1	NW4, Sec. 4, T61S, R73E, CRM 56° 36´ 39” N, 134° 02´ 16” W	2	3,500
Petersburg	Kuiu Mtn. #2	NW4, Sec. 9, T61S, R73E, CRM 56° 35´ 55” N, 134° 02´ 01” W	1	3,355
Petersburg	Kuiu Mtn. #3	SE4, Sec. 10, T61S, R73E, CRM 56° 35´ 16” N, 133° 59´ 46” W	1	3,065
Petersburg	Level Island	Sec. 27 and 28, T62S, R79E, CRM 56° 28´ N, 133° 05´ W	395	50
Petersburg	Lindenberg Peak	SW4NE4, Sec. 23, T59S, R78E, CRM 56° 44´ 38" N, 133° 04´ 30" W	1	3,249
Petersburg	Mt. McArthur	SE4SE4, Sec. 12, T67S, R72E, CRM; 56° 04’ 06” N, 134° 11’ 43” W	1	1,650
Petersburg	Petersburg Mtn.	SW4SW4, Sec. 21, T58S, R79E, CRM 56° 49´ 33" N, 132° 59´ 10" W	1	1,600
Sitka	Biorka Island	NE4, Sec. 7, T58S, R63E, CRM 56° 51´ 32" N, 135° 33´ 40" W	151	230
Sitka	Duffield Peninsula	NE4, Sec. 21, T50S, R62E, CRM 57° 31´ 21.6" N, 135° 27´ 42" W	0.5	2,115
Sitka	Finger Mtn.	Sec. 26, T48S, R61E, CRM 57° 40´ 21" N, 135° 28´ 45" W	0.9	2,925
Sitka	Manley Mtn.	Sec. 7, T55S, R66E, CRM 57° 06´ 54" N, 134° 48´ 38" W	5	2,214

Table E-1 (continued)
Approved Communications Sites on the Tongass National Forest

District	Site Name	Site Location	Site Size (acres)	Elevation (feet)
Sitka	Moore Mtn.	NW4NE4, Sec. 31, T49S, R64E, CRM 57° 35´ 04" N, 135° 11´ 58" W	1	3,075
Sitka	Mt. Furuhelm Area	SW4SW4, Sec. 18, T56S, R66E, CRM 57° 00´ 52" N, 134° 59´ 17" W	1	5,328
Sitka	Mud Bay	SE4SW4, Sec. 25, T54S, R61E, CRM 57° 09´ 09" N, 135° 38´ 45" W	1	1,055
Sitka	Rodman Bay	SW4, Sec. 4, T52S, R63E, CRM 57° 22´ 55" N, 135° 18´ 45" W	2	3,100
Sitka	South Passage	Sec. 36, T47S, R64E, CRM 57° 44´ 48" N, 134° 58´ 04" W	5	2,031
Sitka	Steelhead	NW4SE4, Sec. 13, T47S, R59E, CRM 57° 47´ 27" N, 135° 56´ 26" W	1	2,339
Sitka	Upper Kruzof	SE4NW4, Sec. 18, T53S, R61E, CRM 57° 16´ 30" N, 135° 46´ 36" W	1	2,350
Thorne Bay	Cape Pole	NE4SE4NW4, Sec. 22, T68S, R75E, CRM 55° 57´ 57" N, 133° 47´ 33" W	0.04	10
Thorne Bay	Coffman	SE4, Sec. 35, T67S, R81E, CRM 56° 48´ 02" N, 132° 48´ 16" W	0.156	30
Thorne Bay	Manty Mtn.	SE4, Sec. 26, T69S, R82E, CRM 55° 51´ 10" N, 132° 47´ 30" W	1	3,156
Thorne Bay	Ratz Mtn. #1	SE4, Sec. 9, T70S, R83E, CRM 55° 37´ 07" N, 132° 22´ 39" W	0.1	2,862
Thorne Bay	Tolstoi II	Sec. 16, T72S, R85E, CRM 55° 37´ 07" N, 132° 22´ 39" W	1	2,210
Wrangell	Elbow Mtn.	NW4, Sec. 3, T60S, R86E, CRM 56° 42´ 12" N, 133° 52´ 45" W	1	3,900
Wrangell	Etolin (Keating)	W2SW4, Sec. 17, T66S, R83E, CRM 56° 08´ 50" N, 132° 37´ 20" W	1	3,051
Wrangell	Etolin - Burnett	NE4, NW4, Sec. 22, T66S, R84E, CRM 56° 08´ 10.6" N, 132° 24´ 17.7" W	1	3,500
Wrangell	Fools Peak	SW4, Sec. 21, T65S, R87E, CRM 56° 13´ 02" N, 131° 58´ 27" W	1	3,133
Wrangell	Horn Cliff	SW4NW4, Sec. 14, T58S, R80E, CRM 56° 50´ 50" N, 132° 46´ 36" W	1	2,880
Wrangell	Kashevarof (Shrubby Island)	NW4, Sec. 13, T65S, R80E, CRM 56° 14´ 12" N, 132° 58´ 46" W	1	500
Wrangell	Zarembo	SE4SW4, Sec. 1, T64S, R80E, CRM 56° 20´ 42" N, 132° 51´ 35" W	2	2,444
Wrangell	Tyee Bench	SW4SW4, Sec. 23, T65S, R90E, CRM 56° 12´ 48.995" N, 131° 27´ 18.313" W	1	2,520
Wrangell	Tyee Peak	NE4, Sec. 26, T65S, R90E, CRM 56° 12´ 25" N, 131° 26´ 15" W	1	4,716
Yakutat	Akwe River	SW4SW4, Sec. 9, T30S, R39E, CRM 59° 20´ 15" N, 138° 53´ 17" W	5	2,693
Yakutat	Russell Fiord #1	NW4NE4, Sec. 3, T24S, R34E, CRM 59° 51´ 33" N, 139° 36´ 20" W	1	3,950
Yakutat	Russell Fiord #2 (Mountain Lake)	Sec. 7, T26S, R36E, CRM 59° 40´ 51" N, 139° 23´ 06" W	1	2,742

CRM = Copper River Meridian

APPENDIX F
VISUAL PRIORITY ROUTES AND USE AREAS

Appendix F

Visual Priority Routes and Use Areas

Introduction

This appendix lists routes and use areas from which scenery will be emphasized. Viewsheds are identified and viewpoints are established to assess the existing scenic integrity of any given project area and to develop project designs that will be consistent with the Scenic Integrity Objective (SIO) for each Land Use Designation (LUD). (See the Scenery Forest-wide Standards and Guidelines in Chapter 4 and Plan Components in Chapter 5 for a listing of the Scenic Integrity Objectives for foreground, middleground, and background views by LUD.)

Visual priority routes and use areas are arranged by each of the Ranger Districts. Wilderness areas are not listed because they have a SIO of High that applies throughout the area within the boundaries. Routes are separated into several categories, including the Alaska Marine Highway, tour ship routes, roads, small boat and mid-size tour boat routes, and hiking trails. Use areas are categorized into state marine parks, recommended Wild, Scenic, and Recreational Rivers, saltwater use areas, dispersed recreation areas, communities, Forest Service cabins, developed recreation sites, and boat anchorages.

The SIO and the following list provide some of the tools needed to institute the design art of landscape architecture in projects. The SIO and this list also help convey to the interested public how the Scenic Management System (SMS) will be considered in project design for any given area on the Forest.

As part of the process of applying the SMS to the Forest, a viewshed analysis of the entire Tongass National Forest was completed using GIS. The analysis was completed separately for each Ranger District. Step one involved identifying the Visual Priority Routes (VPRs) and use areas. These are the major points from which people view the forest. They include the Alaska Marine Highway; cruise ship and small boat routes; major roads, trails, and anchorages; and important recreation areas on the land. The viewshed analysis identified points at regular intervals along the VPRs and use areas. Each viewpoint along a route was assigned a viewing height from which a person would observe the forest. For example, the average height of a person was selected for the viewing height along a hiking trail, and the height of the cruise ship's deck was used for the cruise ship route. Each cell in the digital elevation model was evaluated for visibility from each of the points along each VPR and use area. Visibility was assessed separately for each marine viewpoint and land viewpoint.

The second phase of the analysis identified distance zones, breaking the visible areas into foreground, middleground, and background from each viewpoint, based on distance. Foreground is the visible area within 0.5 mile of a VPR; background is the visible area greater than 5 miles and less than 15 miles from a VPR; and middleground is the visible area between foreground and background of a VPR. Areas more than 15 miles from any viewpoint and those not seen from any of the VPRs or Use Areas were considered seldom seen. Distance zones were also assessed separately for land and water viewpoints. The final layers for each Ranger District were generated by combining the results from the marine analysis and the land analysis. Any point that was visible from either a land or marine viewpoint was considered visible in the final layer. Any area that was foreground from either a land or marine viewpoint was considered foreground, and any land that was background from either a land or marine

viewpoint became background. All other visible land became middleground. The distance zones were subsequently overlaid with the LUDs to generate the SIOs (refer to the Forest-wide standards and guidelines in the Tongass Land and Resource Management Plan for details on how SIOs were determined for each LUD).

The following description illustrates how these visual priority areas and routes are used in project planning to identify the scenery management objectives for a specific area.

As an example, for a proposed old-growth timber sale that is to be located within a Modified Landscape LUD, the scenery component of the prescription for this LUD directs that foreground areas will be managed for a Moderate Scenic Integrity Objective and that middleground and background areas will be managed for a Low Scenic Integrity Objective. (See chart in the Scenery Forest-wide Standards and Guidelines and direction under “Scenery Operations” of Modified Landscape LUD in Chapter 3.)

Within the area defined for this timber sale, review all the Visual Priority Routes and Use Areas identified in the Forest GIS database that are within the project area or from which one may look into the project area and make adjustments in the Forest GIS layer if needed. Using the Forest Service GIS database, verify all the foreground, middleground, and background seen areas (viewsheds) from these Visual Priority Routes and Use Areas. Proposed harvest units and other timber sale associated activities located in the foreground areas are then designed to meet the Scenic Integrity Objective of Moderate as seen from these Visual Priority Routes or Use Areas. Proposed activities in the middleground and background zones are designed to meet Low Scenic Integrity Objective as seen from these Visual Priority Routes or Use Areas.

Petersburg Ranger District

Travel Routes

Alaska Marine Highway

Wrangell Narrows
Frederick Sound from Petersburg to Chatham Strait and Kake

Tour Ship Routes

Frederick Sound from LeConte Bay to Chatham Strait
Chatham Strait from Cape Decision to Frederick Sound
Sumner Strait between Wrangell and Cape Decision
Decision Passage
Wrangell Narrows

Public Use Roads

Mitkof Island

Mitkof State Highway: Petersburg to Blaquiere Point
Road 6235 Three Lakes Loop
Kake to Seal Point Road

State Marine Parks

Security Bay
Beecher Pass

Recommended Wild, Scenic, and Recreational Rivers

Blind River
Petersburg Creek
Farragut River
Fall Dog Creek
Kah Sheets Creek and Lake
Kadake Creek
Kutlaku Creek and Lake

Small Boat and Mid-Size Tour Boat Routes

Beecher Pass
Keku Strait
Towers Arm
Whiskey Pass
Duncan Canal to Salt Chuck
W. Coast of Kuiu Island
Dry Strait
Petersburg Creek Estuary
Rowan Bay
Rocky Pass from Beacon Island south to Meadow Island

Saltwater Use Areas

Thomas Bay
Seclusion Harbor
Saginaw Bay
Scenery Cove
Little Duncan Bay
Bay of Pillars
Kadake Bay
Farragut Bay (North and South Arms)
Ideal Cove
Kah Sheets Bay
Duncan Canal to Indian Point
Portage Bay
Hamilton Creek Estuary
Totem Bay east to Mitchell Point
Agate Beach
Blind Slough, Mitkof Island
Mouth of Narrows
Beacon Pt.
Frederick Pt.
Mouth of Blind Slough
Big Creek
Banana Pt.
Fanshaw Bay
Woodpecker Cove
Jap Creek
Rowan Bay

Dispersed Recreation Areas

Petersburg Creek
Kah Sheets Lake
Crystal Lake and Mountain
Kadake Creek
Swan Lake
Kutlaku Lake
Farragut River to Section 21
Petersburg Lake
Alecks Lake
Agate Beach, west of Totem Bay
Goose Lake (Kupreanof Island)
Hamilton Creek
Dry Bay
Thomas Bay
Castle Islands
Ernie Haugen Public Use Area (State)

Petersburg Ranger District (continued)

Communities		
Petersburg	Kake	Kupreanof

Forest Service Cabins		
Beecher Pass	Kadake Bay	Towers Arm
Big John Bay	Kah Sheets Bay	Devil's Elbow
Breiland Slough	Petersburg Lake	Swan Lake
Cascade Creek	Kah Sheets Lake	Spurt Cove
Castle Flats	West Point	Salt Chuck East
Castle River	Portage Bay	Ravens Roost
DeBoer Lake	Harvey Lake	

Developed Recreation Sites

Mitkof Island Sites

Blind Slough Complex:
- Blind Slough Swan Observatory
- Ohmer Creek Campground
- Blind Slough Picnic Area
- Man Made Hole Picnic Area and Trail

Three Lakes Picnic Area, Shelter, and Loop Trail
Twin Creek Shelter
Frenchy Ridge Shelter
LeConte Overlook Picnic Site

Other Sites

Bay of Pillars Shelter
Falls Lake Shelter

Hiking Trails

Mitkof Island

Ideal Cove Trail (#508)
Blind River Rapids Trail (#454)
Upper Twin Ski Trail (#605)
Twin Ridge Ski Trail (#606)
Three Lakes Loop Trails (#600-602)
Raven Trail (#607)
Ohmer Creek Trail (#603)

Kupreanof Island

Kah Sheets Lake Trail (#503)
Goose Lake Trail (#462)
Petersburg Lake Trail (#534)
Petersburg Mountain Trail (#585 and 586)
Castle River Trail (#459)
Colp Lake Trail (#461)
Hamilton Creek Trail (#463)
Cathedral Falls Trail (#467)
Big John Bay Trail (#465)
Portage Mtn. Loop Trail (#535)

Other Locations on the District

Harvey Lake Trail (#488)
Bay of Pillars Portage Trail (#617)
Affleck Canal Portage Trail (#618)
Spurt Lake Trail (#457)
Cascade Creek Trail (#458)
Threemile Arm Portage Trail (#619)

Boat Anchorages		
Portage Bay (2)	Bay of Pillars	Cape Fanshaw: Whitney Island area
Thomas Bay (2)	Bear Harbor	Washington Bay
Threemile Arm	Kell Bay	Security Bay
Seclusion Harbor	Marble Islet	Saginaw Bay
No Name Bay	Table Bay	Francis Anchorage
Alvin Bay	Port Malmsbury	Farragut Bay
Reid Bay	Orel Anchorage (Tebenkof)	Totem Bay
Port Beauclerc (3)	Shelter Cove (Tebenkof)	Castle Islands
Louise Cove	Ideal Cove	

Wrangell Ranger District

Travel Routes

Alaska Marine Highway and Tour Ship Routes

Clarence Strait
Stikine Strait
Chichagof Pass
Snow Passage
Snow Pass to Macnamara Pt. to St. John's Harbor (NW Zarembo)
Kashevarof Passage
Sumner Strait between Wrangell and Cape Decision

Small Boat and Mid-Size Tour Boat Routes

Frederick Sound from LeConte Bay to Chatham Strait
Blake Channel
Zimovia Strait
Eastern Passage
Ernest Sound
Bradfield Canal
Dry Strait
Canoe Passage
Mosman Inlet
Burnett Inlet
Seward Passage
Menefee Inlet
Fools Inlet
Anita Bay
Stikine River

Public Use Roads

Wrangell Island Road System

McCormick Creek to Earl West Cove (#6265)
Big Hallow (#50060)
Zimovia Highway: Wrangell to McCormick Creek Bridge (FH#16)
Nemo-Skip Loop Road (#6267)
Fools Inlet (#6270)
Thoms Creek Crossing (#6299)
Long Lake Access (#6271)
Salamander Rd. to Salamander Creek (#50050)

State Marine Parks

Thoms Place

Recommended Wild, Scenic, and Recreational Rivers

Aaron, Oerns, Berg Creeks
Harding River
Santa Anna Creek and Lake
Anan Creek
LeConte Glacier
Virginia Creek and Lake

Saltwater Use Areas

Anan Bay
Kashevaroff Island Group
Steamer Bay
Santa Anna/Lake Helen
St John's t Middle Craig Pt.
Mud Bay
Sunrise Cove to Elephant Nose
Sandy Beach - Woronkofski
LeConte Bay
Nemo Pt. to Pat's Creek
Clarence Strait, Harrington Pt. to Lincoln Rock
Burnett Inlet
South Brownson Island
Sunny Bay
Stone Island Area
Frosty Bay
Olive Cove
Nesbitt Reef to Macnamara Pt.
Point Highfield
The Bluffs
Babler Point
Anita Bay to King George
Fools Inlet
Menefee Inlet
Whaletail Cove
Earl West Cove
Macnamara Pt. to St. John's
Big Bend
Canoe Passage
Mosman Inlet
McHenry Inlet and Anchorage

Dispersed Recreation Areas

Marten Creek
Virginia Lake
Kunk Lake
Starfish Cove
Honeymoon Creek
Middle Ridge
The Desert (Stikine River)
Fools Inlet
Roosevelt Harbor Portal
Olive Cove/Snake Creek
Paradise Cove
Stikine Flats
Berg Bay / Aaron's Creek
Earl West Marsh
Long Lake
Harding River
Shakes Lake
Eagle Lake
St. John's Harbor Portal
King George
Frosty Portal
Twin Lakes (Stikine River)
Tom's Creek
Little Thoms Lake

Wrangell Ranger District (continued)

Dispersed Recreation Areas (continued)		
Thoms Lake	Thoms Creek	Highbush Lake
Fools Pass Rec. Parking Site	Fools Peak Rec. Parking Site	Eagle Bay
Bradfield Flats	Salamander Ridge Rec. Parking Site	Basin Rec. Parking Site

Communities
Wrangell

Forest Service Cabins		
Anan Bay	Harding River	Virginia Lake
Berg Bay	Koknuk Flats	Twin Lakes
Binkley Slough	Little Dry Island	Steamer Bay
Eagle Lake	Frosty Bay	Shakes Slough #1 and #2
Garnet Ledge	Marten Lake	Sergief Island
Gut Island #1 and #2	Mallard Slough	Mount Rynda
Mount Flemer	Anan Lake	Middle Ridge

Developed Recreation Sites	
Thoms Creek Crossing Rec Site	Kunk Lake Shelter
Earl West Recreation Site	Long Lake Shelter
Upper Salamander Creek Rec Site	Highbush Lake RecSite
Lower Salamander Creek Campsite	Chief Shakes Hot Springs Day Use Site
Rainbow Falls Viewing Platforms	Shoemaker Bay Overlook Shelter
Twin Lakes Recreation Site	Anan Wildlife Observatory
Long Lake Roadside Rec Site	North Wrangell High Country Shelter
Pond Shelter	Nemo Point Host Site
Yunshookuh Loop Site	Three Sisters Viewpoint Rec Site
Anita Bay Overlook Rec Site	Highline Recreation Site
Turn Island Rec Site	

Hiking Trails	
Kunk Lake Trail (#506)	Anan Creek Trail (#408)
Long Lake Trail (#574)	Rainbow Falls Trail (#536)
Mill Creek Trail (#515)	Institute Creek Trail (#537)
Salamander Ridge Trail (#520)	Aaron Creek/Berg Bay Trail (#527)
North Wrangell Trail (#500)	Mallard Slough Trail (#626)
Chief Shakes Hot Springs Trail (#625)	Thoms Lake Trail (#575)
Nemo Saltwater Trail (#424)	

Boat Anchorages		
Anan Bay	Steamer Bay	N. Canoe Passage
Thoms Place	Kashevaroff Island Group	S. Brownson Island
Berg Bay	Johnson Cove	Frosty Bay
Quiet Harbor	Bushy Island	Sunny Bay
Kindergarten Bay	Roosevelt Harbor	S. Deer Island
Stone Harbor	Fools Inlet	St. John's Harbor
Cannery Cove	Anita Bay	McHenry Inlet
St. John's Float	Sunrise Cove	Deep Bay
Burnett Inlet	Point Harrington	Marsh Island
Olive Cove	Harding River	Zimovia Strait
Eagle Bay	Three-Way Pass	Santa Anna
Crittenden Creek	Little Baht Harbor	Mud Bay
Navy	Trapshack	Ogland Float
Abraham Island	East Island	Niblack Islands
Ossipee Channel	McHenry Anchorage	Hamm Island

Juneau Ranger District

Travel Routes

Alaska Marine Highway

Skagway to Juneau via Taiya Inlet, Chilkoot Inlet, Lynn Canal, Favorite Channel, and Auke Bay.
Juneau to Hoonah via Auke Bay, Stephens Passage, Saginaw Channel, Lynn Canal, and Icy Strait.
Juneau south via Auke Bay, Stephens Passage, and Frederick Sound.

Tour Ship Routes

Juneau to Glacier Bay via Lynn Canal and Icy Strait
Juneau via Stephens Passage and Gastineau Channel
Juneau to Skagway/Haines via Lynn Canal
Juneau to Tracy Arm via Stephens Passage, Holkham Bay, and Tracy Arm.

Public Use Roads

Montana Creek Road (#8452)
Mendenhall Glacier Road (FH#37)
Peterson Creek (#8442)
Egan/Glacier Highway (FH#2)
Whitepass/Yukon Railroad
North Douglas Road (FH#31 and #8467)
Fish Creek Road (#8471)
Klondike Highway

State Marine Parks

Chilkat Island
Sullivan Island
St. James Bay
Taku Harbor
Shelter Island
Funter Bay
Oliver Inlet (Adm. NM)

Recommended Wild, Scenic, and Recreational Rivers

Katzehin River
Gilkey River

Saltwater Use Areas

Berners Bay
Shelter Island (Saginaw Channel)
Mansfield Peninsula, West Shore between Point Retreat and the Kittens
Favorite Channel (Breadline) from Pearl Harbor to Tee Harbor
Homeshore (Icy Strait) 4 miles in length along shoreline near the Couverden Log Transfer Facility
Fritz Cove from N.Douglas boat ramp to False Outer Point
Barlow Island (Saginaw Channel)
Couverden Island and surrounding waters from No Use Ledge to Point Howard.
Lynn Canal from Mount Golub to Tidal Flats south of St. James Point
Stephens Passage (Douglas Island) between Dornin Rock and Bishop Point, including Gastineau Channel.

Small Boat and Mid-Size Tour Boat Routes

Stephens Passage:
- Taku Inlet
- Gastineau Channel
- Taku Harbor
- Slocum Inlet
- Hilda Creek (S. Douglas Island)
- Admiralty Cove
- Fritz Cove
- Auke Bay
- Favorite Channel
- Lena Cove
- Saginaw Channel
- Russian Cove (Robert Island)
- Holkham Bay
- Windham Bay
- Twin Point
- Limestone Inlet

Chatham Strait:
- Hawk Inlet
- Funter Bay

Icy Strait:
- North Ansley Island
- Couverden Island

Taku River and Inlet:
- Turner Creek
- Hole in the Wall Glacier
- Twin Glacier Lake
- Yehring Creek
- Wright River

Berners Bay:
- Berners River
- Lace River
- Antler River
- Gilkey River

Juneau Ranger District (continued)

Small Boat and Mid-Size Tour Boat Routes (continued)

Icy Strait:
- Excursion Inlet
- Sawmill Bay

Lynn Canal:
- Barlow Cove
- Saginaw Channel
- North Pass
- Howard Point
- St. James Bay
- Boat Harbor
- William Henry Bay
- Berners Bay
- Tee Harbor
- Rescue Harbor
- Katzehin River
- West Lynn Canal

Tracy Arm:
- Holkham Bay
- Williams Cove
- Endicott Arm

Endicott Arm:
- Fords Terror

Port Snettisham:
- Gilbert Bay
- Whiting Inlet
- Whiting River

Stephens Passage:
- Port Houghton
- Hobart Bay
- Port Snettisham
- Port Houghton Salt Chuck
- Sandborn Canal

Dispersed Recreation Areas

Symonds Point (Saginaw Channel)
Katzehin River
Laughton Glacier
Endicott Arm Native Village Site
Spaulding Meadows Alpine Recreation Area
Barlow Cove (Saginaw Channel)
Funter Bay (Lynn Canal)
Portland Island (Stephens Pass.)
Benjamin Island (Favorite Island)
Echo Cove/Sawmill Cove (Berners Bay)
Speel River
Groundhog Bay Historic Native Village Site
Mansfield Peninsula, East Shore Lone Mountain to Young Bay
Berners Bay Head Water System (Lace, Antler, Gilkey Rivers)
St. James Bay
Wright River
Taku River
Sumdum Mine Site
Chuck River (Windham Bay)
Turner Creek and Lake
Fish Creek Recreation Area
Shelter Island from Halibut Cove to Shelter Cove
Gilbert Creek/Sweetheart Flats
Sullivan Island Fox Farm
Salt Chuck River (2 locations)
Whiting River
Couverden Island and Mainland No Use Ledge to Point Howard

Communities

Taku Harbor
Juneau
Excursion Inlet
Haines
Funter Bay
Douglas
Skagway

Forest Service Recreation Cabins

Peterson Lake
John Muir
Eagle Glacier
Turner Lake East
Dan Moller
Berners Bay
Laughton Glacier
Taku Inlet
White Pass Caboose
Turner Lake West

Private or Public Resorts

Eaglecrest Ski Area
Taku Lodge
Methodist Camp
Scout Camp
Eagle Valley Lodge

Developed Recreation Areas

Mendenhall Recreation Area
Lena Cove Picnic Area
Auk Village Campground
Mendenhall Lake Campground
Eagle Beach State Park
Point Bridget State Park
Auk Village Recreation Area
Portland Island Picnic Area
Earnest Gruening St. Historical Park

Juneau Ranger District (continued)

Hiking Trails		
Bishop Trail (#554)	Photo Point	Lemon Creek (#525)
Salmon Creek	Mount Juneau	Blackerby Ridge
Sheep Creek	Sumdum Glacier	Dan Moller Trail (#518)
Montana Creek (#511)	Lake Dorothy	Peterson Lake (#535)
West Glacier (#513)	Bessie Creek (#565)	Amalga Trail (#447)
East Glacier (#526)	Yankee Basin	Laughton Glacier (#509)
Lake Creek	Mount Roberts	Herbert Glacier (#480)
Spaulding Trail (#547)	Mount Bradley	Windfall Lake (#494)
Nugget Creek (#525)	Hawk Inlet (#491)	Denver Glacier (#465)
Auke Nu (#680)	Moraine Ecology (#543)	

Boat Anchorages		
Entrance Island (Hobart Bay)	Tee Harbor	Hilda Creek (South Douglas Island)
No Name Cove (Tracy Arm)	Gastineau Channel	Amalga Harbor (Favorite Channel)
Sanford Cove (Endicott Arm)	Bridget Cove	Limestone Inlet (Stephens Passage)
Funter Bay (Chatham Strait)	Fritz Cove	Sullivan Mountain Cove (Chilkat Pen.)
St. James Bay (3 locations)	Tracy Arm	Lincoln Anchorage (Favorite Channel)
North Arm (Port Houghton)	Hawk Inlet (2 locations)	Slocum Inlet (Stephens Passage)
Couverden Island (Icy Strait)	Ansley Island (Icy Strait)	Hawk Inlet Cannery (Hawk Inlet)
Lena Cove (Favorite Channel)	East End Endicott Arm	Echo Cove (Favorite Channel)
Gilbert Bay (Port Snettisham)	Hobart Bay	William Henry Bay (Lynn Canal)
Horse Island (Stephens Pass.)	Benjamin Island	West of Sullivan Island (Lynn Canal)
Star Point (Port Snettisham)	North Arm Hobart Bay	Taku Harbor (Stephens Passage)
Mallard Cove (Port Snettisham)	Boat Harbor (Lynn Canal)	Barlow Cove (Saginaw Channel)
Endicott Arm (Native Village)	Holkham Bay (2 locations)	Sandborn Canal (Port Houghton)
Auke Bay (Stephens Passage)	Windham Bay (2 locations)	Russian Cove (Stephens Pass.)
Rescue Harbor (Sullivan Island)		West and East Arm Fords Terror
Slate Creek Bay (Berners Bay)		Young Bay (Stephens Passage)

Sitka Ranger District

Travel Routes

Alaska Marine Highway and Tour Ship Routes

Sitka to Chatham Strait via Olga and Neva Straits, Salisbury Sound, Sergius Narrows, Peril Strait
Sitka south via Chatham Strait to Frederick Sound and the Gulf of Alaska
Gulf of Alaska along the outer coast of Baranof and Chichagof Islands

Public Use Roads

Harbor Mountain Road (#7576)	Corner Creek Road (#7540)
Sawmill Creek Road (FH #11)	Kruzof Island Roads (#7590)

State Marine Parks

Big Bear/Baby Bear Bays	Magoun Islands

Recommended Wild, Scenic, and Recreational Rivers

Kadashan River	Lisianski River
Glacial River	

Small Boat and Mid-Size Tour Boat Routes

Sitka north to Chatham Strait via Olga and Neva Straits, Salisbury Sound, Sergius Narrows, Peril Strait
Chatham Strait to Frederick Sound and the Gulf of Alaska
Gulf of Alaska along the outer coast of Baranof and Chichagof Islands
Sitka south via Cape Burunof, Povorotni Pt., Frosty Reef, Dorothy Narrows, Windy Passage, Walker Ch.

Sitka to Gulf of Alaska	Sitka to Fred's Creek	Camp Coogan
Leeoffskaia Bay	Samsing Cove	Silver Bay
Redoubt Bay	Kanga Bay	Biorka Channel
Big Bay	Sevenfathom Bay	Hot Springs Bay
President Bay	Sitka to Krestof Sd. via Sitka Sd.	Gilmer Bay

Sitka to Shelikof Bay via Vitskari Rocks, St. Lazaria Island, Cape Edgecumbe

DeGroff Bay	Krestof Sd to Sukoi Inlet (south)	St. John's Bay
Sukoi Inlet (north)	Katlian Bay	Sinitsin Cove
Nakwasina Sound and Nakwasina Passage		Kalinin Bay
Piehle Passage	Khaz Bay	Slocum Arm
Ford Arm	Lake Anna	Sister Lake
Klag Bay	Ogden Passage to Goulding Harbor	
Kimsham Cove	Black Bay	Dry Pass
Fish Bay	Suloia Bay	Deep Bay
Big Bear / Baby Bear Bay	South Arm Hoonah Sound	Ushk Bay
Fick Cove	Patterson Bay	North Arm Hoonah Sound
Rodman Bay	Appleman Cove	Saook Bay
Hanus Bay	Sitkoh Bay	Florence Bay
Portage Arm	Kelp Bay	Cosmos Cove
Kelp Bay – Middle Arm, South Arm, The Basin		Kasnyku Bay
Takatz Bay	Warm Springs Bay	Red Bluff Bay
Gut Bay	Deep Cove	Mist Cove
Big Port Walter	Little Port Walter	Port Armstrong
Port Conclusion	Port Alexander	Puffin Bay
Redfish Bay	Snipe Bay	Still Harbor
Whale Bay – Small Arm and Great Arm to heads		Port Banks
Necker Bay	Dorothy Cove	Secluded Bay
Crawfish Inlet	Cedar Pass	West Crawfish Inlet
Shamrock Bay	Hoggatt bay	

Sitka Ranger District (continued)

Saltwater Use Areas	
Silver Bay	Olga Strait
Sitka Point to Beaver Point	Katlian Bay
Fish Bay	Sitka Sound
Port Walter (Chatham Strait)	Kelp Bay to South Arm and Pond Is.
Redfish Bay (Pacific Ocean)	Florence Bay (Peril Strait)
Big Port Walter (Chatham Strait)	Point Amelia to Beaver Pt.
Nakwasina Sound and Inlet	Peril Strait, from Kakul Narrows to Poison Cove
Rodman Bay (Peril Strait)	Deadman's Reach (Peril Strait)
Krestof Island, South shore from Brady Is. to Eastern Point	Necker Islands to Eastern Channel, including W. coast Baranof Island
Salisbury Sound; Searock to Sinitsin	Rodman Bay (Peril Strait)
Hidden Falls area	Cape Burunof to West Crawfish

Dispersed Recreation Areas		
Redoubt Lake	Kook Lake	Harbor Mountain Recreation Area
Salmon Lake	Iris Meadows	Mount Edgecumbe
Baranof Lake	Kadashan Bay	Lake Eva
Blue Lake	Port Frederick Portage	Sitkoh Creek
Magoun Islands	Long Bay (Tenakee Inlet)	Seal Bay (Tenakee Inlet)
Kruzof Island, southeast shore	Goose Flats (Tenakee Inlet)	Sealion Cove
Magoun Islands	Fish Bay Creek	Florence Bay

Communities		
Port Alexander	Tenakee Springs	Sitka
	Baranof Warm Springs	

Forest Service Recreation Cabins		
Freds Creek	Baranof Lake	Shelikof
Plotnikof Lake	Brents Beach	Lake Eva
Davidof Lake	Salmon Lake	Lake Suloia
Avoss Lake	White Sulphur Hot Springs	Kook Lake
Redoubt Lake	Seven Fathom Bay	Sitkoh Lake (2 cabins)
Samsing Cove	Moser Island	North Beach
Piper Island	Goulding Lake	Kanga Bay
Mud Bay Shelter	North Neva Shelter	Kukul Narrows Shelter
Otstoia Island Shelter	Seal Bay Shelter	Mt. Edgecumbe Shelter
Tom Young Memorial Cabin (Goddard Hot Springs)		

Developed Recreation Sites	
Starrigavan Campground	Sawmill Creek Campground

Hiking Trails		
Mount Edgecumbe (#520)	White Sulphur Springs (#560)	Harbor Mountain/Gavan Hill (#499)
Davidof Lake (#463)	Sashin Lake (#668)	Iris Meadows (#521)
Salmon Lake (#566)	Port Banks (#580)	Lake Eva (#472)
Redoubt Lake/Goddard	Sealion Cove #508)	Suloia Lake (#575)
Warm Springs Bay (#559)	Kook Lake	Indian River (#500)
Beaver Lake (#522)	Basket Bay (#451)	Sitkoh Lake (#553)

Sitka Ranger District (continued)

Boat Anchorages		
Katlian Bay head	Cedar Cove	Whitestone Cove
Sukoi Inlet south, head	Sukoi Inlet north, head	Sinitsin Cove
Kalinin Bay	Gilmer Bay	Goleta Cove (Shelikof Bay)
Cuvacan Cove (Shelikof Bay)	St. Lazaria	Fred's Creek
Brent's Beach	Magoun Islands	Mud Bay (Kruzof Island)
DeGroff Bay	Leo Anchorage	Piehle Passage
Deuce Island	Khaz Bay	Tawak Passage (Myriad Islands)
Hidden Cove (Slocum Arm)	Island Cove (Slocum Arm)	Waterfall Cove (Slocum Arm)
Ford Arm (west)	Ford Arm (east)	Double Cove
Klag Bay (Chichagof Mine Site)	Kimsham Cove	Black Bay
Goulding Bay	Dry Pass	Fish Bay head
Schulze Cove	Suloia Bay	Deep Bay
Big Bear / Baby Bear Bay	Poison Cove	Ushk Bay (2 anchorages)
Patterson Bay	Moser Island	False Island
Rodman Bay head	Appleman Cove	Saook Bay
Todd	Lindenburg Harbor	Pt. Moses (Hanus Bay)
Eva Creek (Hanus Bay)	Dead Tree Island (Hanus Bay)	Echo Cove (S. Catherine Is.)
The Basin (Kelp Bay)	Pond Island (Kelp Bay)	Cosmos Cove
Kasnyku Bay	Ell Cove	Takatz Bay
Warm Springs Bay	Red Bluff Bay head	Gut Bay
Deep Cove	Mist Cove	Big Port Walter
Little Port Walter	Port Armstrong	Port Conclusion
Puffin Bay	Tenfathom Anchorage (Redfish)	Redfish Bay head
Snipe Bay	Still Harbor	Port Banks
Whale Bay, Great Arm	Whale Bay, Small Arm head	Yamani Cove
Secluded Bay (Necker Bay)	Dorothy Cove (Necker Bay)	Shamrock Bay (West Crawfish)
President Bay	Sevenfathom Bay	Big Bay
Herring Bay (Elevoi Islands)	Kliuchevoi Bay (Goddard Hot Springs)	Tava Island (Biorka Islands)
Symond Bay (Biorka Island)	Kanga Bay	Kidney Cove
Redoubt Bay (at lake outlet)	Samsing Cove	Camp Coogan
Leesoffskaia Bay	Silver Bay head	

National Wildlife Refuge
St. Lazaria National Wildlife Refuge

Yakutat Ranger District

Travel Routes

Alaska Marine Highway

Gulf of Alaska to Monti Bay

Tour Ship Routes

Gulf of Alaska to Hubbard Glacier

Public Use Roads

Highway 10 (Yakutat to Dangerous R.)
Cannon Beach Road (#9963)
Situk Landing Road (#9969)
Alsek Bay/River Non System Rd.

Small Boat and Mid-Size Tour Boat Routes

Alsek River
East Alsek River
Ahrnklin River
Mouth of Dangerous R. to Harlequin L.
Ankau Saltchucks to Summit Lake
Yakutat Bay to Disenchantment Bay
Mouth of Situk River to Situk Lake
Dangerous River to Ahrnklin River
Shipyard Cove to Sawmill Cove to Redfield Cove
Italio River to Dangerous River
Tawah Creek
Shipyard Cove to: Gilbert Spit to: Eleanor Cove
Akwe River to Alsek River
Situk Lake to Russell Fiord canoe/kayak route
Mouth of Russell Fiord to Nunatak Fiord
Lost River to Situk River
Lost River from bridge to Situk

Saltwater Use Areas

Phipps Peninsula

Dispersed Recreation Areas

Square Lake
Gines Creek
Alsek River Delta
Doame River
Harlequin Lake
Italio Lake Big Game Camp
Ahrnklin River
Dangerous River Guide Camp
Highway 10 Corridor
Gulf of Alaska Coastline
East Alsek River Delta
Pike Lakes
Tanis River Mesa Guide Camp
Alsek Bay Fish Camps & Buying Sta.
Italio River
Lower Dangerous River
Middle Dangerous River
Cannon Beach
Middle Slough River
Upper Dangerous River
Alsek River Big Game & Fish Camps

Communities

Yakutat

Forest Service Recreation Cabins

Square Lake
Tanis Mesa (2 cabins)
Alsek River
Middle Situk (2 cabins)
Situk Lake
Harlequin Lake (2 cabins)
Middle Dangerous River
Lower Dangerous River
Italio River

Private Resorts

Alsek River Rafting Campsite

Hiking Trails

Dangerous River (#654)
Italio River (ATV)
Lower Dangerous River (#653)
Russell Fiord Trail
West Situk (#664)
Lost River Trail (#670)
Harlequin Lake Trail (#655)
SitukRiver ATV Trail (#726)
Situk River Cabin (#649)
Situk Lake (#659)
Mountain Lake (#652)

Boat Anchorages

Eleanor Cove
Ahduck Bay (Square Bay)

Hoonah Ranger District

Travel Routes

Alaska Marine Highway and Tour Ship Routes

Juneau to Sitka via Hoonah, Icy Strait, Cross Sound, Pelican and Gulf of Alaska
Juneau to Tenakee Springs

Public Use Roads

Hoonah to East Point (#8502, #8508, #8510, and #8513)
Hoonah to Whitestone Harbor and Iyoukeen Cove (#8502, #8530, and #8530-4)
Eight Fathom Dock to Neka Hot Springs (#8580)

Small Boat and Mid-Size Tour Boat Routes

Juneau to Sitka via Hoonah, Icy Strait, Cross Sound, Pelican and the Gulf of Alaska
Juneau t Tenakee Springs via Icy Strait and Chatham Strait

Port Frederick	Idaho Inlet	Stag Bay
Neka Bay	South and North Inian Pass	Greentop Harbor
Spasski Bay	Port Althorp	Squid Bay
Whitestone Harbor	Lisianski Inlet	Takanis Bay
Freshwater Bay	Soapstone Harbor	Surge Bay
Mud Bay	Lisianski Strait	

Saltwater Use Areas

Point Adolphus	Inian Islands (Icy Strait)	Idaho Inlet
Pleasant Island (Icy Strait)	Lisianski Inlet (head)	Mud Bay
Lemesurier Island (Icy Strait)	Port Frederick (mouth)	Cross Sound area off Inian Islands

Dispersed Recreation Areas

Port Althorp head	Suntaheen Fish Viewing Area	Pavlof Lake and River
Georges Island	Port Frederick/Tenakee	Lisianski Inlet River
Bear Paw Lake	Fox Creek	Lemesurier Island
Inian Islands	Mud Bay River	Vortex Ridge
Estuary to Trail River	Kennel Creek	Sonyakay Ridge
Neka River flats	Trail River Estuary	Elephant Mountain
Pinta Cove	Chicken Creek	Point Adolphus
False Bay	Redcliff and Cedar Islands	Porpoise Islands
Pleasant Island	Whitestone Harbor	Elfin Cove
Three Hill Island	Iyoukeen Cove	East Point FS Road #8510
Bohemia Basin	Wukuklook Beach	

Communities

Hoonah	Mt. Bether	Elfin Cove
Pelican	Whitestone Logging Camp	Gustavus

Forest Service Recreation Cabins

Green Top	Pinta Cove Shelter
Kennel Creek	8-Fathom
Whitestone Harbor	

Hiking Trails

Pelican/Sunnyside (State)	Spasski Trail (#548)	Spasski Trail (Pvt.)
Lisianski River (#506)	Pavlof Marsh (#705)	Wukuklook (#706)
Greentop (#707)	Stag Bay (#702)	Stag River (#713)
Tekanis (#710)		

Hoonah Ranger District (continued)

Boat Anchorages		
Whitestone Harbor	Kennel Creek	Surge Bay (head, mid-bay, and south entrance)
Spasski Bay	Mud Bay	Takanis Bay (2 anchorages)
Port Althorp head	Flynn Cove (Icy Strait)	Squid Bay
Soapstone Harbor	Mite Cove (Lisianski Inlet)	Green Top Harbor
Bingham Cove (Yakobi Is.)	Neka Bay	Pinta Cove (Icy Strait)
Lisianski Inlet head	Gull Cove (Idaho Inlet)	Cedar Cove (Freshwater Bay)
Deer Harbor	Goose Island (Icy Strait)	Idaho Inlet (head)
Lost Cove (Lisianski Strait)	Salt Chuck Bay (Port Althorp)	Stag Bay (Lisianski Strait)
Bohemia Creek	Earl Cove (Icy Strait)	Inian Cove (Inian Islands)
Freshwater Bay head	Hoktaheen Cove	Shaw Islands (Idaho Inlet)
Granite Cove (George Is.)	Salt Lake Bay Float (Port Frederick)	8-Fathom Float
Port Frederick (tour ship anchorage west of Hoohah)		

Admiralty Island National Monument

Travel Routes

Alaska Marine Highway

Angoon to Juneau via Chatham Strait
Angoon to Petersburg via Chatham Strait and Frederick Sound
Juneau to Petersburg via Stephens Passage and Frederick Sound

Tour Ship Routes

Stephens Passage
Chatham Strait
Frederick Sound

State Marine Parks

Oliver Inlet State Marine Park

Recommended Wild, Scenic, and Recreational Rivers

Hasselborg River and Lakes
King Salmon River

Small Boat and Mid-Size Tour Boat Routes

Stephens Passage including
Oliver Inlet, Green Cove, Doty Cove, Seymour Canal (Windfall Harbor, Swan Cove, Pleasant Cove), Admiralty Cove, Young Bay, Gambier Bay (Middle Good Island Bay, Upper Good Island Bay, Snug Cove, Upper Gambier Bay)

Chatham Strait including
Hawk Inlet, Wilson Cove, Whitewater Bay, Chaik Bay (both arms), Hood Bay (north and south arms),Kilisnoo Harbor, Favorite Bay, Mitchell Bay, Davis Creek, Lighter Creek, Lighter Creek, Kanalku Bay, Stillwater Anchorage, Cube Cove, Square Cove

Frederick Sound including
Pybus Bay (Donkey Bay, Cannery Cove, San Juan Islands) Little Pybus Bay, Woewodski Harbor, Eliza Harbor, Chapin Bay, Murder Cove, Surprise Harbor, Twin Point Cove)

Cross Admiralty Canoe Route including
Lake Alexander, Beaver Lake, Hasselborg Lake, McKinney Lake, Lake Guerin, Hasselborg Creek, Thayer Lake, Distin Lake, Davidson Lake

Saltwater Use Areas

False Point Arden (from Green Cove to Arden Pt)
Pybus Bay West Channel (from Cannery Cove to Little Pybus Bay)
Chatham Strait (from Angoon to Thayer Creek)
Cove Point (from Arden Point to Doty Cove)
Pybus Bay (from Midway Islands to Pybus Bay Cabin

Dispersed Recreation Areas

Admiralty Creek (from Admiralty Cove to and including Young Lake)
Admiralty Lakes (Mole Harbor, Lake Alexander, Beaver Lake, Hasselborg Lake, McKinney Lake, Lake Guerin, Davidson Lake, Distin Lake, Salt Lake, Freshwater Lake, Little Lake, Thayer Lake and surrounding lands)
West Brother Island
Mitchell Bay
Admiralty Cove
Windfall Harbor
Oliver Inlet

Developed Recreation Areas

Pack Creek

Communities

Angoon

Admiralty Island National Monument (continued)

Forest Service Cabins		
Admiralty Cove	Big Shaheen	Little Shaheen
Church Bight	Distin Lake	Florence Lake
Hasselborg Creek	Jim's Lake	North Young Lake
South Young Lake	Lake Alexander	Lake Kathleen
Pybus Bab	Sportsman	Lake Alexander shelter
Mole Harbor shelter	Hasselborg Lake shelter	Lake Guerin shelter
Davidson Lake shelter	Thayer Lake North shelter	Thayer Lake South shelter
Mitchell Bay shelter	Windfall Harbor shelter	

Private Resorts
Thayer Lake Lodge

Hiking Trails	
Admiralty Cove to Young Lake	Distin Lake to Davidson Lake Trail
Distin Lake to Thayer Lake Trail	Hasselborg Lake to Lake Guerin Trail
Hasselborg River Trail	Beaver Lake to Hasselborg Lake Trail
Lake Guerin to Distin Lake Trail	Hasselborg Lake to McKinney Lake Trail
Mole Harbor to Lake Alexander Trail	Pack Creek
Kanalku Lake	Lake Florence to Chatham Strait Trail
Salt Lake to Mitchell Bay	Dividson Lake to Salt Lake
Nort Young Lake Cabin to South Young Lake Cabin	

Boat Anchorages	
Young Bay (Stephens Passage)	Admiralty Cove (Stephens Passage)
Oliver Inlet (Stephens Passage)	Green Cove (Stephens Passage)
Doty Cove (Stephens Passage)	Midway Point Cove (Stephens Passage)
Snug Cove (Gambier Bay)	Good Island (Gambier Bay)
Upper Good Island (Gambier Bay)	Middle Gambier Bay (Gambier Bay)
Upper Gambier Bay (Gambier Bay)	West Brothers Island (Stephens Passage)
Twin Point Cove (Stephens Passage)	Upper Windfall Harbor (Seymour Canal)
Tiedman Island (Seymour Canal)	Bug Island (Seymour Canal)
Swan Island (Seymour Canal)	Glass Peninsula (Seymour Canal)
Liesnoe Island Cove (Frederick Sound)	Sharp Point Cove (Frederick Sound)
Saw Point Cove (Frederick Sound)	Chapin Bay (Frederick Sound)
Murder Cove (Frederick Sound)	Pybus Bay (Frederick Sound)
Donkey Bay (Pybus Bay)	Cannery Cove (Pybus Bay)
San Juan Islands (Pybus Bay)	Wilson Cove (Chatham Strait)
Whitewater Bay (Chatham Strait)	Chaik Bay (end of both arms) (Chatham Strait)
Hood Bay Cabin Point Harbor (Chatham Strait)	Hood Bay Cabins (Chatham Strait)
Killisnoo Harbor (Chatham Strait)	South America Island (Mitchell Bay)
Favorite Bay (Mitchell Bay)	Kanalku Bay (Mitchell Bay)
Square Cove (Chatham Strait)	Unnamed Cove (between Piledriver and Game Covers (Chatham Strait)

Thorne Bay Ranger District

Travel Routes

Alaska Marine Highway	*Tour Ship Route*
Clarence Strait from Ketchikan to Stikine Strait	Sumner Strait from Snow Passage to Cape Decision
Inter-island Ferry: Coffman Cove to Wrangell and Petersburg	

Public Use Roads

Thorne Bay to Sandy Beach Rd. (#30)	Control Lake to Thorne Bay (FH#9)
Klawock to Control Lake Junction (FH#9)	Control Lake to El Capitan
Sandy Beach to Coffman Cove	FH#20 to Coffman Cove
FH#20 to Naukati	

State Marine Parks

Salmon Bay	Grindall Island

Recommended Wild, Scenic, and Recreational Rivers

Salmon Bay Lake and Stream	Sarkar Lakes
Thorne River/Hatchery Creek/Barnes Lake	

Small Boat and Mid-Size Tour Boat Routes

Tuxekan Pass - Edna Bay	Sea Otter Sound to Cape Pole
Tenass and Brockman Passages	Karheen Pass to New Tokeen
El Cap to Coronation	Clarence Strait
Grindall Island to Hollis	El Cap Passage
Coffman Cove to Whale Pass	

Saltwater Use Areas

Port Protection	Marble Pass	Maurelle Islands
Coronation	Naukati Bay	Red Bay
Lake Bay	Salmon Bay	Tuxekan Passage
	Thorne Bay to Snug Anchorage	El Capitan to Shakan Bay

Dispersed Recreation Areas

Salmon Bay Lake	Red Bay	Gold and Galligan Lagoon
Sarkar Lake	Snakey Lakes	Karta Bay and River
Staney Creek	Eagle Creek	Caulder Mountain
Hatchery Creek Area	Neck Lake	Salt Chuck
Dry Pass	Ratz Harbor	
Beach Area around Sandy Beach	Red Bay Lake	Salmon Lake
Honker Canoe Route-Gold and Galligan Lagoon to Thorne Bay	Mouth of Staney Creek and cove to the south	Beach Areas on north coast of Prince of Wales Island
Red Bay Lake	Honker Lake	Salmon Lake
Barnes Lake	Kasaan Bay	Shipley Lake
Karta Lake	Winter Harbor	Control Lake
Sweetwater Lake	Thorne River @ Goose Ck. to Thorne Bay	

Communities

Edna Bay	Thorne Bay	Coffman Cove
Whale Pass	Port Protection	Cape Pole
Point Baker	Naukati	

Thorne Bay Ranger District (continued)

Forest Service Recreation Cabins		
Red Bay Lake	Staney Creek	Control Lake
Salmon Bay Lake	Barnes Lake	Honker Lake
Sarkar	Shipley Bay	Sweetwater Lake
Salmon Lake	Karta Lake	Karta River

Developed Recreation Areas		
Gravelly Creek Picnic Area	Sandy Beach Picnic Area	Staney Bridge Dispersed Use Site
Eagles Nest Campground (Balls Lake)	Neck Lake Boat Launch	Memorial Beach Dispersed Use Area
El Cap Cave Interpretive Site	Big Lake Fish Viewing Site	Sarkar Lake Access
Beaver Falls Trailhead	Horseshoe Hole Dispersed Use Site	Ratz Harbor Boat Launch
Lake Ellen Number 3 Dispersed Use Site	Balls Lake Picnic Area	

Private Resorts	
Whale Pass Resort	El Capitan Lodge
Bear Valley Lodge	Boardwalk Wilderness Lodge (Thorne Bay)

Hiking Trails		
Red Bay Lake Trail (#947720)	Sarkar Canoe Trail	Shipley Lake Trail(#947710)
El Capitan Cave Trail	Staney Creek Trail	Deweyville Trail (#947490)
Honker Divide Canoe Trail	Balls Lake Trail	Salmon Bay Lake Trail (#947730)
Karta Bay Trail	Gravelly Creek Trail	Karta River Trail
Karta Falls Trail	Sweetwater Cabin Trail	Hatchery Trail
Anderson CreekTrail	Cavern Lake Trail	Eagles Nest Trail
Beaver Falls Interpretive Trail	Salt Chuck Trail	

Boat Anchorages		
Pole Anchorage	Windfall Harbor	Warm Chuck Inlet
Karta Bay	Salmon Bay	Nossuk Bay
Cyrus Cove	Salt Lake Bay	Hole-In-The-Wall (Prince of Wales)
Big Ratz Harbor	Little Ratz Harbor	

National Wildlife Refuge
Hazy Islands National Wildlife Refuge

Craig Ranger District

Travel Routes

Alaska Marine Highway

Inter-island Ferry: Guard Island to Hollis via Kasaan Bay to Clark Bay

Public Use Roads

Craig to Klawock (FH #9)
Klawock to Hydaburg Jct. (FH#6)
Hydaburg Rd. (FH#13)
Hydaburg Jct. to Hollis (FH#6)
Klawock to Control Lake Junction

Small Boat and Mid-Size Tour Boat Routes

West Coast Waterway: San Cristoval Channel to Ulloa Channel
West Coast Waterway: Ulloa Channel to Hydaburg
Hollis to Twelvemile, Polk and McKenzie Arms
Craig to Addington Loop
Cholmondeley Arm
Outer Baker Island
Graign to Trocadero Bay
Dall Island
Hetta Inlet
Klackas Inlet
Sukkwan Island
Moira Sound
Hollis to Karta
Port Real Marina

Saltwater Use Areas

Port Refugio
Portillo Channel
Port Santa Cruz
Trocadero Bay
Moira Sound Dickman Bay, South Arm, Fredericks Bay and Johnson Bay
Cholmondeley: North Arm Estuary, South Arm Estuary, Sunny Bay, waters surrounding Hump Island
Hydaburg Harbor Area
Twelvemile Arm Estuary
Kendrick Bay
Hollis Harbor Area
Addington Area
Craig and Klawock Harbor Areas
Veta Bay
Waters around San Juan Bautista
Arena Cove
Waters around San Fernando

Dispersed Recreation Areas

Arena Cove - Cape Felix
Roller Bay
Veta Bay
Twelvemile Estuary
Port Santa Cruz
Trocadero Bay Estuary
Port Santa Lucia
Kegan Lake
Kegan Cove
Maybeso River Area
Black Bear Lake and Valley
Harris River Area
Canoe Point Picnic Area
Essowah Lake
Pt. Amargura (incl. ½ mi. radius around cabin)
Trollers Cove
Josephine Lake

Communities

Craig
Hydaburg
Saltery Cove
Klawock
Hollis

Forest Service Recreation Cabins

Black Bear Lake
Josephine Lake
Trollers Cove
Kegan Lake
Kegan Cove
Essowah Lake
Pt. Amargura
Twelvemile Cabin

Developed Recreation Sites

One Duck Lake Shelter
Trocadero Picnic Area
Pass Lake Picnic Area
Dog Salmon Fish Pass
Harris River Campground and Day Use Area
Cable Creek Fish Pass

Craig Ranger District (continued)

Private Resorts	
Waterfall Resort site and Ulloa Channel north and south of the resort	Clover Bay Resort
Saltery Cove	

Hiking Trails	
One Duck Lake Trail (#9173600)	Soda Bay Trail
Trocadero Bay Trail	Harris River Trail
Cable Creek Trail	Twentymile Spur Trail
Kegan Creek Trail	Pass Lake Trail
Twelvemile Trail	Kegan Lake Trail
Canoe Point Trail	

Recommended Wild, Scenic, and Recreational River	
Essowah Lakes and Streams	Kegan Lake and Streams
Niblack Lakes and Streams	

Boat Anchorages		
Steamboat Bay	Security Cove	Pt. Garcia
Kelly Cove	Datzkoo Harbor	Port Asumcion
Port San Antonio	Kaigani Harbor	Port Refugio
Port Santa Cruz	Nichols Bay	Head of McLean Arm
Port Dolores	Rose Inlet	Kendrick Bay
Bobs Bay	Clover Bay	Dickman Bay
Hole-in-the-Wall (Dall Is.)	Mabel Bay	South Arm Moira Sound (mouth)
Waterfall Bay	Veta Bay	West Arm Moira Sound (mouth)
Gold Harbor	Goose Bay	Kassa Inlet - area inside islands
Port Bazan	Pt. Eugenia	Twelvemile

National Wildlife Refuge
Forester Islands National Wildlife Refuge

Ketchikan-Misty Fiords Ranger District

Travel Routes	
Alaska Marine Highway	***Tour Ship Route***
Clarence Strait to Stikine Strait	Revillagigedo Channel and Clarence Strait
Alternative Route (Clarence Strait and Ernest Sound)	
Main Passage, Tongass Passage and Portland Canal to Hyder	
Revillagigedo Channel from Main Passage to Clarence Strait	

Public Use Roads	
Tongass Highway (State Highway #7)	Salmon River Hwy.-Hyder (#88)
Ward Lake-Harriet Hunt Lake Road (FH #39)	Frog Pond Road
Connell Lake Road	

State Marine Parks		
Grant Island	Dall Bay	Black Sands Beach

Recommended Wild, Scenic, and Recreational River	
Naha River	Orchard Creek and Lake
Wolverine Creek, McDonald Lake	Gokachin, Mirror, Fish, and Low Creeks

Small Boat and Mid-Size Tour Boat Routes	
Bell Island	Naha to Traitor's Cove
Ketchikan to Naha	Ketchikan to Helm Bay

Saltwater Use Areas		
Tongass Narrows	Bailey Bay	Shrimp Bay
Blind Pass	Short Bay	Klu Bay
Yes Bay	Union Bay	Neets Bay
Clover Pass	Helm Bay	Traitors Cove
Naha Bay	George Inlet	Carroll Inlet
Vallenar Bay - Vallenar Point	West Behm Canal	Port Stewart
Revilla Channel to Thorne Arm	Moser Bay	Moth Bay
Behm Narrows	Thorne Arm	Dall Bay
Anchor Pass	Vixen Inlet	Spacious Bay
Blank Inlet	Bostwick Inlet	
Bond Bay	Smugglers Cove	
NE corner of Thorne Arm (Fish Creek to Gokachin Creek)	About 1/2 mi. off shore Cleveland Peninsula from Caamano Point to Niblack Point	

Dispersed Recreation Areas	
Port Stewart	Lower Carroll Creek
Helm Bay	Spacious Bay
Margaret Lake area	Dall Bay
Blank Inlet	Bostwick Bay
Mountain Ranges and Alpine Area between Ketchikan, Ward Lake-Harriet Hunt Lake Road, and George Inlet.	Traitors Salt Chuck

Ketchikan-Misty Fiords Ranger District (continued)

Communities		
Ketchikan	Meyers Chuck	Hyder
Metlakatla	Loring	Saxman

Forest Service Recreation Cabins		
Deer Mountain	Orchard Lake - incl. lake	Patching Lake - incl. lake
Jordan Lake - incl. lake	Plenty Cutthroat - incl. lake	Portage Cabin - incl. lake
Heckman Lake - incl. lake	Helm Bay - incl. bay	Fisheries Cabin - incl. lake
Blind Pass - incl. pass	Phocena Cove - incl. cove	Long Lake Shelter - incl. lake
Anchor Pass - incl. pass	Fish Creek - incl. around buoy	Wolf Lake Shelter - incl. lake
Reflection Lake and Shelter - incl. lake	Smugglers Cove Shelter - incl. lake	Shelokum Lake Shelter - area and lake
McDonald Lake and Shelter - incl. lake	Helm Lake - incl. stream and lake	

Private Resorts		
Yes Bay Lodge	Silver King Lodge	Salmon Falls Resort
Clover Pass Resort		

Developed Recreation Areas	
Ward Lake Recreation Area	Settlers Cove (State Campground)

Hiking Trails		
Deer Mountain Trail (#927060)	Long Lake Trail (#927190)	Gokachin Lake Trail (#927110)
Reflection Lake Trail (#927310)	Connell Lake Trail	Titan Trail (Hyder) (#957550)
Bell Island Trail (#927030)	Fish Creek-Low Lake Trail	Orchard Lake Trail (#927320)
Naha River Trail (#(929250)	Meyers Chuck Trail (#927830)	Lunch Creek Trail
Silvis Lake Trail	Ward Creek Trail	McDonald Lake Trail (#927450)
Ward Lake Nature Trail	Black Mountain Lakes Trail	Perseverance Lake Trail (#927260)
Second Waterfall Creek Trail	Smugglers Lake Trail	
Bailey Bay-Shelokum Lake (#927010)	Dude Mtn / Brown Mtn Alpine Trail	

Boat Anchorages	
Vixen Harbor	Ice House Cove
Thorne Arm	Port Stewart
Vallenar Bay	Naha Bay
Bailey Bay	Moser Bay
Short Pass	Union Bay
Yes Bay	Klu Bay
Spacious Bay	

Routes not constructed nor NEPA cleared: Planned or Opportunities	
Potential Trail corridor between Harriet Hunt Lake and Leask Lake	
Saddle Lakes Recreation Area	Shelter Cove Boat Ramp
Slide Ridge Winter Sports Area	Harriet Hunt - Shelter Cove Connection Road

Misty Fiords National Monument Wilderness

Travel Routes	
Tour Ship Routes	
Portland Canal	Smeaton Bay
Revilla Island	Walker Bay
Rudyerd Bay	

Saltwater Use Areas		
Burroughs Bay	Bakewell Arm	Ella Bay
Saks Cove	Checats Cove	Shoalwater Pass
Alava Bay	Rudyerd Bay	Smeaton Bay
Princess Bay	Manzanita Bay	Wilson Arm
Chickamin	Sargent Bay	Vixen Bay/Mink Bay
Walker Cove		

Dispersed Recreation Areas	
Princess Bay	Saks Cove
Chickamin River	Unuk River
Walker Cove	Rudyerd Bay
Manzanita Bay	Ella Bay
Wilson Arm	

Forest Service Recreation Cabins		
Blind Pass	Alava Bay	Red Alders
Wilson Narrows	Wilson View	Mink Bay
Winstanley Island	Winstanley Lake	Punchbowl Lake Shelter
Big Goat Shelter	Beaver	Checats Lake
Ella Narrows	Fish Creek	Hugh Smith
Humpback Lake	Manzanita Lake	Ella Bay
Klahini Bay	Princess Bay	Punchbowl Cove
Short Bay	Winstanley Creek	

Private Resorts	
Humpback Lake Chalet	Mirror Lake Club Cabin
Mink Bay Lodge	

Developed Recreation Areas
Fish Creek Wildlife Viewing Site

Hiking Trails	
Bakewell Lake Trail	Checats Lake Trail
Ella Lake Trail	Hugh Smith Lake Trail
Humpback Lake Trail	Manzanita Lake Trail
Nooya Lake Trail	Punchbowl Lake Trail
Winstanley Lake Trail	

Anchorages	
Vixen Bay	Checats Cove
Wasp Cove	Manzanita Bay
Foggy Bay	Saks Cove
Fitzgibbon Cove	

APPENDIX G
LOG TRANSFER FACILITY GUIDELINES

Appendix G

Log Transfer Facility Guidelines[1]

Introduction

Log transfer facilities (LTFs) undergo a complex and rigorous permitting process involving four state and four federal resource management and regulatory agencies as well as comments from other interested parties. Through the permitting process, the regulatory agencies may approve or disapprove permits with stipulations that govern the construction and operation of LTFs.

In seeking clarification of permit stipulations expected to be included in LTF permits, the timber industry recommended—through Governor Sheffield's Timber Task Force report (12/13/84)—that:

> "...the principal agency heads and industry representatives meet to agree upon a process which will result in a common set of log transfer facility guidelines..."

As a result of this request, a committee consisting of the principal agency and industry representatives met on April 15, 1985, to consider the Task Force recommendation. This committee created a technical subcommittee of industry, public, and resource agency personnel involved in permitting LTFs to develop LTF guidelines per the Timber Task Force recommendation that:

> "...it would be beneficial for all parties involved in the permitting, construction, and operation of log transfer facilities to have a common set of criteria (guidelines) from which to work when designing facilities and reviewing permit applications for these facilities."

The LTF guidelines are in three sections, including:

- Siting
- Construction and Operation
- Monitoring and Reporting

The Use of Guidelines

The guidelines for planning and permitting of LTFs delineate the physical requirements necessary to construct a log transfer and associated facilities and, in context with requirements of applicable law and regulations, methods to avoid or control potential impacts from these facilities on water quality, aquatic, and other resources. The guidelines emphasize facility siting as the best means of limiting most environmental impacts from LTFs, log raft, storage areas, and adjoining collateral facilities. Additional means of limiting environmental impacts occur through application of construction and operating guidelines. Monitoring and reporting guidelines are necessary to determine if a facility is meeting the permit stipulations.

These guidelines can be used in the existing permitting process that emphasizes best professional judgment of the agencies in close cooperation with the

[1] The Log Transfer Facility Siting, Construction, Operation and Monitoring/Reporting Guidelines (1985) were developed by the Alaska Timber Task Force LTF Guidelines Technical Subcommittee. These guidelines are to be used when considering alternatives for the location and management of log transfer and associated facilities. The guidelines will also be used by the regulatory agencies for evaluating permit applications to ensure consistency with the Clean Water Act. See the log transfer facilities direction in the Transportation Forest-wide Standards and Guidelines (Chapter 4) for direction on the use of these guidelines.

applicants when selecting sites and imposing permit stipulations. The process is preferred because it accommodates site-specific conditions and enables all participants to collectively evaluate the practicable alternatives and determine the best way to minimize impacts.

The guidelines are comprehensive and may apply to any site being evaluated for LTF permits. Because each site is different, in unusual circumstances, there may be need to develop more specific stipulations or limitations during the permit review process for a specific site.

Periodic updating of the guidelines will be necessary because changes may occur in the timber industry and new information may become available on the effects of LTF on water quality and biotic communities.

The guidelines apply to log transfer, log raft storage, and collateral facilities, such as log raft make-up areas, airplane and boat docks, and contiguous upland log storage and sort yards immediately adjacent to the LTF.

The guidelines do not identify which permitting agency or agencies have regulatory and permitting jurisdiction for any guideline. The objective is to provide a comprehensive listing of guidelines applicable to LTFs through state and federal resource management and regulatory programs.

The siting and construction and operation guidelines identify the physical features the timber industry needs to safely and efficiently transport logs as well as the minimum requirements needed to mitigate for changes in water quality and adverse impacts on aquatic biota. When evaluating proposals for these log transfer and associated facilities, all guidelines must be considered. The objective is to consider all guidelines and develop a "best mix" that allows the activities to proceed while meeting all applicable statutory and regulatory requirements.

The following are the Alaska Timber Task Force Guidelines.

Siting Guidelines

Proper siting of log transfer and log raft storage facilities is the single most important means of controlling adverse water quality and biotic impacts from the construction and operation of these facilities. The least biologically productive and sensitive area available that meets industry's physical and economic requirements is the preferred site. The need for regulatory agencies to impose additional permit stipulations above the minimum requirements to mitigate against environmental impacts is reduced to a level commensurate with the site-specific characteristics.

S1. **Proximity to Rearing and Spawning Areas:** Siting of log transfer and log raft storage facilities within 300 feet of the mouth of anadromous fish streams, or in areas known to be important for fish spawning or rearing is normally prohibited.

Discussion: This LTF siting guideline is derived from the Alaska Forest and Resources Practices Regulations (11 AAC 95.150 (c)). The estuarine areas adjacent to the mouths of anadromous fish streams serve as important feeding areas for salmon fry and smolts while they acclimate to saltwater. Impacts to these areas can force outmigrants into deeper waters where there is greater risk for predation. Placement of LTFs in known spawning areas results in loss of spawning habitat.

The outmigrant salmon fry are especially vulnerable and have particularly high value to the fishing industry. The concerns include the possibility of leachates entering fresh water or the possibility of sediments entering waters and affecting fish. Because of the high value of the fisheries resources, the Forest Practices Regulations of

the state exclude LTF siting in these most valuable and highest risk locations.

S2. **Protected Locations:** Log transfer and log storage facilities should be sited in weather-protected waters with bottoms suitable for anchoring and with at least 20 acres for temporary log storage and log booming.

Discussion: Areas protected from adverse weather, tidal, and wave conditions are needed for the safety of the workers responsible for moving log bundles, building rafts, and similar water-oriented work activities. Log rafts and bag booms must be protected from adverse weather, tidal, and wave conditions that can damage the rafts and the bag booms.

Protected conditions are needed for control of the log bundles being placed in the water and the requirement to retain them in the bag booms and rafts so as to avoid hazards to navigation.

At least 20 acres of available space is needed to place log bundles into the water, sort bundles into log booms, construct log rafts, and hold log rafts until moved by tug to the next destination. Additional space is needed for docks and floats, and movement of boats, floatplanes, and other transportation. Most of the space involved is used for the movement of vessels and log rafts.

Log bundle storage with maneuvering space for vessels and rafts requires 3.6 + or - acres per million board feet (MMBF) gross timber volume. Approximately 8 acres is required for storage of a typical tow of four log rafts. An additional 8 acres is needed for booming of bundles, including maneuvering space.

Consolidation and concurrent use of log transfer and storage sites will increase the amount of space required. Each owner of logs will need separate log booms and storage areas to provide for log accountability. Where National Forest and privately owned logs are stored or transferred from a consolidated site, this separation is required by regulation.

While the guidelines suggest 20 acres for normal situations, it is possible to operate in less space under some situations. For small timber harvest operations, with timber volumes of less than one MMBF, the need for space will be reduced dramatically. There is, however, a practical minimum space needed for even the smaller operations. This minimum is approximately 5 acres.

S3. **Upland Facility Requirements:** LTFs should generally be sited in proximity to at least 5 acres of relatively flat uplands. There should also be a body of water sufficient to provide a minimum of a 60-lineal-foot facility face.

Discussion: This guideline has two operative portions: 1) space needed for upland operations near the transfer point; and 2) the length of available space needed at the operating face.

Relatively flat land is required to avoid extensive excavation. The space needed for upland operations adjacent to the LTF is directly related to the type of facility (see Use Descriptions in the Glossary), volume of timber that may be handled annually, and the life of the operation. The amount of space needed may include truck unloading (0.9 acre), log scaling (1.5 acres), log storage (1.6 acres per MMBF),

sorting (0.5 to 2.0 acres), and additional space for incidental related operations. Equipment yard and repair areas are commonly in this vicinity (1.5 to 2.5 acres). The 5-acre minimum would service intermittent use and some occasional use sites, with up to 35 to 40 acres needed for continuous use sites.

Unobstructed width required for the transfer of logs to the water needs to be adequate for the products being moved. The constructed length of the working face can be as little as 40 feet, under special circumstances, but the operating clearance must exceed 60 feet to accommodate the longest log lengths. Most desirable is 110 feet available face.

S4. **Safe Access to a Facility from the Uplands:** To provide safe access to the LTF and adjoining log sort yard, the facility should be sited where access roads to the facility can maintain a grade of 10 percent or less and 4 percent for specialized equipment.

Discussion: Vehicle access must be provided to the point where log bundles are transferred either to the log sort yard facility or to the receiving waters. The operating layout must provide for operations within safe limits for the equipment, operators, and other personnel in the area. The maximum safe grade for log stackers is 4 percent. The maximum safe grade can be increased to 6 percent with special modifications to the log stacker. Prudent consideration of safety suggests a desirable grade less than the maximum be used.

Road grades entering the unloading facility in excess of the 10 percent will not allow the truck driver to safely stop the vehicle in emergencies.

S5. **Bark Dispersal:** LTF should be sited along or adjacent to straits and channels or deep bays where currents may be strong enough to disperse sunken or floating wood debris. Siting LTF in embayments with sills or other natural restrictions to tidal exchange should be avoided.

Discussion: The Environmental Protection Agency and the Alaska Department of Environmental Conservation consider bark to be a pollutant. Problems with bark occur when it accumulates. The accumulated bark both physically smothers organisms and may create anoxic conditions or toxic gases.

In bays that have sills or natural restrictions to tidal exchange, there is a concern that bark may accumulate due to inadequate current velocities. The concern is that sufficient bark accumulation and lack of water exchange in the layer below the sill will cause anoxic conditions.

S6. **Site Productivity:** Sites for in-water storage and/or transfer of logs should be located in areas having the least productive intertidal and subtidal zones.

Discussion: One of the siting methods used to limit the impacts that log transfer and log storage facilities may have on the environment has been to site the facilities in the least productive habitats. These habitats are often found along steep shorelines, where there is little substrate for plant or animal growth. Bark, because of the steep topography, seldom accumulates in such areas. Areas with a minimum bottom substrate in the euphotic zone are to be preferred.

S7. **Sensitive Habitats:** LTF and log raft storage areas should not be sited on or adjacent to extensive tideflats, salt marshes, kelp or eelgrass beds, seaweed harvest areas, or shellfish concentration areas.

Discussion: Tideflats, salt marshes, and aquatic vegetation beds support numerous biological communities, i.e., nursery and rearing areas for commercial species of crab and fish. The areas are usually shallow and high producers of planktonic organisms that support the aquatic food chain.

Woody debris from log transfer and water storage can be carried by currents and deposited on these plant and animal communities. Debris may cover the area and physically smother plants and animals. There is a concern that debris accumulation may reduce dissolved oxygen concentration in the water below the minimum level required by fish and other aquatic life. Bark debris is expected to reduce dissolved oxygen concentration in the bark interstices. High oxygen demand can lead to an anaerobic zone within the bark pile where toxic sulfide compounds are generated, particularly in brackish and marine waters. Reduced oxygen levels, anaerobic conditions, and the presence of toxic sulfide compounds can result in reduced localized habitat value for groundfish species and their forage base (National Marine Fisheries Service 2005). One study found that the dissolved oxygen, pH, oxidation reduction potential, and concentration of toxic products of decomposition in the water column at 30 centimeters (12 inches) above the bark were not significantly different than at the control sites. Reductions in dissolved oxygen below Water Quality Standards have not been documented.

S8. **Safe Marine Access to Facilities:** Log rafting and storage facilities should be safely accessible to tugboats with log rafts at most tides and on most winter days.

Discussion: Tugboats gather log rafts for transshipment to mills and other loading facilities. The lack of safe access to log rafting areas will result in the tug operator refusing to accept or deliver log rafts.

S9. **Storage and Rafting:** Logs, log bundles, or log rafts should be stored in areas where they will not ground at low tide. A minimum depth of 40 feet or deeper measured at Mean Lower Low Water (MLLW) for log raft storage is preferred.

Discussion: Grounding of logs or log rafts compacts the substrate and decreases biota living in and on the substrate. The siting and design of LTFs should provide sufficient water depth to avoid grounding of log bundles at the transfer facility and log raft make-up areas.

Log rafting in depths greater than 40 feet (MLLW) is preferred because rooted aquatic macrophytes and algaes generally begin to decrease in density in Southeast Alaska below this depth. Rafting 40+ feet MLLW or more will protect these organisms and habitat (less than 40 feet MLLW) from bark accumulation and shading by log rafts. Log raft storage may occur at depths less than 40 feet MLLW depending on biological productivity, sensitivity to shading, and potential risk of bark accumulations.

The logging industry retains the need to maintain existing sites that allow log rafts to ground or be stored in areas with low salinity, typically at the head of the bay, and in water less than 40 feet deep. The purpose is to protect logs from shipworm infestation, which can occur immediately after the logs are placed in the water.

Shipworms are an endemic problem because they cause economic loss to timber values, both from the holes they produce in sawtimber, and from the calcium deposits they leave in logs used for pulp purposes. The industry has observed that reductions in shipworms occurs in waters with low salinities and when logs are allowed to ground in cold weather. For this reason, the industry continues to seek the opportunity to have sites where logs will be allowed to ground in order to reduce shipworm damage.

The objective of regulatory agencies is to discontinue the practice of allowing logs to ground or be stored in areas less than 40 feet deep when they are biologically productive or are sensitive habitats.

There is a need for additional research into shipworms and possible ways to reduce infestation in log rafts. Research needs identified by Sedal & Duvall, if accomplished, could reduce the conflicts.

S10. **Bald Eagle Nest Trees:** Site LTFs to avoid bald eagle nests. No project construction or operation should be closer than 330 feet to any bald eagle nest tree unless permitted by U.S. Fish and Wildlife Service. (See the Eagle Memorandum of Understanding for details.)

Discussion: The Bald Eagle Protection Act (16 U.S.C.) protects bald and golden eagles. To provide guidance for the management and protection of bald eagles on National Forest lands in Alaska, a Memorandum of Understanding was signed by the USDA Forest Service (Region 10) and the U.S. Fish and Wildlife Service (Region 7). The Memorandum of Understanding states that a management zone of five chains (330 feet) around each eagle nest tree will be established and all land use activity within the zone will be excluded. The Memorandum of Understanding includes provisions for variances from the requirement.

Construction and Operation Guidelines

The following guidelines apply to the construction and operation of the LTFs and collateral upland facilities, such as sort yards and upland log storage areas. Construction and operation guidelines have not been developed for log raft storage facilities because the only practical means of regulating raft storage is through proper siting. The degree of application of these guidelines to individual LTFs is based on the siting of the facility.

C1. **LTF Design:** LTF design should be the least environmentally damaging, practicable alternative. Factors to be considered in selection of design alternatives include: 1) economic practicability; 2) facility requirements; 3) physical site constraints; 4) timber volumes to be transferred (site usage and duration); 5) total potential effects on biota and water quality, (including biological productivity and sensitivity); and 6) other potential uses of the site and facility.

Discussion: The preferred LTF design(s) should be those that represent the best practicable alternative and the least impact from placement of fill and associated impacts, such as bark accumulations. For example, emphasis on facility designs that minimize bark loss may result in a greater total coverage of the intertidal and subtidal areas by fill (due to design requirements) than would occur under another alternative that allows greater bark loss, but less fill.

C2. **Fill Structures:** Fill structures shall be designed and constructed to prevent erosion, pollution, and structural displacement.

Discussion: The intent is to avoid introducing fine sediments and organic matter into the water. The guideline requires design and construction practices that minimize fine sediment plumes and prevent change in the substrate's composition near the structure as a result of lost fill material.

This guideline is performance-based by allowing the use of a range of materials within fills, provided proper design, construction, and containment procedures are followed. The use of woody debris in fill structures is acceptable with containment.

It is assumed in the guideline that timbers and logs used in construction are not classified as fine organic matter.

C3. **Timing of In-water Construction:** In-water construction, blasting, and/or filling associated with LTF sites should be timed to limit adverse impacts to marine and estuarine fishery resources, and avoid conflicts with other user groups.

Discussion: Juvenile salmonids use shallow, near shore areas for feeding during the first few weeks after they leave freshwater. Construction activities during this outmigration period may cause direct mortality from blasting if the over pressure in the marine waters exceeds 2 pounds per square inch. Increased water column turbidity related to construction or filling may decrease availability of prey organisms and cause physiological damage to fry during this critical period. Spawning herring are also susceptible to turbidity and effects of blasting.

Generally the period from mid-March to mid-June is the period when in-water turbidity and over pressure restrictions will be needed in order to protect juvenile salmon and spawning herring. The actual times will vary depending on the site and the presence or absence of juvenile salmon or spawning herring.

Timing restrictions to avoid conflicts with existing user groups vary and would be evaluated on a site-by-site basis. Facility siting to avoid juvenile salmon nursery areas, herring spawning areas, and areas utilized by other user groups will reduce the need for timing restrictions.

C4. **Bark Accumulation Management:** The siting, design, and operation of the LTF and contiguous collateral upland facilities shall utilize the best practicable procedures and methodologies to control intertidal and submarine accumulations of bark.

Discussion: Intertidal and submarine accumulations of bark impact infauna and epifauna primarily through smothering, but also through alteration of natural habitat and water quality. The extent of the impact is limited to the actual area of complete bark coverage. Through proper implementation of best practicable procedures and methodologies, such as siting, design selection, operation, and solid waste management, the level and impact of intertidal and submarine accumulations can be minimized. Selection of best practicable procedures and methodologies to limit intertidal and tidal bark accumulations for a specific site should be used.

C5. **Solid Waste Management:** Solid wastes, including wood and other solid waste generated from the LTF, contiguous sort yards, and other collateral facilities shall be routinely removed from the LTFs and adjacent facilities and disposed of at an approved upland solid waste disposal site.

Discussion: Disposal of solid wastes, cable, machine parts, and equipment, as well as wastes from logs in the sort yard, truck unloading, and log transfer operations should occur in accordance with 18 AAC 60, which requires that solid wastes be properly disposed of at an approved disposal site. In order to prevent accidental introduction of materials into receiving waters, bull rails, or similar constraints to retain bark and wood waste on the upland improvements adjacent to the LTF, should be utilized. Bark and other solid waste should be periodically removed from uplands and intertidal areas around the log transfer system, depending on the site conditions.

C6. **Bark Accumulation:** The regulatory agency(ies) will impose an interim intertidal and submarine threshold bark accumulation level. When accumulations exceed the threshold level, cleanup, if any, will occur at the discretion of the permitting agency(ies). The interim threshold bark accumulation level is described as 100 percent coverage exceeding both 1 acre in size and a thickness greater than 10 centimeters (3.9 inches) at any point.

Discussion: This guideline is necessary because intertidal and submarine accumulations of bark impact infauna and epifauna primarily through smothering, but also through alteration of natural habitat and water quality. The problem with bark occurs when it accumulates. Through siting, transfer system selection, and solid waste management, the amount of bark lost and accumulating in intertidal and submarine areas is prevented to significantly diminished. Bark accumulation is still expected to occur in some areas promoting the need for this guideline. This is an interim guideline developed by the Log Transfer Facility Guideline Committee. The committee developed this procedural guideline in order to be responsive to ongoing research and, at the same time, raise site-specific problems to the respective decisionmakers for appropriate action.

An interim guideline for threshold bark accumulation levels and cleanup when exceeding those levels is being used due to a lack of information. Technical data are needed to evaluate technical feasibility of various options for managing accumulations, such as removal or other control procedures. Water quality and biological information is needed to evaluate effects on water quality and biota from removal and disposal of bark accumulations and effects of other corrective options that may be used to manage bark accumulations.

C7. **Bundle Speed:** The speed of the log bundles entering receiving waters should be the slowest practicable speed available. Decisions on the allowable transfer system that can be used will occur on a site-specific basis during the permitting process.

Discussion: This guideline is necessary because the amount of bark lost during transfer of log bundles into receiving waters is directly correlated with the speed of log bundles entering receiving waters. These conclusions have been confirmed by an in-progress U.S. Fish and Wildlife Service study. The loss of bark into receiving and submarine areas can adversely affect aquatic biota through smothering and alteration of habitat.

The release of bark into receiving waters initiates a regulatory response that bark is a pollutant when discharged into receiving waters. To the extent practicable, its discharge should be eliminated.

This guideline was developed by the Log Transfer Facility Guidelines Committee. The Committee concluded that rather than pursue a uniform speed requirement for all LTFs, the guideline should emphasize the need to meet the slowest speed achievable after taking into consideration costs, existing technology, and logistics, in light of the overall project purposes.

There is insufficient information to agree upon a guideline that defines a practicable speed for various types and sizes of transfer operations. However, based on current information about existing transfer technology, a 3 feet per second entry velocity is an achievable entry speed and will serve as a reference point for discussion.

C8. **Surface Drainage Management:** The design, construction and operation of LTFs, contiguous sort yards, and/or log storage yards shall utilize practicable procedures for control of surface water runoff from facilities.

Discussion: The surface water runoff from LTFs and adjacent contiguous sorting/storage areas has been observed to carry sediments, woody debris, and hydrocarbons. These pollutants can directly enter receiving waters. Surface runoff control can be accomplished with a variety of techniques. These include such practices as keeping overland flow from entering the LTF or adjacent facilities, collecting runoff from the facility in settling basins, or retaining vegetative buffer strips. The design, construction, and operation of LTFs, in conjunction with adjacent and contiguous sorting storage areas, will utilize practicable procedures for meeting Water Quality Standards for the State of Alaska and the Clean Water Act.

The Alaska Department of Environmental Conservation may require information on sort and/or storage yards contiguous to the LTF that is not routinely provided on permit applications in order to assist permittees in managing surface runoff so as to comply with Water Quality Standards.

C9. **Control of Hydrocarbons:** The log transfer system and adjacent sort yard handling equipment shall be operated and maintained to minimize petroleum and lubricating products from entering waters.

Discussion: The operation of certain log transfer systems and equipment used in any adjoining log unloading facility or log and sort yard storage facility are a potential source of hydrocarbons and hydraulic fluids that can spill on the upland facilities and enter receiving waters. This equipment should be maintained and facilities managed to ensure lubricants and hydraulic fluids do not enter receiving waters. Continuous-chain log transfer systems require periodic lubrication and result in unavoidable introduction of hydrocarbons into receiving waters. Lubrication of these systems should use the manufacturer's specified lubricants, and lubrication should not exceed manufacturer's specifications.

C10. **Onshore Log Storage:** Where feasible, preference must be given to onshore storage and barging of logs.

Discussion: 11 AAC 95.150 of the Alaska State Forest Resources and Practices Regulations specifies preference to onshore storage and barging of logs, where feasible.

C11. **Facility Maintenance and Reclamation:** The permittee shall maintain the structure or work authorized in good condition, and in reasonable

accordance with the approved plans and drawings. If and when the permittee desires to abandon the authorized activity herein, unless such abandonment is part of the transfer procedure by which the permittee is transferring its interests to a third party, the permittee must restore the area to a satisfactory condition.

Discussion: The authorizations from the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act include the general conditions (h) requirements to maintain authorized work and (g) upon abandonment restoration of the area to a satisfactory condition. This guideline repeats those general conditions.

Monitoring and Reporting Guidelines

LTFs are monitored to ensure permit compliance. Monitoring results are used to assess activities associated with the construction, operation, and maintenance of the facilities, and to ensure that corrective action occurs, if appropriate. The level and type of monitoring are dependent on the type of facility.

M1. **Monitoring by Permittee:** Monitoring for bark accumulations, oil sheen, and surface runoff associated with the construction, operation, and maintenance of facilities, and to ensure that corrective action occurs, if appropriate. The level and type of monitoring is dependent on the type of facility (see use definitions in the Glossary).

Discussion: The regulatory agencies, when issuing permits, can include conditions to a permit that require monitoring by the permittee. The agencies can assume some or all monitoring responsibilities.

M2. **Monitoring Requirements:** Monitoring should be undertaken at all continuous and intermittent use LTF sites, and at those occasional and incidental use LTFs at which total volume of logs transferred is similar to that of intermittent use sites. The level of monitoring and parameters to be monitored should be determined on a site-specific basis. Monitoring at occasional and incidental use facilities may be required on a site-specific basis. The need for monitoring of occasional or incidental use sites will be limited. Permittees will be required to submit a monitoring program to the permitting agencies prior to operation of a new continuous or intermittent use LTF. Agency approval of monitoring plans is required. Requirements for monitoring should be responsive to data obtained during prior monitoring activities.

Discussion: Monitoring is required to determine the occurrence and the extent of possible environmental impacts. The nature of monitoring activities shall be site-specific and determined by such factors as volume, site characteristics, life of project, and type of operation, because these factors may determine the extent of environmental impacts. Depending upon monitoring results, permitting agencies have sufficient flexibility to modify monitoring requirements for any LTF at any time during its operation, or after the first 3 years of operation of a continuous LTF. For example, monitoring requirements for a continuous LTF could be dropped if monitoring data indicate that significant deposits of bark debris are not accumulating. Permitting agencies approval is needed to determine if a monitoring plan will satisfy permit conditions.

M3. **Annual Monitoring for Bark Accumulation:** At continuous and intermittent use LTFs, monitoring of bark debris accumulation should occur prior to the operating season as a minimum requirement. Monitoring at intermittent LTFs would occur only during periods when the LTF is active.

Discussion: In order to determine if the bark accumulation conditions and stipulations of the permit are being met, it is necessary to measure bark and debris accumulations.

M4. **Elements of Bark Accumulation Monitoring Program:** Elements that should be included in a monitoring program for continuous and intermittent use LTFs are site-specific and may include, but not be limited to, the following:

a. Permanent transects;

b. Measurement of areal extent, thickness, and percent coverage of bark debris; and

c. Measurements required by M4; a and b are from MHW (Mean High Water) to depths of 60 feet MLLW (Mean Lower Low Water).

Discussion: In order to determine changes in site characteristics over time, installation of permanent transects is required. Thickness, area, and extent of bark coverage affects benthos. Sixty feet below MLLW was selected because it is a depth at which repeated dives can safely be conducted.

Permanent transects are necessary to enable collection of repetitive data. If little or no change is observed, the permit holder may be relieved of the requirement for collecting information along the transects.

The requirement for dive transects, the number of transects, and the method of establishing permanence of the transects will be related to the period of usage, the amount of use intended, the resource values involved, and the expectations of effects as a result of the siting process.

M5. **Monitoring for Oil Sheen:** Waters in the vicinity of an LTF shall be monitored during operations for the presence of a visible sheen and recorded when observed.

Discussion: The monitoring is necessary to determine if an LTF is being operated to comply with Water Quality Standards for petroleum hydrocarbons, oils, and grease. Authority for this guideline is provided by state Water Quality Standards (18 AAC 70), Oil Pollution Regulations (18 AAC 75), and Federal Regulations (40 CFR 110).

M6. **Monitoring Upland Discharges:** On a case-by-case basis, discharges of rainfall from log sorting and storage yard, and discharges from any settling pond used to treat water, may require monitoring to ensure compliance with state Water Quality Standards and the Clean Water Act.

Discussion: This monitoring is necessary to determine if measures or structures designed to concentrate and treat runoff are operating effectively.

M7. **Reporting Guidelines:** Routine annual reports include the following descriptive information:

a. Location of the LTF (404/402 permits require latitude and longitude). The Forest Service traditionally uses legal descriptions;

b. Description of the LTF, including transfer devices and sorting and storage areas;

c. Permit holder and/or operator of LTF;

d. Starting and ending dates of operating season (from first to last bundle), and number of operating days per season;

e. Gross volume in board feet (Scribner Scale), or number of bundles transferred during the operating season; and

f. Monitoring data as described in Monitoring Guidelines.

Glossary

Biological Productivity—Highly diverse biological communities with many individuals.

Clean fill—Clean fill is defined as inorganic material, sized as sand and larger, free of organics. Current practice is to allow 0 to 15 percent material finer than sand and no organic materials in reinforced earth structures used for log transfer. Field observations indicate that the percentage of material is finer than sand from rock pits used for fill and considerably lower than the maximum percentage of fine material.

Log raft make-up area—A facility constructed in waters of the United States near or adjacent to log transfer facilities. The log raft make-up area is utilized for constructing log rafts that are on completion, moved to either a log storage area or loaded on to a vessel.

Log raft storage facility—A facility constructed in the waters of the United States utilized for the purpose of temporary or long-term storage of commercially harvested logs awaiting transfer to a vessel, manufacturing facility, or storage at the manufacturing facility.

Log transfer facility—A facility constructed, in whole or part, in waters of the United States that is utilized for the purpose of transferring commercially harvested logs to or from a vessel or log raft.

Practicable—Means available and capable of being done after taking into consideration costs, existing technology, and logistics in light of overall project purposes (40 CFR 230.3 (q)).

Use Descriptions—There are four classifications to describe the range of use for log transfer operations. The intensity and duration of site use will vary over time and the descriptions for each use provide a benchmark description to relate to operating levels and characteristics. There is a trend away from long-term continuous sites with increased incidence of intermittent and occasional use sites.

Continuous use sites: Sites where use is expected to be continuous on a regular basis for 20 years or longer. These sites were described and analyzed by Sedlak (3-16) in his analysis of alternative log transportation systems. Volume of expected timber is approximately 20 to 50 MMBF per year. Industry practice is to try to operate at a minimum of 35 MMBF activity level if a year-round camp is to be maintained. Log sorting and scaling commonly occurs at these sites. Export shipping is expected for privately owned timber. This operation is described as having "two sides" (two full yarding and support systems) with year-round land-based camp operations normal. Sites originally developed and operated as continuous use will frequently change to intermittent use or occasional use sites subsequent to the initial harvest activities.

Incidental use sites: Sites where use for log transfer is expected to occur only once or twice over a 70- to 100-year period. Typically the focus is on salvage of logs as the result of blowdown, disease, or harvest of isolated stands of timber. The lands involved are generally not accessible by alternative means. Timber volumes at a site will normally not exceed 5 to

10 MMBF. Log sorting areas are normally not constructed and native log structures are expected. Floating camp operations are expected.

Intermittent use sites: Sites where use is expected to vary from zero to approximately 11 to 17 MMBF per year. This operation can be described as having a "single side" (one full yarding operation and supporting system). These sites were described and analyzed by Sedlak (3-17) in his analysis of alternative log transportation systems. Typically these sites will vary in use in a pattern of 4 MMBF for the first year, 11 to 17 MMBF for 3 years, 4 MMBF for 1 year, and 6 to 15 years with no log transfer (3-17). Timber volumes from intermittent use would be at the average annual rate of 3 to 5 MMBF per year over 20 to 50 years. Timber salvage operations may occur in the periods between major operations. Sort yards are not normally constructed if water storage sites are available.

Year-round camp operation is generally not expected. Land-based camps have been common in the past, but increased use of floating camps has been observed at these sites.

Occasional use sites: Sites where intensive log transfer is expected to occur for only 4 to 6 years out of a 20- to 30-year period. These sites have not been analyzed in the literature. The use pattern is expected to be cyclical through the life of the site. Timber volumes from major timber activities would be at the average annual rate of about 1/2 MMBF/year over 20 to 50 years. Small timber operations will occur during the periods when major sale activities do not occur. Sorting yards are constructed only if no other options are available. Direct shipping of export logs is not expected.

Floating camp operations are the expected normal situation, unless commuting of workers from an established camp is feasible.

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APPENDIX H
KARST AND CAVE RESOURCES

Appendix H

Karst and Cave Resources

Karst Resources: Karst

I. Strategy

A. Maintain, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses, where appropriate. This strategy is designed to assess a karst resources vulnerability or sensitivity to a proposed land use, and recognize the differences in degree of karst development and glacial history across the karst landscape.

B. The key elements of the karst strategy focus on the openness of karst and its ability to transport surface water, nutrients, soil and debris, and pollutants into underlying hydrologic systems. Strive to maintain the productivity of the soils of the karst landscape after harvest, maintain the quality and quantity of the waters issuing from karst hydrologic systems, and protect the many resources values within underlying significant cave systems as per the requirements of the Federal Cave Resources Protection Act of 1988 (FCRPA).

II. Management

A. Maintain a karst resource management program that will identify, evaluate, and provide appropriate protection and mitigation for karst resources. Evaluate karst resources as to their vulnerability to land uses affecting karst systems, as described in the Karst and Cave Resource Significance Assessment, Ketchikan Area, Tongass National Forest, Alaska (Aley et al. 1993), Karst Landscapes and Associated Resources: A Resource Assessment (USDA Forest Service Gen. Tech. Rep. PNW-383) (Baichtal and Swanston 1996), Karst Management Standards and Implementation Review, Final Report of the Karst Review Panel (Griffiths et al. 2002), and the information provided herein.

B. Seek participation from interested individuals and organizations, such as caving groups, scientists, recreationists, and development interests in managing the karst resources.

C. Integrate and coordinate karst management with the management of other resources. Consider the function and biological significance of the entire karst landscape; recognize the importance of protection of karst systems, not solely specific karst features.

D. Public education and interpretative programs should be developed to ensure an increased understanding of the components and function of the karst landscape. Use research results to foster and promote conservation and further public education of karst resources.

E. Work with universities and other appropriate research facilities to foster partnerships to study and characterize the function and biological significance of karst landscapes. In order to maintain existing aesthetic and future scientific values, use non-consumptive research techniques as much as possible.

F. Manage the karstlands with an “adaptive management approach.” Guidelines should allow karst managers to exercise their professional judgment in developing karst management strategies and prescriptions. As knowledge is gained from implementation, monitoring, research, and studies, recommended practices should be modified to reflect the needed changes.

III. Karst Landscape Assessment

A. Karst lands impose land management challenges not encountered in non-karst areas because this three-dimensional landform functions differently than other landforms. Karst resources must be evaluated according to their vulnerability to land uses affecting karst systems. Vulnerability mapping recognizes that some parts of the karst landscape are more sensitive than others to surface activities and groundwater contamination. These differences in vulnerability may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from karst groundwater systems. Assess karst resource vulnerability for both large geographic areas and site-specific projects. Complete vulnerability assessments of large geographic areas for any karst area where land-disturbing

activities are planned. Conduct site-specific vulnerability mapping on a project-by-project basis, or as field verification of the larger scale karst vulnerability assessment. Karst lands will be classified as low, moderate, or high vulnerability. This four-step process is discussed below.

1. **Identify Potential Karst Lands.** Identify those lands underlain by carbonate rocks. As a practical matter, all lands underlain by carbonate rocks within the Forest should be considered a karst landscape. These include outcrops of limestone, marble, and dolomite. Karst has also developed within gypsum deposits on the Forest, and caves or tubes can be found within some lava flows.
2. **Inventory Karst Resources.** At the beginning of any land-disturbing project planning effort, determine the project's proximity to or position on a karst landscape. If it is determined that karst occurs in the project area, require an inventory adequate to characterize the resources. Assess the degree and location of karst development. If karst is present, at a minimum, record the information listed below.
   a. The degree to, which karst has developed, including the degree of epikarst development; the presence of caves, the presence of insurgences or sinking or losing water courses and resurgences or springs, sinkholes, collapse channels, and other karst features. If through initial inventory it is determined that the level of karst development and the density of karst features is so high that the landscape should be classified as high vulnerability, a complete inventory of all features is not necessary. It is important to document the level of karst development in the Karst Resource Report and the justification for the vulnerability classification. Document specific karst features on the “Karst Feature” form. Document characteristics of the karst in the area of concern on the “Karst Classification Summary” form.
   b. When caves are identified that may be affected by the proposed land management activity, they will be surveyed and inventoried in accordance with cave management guidelines. To maintain continuity of inventory reports and cave maps, specifications will be addressed prior to commencement of inventory work. During inventory work, caving ethics and protection of cave resources will be stressed.
   c. The relative position of karst features both within and adjacent to the planned activity.
   d. The slope of the land and the depth and nature of soil atop the karst.
   e. The presence of any Class I or Class II streams being significantly contributed to from the karst hydrologic systems. It is only intended that streams that have had sufficient residence time or contact with the carbonate bedrock and which show appreciable geochemical change be considered. Temperatures less than 8.5 degrees Celsius, pH ranging from 7.5 to 9.0, and specific conductance greater than 120 would be an indication of the highest value karst waters. It should be recognized that some normally dry drainage channels in a karst landscape would periodically carry large flows when the capacity of underlying conduits is exceeded during high flow events.
   f. Sensitive habitats and features that might be adversely affected by land use changes in the area being investigated. These habitats and features must specifically include, among other things, streams important to fisheries and streams or springs used as domestic water supplies, habitats that support cave adapted organisms, and critical bat winter habitat and/or roosts. When considering karst streams and springs, the inventory work must recognize that many sensitive habitats and features are likely to be located appreciable distances away from points where waters enter the karst groundwater system. The sensitive habitats may also include unique or unusual plant communities associated with surface karst features or carbonate outcrops.
   g. The results of the survey shall be documented and digitized onto the Forest’s GIS Database. The area's geology, location of karst features and caves, and the vulnerability of specific karst areas shall be recorded.
3. **Delineate Karst Hydrologic System and Catchment Area.** Define, to the extent feasible, the karst hydrologic system and the recharge area watershed or catchment area for each karst system. The character of the catchment area (i.e., the area, slope gradient, vegetation, water quality, soils, etc.) controls the nature of the receiving karst system and defines the volume of runoff available for infiltration into the system. Recharge area delineation is a

crucial component of vulnerability mapping; it is important to know where the water comes from and resurges to credibly assess and characterize possible impacts. At a minimum, record the information listed below.

a. During the inventory phase, record the location of all insurgences, sinking or losing streams, sinkholes, or other features appropriate for injection of tracing dyes. Estimate water volume entering or discharging from the groundwater system at the time of the visit. Record the position and characteristics of as many resurgences or springs as practical believed to be associated with the particular karst system of interest. Describe prevailing weather conditions at the time of the visit and the precipitation trends over the previous 24 hours.
b. Within each project area, the need to conduct tracer dye studies will be determined by a karst management specialist or other resource specialist such as a hydrologist with karst-specific experience or training. If tracer dye studies are determined to be necessary, the dye study needs to be carefully designed. Because subsurface flow paths are not predictable, an initial attempt to locate and sample all springs issuing from the karst area is necessary. Dye introduction sites should be selected to answer the particular resource concerns or threats. As an understanding of the systems complexity is established through initial successful traces, the sampling site strategy can be modified. Dye traces may need to be conducted at both low and high flows to determine the full extent of the karst groundwater system.
c. Record the results of the dye traces, indicating the relative position of the dye injection point and the position of the resurgence or spring where the dye was recovered. Record the tracer dye's travel time and concentration, if known. Record resurgences and streams that were sampled, but where no dye was recovered. Document and digitize results onto the Forest GIS Database.

4. **Assess Vulnerability of Karst Terrain to Management Activity.** The final step is to delineate the land under investigation into various vulnerability categories. An area's vulnerability rating must be sensitive to potential surface management practices based on the extent to which epikarst has developed and the openness of the karst system. Where recharge is diffused through deep soils, the underlying karst is less vulnerable to increased sediment inputs and other pollutants than in areas where recharge is discrete and soils are thin or nearly absent. Where soils are thin or nearly absent, surface disturbances will almost always result in exposure of the epikarst, providing an easy pathway for sediment and other pollutants to enter the subsurface drainage network. Discrete recharge areas are especially vulnerable to ground-disturbing activities because the flowing surface water can carry sediment and other pollutants directly to the subsurface drainage network. Karst vulnerability mapping recognizes the variability in karst terrain and uses the vulnerability concepts described here to assign a high, medium, or low vulnerability rating to an area of karst terrain. The proposed ground disturbing activity is considered when determining mitigation or applying karst management guidelines. The vulnerability categories and their criteria are discussed below.

   a. **Low Vulnerability Karst Lands**
      i. **Classification Criteria.** Low vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate. A generalized characterization of these lands include areas underlain by carbonate bedrock that are moderately well to well drained, most commonly internally drained, but surface streams may be present. Generally, these areas have been greatly modified by glaciation, and a deep (greater than 40 inches deep) covering of glacial till or mineral soil, and little or no epikarst showing at the surface. The epikarst may be buried and/or ground off, depending on the intensity of glaciation. These lands pose little or no threat to organic, sediment, debris, or pollutant introduction into the karst hydrologic systems beneath through diffuse recharge. Often these are areas of little or no slope (less than 20 percent). These tend to be at lower elevations (i.e., less than 500 feet); however, the elevation of low vulnerability karst will vary across the Forest.

ii. **Low Vulnerability Karst Management Objectives and Appropriate Land Uses.** These are areas where no special provision for the protection of karst values is considered necessary. Timber harvest and related activities could be conducted in such areas in a similar manner to those normally employed on lands underlain by insoluble bedrock. Partial suspension yarding may be required. No quarry shall be developed atop karst without adequate site survey and design. Quarries should be properly closed after abandonment. Recreational development would be appropriate with consideration of karst resource values. It is possible that karst areas with high vulnerability will be found within and adjacent to areas found to be of low vulnerability. Along such boundaries or margins, guidelines for protecting these high vulnerability areas outlined under "Moderate Vulnerability Karst Lands" (3.D. b. ii. (a)-(c)) shall apply.

b. **Moderate Vulnerability Karst Lands**

i. **Classification Criteria.** The moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands. A generalized characterization of these lands include areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. The soils of moderate vulnerability areas are a mosaic of shallow organic (20 to 40 percent, McGilvery Soils) and mineral (80 to 60 percent, Sarkar [less than 20-inch depth] and Ulloa [greater than 20-inch depth] Soils) with minor amounts of glacial till. The epikarst is moderate- to well-developed and is visible at the surface. These areas tend to be at higher elevations (i.e., greater than 500 feet, and on knobs, ridges, and on the dip-slope of carbonate bedding planes when near the surface.) The surface of these areas tends to be irregular and undulating, following the epikarst development, which is the result of solution of the bedrock surface rather than solution and/or collapse features such as sinkholes. In other words, moderate vulnerability features are often the result of slow, diffuse processes rather than collapse or major subsidence processes, which typify high vulnerability features. Moderate vulnerability karst lands pose low risk to organics, sediment, and debris introduction into the karst hydrologic systems beneath. It is probable, but not always the case, that these areas contain or are adjacent to areas of high vulnerability.

Much difficulty lies in differentiating between the high end of the moderate vulnerability karst and the low end of the high vulnerability karst. In using a classification system, there is rarely an exact fit to the environment or specific area being investigated. As stated above, classification is dependent upon extent of karst development and openness of the system. This can be difficult when surrounded by an environment with no surface water streams and limited exposure to the development of the underground system, as is often the case in these 'gray areas' between moderate and high vulnerability karst. Aside from the level of development and the openness of the system, the density of both karst features and exposed epikarst can be used when classifying the vulnerability of an area. A high density of features and/or very well developed epikarst in a “gray area” would result in a high vulnerability classification, whereas a few minor features and moderate epikarst development with soil retained might be classified as a moderate vulnerability area. It is crucial to evaluate the immediate area as well as the surrounding environment and any contributing characteristics when using this vulnerability system.

ii. **Moderate Vulnerability Karst Management Objectives and Appropriate Land Uses.** Management objectives on these lands is to provide for other land uses while taking into account function and biological significance of the karst and cave resources within the landscape. Timber harvest and related activities could be conducted in such areas under more restrictive guidelines than normally employed on lands underlain by insoluble bedrock. To protect the fragile soils found here, at a minimum, the yarding system selected may be required to achieve partial suspension. Longer timber harvest rotational periods may be appropriate. Reduced timber harvest

unit size and a greater dispersal of harvest units may be required. Recreational development would be appropriate with consideration of the karst resource values listed above, particularly with respect to reducing disturbance of sensitive soils and use of construction methods that avoid erosion and diversion of natural and road drainage waters into karst features.

(1) Road Construction. Existing roads will be utilized in preference to the construction of new ones. Roads should avoid sinkholes and other collapse features as well as sinking or losing streams. Roads should not divert water to or from karst features. Measures shall be taken to reduce erosion and sediment transport from the road surface and cut slopes. Assess the need for ditches and culverts. Sediment traps, cut and fill slope revegetation, and road closure and revegetation may be appropriate. Because subsurface drainage networks may be more open to the surface in moderate vulnerability areas, additional design criteria may be required. Such criteria may relate to road construction methods, blasting, culvert placement and density, and sediment retention and erosion prevention. Road construction restrictions described below under “high-vulnerability prescriptions” may be required for these areas.

(2) Quarries. Existing quarries will be utilized in preference to the construction of new ones. No quarry shall be developed atop karst without adequate site survey and design. Quarries should be properly closed after abandonment.

(3) Karst Feature Buffers. It is probable that individual features or areas with high vulnerability will be found within and adjacent to areas found to be of moderate vulnerability. Along such boundaries or margins, the following guidelines shall apply:

(a) No surface-disturbing activity such as timber harvest, road construction, and/or quarry development shall occur within a minimum of 100 feet of the edge of a cave, sinkhole, collapse channel, doline field, or other collapse karst feature. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness (RAW) of that zone (pay special attention to the area within two site-potential tree heights of the no-harvest zone). The intent of the buffers surrounding karst features is to minimize the amount of woody debris and sediment entering a given karst system and to maintain, to the extent practical, the natural processes and environment surrounding those features. It is not intended that this level of protection would be applied for relatively minor, isolated features (i.e., where explicit or special management measures would not normally be required). Appropriate protection measures for minor features should be designed on a case-by-case basis as field assessed by a karst management specialist. When designing buffers to protect karst systems and their features, the buffer should be designed to be wind-firm. There is no credible standard buffer distance that will provide the assurance required to protect the systems from blow down of the forest within a given buffer. Each buffer must be carefully designed considering wind direction, blow down history, previous adjacent harvest, topography, and stand windfirmness. Delineated lands surrounding such features and systems must be of sufficient size to ensure protection even if blow down occurs. It is suggested that the specific design of the buffers be an Interdisciplinary Team (IDT) recommendation working with the karst management specialist during the planning process for any given project. Not all features will require the RAW buffer considering the specific characteristics of each.

(b) No surface-disturbing activity such as timber harvest, road construction, and/or quarry development will occur on lands that overlie a known "significant" cave. "Overlie" is defined here as the area between lines projected from the outside walls of the cave passage at a 45-degree angle to the surface. In practice, lands that overlie a significant cave should be classed as high vulnerability even if other characteristics would suggest a lower rating.

As suggested above, the specific design of the buffers should be an IDT recommendation working with the karst management specialist during the planning process for any given project.

(c) As cave discoveries are made and those caves are mapped and inventoried, it is quite probable that very significant cave systems will be discovered. These might contain significant paleontological, cultural, or biologic resources, or the system is of a particular size to warrant an extra level of protection. Cave systems such as El Capitan Cave on Prince of Wales Island, Arabica and associated caves on Heceta Island, Solstice Cave on Chichagof Island, and the Calamity Creek Caves on Revillagigedo Island are examples. It is suggested that on a case-by-case basis for such caves, a Geologic Special Area be defined and managed as such to protect these systems.

(d) Require protection of all sinking or losing streams and their tributaries irrespective of whether the channels carry perennial, ephemeral, or intermittent flows. A non-harvest buffer is required at a minimum of 100 feet from the edge of a sinking or losing stream within no less than 0.25 mile (1,320 feet) upstream of their swallow hole or loss point. Additional protection beyond this point many be needed and should take into consideration parameters such as gradient, channel type, soil characteristics, and susceptibility to mass wasting and erosion along the stream's or tributary's course, or within the watershed. The karst management specialist should work in conjunction with hydrologists and soil scientists to design additional stream protection if needed. Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of windfirmness of that zone (pay special attention to the area within two site-potential tree height of the no-harvest zone). In the event that the stream is less than 0.25 mile long, the stream will be buffered to the stream's source.

(e) The area surrounding resurgences should be protected to maintain the environment surrounding the springs and the quality of the waters flowing from them. Resurgences can, however, be classified as moderate or high vulnerability dependent upon their size, the habitat they provide, and the level of atmospheric connectivity between the resurgence and the underground karst system. Minor resurgences that seep out of the ground between gravels with almost no connectivity between the open atmosphere and the underground system will be classified moderate vulnerability. Appropriate protection measures for moderate vulnerability resurgences and springs should be designed on a case-by-case basis by a karst management specialist. All other resurgences will be classified as high vulnerability and protected as described above in Karst Feature Buffers. Special consideration should be given to the area immediately surrounding the springs to protect the flora and fauna often associated with the spring when considering the vulnerability.

c. **High Vulnerability Karst Lands**

i. **Classification Criteria.** The high vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features. A generalized characterization of these lands is described below.

These are areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. Karst systems and epikarst are extremely well-developed and collapse karst features may be numerous. These include all collapse karst features, caves, sinking or losing streams, insurgences, open resurgences, and open grikelands (i.e., those without soil or moss infilling and with open connections to the subsurface). The highest vulnerability features are those that could produce and transport the greatest amount of sediment, debris, and/or organics if disturbed. These

include till-lined sinkholes and cave entrances accepting a sinking stream, whether intermittent or not. Also considered high vulnerability are karst lands in which the epikarst is well- or extremely well-developed and the soils are predominately (greater than 50 percent) very shallow organic (less than 10 inches deep, McGilvery) and (less than 50 percent) mineral (less than 20 inches deep, Sarkar). The subsurface drainage network is highly vulnerable to sediment, organic matter, logging debris, and other pollutants generated as the result of surface activities.

ii. **Karst Management Objectives and Appropriate Land Uses.** These areas shall be managed to ensure conservation of karst values through the implementation of a high level of protection. Timber management and related activities should be excluded from these lands. Limited recreational development may be appropriate. Recreational facilities and trails would have to consider karst resource values and objectives discussed above, particularly with respect to reducing disturbance of significant epikarst features and sensitive soils and use of construction methods that avoid erosion and diversion of natural drainage waters into karst features. Roads are considered inappropriate with the following exception if no other route or option is available and karst resource values would not be compromised. Small expanses of these areas may be crossed by roads to access areas where harvest is appropriate (i.e., low or moderate vulnerability karst lands and non-carbonate areas). If roads must be built across areas of high vulnerability, karst lands found to be of high vulnerability shall be identified and removed from the commercial forest lands suitable land base. If roads must be built across areas of high vulnerability, the following design and construction may be appropriate:

(1) Minimize clearing limits and grubbing. Flush cut stumps to the ground. Do not deck logs pioneered from the road clearing limits outside the clearing limits.
(2) Use a fill-type construction rather than a balanced cut and fill design. This most likely will be possible because the slope gradient of these areas are generally greater than 15 percent.
(3) Utilize log stringer bridges or similar structures to span across collapse features, if necessary. Geotextile should be used to keep aggregate overlay from falling into the collapse feature.
(4) Sediment traps and erosion control measures will be needed in most cases.
(5) Same-season re-vegetation of the cut and fill slopes should be required to minimize sediment production potential.
(6) A "plan-in-hand" review by the karst management specialist of the proposed road construction prior to actual construction is required.
(7) The karst management specialist needs to work closely with engineering to carefully design these roads and coordinate efforts with the planning team.
(8) No quarry development would be allowed on these lands.

IV. Catchment Area Management

A. The catchment areas for karst systems, comprised of carbonate or non-carbonate substrate, are an integral portion of those systems. Many karst watersheds receive part of their drainage from runoff originating on higher elevation non-carbonate rocks. This recharge originating from non-carbonate outcrops is called "allogenic recharge," and it usually sinks or recharges the carbonate aquifer at specific points. This water quickly enters and is transmitted through the conduit part of the aquifer and classified as concentrated "discrete" or "direct" recharge. Precipitation falling directly on the carbonate outcrop area is called "autogenic" recharge. It may rapidly enter the subsurface through sinkholes at discrete points or may percolate down through a soil or cover layer and enter the aquifer or cave systems as diffuse recharge. Catchment area management measures can be most effectively developed if both catchment types are delineated and their sensitivity to cumulative land use activities is evaluated. Difficulties arise because relative proportions of the two catchment types can be diverse and their sensitivities different; hence, different catchment assessment strategies need to be formulated for both types, each with its own set of guidelines.

The Forest currently does not have a catchment area management strategy for autogenic recharge areas (ARAs). As an interim measure, use the karst vulnerability assessment procedures to approximate the sensitivity of specific autogenic recharge areas. The Forest should pursue research opportunities that help to define and describe the parameters of both allogenic and autogenic recharge associated with karst catchments and recharge. Each karst system will have a unique set of recharge characteristics, which, in turn, will determine the level of catchment area management required. It is recommended that catchment area management strategies employ guidelines that can be adjusted and refined over time as more information is acquired.

V. Salvage of Windthrown Timber on Karst

A. On lands underlain by carbonate, where salvage of windthrown timber is proposed, a karst resource inventory shall be conducted as described above. The openness of the underlying karst system, that system's vulnerability to surface disturbance, and the likelihood of additional sediment production or surface runoff by harvesting the windthrown timber shall be determined. The appropriateness of salvage of windthrown timber on karstlands will be determined on a case-by-case basis in the field by a karst management specialist. Salvage is appropriate on low to moderate vulnerability karst lands when the karst management objectives can be met. Generally, no salvage shall be permitted on lands determined to be of high vulnerability, within 100 feet of a losing stream, a karst feature, or on lands that overlie a "significant cave." For relative minor, isolated features surrounded by low to moderate vulnerability karst, if the logging system to salvage the windthrown timber can be designed to not disturb the timber spanning or blown into the feature, salvage shall be permitted within 100 feet of the lip or edge of the feature. This salvage must be carefully designed. Before harvest, the sale administrator, purchaser representative, and karst management specialist should walk through the harvest unit to review the layout and resource management concerns.

VI. Mineral Development

A. The chemically pure carbonates of Southeast Alaska have long been considered for their commodity values. Values are not determined solely on chemical purity but on brightness as well. The more pure the carbonate bedrock, the more conducive the bedrock is to karst development. It is not the intent of these standards and guidelines to restrict any lands from mineral development, though that may be appropriate if a specific project or area is allocated to the Special Interest Area Land Use Designation. The impacts of any proposed mineral development within the karst landscape can be analyzed through the environmental analysis that is triggered once a Plan of Operations is received.

Cave Resources: Cave

I. Management

A. Manage lands in a manner that, to the extent feasible, protects and maintains significant caves and cave resources. See direction in 36 CFR 290.3 and "definitions" for guidance determining cave significance.

B. Locate, map, and describe caves, and evaluate and document the resource values discovered, when appropriate. The significant cave designation process is an inventory process for identifying caves that will require some form of management. Carry out data storage and collection in a manner that is consistent, at a minimum, with the processes outlined in 36 CFR 290.3 and FSM 2881.42 for nomination, evaluation, and designation of significant caves.

C. Develop a comprehensive Cave Resource Management Strategy on known cave resources. At a minimum, the strategy should include components that outline processes for cave inventory, record keeping, cave naming, handling of confidential cave information, partnership opportunities, recreational use monitoring, cave access and entry permits, and cave resource evaluations.

1. **Cave Inventories and Designation.** The inventory of caves is an ongoing process. The Forest will continue to aggressively pursue collection of inventory data.
2. **Records.** On each management unit with caves, a file of permanent data will be maintained for each cave. A complete set of this information will be held on the Forest. This file will remain locked, with access provided on a need-to-know basis only.

3. **Naming of Caves.** A cave should never be named after a living person, nor should it be named after a geographic feature that discloses the location of the cave.
4. **Cave Locations.** Specific information concerning significant caves on the Forest will not be made available to the public in accordance with provisions of FCRPA and 36 CFR 290.4.
5. **Protection of Cave Entrances.** Cave entrances are both sensitive and critical to cave ecosystems. Disruption of this ecosystem by development or heavy recreational use should be avoided. Management of cave entrances should consider recreational use including camping when it is consistent with provisions of the FCRPA, providing narrow pathways to minimize disturbance, and prohibiting fires.
6. **Digging in Caves.** All digging, moving of rocks, or enlargement of passages to allow exploration requires a permit. Issue permits only when it has been determined that no damage to cave resources will take place. Digging should generally be minimal, and waste products disposed of, or graded in a manner specified in the digging permit. Excavations made as a part of scientific investigations will be backfilled and graded to natural contours. If formerly closed passages are opened, take measures to maintain former atmospheric conditions through use of airlocks or gates.
7. **Permanent Anchors.** In vertical caves, use natural anchors for rigging ropes when possible. Chocks, cams, and slings are acceptable low impact anchoring devices. The use of permanent anchors, such as expansion bolts, will be set only when approved in advance by the Forest Service and generally not in Wilderness. Acceptable reasons to set bolts would be lack of safe natural anchors, to direct ropes to avoid loose rocks, to reduce rope abrasion, or to protect fragile cave resources.
8. **Climbing.** Climbing in caves may be allowed when needed to overcome vertical obstacles during exploration. Sport climbing may be allowed in the vicinity of cave entrances when no risk of damage to cave resources is present. Climbing must not mar, deface, for leave visible signs of activity having taken place. The use of chalk to dry climber's hands, and which leave marks on handholds, is considered defacement and will not be permitted.
9. **Closed Caves/Cave Entry Permits.** All sensitive caves will be closed by order of the Forest Supervisor and, entry will be allowed by permit only. A sign at the entrance of each sensitive cave will designate it as closed to visitation without a permit, and indicate the address and phone number where permit information may be obtained.
10. **Cave Evaluation.** All caves on the Tongass National Forest will be evaluated using the rating system described below. The system assigns values to various cave resources. The assigned values will be used in determining cave classification and making determinations of cave significance as provided by the implementation regulations for the Federal Cave Resources Protection Act of 1988 (FCRPA). If a cave has a value of "1" or greater, in one or more categories, the cave will be considered for designation as significant using the criteria in 36 CFR 290.3(c) and (d) (FCRPA Implementation Regulations 1994).
11. **Cave Classification.** Place caves into one of the classes described below based on management objectives consistent with identified cave resource values. As new caves are discovered, temporarily manage them as Class 1 until an analysis of resource values is completed.
    a. **Class 1. Sensitive Caves**. Caves considered unsuitable for exploration by the general public either because of their pristine condition, unique resources, or extreme safety hazards. They may contain resources that would be impacted by low levels of visitation. These caves are not shown on maps or discussed in publications (such as guides, brochures, or magazines) intended for general public use. Develop specific management guidelines for each sensitive cave for the purpose of protecting and maintaining their resources. Close these caves by order of the Forest Supervisor, and allow entry by permit only.
    b. **Class 2. Directed Access Caves**. Caves with directed public access and developed for public use. These caves are shown on maps or have signs directing visitor access. These caves also frequently have guided tours and artificial lighting. Regardless of the level of development, encourage public visitation. The caves may have sensitive resources that are protected.

c. **Class 3. Undeveloped Caves**. Caves that are undeveloped but are suitable for exploration by persons who are properly prepared. In general, these caves contain resources that resist degradation by moderate levels of recreational use. Public attention will not be directed toward these caves. They will neither be shown on maps nor discussed in brochures or publications intended for general public distribution.

12. **Prohibitions.** The following acts will be prohibited by order of the Forest Supervisor pursuant to 36 CFR Section 261, 262, Subpart B:

    a. In bat caves, or caves with sensitive species (261.53), it is prohibited to go into or be upon any area that is closed for the protection of threatened, endangered, rare, unique, or vanishing species of plants, animals, birds, or fish.
    b. Applicable to all caves, except for purposes of research and exploration, it is prohibited to:
        i. [261.52(a)] Build, maintain, attend, or use a campfire or stove fire; fires may be allowed in regard to traditional Native ceremonies in compliance with the American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act, their amendments and implementing regulations;
        ii. [261.52(c)] Smoke;
        iii. [261.58(e)] Camp;
        iv. [262.52(f)] Possess, discharge, or use any kind of fireworks or other pyrotechnic device;
        v. [261.58(m)] Discharge a firearm, air rifle, or gas gun; or
        vi. [261.58(s)] Possess a dog or cat.

13. **Collection or Removal of Cave Resources.** FCRPA authorizes the Secretary of Agriculture to issue permits for the collection and removal of cave resources under such terms and conditions as the Secretary may impose, including the posting of bonds to ensure compliance with the provisions of any permit. Specific guidelines are found for the issuance of such permits in FCRPA.

APPENDIX I
ROS CLASS STANDARDS AND GUIDELINES

Appendix I

ROS Class Standards and Guidelines

The Recreation Opportunity Spectrum (ROS) can help identify, quantify, and describe the types of recreation settings that the Tongass provides. The ROS system portrays the combination of activities, settings, and experience expectations along a continuum that ranges from highly modified to primitive environments. Seven classifications are identified along this continuum: Urban (U), Rural (R), Roaded Natural (RN), Roaded Modified (RM), Semi-Primitive Motorized (SPM), Semi-Primitive Non-Motorized (SPNM), and Primitive (P). The ROS inventory may be used to assess the potential effects of the alternatives on recreation settings. The setting indicators and applicable standards and guidelines for the seven ROS classes are discussed below.

Primitive

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the High Scenic Integrity Objective. An Existing Scenic Integrity level of Very High is fully compatible and encouraged.
Access	Non-motorized cross-country travel and travel on non-motorized trails and on waterways is typical. Use of airplanes, helicopters, motorboats, off-highway vehicles, and snowmachines for traditional activities, subsistence, emergency search and rescue, and other authorized resource management activities may occur but is rare.
Remoteness	No or infrequent sights and sounds of human activity are present. Setting is located more than 1.5 hours walking or paddling distance, or 3 miles, from any human developments other than infrequently traveled marine travelways. Areas are generally greater than 5,000 acres, but may be smaller if contiguous with a Semi-Primitive class.
Visitor Management	On-site regimentation and controls are very rare. Signing is limited to directional information and safety. There are no on-site interpretive facilities. There is great opportunity for discovery on the part of the users.
On-site Recreation Development	Structures do not exceed Development Scale I, except for public recreation cabins, and are maintained for appropriate levels of use.
Social Encounters	User meets less than three parties per day during trip. No other parties are within sight or sound of dispersed campsites or cabins. Authorize a party size of no more than 12 persons for any one site or activity group for commercial recreation use. Exceptions to the commercial group's size should be rare. A group size of 12 persons or less is recommended for general public use. Refer to REC3 in Chapter 3 Wilderness and National Monument Wilderness and Chapter 4 Recreation and Tourism for exceptions.
Visitor Impacts	Visitor-caused impacts to resources are slight and usually not noticeable the following year. Site hardening is limited to boardwalk trails and necessary boat moorings or bear-proof food caches and rustic public recreation cabins.

Semi-Primitive Non-Motorized

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the High Scenic Integrity Objective. An Existing Scenic Integrity level of Very High is fully compatible and encouraged.
Access	Non-motorized cross-country travel and travel on non-motorized trails is typical. Use of airplanes, helicopters, motorboats, and snowmachines for traditional activities, subsistence, emergency search and rescue, and other authorized resource management activities may occur unless specifically restricted for safety and/or resource protection purposes. Use of off-highway vehicles may occur on designated routes in accordance with 36 CFR 212, 251, and 261 – Travel Management; Designated Routes and Areas for Motor Vehicle Use.
Remoteness	Nearby sights or sounds of human activity are rare, but distant sights or sounds may occur. Setting is located more than 0.5 hour walk or paddle, or approximately 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) from 1) infrequently traveled waterways; 2) roads and trails open to motorized recreation use; and 3) clearcut harvest areas. Aircraft access is only occasional. Areas are generally greater than 2,500 acres, but may be smaller if contiguous with Primitive or Semi-Primitive Motorized classes.
Visitor Management	On-site regimentation and controls are rare. Visitor information facilities may be used to interpret cultural and natural resource features, but are not elaborate and harmonize with the setting.
On-site Recreation Development	Facilities and structures generally do not exceed Development Scale II and are maintained to accommodate the types and levels of use anticipated for the site. Forest Service recreation cabins are fully compatible.
Social Encounters	User meets less than 10 parties per day (6 parties per day in Wilderness) on trails and waterways during 80 percent of the primary use season. No other parties are within sight or sound of dispersed campsites during 80 percent of the primary use season. Maximum party size for commercial use within Wilderness is 12. Exceptions for larger party sizes within Wilderness should be rare. Refer to REC122 in Chapter 3 for exceptions. A party size of up to 20 people can be considered in Semi-Primitive settings outside of Wilderness. Outside of Wilderness, party sizes larger than 20 people may occur during less than 15 percent of the primary use season in limited locations as appropriate by LUD.
Visitor Impacts	Visitor-caused impacts to resources are rare and usually not long-lasting. Site hardening is limited to boardwalk trails, boat tramways, moorings and docks, bear-proof food cache facilities, and rustic public recreation cabins.

Semi-Primitive Motorized

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the Moderate Scenic Integrity Objective. Existing Scenic Integrity levels ranging from Very High through High are fully compatible and encouraged.
Access	Travel on motorized and non-motorized trails and Traffic Service Level D roads, although some Traffic Service Level C roads provide access to and through the area. Use by high-clearance vehicles and motorized water travel is common. Road density is less than 1 mile per square mile. Off-road snowmachine travel on snow may occur.
Remoteness	Nearby sights or sounds of human activity are rare, but distant sights or sounds may occur. Setting is located within 0.5 hour walk or paddle or within 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) of infrequently traveled waterways or small aircraft access points and/or roads that are open and maintained for passage by high-clearance and four-wheel drive vehicles (Maintenance Level 2), and provide access to recreation opportunities and facilities. Areas are generally greater than 2,500 acres, but may be smaller if contiguous with Primitive or Semi-Primitive Non-Motorized classes.
Visitor Management	On-site regimentation and controls are few. Control facilities consist primarily of informational signs and site-specific road closures. Visitor information facilities may be used to interpret cultural and natural resource features, but are not elaborate and harmonize with the setting.
On-site Recreation Development	Facilities and structures generally do not exceed Development Scale II and are maintained to accommodate the types and levels of use anticipated for the site and area. Forest Service recreation cabins are fully compatible.
Social Encounters	User meets less than 10 parties per day (6 parties per day in Wilderness) on trails, roads, and shorelines during 80 percent of the primary use season. During 80 percent of the primary use season, no other parties are visible from campsites. Maximum party size for commercial uses in Wilderness is 12 people. Exceptions should be rare. Refer to REC122 in Chapter 3 for exceptions. A party size of up to 20 people can be considered in Semi-Primitive settings outside of Wilderness. Outside of Wilderness, party sizes larger than 20 people may occur during less than 15 percent of the primary use season in limited locations.
Visitor Impacts	Visitor-caused impacts may be noticeable, but not degrading to basic resource elements. Site hardening is very infrequent, but, when it occurs, is in harmony with, and appropriate for, the natural-appearing backcountry setting.

Roaded Natural

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the Low Scenic Integrity Objective and typically is Moderate. Existing Scenic Integrity levels ranging from Very High through High are fully compatible and encouraged.
Access	All forms of access and travel modes may occur. Access to and through the area is typically by passenger vehicle, although motorized use may be restricted to provide for resource protection, user safety, or to provide a diversity of recreation opportunity.
Remoteness	Remoteness from urban conditions and high concentrations of other people is important. Low concentrations of human sights and sounds in a backcountry roaded setting are preferred. These areas are accessed by Forest roads that are maintained to Levels 2, 3, and 4 and are available for public use. They generally involve areas with timber management activities.
Visitor Management	On-site regimentation and controls are few. Control facilities are appropriate for the predominating backcountry roaded setting. Visitor information facilities may be used to interpret management activities, but are not elaborate and are appropriate for the setting.
On-site Recreation Development	Facilities and structures generally do not exceed Development Scale II and are maintained to accommodate the types and levels of use anticipated for the site and area.
Social Encounters	User meets less than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season. Numerous other parties may be encountered on roads. Few, if any, other parties are visible at dispersed campsites.
Visitor Impacts	Visitor-caused impacts are noticeable, but not degrading to basic resource elements, nor do they exceed established Scenic Integrity Objectives. Site hardening may be dominant, but is in harmony with natural-appearing landscape and appropriate for the site and setting.

Roaded Modified

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the Very Low Scenic Integrity Objective. Apply scenery management techniques to soften effects of very low conditions in the foreground of sensitive travel routes and recreation sites.
Access	All forms of access and travel modes may occur, although roads are generally not well suited to highway-type vehicles. Off-highway vehicle use on designated routes or areas is encouraged. Use by high clearance vehicles is common.
Remoteness	Remoteness is of little importance, but low to moderate concentrations of human sights and sounds are preferred. Setting is located within 0.5 mile (greater or less depending on terrain and vegetation, but no less than 0.25 mile) of moderate- to heavily-traveled waterways and/or roads that are maintained to Levels 3, 4, and 5, and open for use by the public or those areas that receive heavy small aircraft travel.
Visitor Management	On-site regimentation and controls are obvious. Control facilities such as parking areas, barriers, and signs harmonize with the natural environment. Visitor information facilities are not elaborate or complex.
On-site Recreation Development	Facilities and structures generally do not exceed Development Scale III and are maintained to accommodate the types and levels of use anticipated for the site and area. Typical facilities include outdoor interpretive displays and rustic campgrounds and picnic areas.
Social Encounters	User meets less than 20 other parties per day on trails and in dispersed areas, during at least 80 percent of the primary use season. User may meet numerous other parties on roads and developed recreation sites. Developed sites often are at full capacity, but do not exceed 80 percent of the design capacity over the season of operation.
Visitor Impacts	Visitor-caused impacts are noticeable, but not degrading to basic resource elements. Site hardening may dominate at campsites and parking areas, but is in harmony with, and appropriate for, backcountry roaded setting.

ROS Class Standards and Guidelines

Rural

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the Low Scenic Integrity Objective in the Foreground and Very Low in middleground.
Access	All forms of access and travel modes may occur, although access to and through the area is primarily by passenger vehicle. Road and trail surfaces are often hardened.
Remoteness	Remoteness is of little importance, and moderate to high concentrations of people and sights and sounds of human activity are acceptable when not continuous. Setting is located within 0.5 mile of heavily traveled roads and state highways or areas that receive heavy aircraft travel.
Visitor Management	On-site regimentation and controls are obvious. Control facilities such as parking areas, medians, and barriers harmonize with natural/exotic landscaping. Information and interpretive facilities may be complex and dominant on developed sites.
On-site Recreation Development	All Development Scales (I-V) are appropriate and maintained at intended standards necessary to accommodate the types and levels of use anticipated for the site and area. Facilities typically include visitor centers, major campgrounds, and other facilities for concentrated use.
Social Encounters	User may meet many (more than 20) other parties per day on trails, in dispersed areas, on roads, and in developed facilities. Developed sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.
Visitor Impacts	Visitor-caused impacts are noticeable, but not degrading to basic resource elements nor do they exceed established Scenic Integrity Objectives. Site hardening may be dominant, but is in harmony with natural/exotic landscape and appropriate for the site and setting.

Urban

Setting Indicators	Standards and Guidelines
Scenic Quality	Not to fall below the Low Scenic Integrity Objective in the foreground and Very Low in middle ground.
Access	Access and travel facilities are highly intense, motorized and often with mass transit supplements.
Remoteness	Remoteness is not important. High concentrations of people and sights and sounds of human activity are acceptable.
Visitor Management	Intensive on-site controls are numerous and obvious. Information and interpretive facilities may be complex and dominant.
On-site Recreation Development	All Development Scales (I-V) are appropriate and maintained at intended standards necessary to accommodate the types and levels of use anticipated for the site and area. Synthetic materials are commonly used. Facility design may be highly complex and refined, but in harmony or complimentary to the site. Facilities typically include visitor centers, major campgrounds, and other facilities for concentrated use.
Social Encounters	Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.
Visitor Impacts	Visitor-caused impacts are noticeable, but not degrading to basic resource elements or exceed established Scenic Integrity Objectives. Site hardening may be dominant, but is in harmony with natural/exotic landscape and appropriate for the site and setting.

Major and Minor Recreation-Special Use Developments

Four strategies (not allowed, discouraged, case-by-case, compatible) guide what level of development is permitted in each LUD. One of these strategies is assigned to each LUD to address major and minor proposals. The definitions and strategies applied to major and minor developments are discussed in the Recreation section of Chapter 4, Forest-wide Standards and Guidelines. While Renewable Energy sites and Transportation System Corridors are not LUDs, they are included in the table below to identify strategies applicable to these areas.

Strategy	Major	Minor
Not Allowed	Wilderness Wilderness National Monument Research Natural Area Wild River	Wilderness Wilderness National Monument Research Natural Area
Discouraged	Nonwilderness National Monument Remote Recreation Municipal Watershed LUD II Experimental Forest	Municipal Watershed Experimental Forest
Case-by-Case	Special Interest Area Old-growth Habitat Scenic River Modified Landscape Timber production Minerals Renewable Energy sites and Transportation System Corridors	Nonwilderness National Monument Remote Recreation Special Interest Area Old-growth Habitat Wild River Modified Landscape Renewable Energy sites and Transportation System Corridors Timber production Minerals LUD II
Compatible	Semi-Remote Recreation Recreational River Scenic Viewshed	Semi-Remote Recreation Recreational River Scenic Viewshed

Definitions

Not Allowed — Recreation special use developments are not allowed by law or regulation, or are not consistent with agency policy and regulations.

Discouraged — Recreation special use developments are generally not consistent with the objectives of the LUD. Development proposals require scrutiny of magnitude and scope for LUD conformance.

Case-by-Case — Recreation special use developments may be compatible with the LUD objectives depending upon the scope, purpose, and magnitude of the proposal. Proposals will be evaluated on a case-by-case basis.

Compatible — Recreation special use developments are generally compatible with this LUD, and applicants are encouraged to examine these areas first where there is a public need and no private lands are available or suitable for development.

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APPENDIX J
SPECIAL LAND DESIGNATIONS OR CLASSIFICATIONS

Appendix J

Special Land Designations or Classifications

Special Designations or Classifications

The following listing shows, by name, the areas of the Forest identified as Congressionally designated Wilderness and LUD IIs, Wild, Scenic, and Recreational Rivers (recommended), Research Natural Areas, Special Interest Areas, and Experimental Forests.

Congressionally Designated Wilderness and LUD IIs
Wilderness established December 2, 1980, by the Alaska National Interest Lands Conservation Act (ANILCA), Section 703

Kootznoowoo Wilderness (Admiralty Island National Monument)
Coronation Island Wilderness
Endicott River Wilderness
Maurelle Islands Wilderness
Misty Fjords National Monument Wilderness
Petersburg Creek-Duncan Salt Chuck Wilderness
Russell Fjord Wilderness
South Baranof Wilderness
South Prince of Wales Wilderness
Stikine-LeConte Wilderness
Tebenkof Bay Wilderness
Tracy Arm-Fords Terror Wilderness
Warren Island Wilderness
West Chichagof-Yakobi Wilderness

Wilderness established November 28, 1990, by Section 202 of the Tongass Timber Reform Act (TTRA), which amended ANILCA to include these Wilderness areas

Chuck River Wilderness
Karta Wilderness
Kuiu Wilderness
Pleasant-Lemesurier-Inian Islands Wilderness
South Etolin Wilderness
Young Lake Addition to Kootznoowoo Wilderness

LUD IIs established November 28, 1990, by Section 201 of the TTRA, which amended ANILCA to include these LUD II Management Areas

Anan Creek
Berners Bay
Kadashan
Lisianski River/Upper Hoonah Sound
Mt. Calder/Mt. Holbrook
Naha
Nutkwa
Outside Islands

Point Adolphus/Mud Bay
Salmon Bay
Trap Bay
Yakutat Forelands

LUD IIs established December 19, 2014, by the Sealaska Land Entitlement Finalization (sec. 3002 of P.L. 113–291), which amended ANILCA to add these LUD II Management Areas

Bay of Pillars
Kushneahin Creek
Northern Prince of Wales
Western Kosciusko
Eastern Kosciusko
Sarkar Lakes
Honker Divide
Eek Lake and Sukkwan Island

Wild, Scenic, and Recreational Rivers
The following rivers or river segments, as described in Appendix A of the 1997 Record of Decision (ROD), including the segment classifications, have been recommended to Congress for inclusion in the National Wild and Scenic Rivers System:

	Miles of River Classification		
River or River Segments	**Wild**	**Scenic**	**Recreational**
Aaron, Oerns, and Berg Creeks		21	16
Anan Creek	17.5	0.5	
Blind River			5
Blue River	26		
Chickamin River	94	2	
Essowah Lakes and Streams	13		
Fall Dog Creek	4		
Farragut River	29	1	
Gilkey River	9		
Glacial River	10		
Gokachin, Mirror, Fish, and Low Creeks	30		
Harding River		16	
Hasselborg River and Lakes	24		
Kadake Creek			23
Kadashan River		8	
Kah Sheets Creek and Lake	5	4	
Katzehin River	10		
Kegan Lake and Streams	9		
King Salmon River	8		
Kutlaku Creek and Lake	2		
LeConte Glacier	6		
Lisianski River	5		
Naha River	17	2	
Orchard Creek and Lake	10		16
Petersburg Creek	7		
Salmon Bay Lake and Stream	4	2	
Santa Anna Creek and Lake Helen		4	
Sarkar Lakes	14	3	2
Thorne River and Hatchery Creek		24	18
Virginia Lake and Creek			9
Wolverine Creek and McDonald Lake	6		

Research Natural Areas

Cape Fanshaw
Dog Island
Limestone Inlet
Old Tom Creek (reduced in size by Public Law 113-291)
Red River
Kadin Island
Marten River
Rio Roberts (now included in Honker Divide LUD II area due to Public Law 113-291)
Robinson Lake
Tonalite Creek
Warm Pass
West Gambier Bay

Special Interest Areas

Descriptions of the following Special Interest Areas, with the exception of the Geologic Areas expanded in 2008, are located in 1997 Forest Plan Revision FEIS, Appendix F. Descriptions of the Geological Areas expanded in 2008 are located in 2008 Forest Plan, Appendix L. The following areas will continue under a Special Interest Area classification:

Admiralty Lakes Recreation Area
Bailey Bay Hot Springs Recreation Area
Big Creek Geological Area
Blake Channel Geological Area
Blind Slough Scenic and Zoological Area
Blue River Lava Flow Geological Area
Calamity Creek Caves Geological Area
Clear River Zoological Area
Dall Island Geological Areas (includes part of former Karst Geological Area)
Duke Island Zoological Area
Eastern Chichagof Geological Areas
Falls Creek Windthrow Botanical Area
Fish Creek Hot Springs Recreation Area
Heceta Island Geological Area
Hubbard Glacier Geological Area
Keku Islets Geological and Scenic Area
Kosciusko Island Geological Areas (reduced by about 4,245 acres by Public Law 113-291 [about 3,505 acres became LUD II and 740 acres were conveyed to Sealaska])
Mendenhall Glacier Recreation Area
Mount Edgecumbe Geological Area
Naha Recreation Area
New Eddystone Rock Geological Area
North Hamilton River Redcedar Cultural and Botanical Area
North-central Prince of Wales Geological Areas
Northern Prince of Wales Geological Areas (reduced by about 9,060 acres by Public Law 113-291 [about 8,335 acres became LUD II and 725 acres were conveyed to Sealaska])
Pack Creek Zoological Area
Patterson Glacier Geological and Botanical Area
Pike Lakes Recreation Area
Soda Springs Geological Area

Suemez Island Volcanics Geological Area (expansion of Suemez Island Geological Area)
Tracy Arm-Fords Terror Scenic Area
Walker Cove-Rudyerd Bay Scenic Area
Ward Lake Recreation Area (including expansion)

Experimental Forests
The Maybeso Experimental Forest will continue to be managed as an Experimental Forest as it has been since 1997. This includes evaluating aspects of forest regeneration, riparian succession and evolution of stream channel morphology, and response of salmonid populations to changes in large-wood density and distribution.

The Héen Latinee Experimental Forest was established by the Chief of the Forest Service on June 25, 2009, and is managed as an Experimental Forest. This forest represents coastal temperate rain forests and allows research over many different landscape types from glacial ridges to marine estuaries.

The Young Bay Experimental Forest was disestablished by the Chief of the Forest Service on June 25, 2009, and this area is managed under the Semi-Remote Recreation LUD.

APPENDIX K
OLD-GROWTH HABITAT RESERVE MODIFICATION PROCEDURES

Appendix K

Old-growth Habitat Reserve Modification Procedures

Introduction

This appendix describes criteria for changing the boundaries of old-growth reserves (OGRs) at the project level as described in the Old-growth Habitat Land Use Designation (LUD) Standards and Guidelines (Wildlife section). For a complete review of the Conservation Strategy, including assumptions for the design of the OGR system, refer to Appendix N of the 1997 Final EIS and Appendix D of the 2008 Final EIS.

Significant modifications to OGRs (e.g., in the case of a land exchange) require consideration of other factors outside the scope of this appendix. Factors include connectivity, size, and shape of the reserve, as well as basic assumptions behind the location of the reserves. Some activities (i.e., major land conveyance or substantial timber harvest in non-development LUDs) could significantly affect the integrity of the Conservation Strategy. In this case, an overall review of the effects on the Conservation Strategy would be necessary. These activities are anticipated to be infrequent events.

Review of OGRs

During the 2008 Amendment process, the USDA Forest Service, U.S. Fish and Wildlife Service (USFWS), and Alaska Department of Fish and Game (ADF&G) reviewed all of the small OGRs and a few of the medium and large OGRs. These were reviewed primarily because under the 1997 Forest Plan, small OGRs were not adequately mapped, so it was necessary to review and designate them at the project level. Medium and large OGR locations were finalized in the 1997 Forest Plan and brought forward. The location of the majority of the small OGRs was completed during the 2008 Forest Plan review; therefore, project-level reviews are not necessary, except as outlined below.

Minor modifications to any OGR boundary as a result of imprecise mapping are considered an administrative change. The changes will not be considered changes in the Forest Plan and may be completed without project level or other review provided that changes meet OGR goals and objectives. Changes should only be completed to follow physical and other recognizable on-the-ground features or defined boundaries (e.g., roads, streams, LUD, watersheds).

Under limited circumstances, a line officer may decide to modify the size and location of an OGR. Modifications of OGRs, other than minor as described above, will require the completion of a project level review. This review may be necessary if:

A. The project occurs in VCUs 1930, 2010, 5371, 5620, 6100, 6140, 6150, 6160, 6170, 6320, 6710, 6750, and 6760. A project-level review is required because critical site-specific information for these small and medium OGRs was not available for the 2008 Forest Plan review. This review requires an assessment of landscape connectivity (refer to Appendix D of the Final EIS). Once a review and approval through the NEPA process is complete, no further review for these OGRs is necessary.

B. The project proposes young-growth harvest in the Old-growth Habitat LUD.

C. Site-specific information for a small OGR indicates that the OGR habitat criteria are not met in the mapped location.

D. Actions are proposed within the OGR that will reduce the integrity of the old-growth habitat in the OGR.

E. The OGR will be affected by a land conveyance, power line, mine, or other project that was not considered in the Forest Plan. An overall review of the Conservation Strategy is not necessary for a modification to an individual small OGR, but it could be necessary for modifications to medium and large OGRs, or if a proposal affects multiple OGRs. If an overall review is deemed unnecessary by the line officer for modification to medium and large OGRs, documentation of the rationale will be done through the NEPA process.

Project-Level Review

Project-level reviews will ensure that OGRs meet Forest Plan OGR criteria while addressing forest-wide multiple use goals and objectives. There are two levels of review included in the project-level review: 1) the interagency review, and 2) the decision process.

Step 1, Interagency Review Process—The purpose of an interagency review is to identify the biologically preferred location for the OGR. An interagency team of USDA Forest Service, USFWS, and ADF&G biologists will jointly evaluate the location and habitat composition of the OGR by reviewing all the large productive old growth blocks within a Value Comparison Unit (VCU). The interagency review team will develop a proposal for the OGR that meets the criteria of this appendix and document why other proposals were not recommended.

The review will include the following steps:

A. Review the purpose and rationale for current location of the Forest Plan OGR as documented in the current Tongass Old Growth database.

B. Assess whether the purpose and rationale for the location of the OGR has changed.

C. Use the design criteria to define the biologically preferred location for the OGR.

D. Document this proposal as the interagency proposed OGR in the Tongass Old Growth database and in an Interagency OGR Review report.

Step 2, Decision Process—Line officers will incorporate the interagency review team OGR recommendation in the NEPA process, considering the best biological location for the OGR while balancing other considerations. The interagency team will work with the decision maker to develop alternate proposals, if necessary to meet other Forest Plan objectives. The implemented OGR must meet the minimum criteria as described below.

The Decision process will include the following steps:

A. Attempt to develop a viable project that avoids conflicts with the biologically preferred OGR. At a minimum, the biologically preferred OGR will be considered in an alternative in the NEPA document.

B. Where modifications to the biologically preferred OGR are required to meet Forest-wide multiple use goals and objectives:

   1. Follow the management prescriptions as defined for the Old-growth Habitat LUD; and

   2. Document the rationale for modifications to the biologically preferred OGR.

C. Changes to the OGR LUD require a NEPA analysis and a Forest Plan amendment.

D. Analyze the amount of land suitable for timber production impacted by the change in OGR.

E. Add the updated information (including the rationale for the final location) to the Tongass Old Growth database.

Criteria for Small OGRs

A. Review Appendix D of the Final EIS, which includes the assumptions for the design of the old-growth reserve system.

B. Small reserves are a contiguous landscape of at least 16 percent of the National Forest System land area of each VCU and at least 50 percent of the small reserve, should be productive old growth. The size and location of small OGRs will consider the following:

1. OGRs shall contain a minimum of 400 acres of productive old-growth forest. Do not map isolated reserves with less than 400 acres of productive old growth.
2. The preferred biological objective is for each reserve to contain at least 800 acres of productive old-growth forest.
3. In VCUs that are partially allocated to a Non-development LUD, compare the computed acreage required to the acres of productive old growth in the Non-development LUD. If the Non-development LUD acres are less than the area necessary for a small reserve, first use the productive old growth acres in the existing Non-development LUD to establish a small reserve, and then add additional acres of productive old growth to achieve the required small reserve size and composition.
4. In VCUs that are separated by saltwater channels, reserves may be separated, but attempt to retain 800 acres of productive old growth in each.
5. In very large VCUs, generally larger than 10,000 acres, the allocated old growth may be mapped in separate reserves as long as each reserve has a minimum of 800 acres of productive old growth. However, larger contiguous reserves are preferred to multiple smaller reserves.
6. In very large VCUs that contain relatively little productive old growth and the computational rule requires an amount of productive old growth that exceeds 50 percent of the existing productive old growth in the VCU, map a reserve of at least 400 acres of productive old growth.
7. Where VCU boundaries do not match watershed or ecological boundaries, up to 30 percent of the allocated old growth acres in a VCU may be mapped in an adjacent VCU if the resulting reserve achieves old-growth reserve objectives. The resulting small reserve in both VCUs must be contiguous. Total acreage is attributed to the VCU with 70 percent of the OGR.
8. OGR boundaries should follow recognizable features that are identifiable on the ground. Features should be permanent and easily identifiable. Features may include but are not limited to streams, roads, distinctive ridges and ridge-tops, watershed boundaries, and v-notches.

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Monitoring & Evaluation Program

Monitoring and evaluation is a quality control process required for implementation of the Tongass Forest Plan; it is essential in implementation of the adaptive management strategy.

Specifically, the purpose of Tongass Monitoring is to provide periodic evaluation of Tongass Forest Plan goals, objectives, and standards and guidelines (with assumptions made to reflect contemporary statute, policy, theory, data, technology, and public needs and desires). Evaluation is the process for interpreting monitoring data and information to determine whether changes in management direction are needed. Monitoring and evaluation comprise an essential feedback mechanism within an adaptive management framework to provide the public, the Forest Service, and other concerned resource agencies with information on the progress and results of forest plan implementation.

Tongass Forest Plan incorporates three kinds of monitoring:

Implementation monitoring is used to determine whether or not t Tongass Forest Plan standards and guidelines are implemented;
Effectiveness monitoring is used to determine whether or not standards and guidelines are are ultimately bringing the Forest closer to achieving significant changes in productivity of the land as a result of the objectives, and the objectives achievement of goals, stated in the Forest Plan;
Finally, validation monitoring is used to examine if the accuracy of the assumptions and predicted effects used to formulate the plan are accurate.

Note: All reports are in Adobe PDF format. **Free Adobe Acrobat® Reader software** for reading/downloading/printing PDF documents files is available from the following Web pages:

Computer: Adobe Website
iPhone and iPad: iTunes Store
Android devices: Google Play store

Tongass Plan Monitoring Program

Administrative changes to the Tongass National Forest Plan Monitoring Program were approved on May 9, 2016 and become effective immediately; Chapter 6 of the 2008 Tongass National Forest Land and Resource Management Plan (Forest Plan) is rescinded and replaced by this updated Plan Monitoring Program. Administrative changes are not subject to the objections process. The changes were made to meet the 2012 Planning Rule (36 CFR 219). The 2012 Planning Rule includes eight requirements in 36 CFR 219.12 (a)(5) for plan monitoring programs. The Plan Monitoring Program describes the eight requirements and identifies which monitoring questions meet each of those requirements. It also outlines the changes made to the 2008 monitoring program to better align the Plan Monitoring Program with both the 2012 Planning Rule and the 2008 Forest Plan.

2016 Monitoring Program Administrative Change Letter
2016 Monitoring Program full document

Future administrative changes may be necessary after completion of the ongoing Forest Plan Amendment. In addition, the Tongass is deferring action on two requirements: focal species and species of conservation concern. The requirement to monitor the status of focal species to assess ecological conditions is in 36 CFR 219.12(a)(5)(iii) and the requirement to monitor the status of ecological conditions to maintain viable populations of species of conservation concern is location at 36 CFR 219.12(a)(5)(iv). Once these species and their associated ecological conditions have been identified, relevant monitoring questions will be added or modified as necessary. The public will be notified of any proposed substantial administrative changes and will have the opportunity to comment at that time.

Substantive changes to the monitoring program made outside a forest plan revision or amendment process require notice to the public of the intended changes and consideration of public comments (36CFR 219.13(c)(1)). A Draft Plan Monitoring Program was released for a 30-day public comment period on March 9, 2016

(**Notice of 30 Day Comment Period**). Seven external comment letters were received in addition to internal comments from resource specialists. Those comments have been considered and a few changes were made to the Plan Monitoring Program as a result:

2016 Monitoring Program Response Comments

FOR FURTHER INFORMATION CONTACT: Cathy Tighe, Inventory and Monitoring Program Manager, Tongass National Forest, 907-228-6274, **ctighe@fs.fed.us**.

Draft Plan Monitoring Program

Tongass Monitoring & Evaluation Reports

Each annual report supplies a Monitoring Overview summary report and reports on specific time-critical monitoring whereas the five year report is a comprehensive review of the data and the evaluation, serving as the annual summary of forest-wide monitoring programs; this provides a comprehensive description of results for each monitoring question, and an evaluation of the last five years of data.

FY2015 Annual Monitoring Report
FY2014 Annual Monitoring Report
FY2013 Annual Monitoring Report (2013 report is being provided in one PDF document, we recomend right clicking and saving this off to your computer)
FY2013 Report Errata: Wildlife Terrestrial Habitat Table 3
FY2012 Annual and 5-year Monitoring Report

Tongass Monitoring Protocols

Monitoring design and sampling methods employed by the Tongass for the three kinds of monitoring are described in the Tongass Forest Monitoring Guidebook.

Monitoring and Evaluation Guidebook For The Tongass Land and Resource Management Plan (January 2005 (3 Mb PDF)
Best Management Practices Policy (BMPs)

SPECIES STATUS ASSESSMENT
for the
ALEXANDER ARCHIPELAGO WOLF
(*Canis lupus ligoni*)

U.S. Fish and Wildlife Service
Region 7, Alaska

November 23, 2015

Suggested citation: U.S. Fish and Wildlife Service. 2015. Species status assessment for the Alexander Archipelago wolf (*Canis lupus ligoni*). Version 1.0, December 2015. Alaska Region, Anchorage, Alaska. 162 pp.

EXECUTIVE SUMMARY

The purpose of this document is to synthesize scientific information relevant to assessing the current and future status of the Alexander Archipelago wolf (*Canis lupus ligoni*). It will be used to inform the U.S. Fish and Wildlife Service's (Service) decision on whether or not the Alexander Archipelago wolf warrants protection under the U.S. Endangered Species Act (Act). As such, it is not a decision document; instead, it forms the scientific basis from which the Service will draw conclusions and make decisions regarding the Alexander Archipelago wolf under the Act.

In this assessment, we review the morphology, taxonomy, distribution, life history, ecology, and population dynamics of the Alexander Archipelago wolf and, as appropriate, its primary prey, black-tailed deer (*Odocoileus hemionus* spp.). We acknowledge uncertainty surrounding the taxonomic status of the wolf, but after careful review of the best available information, we assume for the purpose of this assessment that the Alexander Archipelago wolf is a valid subspecies of gray wolf (*C. lupus*). We then describe current habitat and resource conditions of the Alexander Archipelago wolf and project future conditions by evaluating effects of environmental and anthropogenic stressors to wolves at the individual, population, and rangewide levels. We conclude this assessment by characterizing future status of the Alexander Archipelago wolf using the conservation biology principles of redundancy (ability to withstand catastrophic events), resiliency (ability to withstand stochastic disturbance events), and representation (ability to adapt to changing environmental conditions).

The Alexander Archipelago wolf occurs on the mainland of southeastern Alaska and coastal British Columbia west of the Coast Mountain Range and on larger islands except Admiralty, Baranof, and Chichagof islands and all of the Haida Gwaii, or Queen Charlotte, Islands (Figure ES-1). Its current range, which is similar to its recent historical range, covers roughly 217,000 km^2. These coastal wolves probably interact at low levels with interior, continental wolves via trans-boundary rivers and low mountain passes. Therefore, distribution boundaries of the Alexander Archipelago wolf are porous and are not defined sharply or with certainty; zones of intergradation with interior, continental wolves exist.

We estimated the rangewide population of the Alexander Archipelago wolf to be approximately 850–2,700 wolves with the majority (~62%) occurring in coastal British Columbia where populations have been stable since 2000. In southeastern Alaska (38% of the rangewide population), trend is estimated for only the population occupying Prince of Wales Island and surrounding islands (6% of rangewide population), which constitutes Game Management Unit (GMU) 2. Between 1994 and 2014, the GMU 2 wolf population declined by about 75% (SE=15), although confidence intervals of the point estimates overlap. For the remainder of southeastern Alaska (32% of rangewide population), population trend is not known. Generally, populations of Alexander Archipelago wolf are connected to one another, although some geographical disruptions exist due to the island geography within its range; the GMU 2 population is the most insular population.

The Alexander Archipelago wolf appears to be a habitat and diet generalist, although it exhibits some general preferences. These coastal wolves spend most of their time at elevations below 400

m, probably because abundance of prey typically is higher at low elevations compared to higher elevations. Their diet is highly variable across the range and seasons, but similar to gray wolves, ungulates compose a large portion of it with deer being the most common ungulate species available. The GMU 2 wolf population is more dependent on deer as prey compared to other coastal wolf populations because deer are the only ungulate available in GMU 2; elsewhere, at least two additional ungulate species occur. Consistent with their opportunistic predatory behavior, Alexander Archipelago wolves also consume marine and intertidal species including salmon (*Oncorhynchus* spp.) and marine mammals when and where available.

We identified multiple stressors that may be impacting individuals and populations of the Alexander Archipelago wolf, although most of them have the potential to affect wolves indirectly, not directly. Key stressors examined as part of this assessment include timber harvest, road development, wolf harvest, and climate-related events. Of these, wolf harvest is the only source of direct mortality that may have an impact at the population and rangewide levels. Although road development has little direct effect on wolves, roads provide access for hunters and trappers to areas that otherwise may be inaccessible or difficult to access. Timber harvest and winter severity influence deer habitat capability and abundance, which can impact wolf populations, especially if other ungulate species are not available. We also considered a variety of other stressors such as effects of small populations, oil development, overexploitation of salmon, and hybridization with dogs.

Because many stressors that may be affecting Alexander Archipelago wolves interact with one another, sometimes synergistically, we revised an existing, but outdated model of a hypothetical wolf population in GMU 2, to help determine the relative strength of influence of each stressor and the cumulative impact on wolves. In the model, we explicitly considered timber harvest, frequency of severe winters, and wolf harvest as functions of road development and ocean distance from towns and villages (both measures of access for hunters and trappers). We also used the model to predict wolf population trajectory in GMU 2, the area for which the most data on wolf population dynamics exist, under six scenarios representing possible future conditions. We summarize results of the model in this status assessment and fully describe the model, its assumptions, and outputs in Gilbert et al. (2015).

We then evaluated the relative level of resiliency (low, intermediate, high) of five populations, or group of populations, of the Alexander Archipelago wolf by examining the magnitude of stressors and their known or expected effect on wolves. Those populations included southern coastal British Columbia (Regions 1 and 2), northern coastal British Columbia (Regions 5 and 6), mainland southeastern Alaska (GMUs 1 and 5A), and GMUs 2 and 3 in southeastern Alaska (Figure ES-1). For three populations (i.e., southern and northern coastal British Columbia and GMU 2), we relied on trend information to inform our assessment of their resiliency to stressors, individually and cumulatively. However, for two populations in southeastern Alaska (GMUs 1 and 5A, and GMU 3), we lacked trend information. Therefore, we compared magnitude of stressors to those populations with those of populations for which trend information exists and then assigned a level of resiliency based on degrees of similarity and difference; for these two populations, uncertainty regarding resiliency and future status is greater than for the three populations with existing trend information.

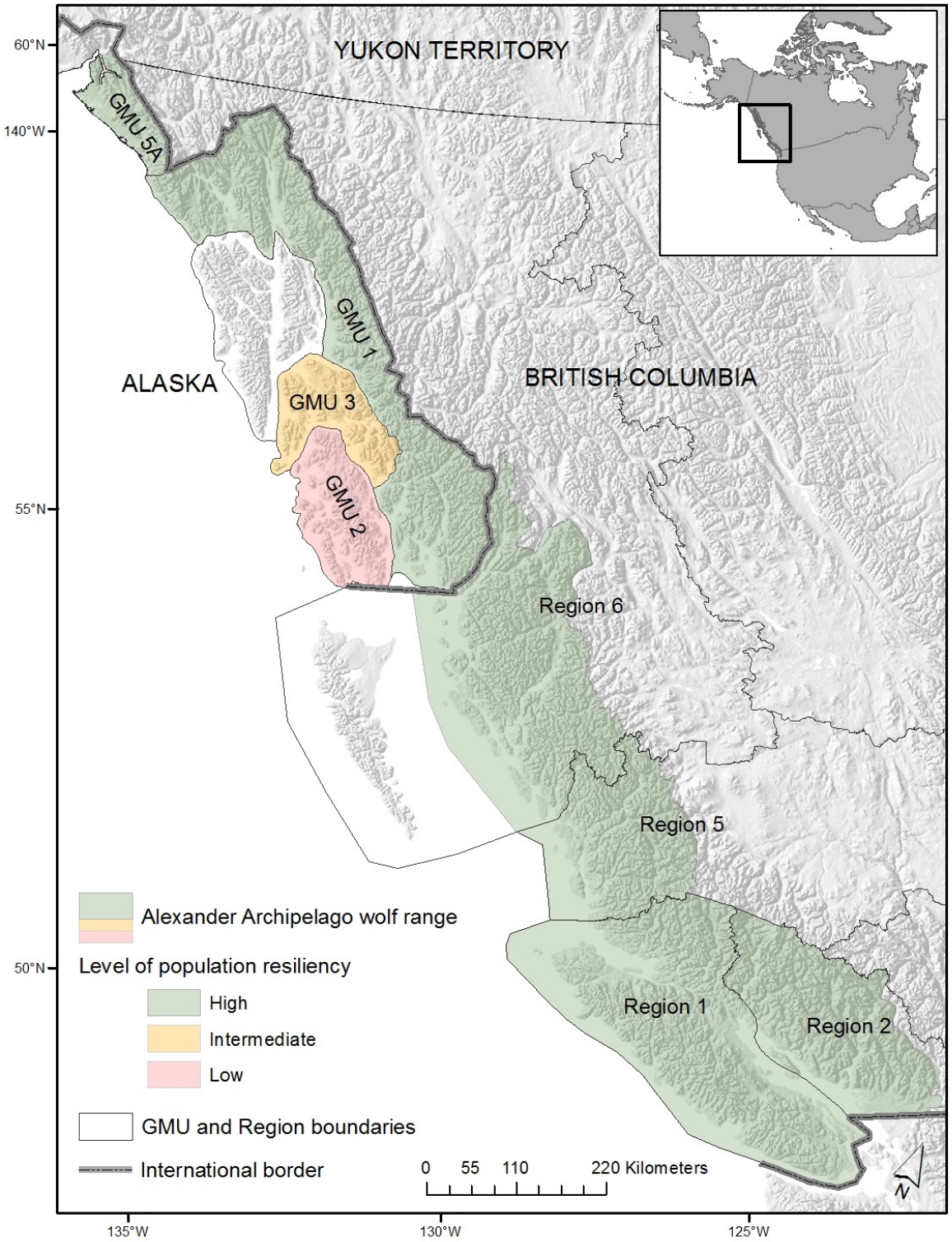

Figure ES-1. Assumed range of the Alexander Archipelago wolf (*C. l. ligoni*), and level of resiliency of individual or groups of populations, which were defined using boundaries of Game Management Units (GMU) in southeastern Alaska and Regions in coastal British Columbia.

Of the five populations evaluated, we found that three of them, composing 80% of the rangewide population, exhibit high resilience to stressors (Figure ES-1). Both populations in coastal British Columbia have been stable since 2000 despite intensive and extensive timber harvest in the southern portion (Regions 1 and 2; 30% of the forest logged) and in the northern portion (Regions 5 and 6; 16% of the forest logged). We attribute their resiliency to the availability of ungulate species other than deer as prey and to apparently sustainable rates of wolf harvest (average reported harvest of <7% of the population annually). Further, these populations likely encounter few disruptions to demographic and genetic connectivity, although we found no estimates of dispersal specific to wolves in coastal British Columbia. Based on similarities in the overall magnitude of stressors and population characteristics, such as ungulate prey availability, with coastal British Columbia, we determined that the Alexander Archipelago wolf population on the mainland of southeastern Alaska (GMUs 1 and 5A) also exhibits high resilience, although we lack trend estimates for this population and therefore are less certain of its ability to withstand stochastic disturbances.

The GMU 2 wolf population, which constitutes 6% of the rangewide population, demonstrates low resilience to stressors, specifically the synergistic effects of wolf harvest and timber harvest (Figure ES-1). Although this population appears to be harvested at sustainable rates (average of 17% of the population annually), unreported harvest contributes substantially to total wolf harvest (38–45% of total harvest) in GMU 2, resulting in unsustainable rates of wolf harvest in some years. High rates of total harvest in GMU 2 have been facilitated by the highest levels of road and boat access for hunters and trappers across the range of the taxon. In addition, approximately 23% of the forest has been logged, likely reducing numbers of deer, the only ungulate species available as prey. The combination of these factors likely has caused an apparent population decline of about 75% (SE=15) since 1994 and, as predicted by our population model, wolf abundance in GMU 2 is expected to decline by another roughly 8–14% of current levels over the next 30 years.

Lastly, we determined that the GMU 3 wolf population in central southeastern Alaska (14% of the rangewide population), shows an intermediate level of resiliency to stressors (Figure ES-1). However, like the population on the mainland of southeastern Alaska (i.e., GMUs 1 and 5A), we lack a trend estimate for the GMU 3 population and therefore, we used a comparative approach. The GMU 3 wolf population has similarities with both a stable population in northern coastal British Columbia (Regions 5 and 6; e.g., level of timber harvest) and with a declining population in GMU 2 (e.g., island geography). For example, in GMU 3, 14% of the forest has been logged, reducing deer habitat capability, although wolves have access to ungulate prey other than deer; these attributes are similar to those in northern coastal British Columbia. Yet, rates of reported harvest in GMU 3 (21% of population annually) are slightly higher than those in GMU 2 (17% of population annually), although we found no evidence indicating that unreported harvest in GMU 3 is occurring at or near the high rates documented in GMU 2; in addition, road and boat access for hunters and trappers in GMU 3 is lower than that in GMU 2. Thus, in considering the evidence collectively, we classified the GMU 3 population as exhibiting an intermediate level of resiliency, in part owing to its island geography.

In conclusion, we believe that the future status of the rangewide population of the Alexander Archipelago wolf likely will be stable or perhaps slightly lower than current levels based on its

resiliency, redundancy, and representation. We found that (1) most (80%) of the rangewide population exhibits high resilience to stochastic disturbance events; (2) multiple populations are distributed across a broad range, demonstrating redundancy for withstanding catastrophic events, although two island populations (i.e., GMUs 2 and 3) constituting 20% of the rangewide population are more insular than the mainland populations; and, (3) as a habitat and diet generalist, the Alexander Archipelago wolf exhibits a high degree of ecological diversity and most populations appear to harbor sufficient levels of genetic diversity with no evidence of genetic bottlenecking; both of these characteristics indicate representation, or the ability to adapt to changing environmental conditions. Owing to predicted declines in the GMU 2 wolf population, it is likely that the rangewide population will decrease in the future, but we expect the overall effect to be minor given that the GMU 2 population constitutes only 6% of the rangewide population, is geographically peripheral to the other populations, and appears to serve as a sink population. Nonetheless, the persistence of the GMU 2 population is desired and requires careful management actions and decisions to ensure its future health.

TABLE OF CONTENTS

Executive summary		ii
Table of contents		vii
List of figures		ix
List of tables		xi
Chapter 1: Introduction	1.1. Purpose and focus of this assessment	1
	1.2. Geographic scope	2
	1.3. Review of previous efforts	4
	1.4. Terminology used in this assessment	4
Chapter 2: Description of the Alexander Archipelago wolf	2.1. Physical description	6
	2.2. Taxonomy	8
	2.2.1. Morphometric analyses	8
	2.2.2. Genetic analyses	9
	2.2.3. Other relevant analyses	13
	2.2.4. Uncertainty of taxonomic status	14
	2.3. Distribution	15
Chapter 3: Life history and ecology	3.1. Vital rates	17
	3.1.1. Abundance and trend	17
	3.1.2. Reproduction	22
	3.1.3. Survival	22
	3.1.4. Within-population dispersal	23
	3.1.5. Sex ratio	24
	3.2. Social organization	25
	3.3. Ecology	25
	3.3.1. Food habits	26
	3.3.2. Space and habitat use	32
Chapter 4: Dynamics of multiple populations	4.1. Connectivity	39
	4.1.1. Demographic connectivity	39
	4.1.2. Genetic connectivity	40
	4.2. Population processes	42
Chapter 5: Current and future habitat and resource conditions	5.1. Environment	43
	5.2. Land ownership	44
	5.3. Cause and effect analysis	47
	5.3.1. Wolf population model	47
	5.3.2. Timber harvest	48
	5.3.3. Road development	68
	5.3.4. Wolf harvest	75
	5.3.5. Disease	95
	5.3.6. Climate-related events	98
	5.3.7. Other	102
	5.3.8. Summary of stressors	104
	5.4. Existing conservation mechanisms	106
	5.4.1. Southeastern Alaska	106
	5.4.2. Coastal British Columbia	108
Chapter 6: Current and future status of the Alexander Archipelago wolf	6.1. Biological considerations	110
	6.2. Assessment by population	112
	6.2.1. GMU 2 wolf population	114
	6.2.2. GMUs 1 and 5A wolf population	118

	6.2.3. GMU 3 wolf population	119
	6.2.4. Region 5/6 wolf population	120
	6.2.5. Region 1/2 wolf population	121
	6.2.6. Summary of individual populations	122
	6.3. Characterizing future status	124
	6.3.1. Redundancy	124
	6.3.2. Resiliency	124
	6.3.3. Representation	124
	6.4. Summary	127
Literature cited		128
Appendix I: Land area (km^2) of Game Management Units and Regions		150

Note on typography: This document consists of six chapters, a list of literature cited, and two appendices. Chapters are presented in all capital letters (primary headings); sections are labeled by chapter then section number (e.g., 3.1 refers to Chapter 3, Section 1) and are underlined (secondary headings); and, subsections are denoted by chapter, section number, and subsection number (e.g., 3.1.2. refers to Chapter 3, Section 1, Subsection 2) and are presented in bold typeface (tertiary headings). Primary, secondary, and tertiary headings are listed in the Table of Contents. In some subsections, we found it necessary to include fourth- and fifth-order headings. Fourth-order headings are labeled in italics and underlined and fifth-order headings are presented in standard text; in both cases, the heading is followed by an Em Dash (i.e., "—") and the paragraph begins on the same line. Tables and figures are numbered in chronological order as they appear in the text.

Typography example:
CHAPTER
Section
Subsection
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Fifth-order heading.—Paragraph begins.

LIST OF FIGURES

Figure ES-1. Assumed range of the Alexander Archipelago wolf (*C. l. ligoni*), and level of resiliency of individual or groups of populations, which were defined using boundaries of Game Management Units in southeastern Alaska and Regions in coastal British Columbia.	iv
Figure 1. Assumed range of the Alexander Archipelago wolf (*C. l. ligoni*), as reviewed in this assessment, southeastern Alaska and coastal British Columbia.	3
Figure 2. Range of the Alexander Archipelago wolf by Game Management Unit in the southern portion of southeastern Alaska.	7
Figure 3. Estimates of Φ_{ST} and Φ_{CT} from three studies of mitochondrial DNA variation in coastal and inland wolves from northwest North America.	12
Figure 4. Game Management Unit boundaries in southeastern Alaska and Region boundaries in British Columbia that are within the assumed range of the Alexander Archipelago wolf.	16
Figure 5. Land cover across southeastern Alaska south of Yakutat.	44
Figure 6. Map depicting land ownership and management across southeastern Alaska south of Yakutat.	46
Figure 7. Age distribution of logged forest across all land ownerships in southeastern Alaska.	51
Figure 8. Current distribution of (unlogged) productive old-growth forest and (logged) young-growth forest across southeastern Alaska with Game Management Unit boundaries.	53
Figure 9. Age distribution of logged forest by Game Management Unit, southeastern Alaska.	55
Figure 10. Map depicting current land cover in coastal British Columbia.	58
Figure 11. Estimated percent change in mean abundance of wolves and deer under six vegetation conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	65
Figure 12. Modeled estimates of percent change in mean abundance of wolves and deer based on four rates of wolf predation on deer between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	66
Figure 13. Map depicting road densities estimated by Wildlife Analysis Area and presented by Game Management Unit within the range of the Alexander Archipelago wolf in southeastern Alaska.	70
Figure 14. Map depicting road densities estimated by Wildlife Management Unit within the apparent range of the Alexander Archipelago wolf in coastal British Columbia.	73
Figure 15. Mean percent of successful hunters and trappers of Alexander Archipelago wolves by type of transportation and Game Management Unit, southeastern Alaska, 1997–2014.	78
Figure 16. Map of human settlements by population size and roads to demonstrate variation in access (e.g., road, boat) for hunters and trappers within the range of the Alexander Archipelago wolf, southeastern Alaska.	79
Figure 17. Number of Alexander Archipelago wolves harvested and reported by hunters and trappers (A) by Game Management Unit and (B) after accounting for variation in size of GMU (per 1,000 km^2) between 1997 and 2014, southeastern Alaska.	82
Figure 18. Reported number of wolves harvested by regulatory year in Game Management Unit 2, southeastern Alaska, 1997–2014.	84
Figure 19. Minimum number of Alexander Archipelago wolves harvested by hunters and trappers by Region between 1997 and 2012, coastal British Columbia.	85
Figure 20. Estimated total number of wolves harvested by regulatory year in Game Management Unit 2, southeastern Alaska, 1997–2014.	87
Figure 21. Estimated percent change in mean abundance of wolves and deer under three wolf harvest guidelines (i.e., 0% reported harvest, and 20% and 30% of the estimated fall population size) between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	91

Figure 22. Estimated percent change in mean abundance of wolves and deer under five road conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	93
Figure 23. Estimated percent change in mean abundance of wolves and deer when no legal harvest of deer was permitted and when current regulations were allowed between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	94
Figure 24. Mean number of reported deer harvested by (A) Game Management Unit (GMU) and (B) after accounting for variation in size of GMU (per 1,000 km^2) within the range of the Alexander Archipelago wolf, southeastern Alaska, 2010 and 2011.	95
Figure 25. Estimated percent change in mean abundance of wolves and deer under three frequencies of a severe winter occurring (0.07, 0.08, and 0.10, respectively) between 2015 and 2045, as projected by downscaling regional climate models to Game Management Unit 2, southeastern Alaska.	101
Figure 26. Estimated percent change in mean abundance of wolves and deer under six scenarios with variations of vegetation, wolf harvest, road density, and frequency of severe winter conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	116
Figure 27. Percent change in (A) wolf abundance and (B) deer abundance across model scenarios from 2014 levels, shown from the year 2000–2045, in Game Management Unit 2	117

LIST OF TABLES

Table 1. Weights (kg) of Alexander Archipelago wolves greater than six months old by ADFG Game Management Units in southeastern Alaska.	6
Table 2. Key genetic studies of wolves in southeastern Alaska and British Columbia that generated new data (i.e., not meta-analyses or reinterpretations of existing data) using mitochondrial DNA, microsatellite, and single nucleotide polymorphism markers.	10
Table 3. Estimated fall densities of wolves within overlapping study areas of varying size across years and extrapolated population estimates and associated standard errors for Game Management Unit 2.	18
Table 4. Estimated wolf population size by Game Management Unit and subunits derived from habitat capability models of deer, moose, and mountain goat developed in the early 1990s, southeastern Alaska.	20
Table 5. Estimated population size of the Alexander Archipelago wolf by Region based on estimates of wolf density and ungulate biomass and adjusted by the proportion of the Region in the coastal portion of British Columbia.	21
Table 6. Estimated rangewide population size of the Alexander Archipelago wolf based on the most recent and best available population estimates in Game Management Units of southeastern Alaska and Regions in coastal British Columbia.	22
Table 7. Generalized distribution of ungulate species by Game Management Unit in southeastern Alaska and Region in coastal British Columbia within the range of the Alexander Archipelago wolf.	27
Table 8. Percent occurrence of prey remains in wolf scats from various locations in southeastern Alaska and coastal British Columbia.	28
Table 9. Percent occurrence by year of prey remains in wolf scats collected during spring and summer from Coronation Island between wolf introduction in 1960 and near extirpation in 1970.	30
Table 10. Select recent (post-1997) studies of Sitka black-tailed deer within the range of the Alexander Archipelago wolf.	36
Table 11. Land ownership and management (km^2) by Game Management Unit across southeastern Alaska south of Yakutat Bay and within the range of the Alexander Archipelago wolf.	45
Table 12. Current condition (km^2) of forest stands by land ownership and management, southeastern Alaska.	51
Table 13. Current condition (km^2) of forest stands by Game Management Unit and within the range of the Alexander Archipelago wolf, southeastern Alaska.	54
Table 14. Timber volume (mmbf) scheduled to be for sale on the Tongass National Forest between 2015 and 2019 by Game Management Unit, southeastern Alaska.	59
Table 15. Timber volume (mmbf) by Game Management Unit and status on the Tongass National Forest, southeastern Alaska, as of June 2015.	60
Table 16. Description of vegetation conditions and assumptions for rate of harvest by land ownership and management under which we modeled changes in wolf abundance between 2015 and 2045 in Game Management Unit 2, southeastern Alaska.	64
Table 17. Mean estimates of road density and ranges calculated by Wildlife Analysis Area (WAA) with each Game Management Unit.	69
Table 18. Mean estimates of road density and ranges estimated by Wildlife Management Units and summarized by Region, coastal British Columbia.	71
Table 19. Current hunting and trapping regulations for wolves implemented by the State of Alaska and U.S. Forest Service.	77

Table 20. Description of road and boat access for hunters and trappers by Game Management Unit in southeastern Alaska and Region in coastal British Columbia within the range of the Alexander Archipelago wolf.	81
Table 21. Mean annual reported harvest of Alexander Archipelago wolves by Game Management Unit between 1997 and 2014 relative to estimated population size.	83
Table 22. Region-specific Alexander Archipelago wolf population estimates (specific to coastal area only) and minimum reported wolf harvest between 1997 and 2012.	86
Table 23. Summary of selected stressors within the range of the Alexander Archipelago wolf.	105
Table 24. Summary of range and population characteristics and primary stressors facing populations of the Alexander Archipelago wolf by Game Management Unit in southeastern Alaska and Region in coastal British Columbia.	113
Table 25. Description of scenarios evaluated using population model to estimate percent change in mean wolf abundance in Game Management Unit 2 between 2015 and 2045.	115
Table 26. Relative level of resiliency of individual populations of the Alexander Archipelago wolf, southeastern Alaska and coastal British Columbia.	123
Table 27. Characterization of future status of the Alexander Archipelago wolf using the conservation biology principles of redundancy, resiliency, and representation.	126

CHAPTER 1: INTRODUCTION

1.1. Purpose and focus of this assessment

The purpose of this document is to synthesize scientific information relevant to assessing the current and future status of the Alexander Archipelago wolf (*Canis lupus ligoni*). We compiled it using the U.S. Fish and Wildlife Service's (Service) guidance on developing a Species Status Assessment (Service 2015. This document will be used to inform the U.S. Fish and Wildlife Service's (Service) decision on whether or not the Alexander Archipelago wolf warrants protection under the U.S. Endangered Species Act (Act). However, we emphasize that this is not a decision document; it contains no conclusions on whether or not the wolf should be listed. Instead, it forms the scientific basis from which the Service will draw conclusions and make decisions.

We collated existing information from published papers, final agency reports and pertinent archived datasets. We also considered information submitted to the Service in the petition (Center for Biological Diversity [CBD] and Greenpeace 2011), during the 90-day finding public comment period (March 31–May 30, 2014), and in response to specific data requests. To the best of our ability, we worked directly with researchers actively studying the Alexander Archipelago wolf or aspects of the ecosystem in which it lives, to include the most current information available. Thus, we aimed to be as comprehensive as possible, but did focus our review on two areas. First, we concentrated on information describing the Alexander Archipelago wolf, drawing on information about the gray wolf (*C. lupus*) and its' subspecies only when necessary (e.g., significant data gap, context). We consulted frequently with Mech and Boitani (2003), a compilation of summaries on wolf behavior, ecology, and conservation throughout the world, and in some sections of this assessment, we refer the reader directly to tables and figures in their publication that list summary statistics for well-studied wolf populations outside of southeastern Alaska and coastal British Columbia. Second, we focused our review on new information collected since 1997 when the Service last reviewed the status of the Alexander Archipelago wolf (62 Federal Register 46710, September 4, 1997).

As part of this effort, we also updated a population model for wolves on Prince of Wales Island (POW) that was originally developed by Person and Bowyer (1997) during our last review of the Alexander Archipelago wolf. This model was used to project future wolf abundance based on hypothetical wolf packs on POW under different resource condition scenarios with variations on levels of timber harvest, road management, wolf harvest, and frequency of winter severity. It was developed with input from key agency partners (e.g., Alaska Department of Fish and Game [ADFG], U.S. Forest Service [USFS]) and from experts on wolves and population modeling. Because of deadlines associated with the Alexander Archipelago wolf listing decision, we wrote this assessment in parallel with a final report describing the population model (Gilbert et al. 2015). These two documents complement one another yet are separate standalone documents. In addition, both documents underwent substantial peer review, as well as agency review; we incorporated comments received during the review process into the final versions of the documents.

1.2. Geographic scope

In this assessment, we summarize scientific information on wolves in southeastern Alaska and coastal British Columbia (Figure 1). Although the taxonomic status of wolves in this region is uncertain at this time (see *Taxonomy* below), we acknowledge that these wolves harbor unique ecological and genetic traits specific to this coastal region and that they appear to constitute a different group compared to continental wolves. Thus, for the purpose of this assessment, we used the Coast Mountain range, which extends 1,600 km from the southwestern corner of Yukon Territory, Canada in the north to the mouth of the Fraser River in the south, as a geographic boundary. We define southeastern Alaska as the area extending from Yakutat in the north to Dixon Entrance in the south, including all islands in the Alexander Archipelago and the narrow strip of mainland eastward to the Coast Mountain range and the Canadian border (Figure 1). We delimit coastal British Columbia to be Dixon Entrance in the north to the Fraser River in the south, including all islands and the mainland west of the Coast Mountains (Figure 1). See *Distribution* below for more detailed descriptions of wolf distribution in this region.

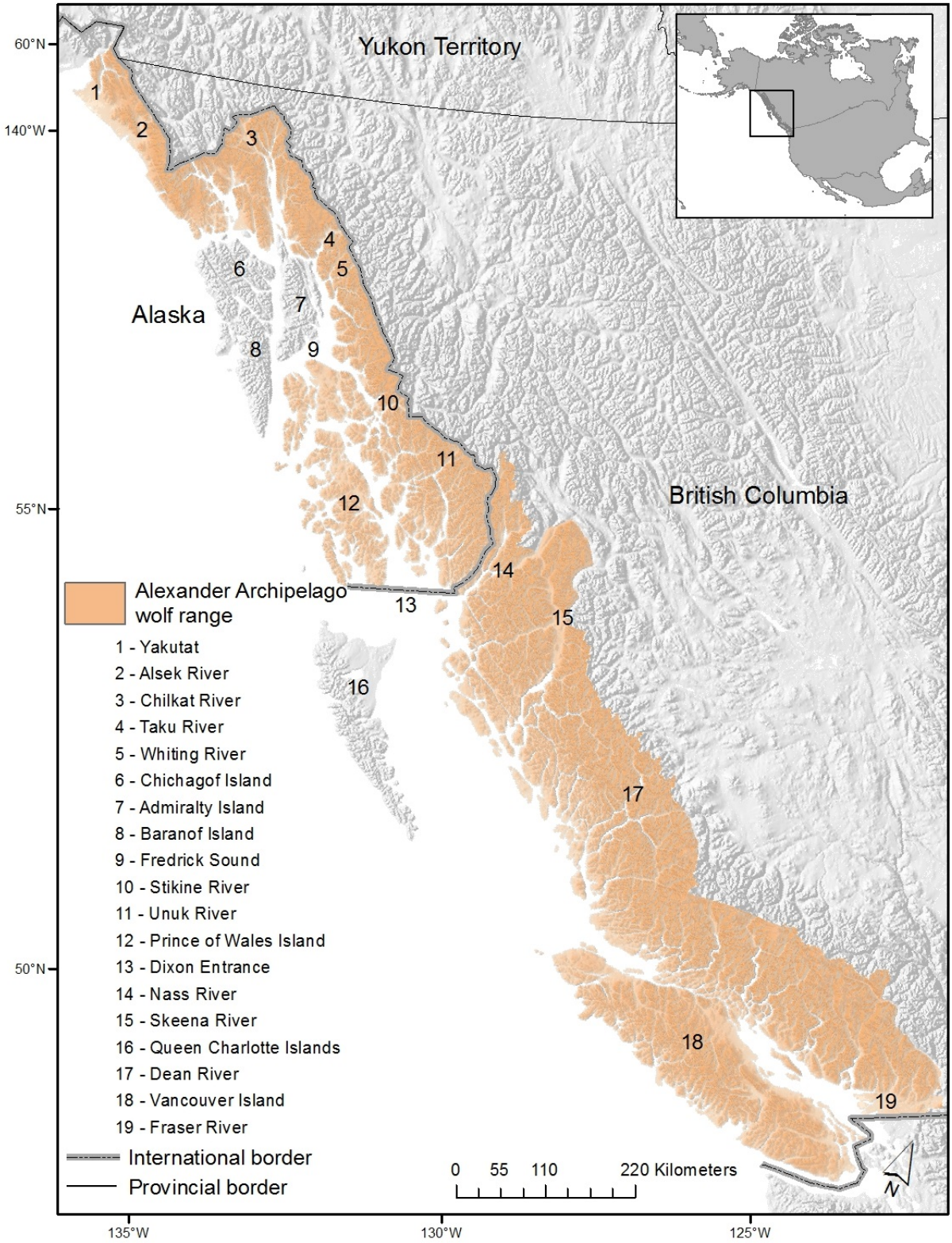

Figure 1. Assumed range of the Alexander Archipelago wolf (*C. l. ligoni*), as reviewed in this assessment, southeastern Alaska and coastal British Columbia.

1.3. Review of previous efforts

Prior to this assessment, the most recent comprehensive compilation of information on the Alexander Archipelago wolf in southeastern Alaska was completed by the Service in 1997 as part of an evaluation to determine whether or not listing was warranted under the Act (62 Federal Register 46710, September 4, 1997). This evaluation was conducted in parallel and in close collaboration with a similar effort led by the U.S. Forest Service (USFS), "The Alexander Archipelago Wolf: A Conservation Assessment" (Person et al. 1996) during the 1997 revision of the Tongass Land and Resource Management Plan (USFS 1997). This USFS-led assessment remains a primary resource for information on Alexander Archipelago wolf in southeastern Alaska.

Since 1997, several other assessments or compilations of information in Alaska were conducted, but none was focused solely on the Alexander Archipelago wolf. For example, MacDonald and Cook (2007) summarized data on taxonomy, status, and distribution of amphibians and mammals, including the wolf, in southeastern Alaska using museum specimens; this publication generally serves as an expanded checklist of species. In addition, Albert and Schoen (2007) completed a conservation assessment and resource synthesis for southeastern Alaska, specifically the Tongass National Forest (hereafter Tongass). This comprehensive assessment includes sections describing status, habitat relationships, and conservation implications for key species of fish, birds, and mammals, including the Alexander Archipelago wolf.

We are not aware of a status assessment targeted to wolves in coastal British Columbia. Darimont and Paquet (2000, 2002) described distribution of wolves on the central and northern coast based on wolf sign including tracks, scat, sightings, and carcasses; the authors also analyzed patterns of distribution in terms of island size, isolation, and distance from the mainland. In 2014, the provincial government published a management plan for wolves in British Columbia (British Columbia Ministry of Forests, Lands and Natural Resource Operations [BCMO] 2014). This plan summarizes the best available information for managing wolf populations, including a threats assessment, in British Columbia, but it is not specific to the coastal region.

1.4. Terminology used in this assessment

Within the range of the Alexander Archipelago wolf, old-growth forests are heterogenous at the scale of watersheds and at finer scales. Some wildlife species select for various attributes of the forest habitat, but these attributes vary from species to species. Likewise, terminology used to describe forest habitat types and attributes also varies across authors, researchers, agencies, countries, etc. Throughout this assessment, we were unable to use a consistent classification system when referring to forest habitat. Generally, we aimed to follow Farmer and Kirchhoff (2007), although we also drew on information included in Alaback (1982). However, when describing results of studies reported by other authors, we chose to retain the terminology used in those publications or reports. We included citations and page numbers throughout the document, allowing the reader to consult with specific studies if desired.

We typically reference two forest habitat types: young-growth and old-growth forests. Young-growth forest (also called second-growth forest) refers to forest stands that have regenerated following timber harvest or large natural events (e.g., wind storms). When relevant, we further

defined second-growth forests as: (a) young young-growth to describe forest stands less than 25 years in age; (b) transitional young-growth as forest stands 26–75 years of age; and, old young-growth as 76–150 years of age. Old-growth forests are forest stands in the late successional stage of forest development, typically at least 150 years old. They are defined in many ways, but usually include a mix of tree sizes and ages, ranging from the largest and oldest that a site and the tree species are capable of producing, to young trees emerging through the understory. Old-growth forests also tend to have a significant component of dead trees and downed logs. These forests traditionally have been described based on timber volume (e.g., low-volume old-growth forest). In this document, we refer to productive old-growth forest, which includes all timber volume classes that render a stand commercially viable (i.e., capable of producing at least 8,000 board feet per acre, as defined by the USFS [2008a, p. 7-29]).

CHAPTER 2: DESCRIPTION OF THE ALEXANDER ARCHIPELAGO WOLF

2.1. Physical description

The Alexander Archipelago wolf has been described as being darker and smaller, with coarser and shorter hair compared to continental gray wolves (Goldman 1937, pp. 39–40; Wood 1990, p. 1). However, we are not aware of a recent comprehensive study or examination of specimens that supports this statement.

Like most gray wolves, fur coloration of Alexander Archipelago wolves varies considerably from pure white to uniform black with most wolves having a brindled mix of gray or tan with brown, black, or white. Based on recent harvest records (2008–2011), the black color morph is more common on the mainland of southeastern Alaska (20–30%; ADFG 2012, pp. 5, 18, 24) compared to the southern islands (2%; ADFG 2012, p. 34). On the British Columbian coast, Darimont and Paquet (2000, p. 17) reported that 25% of wolves were black in color and, of the remaining 75% that were gray, 40% had a brownish-red tinge. The pure white color morph appears to be rare throughout the region. For comparison, Adams et al. (2008, p. 8) reported 24% (12 of 51) of wolves captured as part of a research study in the Central Brooks Range, Alaska to be black with the remainder having gray pelts.

In southeastern Alaska, Alexander Archipelago wolves greater than six months old weigh between 22 and 52 kilograms (kg) with males averaging 37.8 kg (SE=0.6) and females averaging 31.2 kg (SE=0.6; Valkenburg 2015). On some islands in the archipelago (e.g., POW) wolves are smaller on average compared to those on the mainland (Table 1; Valkenburg 2015), although these differences are not statistically significant for males ($F[2,85]=3.00$, $p=0.06$) or females ($F[2,74]=1.30$, $p=0.28$). In all of British Columbia (not just the coastal area), wolves generally weigh between 30 and 50 kg (BCMO 2014, p. 3). For context, in the Central Brooks Range female wolves greater than one year old averaged between 36.9 and 40.1 kg and males were between 42.4 and 47.8 kg (Adams et al. 2008, p. 8). In northwestern Minnesota, average weights of both sexes were lower (females=30.0 kg, males=35.9 kg; Mech and Paul 2008, p. 935) and were more similar to wolves in southeastern Alaska.

Table 1. Weights (kg) of Alexander Archipelago wolves greater than six months old by ADFG Game Management Units (GMU) in southeastern Alaska (Valkenburg 2015; Figure 2).

GMU	Geographic area	Male				Female			
		Mean	SE	n	Range	Mean	SE	n	Range
1	Mainland	36.6	1.5	23	22.7–47.2	30.3	1.3	23	17.2–41.3
2	Prince of Wales Island and surrounding islands	35.7	0.9	17	29.5–43.1	30.6	0.8	20	24.5–36.4
3	Kuiu, Kupreanof, Mitkof, Zarembo, Etolin, and Wrangell islands	39.1	0.8	48	27.7–51.7	32.2	0.7	34	20.9–43.1

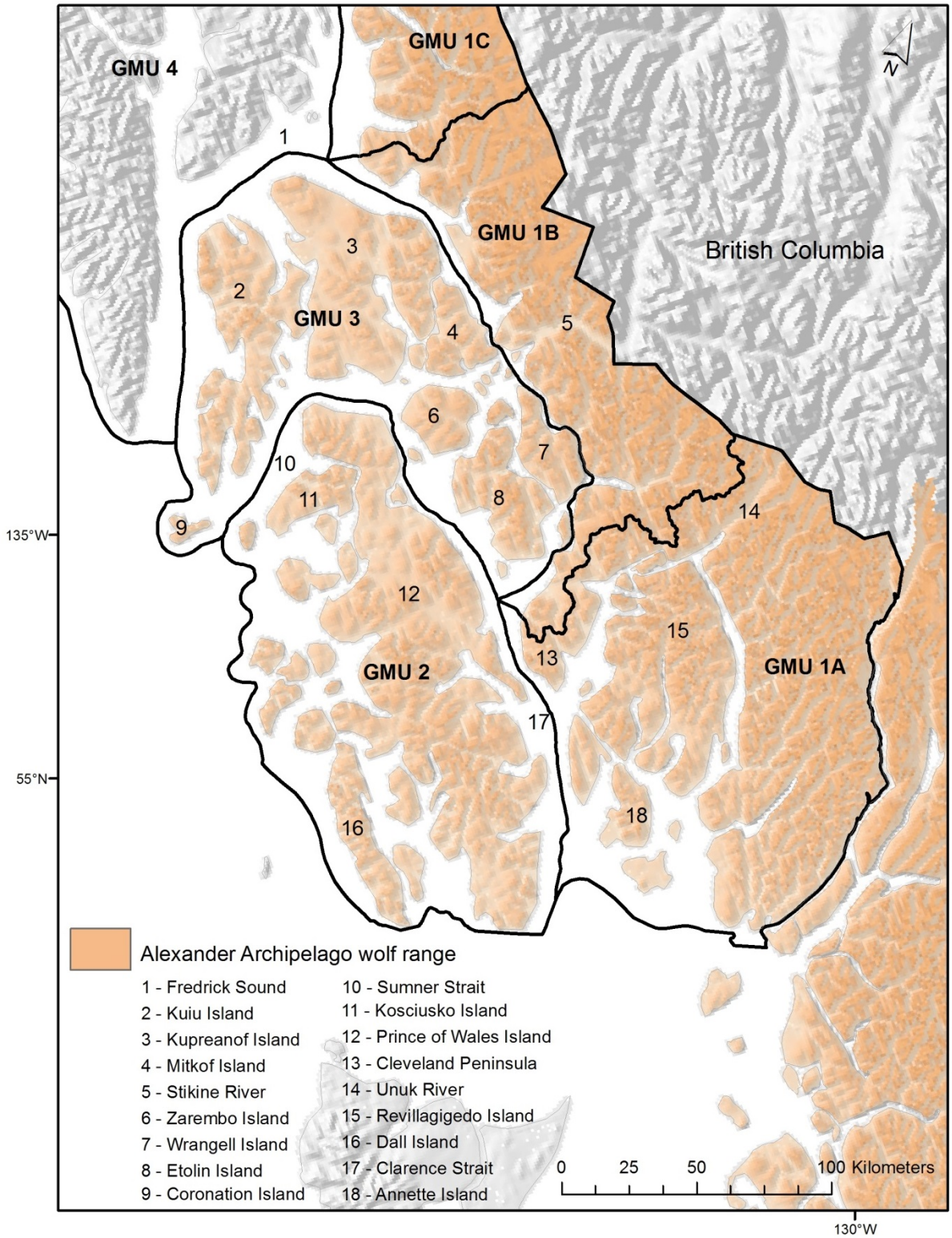

Figure 2. Range of the Alexander Archipelago wolf by Game Management Unit (GMU) in the southern portion of southeastern Alaska.

2.2. Taxonomy

The taxonomy of wolves in North America, including the recognition of *C. l. ligoni* as a subspecies, is a complex topic that has been debated for decades. Chambers et al. (2012) contains the most recent and comprehensive review of the taxonomy of wolves in North America. Although, the authors' interpretation of subspecific groupings has been contested (National Center for Ecological Analysis and Synthesis [NCEAS] 2014; see Uncertainty of taxonomic status), we found the review and references therein to be a valuable resource describing key morphological and genetic analyses. We refer the reader to Chambers et al. (2012) for a detailed account of taxonomy of North American wolves.

For the purpose of this assessment, we assume that the Alexander Archipelago wolf, *C. l. ligoni*, is a subspecies of gray wolf, although we recognize the uncertainty associated with this designation (see *Uncertainty of taxonomic status*). Nonetheless, we believe persuasive evidence exists in the literature suggesting that wolves in southeastern Alaska and coastal British Columbia are an ecological and genetic unit worthy of analysis under the Act. We recognize that zones of intergradation between coastal and interior continental wolves exist and that they probably are dynamic and may be substantial in size, especially in areas where few physical barriers to wolf movement are present (e.g., southern portion of coastal British Columbia) or where major river valleys facilitate movement (e.g., northern portion of southeastern Alaska). Below, we summarize morphological and genetic information on the Alexander Archipelago wolves with an emphasis on recent studies.

2.2.1. Morphometric analyses

Goldman (1937, pp. 39–40) was the first to propose the Alexander Archipelago wolf as a subspecies of the gray wolf (*C. lupus*). He described *C. l. ligoni* as a dark colored subspecies of medium size and short pelage that occupied the Alexander Archipelago and adjacent mainland of southeastern Alaska, northward along the Pacific Ocean coast to Yakutat Bay. Goldman (1944) later described 23 wolf subspecies in North America, including *C. l. ligoni*, and shortly thereafter Hall and Kelson (1952) described 24 subspecies of gray wolf.

As researchers developed more sophisticated and powerful tools for understanding morphological variation (e.g., multivariate discriminant analysis), wolf taxa in Alaska and North America tended toward consolidation. Jolicouer (1959, p. 298) examined pelage coloration and skull measurements of wolves in western North America and deemed it probable that "far too many subspecific designations were in use." Pedersen (1982) then analyzed morphological data from four populations of wolves in Alaska that were recognized as subspecies by Goldman (1944) and proposed two phenotypically distinct subspecific groups, *C. l. ligoni* in southeastern Alaska and *C. l. pambasileus* in interior and southcentral Alaska (pp. 345, 360). Friis (1985) concluded that wolves in southeastern Alaska were morphologically similar to wolves that historically occupied coastal British Columbia, Vancouver Island and the contiguous western United States, although her study included only eight samples from coastal British Columbia. She found "no evidence to justify separation of *C. l. ligoni* as a distinct subspecies confined to the Alaska panhandle," and suggested that perhaps instead the southern boundary of the "*ligoni*" group should be extended southward.

Concurrently, Nowak (1983) suggested a consolidation of wolf taxa in North America into five "groups" based on a review of the literature and bivariate analysis of two skull measurements. Like Friis (1985), he also suggested that wolves in southeastern Alaska showed an affinity to wolves that historically occupied the mountains and plains of the western United States, the Great Lakes region, the Pacific coast of the United States, and southwestern Canada (Nowak 1983). Later, Nowak (1995, p. 375) conducted a more comprehensive multivariate analysis of 10 measurements of 580 skulls of modern adult male wolves and proposed a revised taxonomy for wolves in North America that recognized five subspecies of gray wolf (*C. l. arctos*, *C. l. baileyi*, *C. l. lycaon*, *C. l. nubilus*, and *C. l. occidentalis*). In this taxonomic revision, he combined *C. l. ligoni* with *C. l. nubilus*, a subspecies he believed was formerly distributed from the western coasts of the United States and Canada east to the Great Lakes region and north through central and northeastern Canada (p. 396).

More recently, Chambers et al. (2012) reviewed morphological and genetic analysis of North American gray wolves and concluded that three (*C. l. baileyi*, *C. l. nubilus* [including *C. l. ligoni*], and *C. l. occidentalis*) subspecies are valid with a possible fourth subspecies (*C. l. arctos*), but too few data exist to verify its legitimacy; the authors also determined that *C. l. lycaon* is a full species (*C. lycaon*). In this latest review, *C. l. ligoni* again was grouped with and referred to as *C. l. nubilus* (Chambers et al. 2012, p. 1; see *Uncertainty of taxonomic status*).

We emphasize that our description of morphological analyses contains only the key studies related to taxonomy of wolves in southeastern Alaska and coastal British Columbia. We found others (e.g., Hall 1981), but these studies do not add significantly to the information presented above.

2.2.2. Genetic analyses

Since 1997 when the last status assessment was completed for Alexander Archipelago wolf (62 FR 46710, September 4, 1997), several molecular ecology studies have been conducted on wolves from southeastern Alaska and coastal British Columbia. All of these studies measured neutral genetic variation, which has no direct effect on fitness, but is useful for investigating processes such as gene flow or dispersal. We are not aware of any studies that have examined adaptive genetic variation, or the potential to adapt to local conditions, of wolves in this region.

Researchers have used both mitochondrial DNA (mtDNA) and nuclear DNA markers to investigate neutral genetic variation of the Alexander Archipelago wolf (Table 2). The scope of inference of these studies and their value to informing taxonomy depends on the type of genetic marker used and the spatial and temporal extent of the samples analyzed. Generally, mtDNA is useful for questions related to phylogeny (e.g., evolutionary relationships among groups of organisms, detecting hybridization, tracing maternal lineages) and nuclear DNA (e.g., microsatellite, single nucleotide polymorphisms [SNPs]) is well suited for traditional population genetic studies (e.g., measuring genetic variation, determining population structure; for a review of genetic concepts and tools, see Mills 2013, pp. 33–53). Below, we summarize key genetic studies of wolves in southeastern Alaska and coastal British Columbia that are relevant to taxonomy, specifically *C. l. ligoni*; see Genetic connectivity for a more detailed discussion of genetic structuring and gene flow within the range of the Alexander Archipelago wolf.

Table 2. Key genetic studies of wolves in southeastern Alaska and British Columbia that generated new data (i.e., not meta-analyses or reinterpretations of existing data) using mitochondrial DNA (mtDNA), microsatellite, and single nucleotide polymorphism (SNPs) markers.

		Source of samples		
Study	Type of marker	Southeastern Alaska	Coastal British Columbia	Continental North America
Shields 1995	mtDNA	Yes	No	Yes
Weckworth et al. 2005	Microsatellite	Yes	No	Yes
Breed 2007	Microsatellite	Yes	Yes	No
Munoz-Fuentes et al. 2009	mtDNA	No	Yes	Yes
Weckworth et al. 2010	mtDNA	Yes	No	Yes
Von Holdt et al. 2011	SNPs	No	Yes	Yes
Weckworth et al. 2011	mtDNA	Yes	Yes	Yes
Cronin et al. 2015a	SNPs	Yes	No	Yes

Mitochondrial DNA.—Shields (1995, pp. 6, 11) conducted the first genetic study of the Alexander Archipelago wolf by analyzing mtDNA. Based on a single fixed allelic substitution in 28 of 29 wolves sampled in southeastern Alaska, he concluded that these wolves (assumed to be *C. l. ligoni*) were genetically distinct from wolves in interior Alaska and Yukon Territory, Canada (n=9; pp. 6, 9, 11). Within southeastern Alaska, Shields (1995, pp. 7–8) found considerable genetic variability among wolves, but did not find geographic structure indicating that genetically unique subpopulations of wolves occurred on individual islands in the archipelago. Since this foundational study, three additional studies using mtDNA confirmed that coastal wolves in southeastern Alaska and coastal British Columbia appear to be genetically differentiated from interior continental wolves (Munoz-Fuentes et al. 2009; Weckworth et al. 2010; Weckworth et al. 2011).

Munoz-Fuentes et al. (2009, p. 5) sampled 160 wolves in British Columbia and found eight distinct haplotypes, one of which was absent in inland wolves, five were absent in coastal wolves, and only two were shared; coastal wolves were the only sampled population across northwestern North America to have an endemic haplotype with a frequency greater than 5% (p. 9). Pairwise fixation indices (Φ_{ST}), or the relative magnitude of gene differentiation among subpopulations (Nei 1987, p. 190), between coastal and inland British Columbia was 0.242 and between coastal British Columbia and elsewhere in North America was greater than 0.410 (p. 9). The authors found that habitat (coastal, interior) explained most (21%) of the genetic variation among wolf populations in their sample (p. 8; Figure 3), suggesting that ecological factors may be driving differentiation of wolves. Munoz-Fuentes et al. (2009, p. 9) also determined that coastal wolves were more differentiated from *C. l. occidentalis* (samples from Alaska, Alberta, and Northwest Territories; Φ_{ST}=0.305) and *C. l. nubilus* (historical samples from Leonard et al. 2005; Φ_{ST}=0.550) than *C. l. occidentalis* and *C. l. nubilus* were from each other (Φ_{ST}=0.125).

Weckworth et al. (2010, p. 366) analyzed mtDNA from a large sample of wolves from southeastern Alaska (n=130), interior continental North America (n=173), and Russia (n=4) and reported results similar to Munoz-Fuentes et al. (2009). Seventeen haplotypes were identified

with four restricted to Russian individuals, two to wolves from southeastern Alaska, and nine found only in the continental group; two haplotypes were shared between the coastal group of southeastern Alaska and the continental group (Weckworth et al. 2010, p. 367). Subdivision of North American wolves into coastal and continental groups explained 56% of the genetic variation (p. 368; Figure 3). The authors reported mtDNA pairwise population estimates of Φ_{ST} within the coastal group to range from 0.00 to 0.47 and between the coastal and continental groups to be between 0.32 and 0.97 (p. 370).

Lastly, Weckworth et al. (2011, p. 2) conducted the most comprehensive analysis of mtDNA from wolves in southeastern Alaska (n=130) and coastal British Columbia (n=75) and compared results to wolves from continental North America (n=102). Twenty haplotypes were recorded, including some from extirpated regions; three haplotypes were restricted to coastal British Columbia and southeastern Alaska with two of them shared and one found only in southeastern Alaskan wolves. The most common haplotype found in the coastal region was shared with wolves in interior British Columbia (pp. 2–3). When divided into coastal and continental groups, 51% of the genetic variation was explained (p. 5; Figure 3). Pairwise population comparisons indicated some genetic structuring within the coastal group, but the pattern was complex and did not conform to an isolation-by-distance pattern; for example, populations in southeastern Alaska were more similar to Vancouver Island than they were to one another (Figure 3 on p. 6). Generally, however, island populations were differentiated from one another and the mainland, but differences were not always statistically significant (pp. 4–5). The authors concluded that coastal lineages of wolves in southeastern Alaska and coastal British Columbia are distinct from North American continental wolves (p. 5), corroborating mtDNA results of Munoz-Fuentes et al. (2009) and Weckworth et al. (2010).

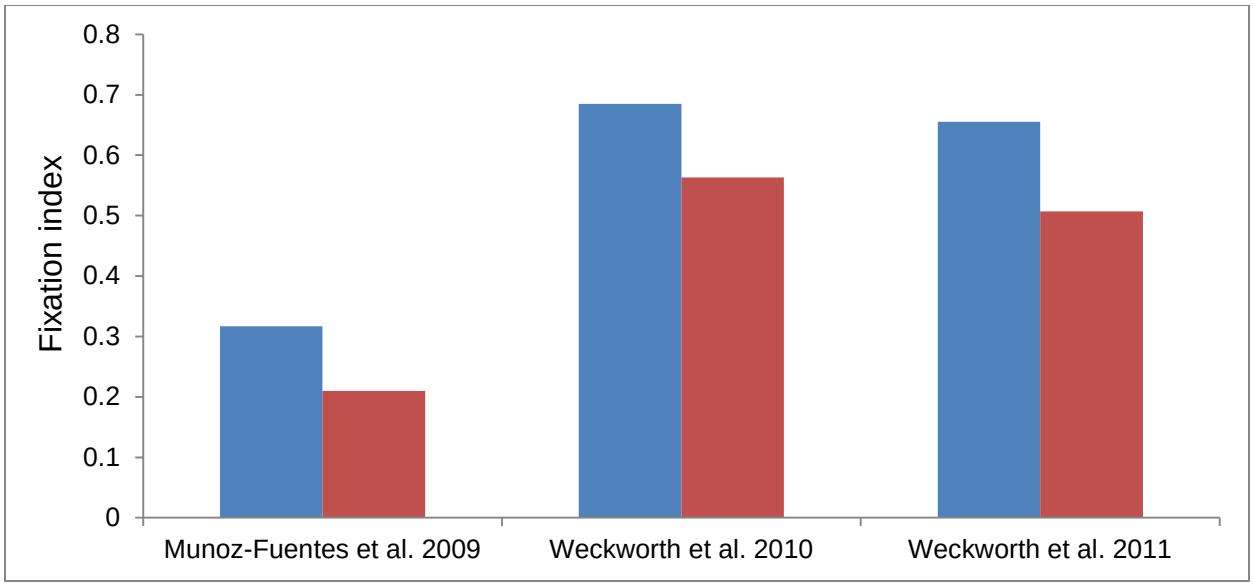

Figure 3. Estimates of Φ_{ST} (blue bars) and Φ_{CT} (red bars) from three studies of mitochondrial DNA variation in coastal and inland wolves from northwest North America. Here Φ_{ST} is the proportion of the total genetic variation that is explained by differences among all populations (overall population structure) and Φ_{CT} is the proportion of the total genetic variation explained by differences between the coastal and continental population groups (between group population structure). Source studies are Munoz-Fuentes et al. (2009, p. 8), Weckworth et al. (2010, p. 369), and Weckworth et al. (2011, p. 5). Results of all three studies demonstrate that most of the genetic variation among wolves sampled was explained by the coastal and continental groupings.

Nuclear DNA.—Weckworth et al. (2005) was the first to examine nuclear DNA of the Alexander Archipelago wolf. Based on microsatellite markers of 101 wolves from southeastern Alaska and 120 wolves from interior continental populations (p. 919), they found that coastal wolves appear to be geographically isolated from continental wolves (p. 924). Mean number of alleles per locus was 5.00 in the coastal group and 7.09 in the continental group; continental populations had a higher frequency of private alleles (4.60 alleles per population) than the southeastern Alaskan population (1.25), although these alleles were restricted to single individuals (p. 921). Within southeastern Alaska, two distinct clusters emerged from an assignment test, one on POW and the other encompassed the remainder of the area (pp. 923, 926). Pairwise estimates of the fixation index (F_{ST}) between POW and three other coastal populations ranged from 0.10 to 0.20, yet F_{ST} values among these three coastal populations were smaller (range=0.02–0.06; p. 923).

Shortly thereafter, Breed (2007) conducted a similar study using microsatellite markers, but included samples of wolves from southeastern Alaska and British Columbia only. The authors considered three "management units" in their analysis, POW (n=45 wolves), mainland coastal Alaska (n=31), and coastal British Columbia (n=42), which served as a control (p. 7). Mean number of alleles ranged from 3.85 on POW to 5.54 in coastal British Columbia (p. 17); POW displayed only two private alleles followed by mainland southeastern Alaska with four and coastal British Columbia with 18 private alleles (79 alleles total across all three units; p. 18). Pairwise F_{ST} values were 0.09 between coastal British Columbia and mainland southeastern Alaska, 0.12 between POW and mainland southeastern Alaska, and 0.15 between coastal British Columbia and POW (p. 19). Assignment tests suggest that two clusters (i.e., management units;

coastal British Columbia and southeastern Alaska) may be more appropriate than three clusters (p. 21).

In recent years, researchers began using SNPs and next-generation sequencing to understand population structure. SNPs are single base variants in DNA that can be used, like microsatellites, to evaluate differences among individuals, populations, and species. Von Holdt et al. (2011) analyzed SNPs of wolf-like species worldwide, including a few samples from coastal British Columbia. Although this study was well beyond the spatial extent of our assessment of Alexander Archipelago wolves, the authors found that wolves on the British Columbian coast formed a genetically distinct population when compared to wolves and their relatives globally (p. 1297, Supplemental Table S5).

Cronin et al. (2015a) led the first genetic study using SNP genotyping that focused on wolves from southeastern Alaska. Their sample included 138 individual wolves from southeastern Alaska (n=6 populations), 35 from British Columbia (although only one wolf from the coastal area; n=1 population), and 132 from continental North America (including eight wolves from New Mexico where *C. l. baileyi* occurs; n=6 populations); additional samples of coyote (*C. latrans*) and dog (*C. familiaris*) were included in the analysis for context (p. 3). Among wolf populations, pairwise F_{ST} values were the lowest comparing populations in Wyoming and Idaho (0.012) and highest comparing populations in New Mexico and GMU 2 (0.390; Supplemental Table 3 to Cronin et al. 2015a). Mean F_{ST} between southeastern Alaska and British Columbia was 0.120 (p. 7). Within southeastern Alaska, F_{ST} values between populations (by GMU) ranged between 0.034 (GMUs 1B and 3) and 0.281 (GMUs 1D and 2; Supplemental Table 3 to Cronin et al. 2015a). The authors stated that genetic variation observed among wolf populations in southeastern Alaska was equivalent to or surpassed variation between other populations in continental North America (p. 8). Generally, results of Cronin et al. (2015a) were similar to other studies of the Alexander Archipelago wolf described above, although interpretations of results differed; most notably, the authors determined that *C. l. ligoni* is not a valid subspecies of the gray wolf (see *Uncertainty of taxonomic status*).

We note that many other genetic studies, meta-analyses, and taxonomic interpretations of wolves in North America and beyond exist, but are not described above (e.g., Carmichael et al. 2007, 2008; Knowles 2010). For brevity, we included only the key genetic studies specific to the Alexander Archipelago wolf.

2.2.3. Other relevant analyses

In addition to morphological and genetic analyses, we reviewed ecological and behavioral traits of Alexander Archipelago wolves and compared them with those of other gray wolf populations. We found that coastal wolves exhibit uncommon behaviors such as feeding on salmon (*Oncorhynchus* spp.) and other marine prey when available (although see *Food habits*, and Adams et al. 2010) and occupying home ranges that include marine habitat, requiring them to swim regularly among islands in the archipelago (Szepanski et al. 1999, p. 331; Munoz-Fuentes et al. 2009, p. 10, and references therein; Stronen et al. 2014, p. 1; see *Ecology* for detailed descriptions). Additionally, researchers have hypothesized that coastal wolves may have evolved to resist disease associated with marine food resources, potentially restricting movements between inland and coastal habitats (Darimont et al. 2003, p. 352; Darimont et al. 2008, pp. 9–

10; also see *Disease*). These traits alone probably would not meet taxonomic standards, but when combined with morphological and genetic analyses they serve as supporting evidence that wolves occupying southeastern Alaska and coastal British Columbia form a distinct group of populations with unusual and shared characteristics.

2.2.4. Uncertainty of taxonomic status

In this assessment, we assume that *C. l. ligoni* is a valid subspecies, although we acknowledge uncertainty associated with this assumption. We emphasize here that uncertainty in subspecies designations nearly always exists, largely because we lack a universally accepted subspecies definition (Haig et al. 2006, p. 1586). For *C. l. ligoni*, we found this to be the case with most of the uncertainty stemming from different interpretations of the same or similar data.

Cronin et al. (2015a, p. 9) concluded that wolves in southeastern Alaska do not comprise a genetically homogenous group and are not genetically isolated from other gray wolf populations and therefore do not qualify as a subspecies. This conclusion was challenged by Weckworth et al. (2015, p. 2) who argued that subspecies should not be defined on the basis of complete reproductive isolation; instead, subspecies should be viewed as groups of populations that are distinguishable and restricted to a geographic region where characters could overlap and interbreeding with adjoining subspecies may occur to a small degree. Weckworth et al. (2015, p. 2) stated that regardless of whether *C. l. ligoni* was recognized as a subspecies or not, a large set of characters (morphological, behavioral, and ecological) and genetic traits demonstrate that coastal wolves are distinctive from interior continental wolves, and that coastal wolf populations harbor a large amount of genetic variation of remaining North American wolf populations. Cronin et al. (2015b, pp. 2–3) responded to Weckworth et al. (2015) defending their conclusion that too much genetic variation exists among wolf populations in southeastern Alaska and between other wolf populations to justify a coastal subspecies of gray wolf.

Similarly, in the most recent meta-analysis of taxonomy of North American wolves, Chambers et al. (2012) proposed five subspecies of gray wolf not including *C. l. ligoni*. Instead, the authors grouped wolves in southeastern Alaska and coastal British Columbia with wolf populations in central and western United States, *C. l. nubilus* (pp. 9, 40–41). Their reasoning was that wolves in southeastern Alaska and coastal British Columbia had haplotypes both unique to the region and shared with historical samples from wolves in Kansas, Nebraska, and the western United States (p. 41). The authors then hypothesized that coastal wolves were a northward extension of *C. l. nubilus* prior to extirpation of that subspecies in inland portions of the western United States (pp. 41–42). Chambers et al. (2012, p. 41) postulated that the large proportion of unique, and apparently extinct, haplotypes in the historical sample of *C. l. nubilus* (Leonard et al. 2005, pp. 13–15) likely exaggerated the measure of divergence between the coastal populations and historical inland *C. l. nubilus* (Munoz-Fuentes et al. 2009, p. 9). The grouping of coastal wolves with *C. l. nubilus* has been contested by several recognized experts that believe wolves in southeastern Alaska and coastal British Columbia are ecologically and genetically distinct and warrant recognition as a distinct group (NCEAS 2014, pp. 10, 14, 17, 47–49, 61). The basis of these contentions generally lies with the lack of a universally accepted definition of subspecies and the history of gray wolf populations in North America. An evaluation of the taxonomy proposed by Chambers et al. (2012) and the arguments against it (detailed in NCEAS 2014) is beyond the scope of this document, yet we acknowledge the uncertainty and continued scientific

debate associated with the subspecific designation of wolves in southeastern Alaska and coastal British Columbia.

In summary, we recognize that the science informing taxonomy of wolves in North America is evolving and that some researchers have conflicting opinions, particularly on subspecific designations. However, for the purpose of this assessment, we believe that persuasive evidence exists suggesting that wolves in southeastern Alaska and coastal British Columbia are an ecological and genetic unit worthy of analysis under the Act.

2.3. Distribution

The Alexander Archipelago wolf occurs along the mainland of southeastern Alaska and coastal British Columbia west of the Coast Mountains and on larger islands except Admiralty, Baranof, and Chichagof islands and all of the Haida Gwaii, or Queen Charlotte Islands (Person et al. 1996, p. 1; BCMO 2014, p. 14; Figure 1). Its range is approximately 219,101 km^2 (Appendix I), stretching roughly 1,500 km in length and 250 km in width. The northern, eastern, and southern boundaries of its range are porous and therefore are not defined sharply or with certainty.

In southeastern Alaska, wolves occur throughout the mainland and on most of the islands south of Frederick Sound (GMUs 1, 2, 3, and 5A; Figure 4), excluding Coronation, Forrester, and the smaller, more isolated islands without an adequate prey base (Person et al. 1996, p. 1; MacDonald and Cook 2007, p. 71; Figure 2). Only the largest islands such as POW, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, and Dall islands likely support wolves consistently over time (Person et al. 1996, p. 1); for example, within GMU 2, only the three largest islands (POW, Kosciusko, and Dall; Figure 2) are known to have been continuously occupied by wolves for more than 20 years (Person and Ingle 1995, p. 10). Wolves were experimentally introduced to Coronation Island in 1960 and 1963, but died out by the early 1970s, presumably due to starvation (Klein 1995, p. 280; Paul 2009, p. 112). MacDonald and Cook (2007, p. 71) report no substantiated records of wolves from any of the islands north of Fredrick Sound, although ADFG has records of them on Douglas Island near Juneau and Sullivan Island near Haines (ADFG 2015a, p. 2). On the mainland, the distribution of wolves probably is limited by icefields and high-elevation rugged terrain, even though they use these habitats occasionally (ADFG 2015a, p. 2); in addition, wolves occur within the six primary river drainages (Alsek, Chilkat, Taku, Whiting, Stikine, and Unuk rivers; Figure 2) that penetrate the Coast Mountains connecting interior British Columbia and southeastern Alaska. Thus, we expect that these areas serve as intergradation zones between the Alexander Archipelago wolf and its continental counterpart.

In coastal British Columbia, wolves occur continuously along the mainland and on all islands (Darimont and Paquet 2002, p. 418; Figure 1), including Vancouver Island where they possibly were extirpated between 1950 and 1970 (Munoz-Fuentes et al. 2010, pp. 547–548). On the mainland, wolves generally are restricted to a narrow coastal zone, but also occupy the few major river systems that connect interior and coastal British Columbia such as the Nass, Skeena, Dean, and Fraser rivers (Figure 1). Alexander Archipelago wolf populations south of the Dean River probably intermix more regularly with other gray wolves than their northern counterparts and therefore the southern part of coastal British Columbia likely is an intergradation zone (Figure 1; Weckworth et al. 2011, pp. 2, 4).

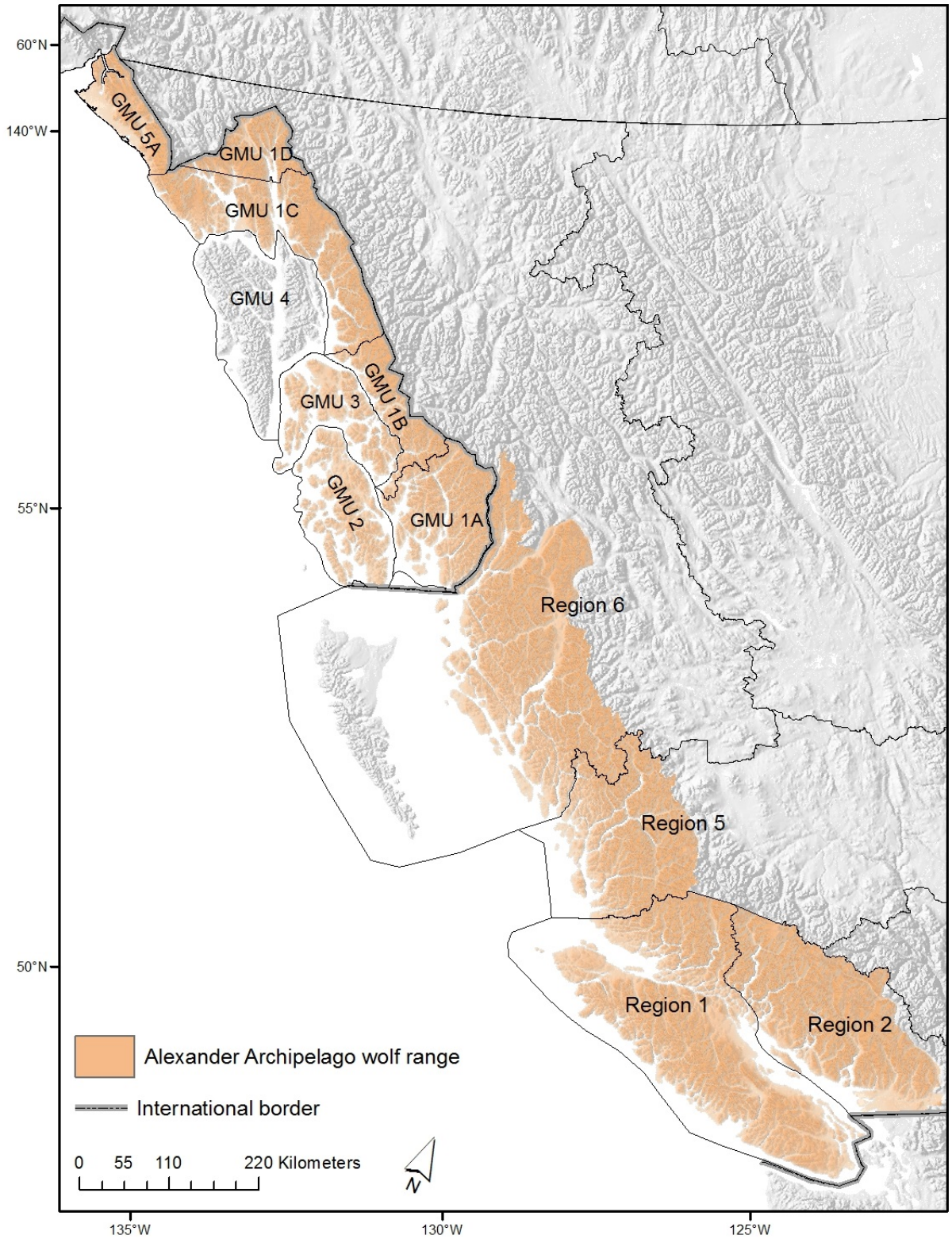

Figure 4. Game Management Unit (GMU) boundaries in southeastern Alaska and Region boundaries in British Columbia that are within the assumed range of the Alexander Archipelago wolf. These boundaries were used in this assessment to define a population of wolves.

CHAPTER 3: LIFE HISTORY AND ECOLOGY (INDIVIDUAL AND WITHIN-POPULATION LEVELS)

For this assessment, we consider a population to be a collection of individuals of a species in a defined area; the individuals in a population may or may not breed with other groups of that species in other places (Mills 2013, p. 3). Therefore, we defined populations of wolves in southeastern Alaska by GMU (including subunits) and in British Columbia by Region because these are defined areas and wolf populations are managed at these spatial scales (Figure 4). For example, GMU 2 comprises one population of wolves on POW and adjacent islands. In this chapter, we describe the life history and ecology of wolves at the individual and within-population levels; see *Chapter 4* for information on dynamics of multiple populations.

3.1. Vital rates

3.1.1. Abundance and trend

Estimating wolf abundance and densities in the temperate rainforests of southeastern Alaska and British Columbia is challenging. Researchers have attempted to generate population estimates using direct methods such as radio-collaring wolves (e.g., Person 2001, pp. 33, 55–70), non-invasive methods such as genetic analysis of hair samples (e.g., ADFG 2014, p. 1), and habitat- or prey-based methods (e.g., BCMO 2014, pp. 5–6). Additionally, managers typically use local knowledge and anecdotal information on wolves in their areas to estimate population size, although these estimates are qualitative and their accuracy is unknown. See Fuller et al. (2003, pp. 165–169) and Boitani (2003, pp. 322–323) for population, density and trend estimates of gray wolf populations worldwide.

Southeastern Alaska.—In southeastern Alaska, the only field-derived, empirical population estimates for wolves exist for POW and the surrounding islands (i.e., GMU 2) where an intensive field study has been conducted almost continuously since the early 1990s. Person and Ingle (1995, p. 11) generated the first estimate by locating Very High Frequency (VHF) radio-collared wolves regularly to determine number of packs, pack size and home range size; they estimated the wolf population on POW and neighboring Kosciusko Island to be 321 (SE=135) during fall 1994, and 199 (SE=111) during spring 1995. Person et al. (1996, p. 11) used a different analytical approach with the same data to estimate the wolf population on POW and Kosciusko as 217 (SE=65) in fall 1994. The authors concluded that the average of the two fall estimates (N=269, SE=80) probably was the “best” wolf population estimate for the two islands (p. 11) and, when extrapolated to nearly all of GMU 2 (8,510 km^2), the population was estimated to be 336 (SE=100) wolves in fall 1994 (p. 12). As part of the same study and using similar methods, in fall 2003, the wolf population in nearly all of GMU 2 was estimated as 326 wolves (SE=75; ADFG 2009, p. 32). Thus, the accepted population estimates for nearly all of GMU 2 were 336 (SE=100) wolves for fall 1994 and 326 (SE=75) wolves for fall 2003.

A decade later with more laboratory and field techniques to study wildlife, researchers developed and tested new methods for estimating wolf abundance on a portion of POW. The goal was to identify a more efficient, cost effective approach compared to radio-telemetry that could be applied broadly in GMU 2 as well as the rest of southeastern Alaska. To allow for reliable comparisons with previous efforts, researchers aimed to radio-collar wolves again, but with downloadable Global Positioning System (GPS) collars as opposed to VHF collars, and to use

hair snare traps as a method for collecting wolf hair for genetic analyses. Following a pilot year in 2012, the wolf population in all of GMU 2 (9,069 km^2) was estimated using genetic capture-recapture methods from a sample on a portion of POW to be 221 (95% CI=130–378) wolves in fall 2013 (ADFG 2014, p. 2) and 89 (95% CI=50–159) in fall 2014 (ADFG 2015b, p. 2). Between 2012 and May 2015, too few wolves (n=12) were captured for radio-collaring to permit useful comparisons between techniques (ADFG 2015a, p. 4; ADFG 2015c, p. 10).

Comparison of wolf density and population estimates for GMU 2 across years is possible, but not straight-forward. First, different techniques were used to derive the four available density estimates. Both VHF telemetry and genetic capture-recapture have associated assumptions and potential sources of bias associated with them (e.g., sightability bias, independence of encounters). Second, field efforts in all four years occurred on a portion of POW only and, although the same general study area (i.e., north central POW) was used, the size of the actual study area varied (Table 3), but always overlapped. Third, density estimates initially were not extrapolated to the same area of GMU 2; the 1994 and 2003 estimates were based on an area of 8,510 km^2 and estimates in 2013 and 2014 were based on an area of 9,025 km^2. Recently, researchers performed spatial conversions to allow for comparisons of density and population estimates across years, assuming that the individual point estimates are statistically valid and accurate (Table 3; ADFG 2014, pp. 2–4). When extrapolating density estimates uniformly, it also is necessary to assume that differences in habitat, prey densities, territoriality, and other factors known to influence wolf abundance are the same or reflect the average (i.e., are not disproportionate) across GMU 2. Acknowledging all of these assumptions and caveats, the GMU 2 wolf population declined by 75% (SE=15), or 6.7% (SE=2.8) per annum, between 1994 and 2014, although the confidence intervals of the four point estimates overlap; the steepest decline occurring over a single year (2013–2014) when the population was reduced by 60% (Table 3). We note here that even the lowest density estimate of Alexander Archipelago wolf in GMU 2 (9.9 wolves/1,000 km^2) is not particularly low by most standards for Alaska or elsewhere in North America (Fuller et al. 2003, pp. 167–169).

Table 3. Estimated fall densities of wolves within overlapping study areas of varying size across years and extrapolated population estimates and associated standard errors for Game Management Unit (GMU) 2 (size=9,025 km^2).

Year	Primary estimation method	POW study area		GMU 2 population	
		Size (km^2)	Density (wolves/1,000 km^2)	Estimate	95% confidence interval
1994[1,2]	VHF telemetry	4,014[3]	39.5	356	148–564[4]
2003[2,5]	VHF telemetry	unknown	38.0	345	190–500[4]
2013[6]	genetic capture-recapture	1,683	24.5	221	130–378
2014[6]	genetic capture-recapture	3,280	9.9	89	50–159

[1]Person et al. 1996, pp. 11–12; [2]ADFG 2014, pp. 2–4; [3]As described in Person 2001, p. 31, but size of trap area unknown; [4]Estimates derived from reported standard errors (reported in text) to be consistent with 2013 and 2014; [5]ADFG 2009, p. 32; [6]ADFG 2015b, pp. 1–2.

Outside of GMU 2, few quantitative data on population size, trend, and densities from field studies are available. ADFG Management Reports summarize information from biologists, trappers, hunters, and other resource users, although these reports are based on observations only. With that caveat stated clearly, in the most recent ADFG Management Report (spanning 2008–2011), ADFG (2012, pp. 10, 41) stated that 45–85 wolves in eight packs occupied GMU 1B and 125–385 wolves in 23 packs occupied GMU 3; wolf populations in both of these GMUs are thought to be at higher densities than the early 1990s because of increased moose (*Alces americanus*; GMU 3) and Sitka black-tailed deer (*Odocoileus hemionus sitkensis*; GMU 1B) numbers. In GMUs 1A and 1D, wolf populations apparently are stable (ADFG 2012, pp. 2, 24), and in GMUs 1C and 5A, they are thought to be increasing probably because of increasing moose abundance (ADFG 2012, pp. 18, 48). We reiterate here that these assessments are based on anecdotal information, not survey data or scientific investigations.

Kirchhoff (1994a) summarized density estimates by GMU, but their accuracy is unknown. He reported that Alexander Archipelago wolves apparently attain their highest densities in the southern portion of southeastern Alaska in GMUs 1A and 2, including POW, Revillagigedo Island, and the Cleveland Peninsula, with 16–22 wolves/1,000 km^2 (p. 5); this estimate was lower than that empirically estimated at a similar time for POW and Kosciusko Island (39.5 wolves/1,000 km^2; Table 3), which was comparable with densities for other wolf populations where deer are the primary prey (see Table 1 in Person et al. 1996, p. 13). Kirchhoff (1994a, p. 5) estimated wolf densities on Kuiu, Kupreanof, Mitkof, Wrangell, Zarembo, Etolin, and associated islands (i.e., GMU 3) to be 8 wolves/1,000 km^2, and to be the least on the mainland of southeastern Alaska (5 wolves/1,000 km^2).

We are aware of only one effort to estimate the size of the wolf population as a whole in southeastern Alaska. Using a model linking wolf abundance to habitat capability for deer and other prey (moose, mountain goat [*Oreamnos americanus*]), Suring et al. (1993) estimated that wolves in GMU 2 represent about 37% of the total wolf population in southeastern Alaska, followed by GMU 1 (33%), GMU 3 (28%), and GMU 5A (2%); presented in Person et al. 1996, p. 13). Based on the GMU 2 proportion estimate and their own empirically derived estimates of wolf population size on POW, Person et al. (1996, p. 12) estimated the fall 1994 population in southeastern Alaska to be 908 (SE=216) individuals. The authors noted that the large standard error of this estimate was an underestimate of the true error because the model used to estimate the number of wolves from habitat capability for deer provided no estimate of variance. Using this population estimate for southeastern Alaska, we estimated the number of wolves in each GMU based on the allocations from Suring et al. (1993; Table 4) and applied the overall coefficient of variation to individual estimates to calculate variance. We acknowledge the uncertainty associated with these estimates, but to the best of our knowledge, they represent the only wolf population estimates available for all GMUs except GMU 2 (see Table 3), which we included here for comparison and completeness. We urge caution in interpreting these numbers as absolute because they are based on outdated habitat capability of prey and do not take other factors into account (e.g., wolf harvest and density, territoriality; e.g., Cubaynes et al. 2014).

Table 4. Estimated wolf population size by Game Management Unit (GMU) and subunits (gray shaded area) derived from habitat capability models of deer, moose, and mountain goat developed in the early 1990s, southeastern Alaska (Suring et al. 1993; as presented in Person et al. 1996, p. 13); GMU-specific estimates were based on a total estimate of 908 wolves (SE=216) in southeastern Alaska (Person et al. 1996, p. 12).

GMU	Percent of southeastern Alaska wolf population	Derived population estimate	95% confidence interval	
			Lower	Upper
1 (all)	33	300	160	439
1A	20	182	97	266
1B	8	73	39	107
1C/1D	5	45	24	67
2[1]	37	336	179	493
3	28	254	136	373
5A	2	18	10	27

[1]More recent field-derived estimate available; see Table 3.

British Columbia.—We found only one population estimate specific to coastal wolves in British Columbia, although it is more than 15 years old. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2001, p. 38) estimated that roughly 2,200 wolves occupy the Pacific Ecological Area. However, we found two more recent population estimates for wolves in the entire province of British Columbia, which includes both coastal (*C. l. ligoni*) and interior wolves (*C. l. nubilus*). Based on prey densities (moose, deer) and local knowledge, low and high density areas of wolves were delineated throughout British Columbia (BCMO 2014, p. 5). Then, using density estimates of wolves in other parts of Canada and neighboring Alaska, low density areas were assigned a range of 2–5 wolves/1,000 km^2 and high density areas were estimated to have 5–15 wolves/1,000 km^2 (pp. 5–6). When extrapolated, the provincial population of wolves was estimated as 4,700–11,400 individuals (p. 7). Kuzyk and Hatter (2014) applied a more empirical approach that used ungulate biomass to estimate abundance of wolves in British Columbia. Regional ungulate population surveys were used to estimate biomass, which then was included in a regression model to predict wolf abundance for 2000, 2003, 2008, and 2011 (p. 879). The most recent provincial population estimate was 8,688 (95% CI=5,898–11,760) wolves, indicating a slight but consistent trend upward since 2000 when the estimate was 7,213 (95% CI=4,977–9,696) wolves (p. 881). Because these estimates are more recent, we used them in our assessment after making adjustments to reflect the coastal population of wolves only (i.e., Alexander Archipelago wolves).

By multiplying regional wolf population estimates by the proportion of the region that fell within the range of the Alexander Archipelago wolf, we generated population estimates for coastal British Columbia (Table 5). Using the wolf density approach (BCMO 2014), we estimated that 691–1,688 wolves occupy coastal British Columbia and, using results of Kuzyk and Hatter (2014), we calculated a mean population estimate of 875 wolves (range=597–1,183). We suspect that the latter estimate may be biased slightly high because wolves on the coast primarily eat deer and to a lesser extent mountain goats, which have lower biomass values (0.75 and 1, respectively) compared to moose (biomass value=6), the primary prey item of wolves in interior

British Columbia (Darimont et al. 2004, p. 1871; Kuzyk and Hatter 2014, p. 880). Though, moose are expanding their range into coastal British Columbia (Darimont et al. 2005, p. 235) and have been detected in wolf scats found on the coastal mainland and nearby islands (Darimont et al. 2004, p. 1871). Nonetheless, we urge caution in interpreting these numbers as absolute values, but present them here as general estimates of the size of the wolf population in coastal British Columbia.

Table 5. Estimated population size of the Alexander Archipelago wolf by Region based on estimates of wolf density (BCMO 2014) and ungulate biomass (Kuzyk and Hatter 2014) and adjusted by the proportion of the Region in the coastal portion of British Columbia.

	Proportion of Region along coast	Ungulate biomass method			Wolf density method	
		Mean	Low	High	Low	High
Region 1	1.00	307	218	404	150	480
Region 2	0.83	123	83	170	62	166
Region 5	0.22	200	141	265	94	272
Region 6	0.17	244	156	344	385	770
All of coastal British Columbia		875	597	1,183	691	1,688

Methods to estimate wolf abundance in British Columbia have changed over time and therefore no trend is evident from these estimates (BCMO 2014, p. 25). However, provincial managers believe that wolf populations are stable or increasing based on local knowledge and increased harvest by trappers and hunters; also, they found no contrary evidence of a population decline or significant conservation threat (BCMO 2014, p. 25). Similarly, as stated above, Kuzyk and Hatter (2014, p. 881) reported that provincial wolf populations have increased slightly between 2000 and 2011 using ungulate biomass as an index; in Regions 1, 2, 5, and 6, the same trend has been observed since 2000 (BCMO 2015a). Thus, collectively these findings indicate that the Alexander Archipelago wolf populations in coastal British Columbia are stable or slightly increasing.

Rangewide.—Using the most recent and best available wolf population estimates in southeastern Alaska and coastal British Columbia, we estimate a rangewide population of about 850–2,700 wolves (Table 6). Given the uncertainty in terms of both precision and accuracy associated with the individual estimates, we present an estimated range, which generally corresponds to the estimated 95% confidence limits, for populations or groups of populations within a specific geographical areas. Using the midpoints of these estimates, approximately 62% of the rangewide population of the Alexander Archipelago wolf occurs in coastal British Columbia and 38% inhabits southeastern Alaska.

Table 6. Estimated rangewide population size of the Alexander Archipelago wolf based on the most recent and best available population estimates in Game Management Units (GMU) of southeastern Alaska and Regions in coastal British Columbia. See text for an explanation of derivation, assumptions, and caveats.

Area	Populations	Low	High	Percent of rangewide population based on midpoint
Mainland of southeastern Alaska	GMUs 1 and 5A	170	466	18%
Prince of Wales and surrounding islands[1]	GMU 2	50	159	6%
Middle islands of southeastern Alaska	GMU 3	136	373	14%
Northern coastal British Columbia	Regions 5 and 6	297	1,043	38%
Southern coastal British Columbia	Regions 1 and 2	212	646	24%
Total	All	865	2,687	100%

[1]ADFG 2015b, pp. 1–2

3.1.2. Reproduction

Most wolf packs contain a pair of breeding adults plus other adults that may or may not breed (see *Social organization*). Age of first breeding of the Alexander Archipelago wolf is about 22 to 34 months (Person et al. 1996, p. 8). Sizes of litters range from 1 to 8 pups with an average of 4.1 pups (SD=1.7); new mothers produce fewer pups than older, more-experienced mothers (Person and Russell 2009, p. 216). Although uncommon, some wolf packs fail to exhibit denning behavior or produce litters and, multiple litters within packs of Alexander Archipelago wolves has not been documented (Person and Russell 2009, p. 216). See Fuller et al. (2003, p. 177) for data on litter size and percentage of pups in packs from other gray wolf populations.

Alexander Archipelago wolves use dens from mid-April through early July with peak activity between early May and the third week of June (Person 2001, p. 61; see *Denning* below for habitat description). After early July, most dens are abandoned and pups are located to rendezvous sites typically <1 km from the natal den where they remain until October (Person and Russell 2009, p. 216). At this time, the pups typically are full size, although weigh less than a yearling or adult, and begin traveling with the pack; most disperse the following spring as yearlings.

3.1.3. Survival

Only one study has estimated survival rates of Alexander Archipelago wolves. Based on radio-collared wolves on a portion of POW and adjacent islands (GMU 2), Person and Russell (2008, p. 1545) reported mean annual survival rate of wolves greater than four months old as 0.54 (SE=0.17); survival was lower between 1993 and 1995 (0.45, SE=0.17) than between 1999 and 2004 (0.62, SE=0.16). Survival did not differ between age classes or sexes, but was higher for resident wolves (0.65, SE=0.17) compared to non-residents (i.e., wolves not associated with a pack; 0.34, SE=0.17). None of the non-resident wolves lived more than 86 weeks after radio-

collaring or dispersal unless they settled (19% of all non-residents). See Fuller et al. (2003, pp. 176, 179) for annual survival rates of wolves elsewhere in North America.

Of the 55 radio-collared wolves in GMU 2 between 1993 and 2004, 39 of them died from legal harvest by hunters and trappers (n=18), unreported harvest (n=16), and natural causes (n=5; Person and Russell 2008, p. 1545). Thus, 87% of wolves that died during the study were killed by humans. Between 2012 and May 2015, researchers on POW collared 12 additional wolves as part of a study to estimate population size (see *Abundance and trend*); of these wolves, five died from legal harvest, three from unreported harvest, and one from natural causes (ADFG 2015a, p. 4). In addition, one collared wolf has an unknown fate due to technical difficulty (i.e., premature collar release), one has an unknown fate because the collar has not been retrieved yet, and one wolf is alive still (ADFG 2015c, p. 10; ADFG 2015d, p. 2). Thus, during the 3-year period of this ongoing study, 67% of the collared wolves were killed by humans. Both of these studies that involved radio-collaring wolves in GMU 2 took place in a portion of GMU 2 that is roaded and therefore has higher levels of human use compared to unroaded portions, which may have inflated mortality rates. See *Chapter 5* (specifically, *Wolf harvest* and *Road development*) for further description of correlates of mortality of Alexander Archipelago wolves. To the best of our knowledge, estimates of annual survival or mortality of wolves on other islands or the mainland of southeastern Alaska and coastal British Columbia are not available.

3.1.4. Within-population dispersal

Pups that survive to adulthood either remain in their natal pack or disperse (Person et al. 1996, p. 10), here defined as permanent movement of an individual away from its pack of origin. Dispersers typically search for a new pack to join or associate with other wolves and ultimately form a new pack in vacant territories or in vacant areas adjacent to established territories. Hence, dispersal is a critical element of wolf ecology and social biology.

Wolves are capable of dispersing long distances, sometimes hundreds of kilometers (e.g., Fritts 1983, p. 166; Ballard et al. 1987, p. 20; Adams et al. 2008, pp. 10–11), and can quickly re-occupy vacant territories (e.g., Bergerud and Elliot 1986, pp. 1519–1523). Generally, young wolves are more likely to disperse than older ones (e.g., Adams et al. 2008, p. 11) and males are more likely to disperse than females, although females may disperse farther (Ballard et al. 1987, p. 20). Successful dispersal often is short in duration because dispersing wolves are more vulnerable than non-dispersers to hunting and trapping and being killed by other wolves (e.g., Peterson et al. 1984, p. 29).

Within-population dispersal metrics for Alexander Archipelago wolves are available only for GMU 2 where the annual rate of dispersal was 39% (95% CI= ± 23%, n=18) with adults greater than two years of age composing 79% of all dispersers (Person and Ingle 1995, p. 20). Annual rate of survival of dispersing wolves was low (0.16) with most killed by hunters and trappers before settling (Person and Russell 2008, p. 1547); therefore, successful dispersal may be more limited by low survival rates than by actual dispersal capability. Nonetheless, minimum dispersal distances from the point of capture ranged between 13 and 182 km. Two of three wolves captured and radio-collared on Kosciusko Island dispersed long distances; one was located subsequently on the southern end of Dall Island, a minimum distance of 182 km that required at least two swims greater than 350 m each, and the other moved at least 160 km to the south end of

POW (Person and Ingle 1995, p. 23). To the best of our knowledge, these dispersal events are the longest distances documented for the Alexander Archipelago wolf. Stronen et al. (2014) postulated that wolves prefer to disperse to ecological environments similar to their natal habitat. See Fuller et al. (2003, p. 179) for age-specific dispersal rates of gray wolves in North America.

Of considerable relevance to the conservation biology of the Alexander Archipelago wolf is their ability to disperse over water barriers. Wolves introduced to Coronation Island (Figure 2) ultimately starved, yet did not swim 900 m to nearby habitat with abundant food (Klein 1995, p. 280). Person and Ingle (1995, p. 23) reported that none of the dispersing wolves studied by them (n=13) swam to other islands greater than 1 km from POW or dispersed across Clarence or Sumner Straits, which separates POW from other islands in the archipelago and from the mainland (Figure 2). Similarly, none of the wolves on POW that were collared recently with GPS technology, which provides finer temporal resolution of location, has swum more than 1 km (ADFG 2015d, p. 2).

Nevertheless, some evidence exists demonstrating that Alexander Archipelago wolves are capable of swimming large distances, although success probably depends on local water conditions (e.g., tidal current and strength). For example, Darimont and Paquet (2002, p. 418) found wolves on isolated islands in coastal British Columbia that were 5–13 km from other large landmasses. In addition, of three wolves that were radio-collared opportunistically on or near Kupreanof Island in 1999, one was relocated on 17 occasions, all confined to Kupreanof Island, but another was trapped and killed nearly three years later on Revillagigedo Island, roughly 134 km straight-line distance from the capture location (USFS 2015a). Although we do not know the travel route of the dispersing wolf, we know that at some point that wolf must have made at least four water crossings with the shortest being about 2 km in distance. No data on the third wolf were available. More recently, ADFG (2015d, p. 2) photographed a wolf on Shrubby Island, a small island located between POW (~3.5 km) and Zarembo islands (~1.2 km via Bushy Island). These photographs suggest that wolves potentially have the opportunity to move to and from POW if tidal currents and sea state allows, although we do not know the frequency of these movements (see *Connectivity*).

3.1.5. Sex ratio

We found no information describing sex ratios in litters of Alexander Archipelago wolves. Peterson et al. (1984, p. 26) reported a statistically significant male bias in pups captured as part of their study (22 males:10 females), although hunter-killed pups had a female bias (23 males:39 females). In Minnesota, Mech (1975, p. 738) reported a range of pup sex ratios in Minnesota and hypothesized that male-biased litters were more common in saturated, high density wolf populations; otherwise, sex ratio favors females. We found that sex ratio of pups often is not reported in the literature, even though it is an important demographic parameter when considering future population size.

As part of a capture-recapture study of Alexander Archipelago wolves employing genetic markers in a portion of GMU 2, the proportion of females captured via hair board sampling was 0.57 (SE=0.13) in fall 2013 (ADFG 2015b, p. 2). One year later in fall 2014, the proportion was 0.25 (SE=0.11; ADFG 2015b, p. 2), coincident with an observed decrease in abundance (Table 3).

3.2. Social organization

Wolves are social animals that live in packs usually composed of one breeding pair (i.e., alpha male and female) plus offspring of 1–2 years old. Generally the adult parents guide activities of the group with the female leading pup care and defense and the male taking charge of foraging and food provisioning (Mech 1999, p. 1196). Occasionally, unrelated or related wolves are adopted into the pack, but usually the pack functions as a family or a small group of families. The pack is a year-round unit, although all members of a wolf pack rarely are observed together, except during winter (Person et al. 1996, p. 7).

Loss of alpha members of a pack can result in social disruption and unstable pack dynamics. During this time, dominance relationships within and among packs and individuals are re-established, which may lead to higher rates of intraspecific strife and possibly plural breeding, although this is rare (Mech 1999, p. 1200; Packard 2003, pp. 52–56). Pack dynamics are complex and shift frequently as individuals age and gain dominance, disperse from, establish or join existing packs, breed and die (Mech 1999, pp. 1197–1202). The social and reproductive fates of individuals are based mostly on the opportunities presented by these shifting dynamics (Packard 2003, p. 35). Although loss of breeding individuals impacts social stability within the pack, at the population level wolves appear to be resilient enough to compensate for any negative impacts to population growth (Borg et al. 2015, p. 183).

Pack sizes, especially in southeastern Alaska, are difficult to estimate because of heavy vegetation cover. Nonetheless, data are available from three studies. Smith et al. (1987, pp. 4–7) found that pack sizes on Revillagigedo Island range from 2 to 12 wolves and averaged 5.4 wolves (time of year not specified consistently). On POW and Kosciusko islands during the mid-1990s, fall pack size ranged from 2 to 12 wolves, but averaged 7–9 wolves (Person et al. 1996, p. 7). More recently on POW, ADFG (2015d, p. 2) reported similar pack sizes with an average of 7.6 wolves in the fall (SE=0.8, range=1–16) and 4.0 wolves in the spring (SE=0.7, range=1–15). We are not aware of any similar counts for wolf packs in coastal British Columbia. For context, Adams et al. (2008, p. 8) observed mean pack sizes of 6.7 to 9.3 in autumn and 4.3 to 7.1 in spring with packs less than or equal to 17 wolves in the Central Brooks Range, Alaska, and Peterson et al. (1984, p. 25) reported mean pack size in early winter as 11.2 wolves. See Fuller et al. (2003, pp. 165–166, 172–174) for ranges of pack size of wolves in North America.

3.3. Ecology

Most recent information on the ecology of the Alexander Archipelago wolf was generated as part of two primary studies with one centered on the northern portion of POW (early 1990s–mid 2000s, 2012 to present) and the other on the central and northern coasts of British Columbia (early 2000s to present, but more intermittent than POW). Researchers have studied wolves on POW primarily by capturing, radio-collaring and re-locating them throughout the year (e.g., Person 2001); in more recent years, non-invasive sampling (e.g., remote camera systems, hair snares) in addition to more traditional radio-collaring methods has been used, as part of a study to test methods for estimating abundance, to learn about distribution, movements, and space use (e.g., ADFG 2015b). In contrast, researchers in coastal British Columbia have conducted surveys for wolves (or sign of wolves) and studied their ecology using non-invasive methods (e.g., scat analysis; e.g., Darimont and Paquet 2002); to the best of our knowledge no wolves have been radio-collared in coastal British Columbia.

3.3.1. Food habits

Alexander Archipelago wolves are opportunistic predators that eat a variety of prey species, although, like gray wolves (Mech and Peterson 2003, p. 131), ungulates compose most of their diet. One of the apparently unusual aspects of the Alexander Archipelago wolf diet is the seasonal consumption of salmon (15–20% of lifetime diet; Szepanski et al. 1999, p. 327). However, Adams et al. (2010, p. 251) found that inland wolves in Denali National Park, Alaska also ate salmon in slightly lower, but similar quantities (3–17% of lifetime diet) compared to Alexander Archipelago wolves, suggesting that salmon in wolf diet may be common where salmon are available. Further, gray wolves in southwestern Alaska also feed regularly on salmon and other marine mammals when available (Watts et al. 2010, p. 145), indicating that consumption of salmon (and other marine-derived prey) is not unique to the Alexander Archipelago wolf. Regardless, salmon provides a seasonal alternate food source to Alexander Archipelago wolves during a period of year with high food and energy demands (i.e., provisioning pups; Darimont et al. 2008, p. 5).

In this section, we report only the most comprehensive studies of Alexander Archipelago wolf diets that we found during our literature search, but recognize that other smaller studies have occurred (e.g., Garceau 1960). We also note that the biogeography of southeastern Alaska in particular presents difficulties when assessing the diet of wolves in this area because not all prey items are available on all islands (e.g., beaver do not occur on Coronation Island; MacDonald and Cook 2007, p. 27) and because prey species have been introduced to some islands (Table 7). For example, mountain goats were introduced successfully to Revillagigedo Island in 1983 and after several attempts elk (*Cervus canadensis*) are now established on Etolin and Zarembo islands with credible sightings on large nearby islands such as POW, Wrangell, Mitkof, and Kupreanof islands (MacDonald and Cook 2007, p. 188). Given the general importance of ungulates in the diet of wolves (Mech and Peterson 2003, p. 131), presence (or absence) of ungulate species on a specific island or group of islands is particularly relevant. See Peterson and Ciucci (2003, pp. 104–130) and Mech and Peterson (2003, pp. 131–160) for information on wolf food habitats throughout the world, which demonstrate the relationship between breadth of diet and availability of prey, especially ungulates.

Table 7. Generalized distribution of ungulate species by Game Management Unit (GMU) in southeastern Alaska and Region in coastal British Columbia within the range of the Alexander Archipelago wolf. Gray-shaded areas indicate presumed absence on a regular basis.

GMU or Region	Black-tailed deer	Moose	Mountain goat	Elk
	Odocoileus hemionus	*Alces americanus*	*Oreamnos americanus*	*Cervus canadensis*
GMU 1	Present	Present	Present	
GMU 2	Present			
GMU 3	Present	Present		Present
GMU 5A	Present[1]	Present	Present	
Region 1	Present	Present[2]	Present	Present
Region 2	Present	Present[2]	Present	
Region 5	Present	Present[2]	Present	
Region 6	Present	Present[2]	Present	

[1]Small (<50 individuals) introduced population near the village of Yakutat only.
[2]Recent range expansion from inland to coastal habitats; populations are stable or increasing (Darimont et al. 2005, p. 235; BCMO 2015b).

Scat analyses.—A common method for describing wolf diet involves collection and analysis of scat, although results and inference from scat analyses require careful interpretation. Sampling design and protocol can have a strong influence on results, in part owing to the social organization and cooperative hunting by wolves. Additionally, results of scat analyses typically are reported as frequency of occurrence of prey items without accounting for differences in prey size and digestibility, which can be done by converting frequency of occurrence to biomass consumed (e.g., Floyd et al. 1978). Nonetheless, frequency of occurrence can be useful as a general description of wolf diet, but should be interpreted with caution in terms of quantifying it. Recognizing these caveats, in this section we summarize results of scat analyses conducted for the Alexander Archipelago wolf using frequency of occurrence primarily due to the nature of the available data.

The most detailed analyses of Alexander Archipelago wolf food habits based on scat were those by Fox and Streveler (1986), Smith et al. (1987), Milne et al. (1989), Merriam (summarized in Klein 1995), Kohira and Rexstad (1997), Darimont et al. (2004), and Lafferty et al. (2014). Generally, remains of deer had the highest frequency of occurrence in scats found in southeastern Alaska and coastal British Columbia with the exception of the northern mainland, including Glacier Bay where deer are scarce (Table 8); instead, in these areas remains of mountain goats or moose had the highest frequency of occurrence. Beaver (*Castor canadensis*) had the second highest frequency of occurrence in scats found on POW and Revillagigedo islands. Alexander Archipelago wolves also feed on harbor seals (*Phoca vitulina*), mustelids, small mammals, birds, marine invertebrates, and plants. Spawning salmon are taken during the summer and fall by some wolf packs in southeastern Alaska and coastal British Columbia. Thus, consistent with their opportunistic food habits and lack of specialization, Alexander Archipelago wolves seem to eat (or sample) most available prey items within a habitat type or area provided that the cost-to-benefit ratio requirements are met (e.g., prey availability, capture efficiency, nutritional gain, and potential for injury).

Table 8. Percent occurrence of prey remains in wolf scats from various locations in southeastern Alaska and coastal British Columbia (from north [left] to south [right]). Items of infrequent occurrence (<1%) in only one study and unidentified items not included.

Common name	Scientific name	Northern mainland[1]	Glacier Bay[2]	Prince of Wales Island[3]	Revillagigedo Island[4]	Coastal British Columbia[5]
Predominant time of year that wolf scat was collected		Summer	May–July	November–July	Year-round	Summer
Number of scats		78	55	182	329	595
Rodents						
Hoary marmot	*Marmota caligata*	27	0	0	0	0
American beaver	*Castor canadensis*	0	<1	31	20	3
Vole	*Microtus* spp.	0	9	0	0	0
North American porcupine	*Erethizon dorsatum*	0	7	0	0	0
Unidentified rodent	*Rodentia* spp.	10		0	0	1
Lagomorphs						
Snowshoe hare	*Lepus americanus*	0	7	0	0	0
Carnivores						
American black bear	*Ursus americanus*	0	0	8	<1	3
Harbor seal	*Phoca vitulina*	1	<1	0	0	<1
North American river otter	*Lontra canadensis*	0	<1	0	0	4
Pacific marten	*Martes caurina*	0	0	0	0	6
Ermine	*Mustela erminea*	0	0	0	0	6
American mink	*Neovison vison*	0	0	0	0	3
Unidentified mustelid	*Mustelidae* spp.	9	0	17	0	0
Hoofed mammals						
Moose	*Alces americanus*	0	80	0	0	2
Black-tailed deer	*Odocoileus hemionus*	0	0	90	74	63
Mountain goat	*Oreamnos americanus*	53	0	0	0	6
Other						
Marine invertebrates		0	0	0	0	4
Fish and shellfish		4	4	5	<1	8
Unidentified bird		6	11	0	1	6
Vegetation		0	0	0	0	2

[1]Fox and Streveler 1986, pp. 192–193; [2]Lafferty et al. 2014, p. 145; [3]Kohira and Rexstad 1997, pp. 429–430; [4]Smith et al. 1987, pp. 9–11,16; [5]Darimont et al. 2004, p. 1871.

Fox and Streveler (1986, pp. 192–193) examined 124 wolf scats collected between 1973 and 1980 (predominantly during the summer) from four mainland sites, most of which were in alpine, in the northern part of southeastern Alaska. Mountain goat was the most frequent item in the scats from all sites (Table 8). Deer remains were found in 21% of the scats from Chilkat and Herbert glaciers. At Dixon Harbor and Lituya Bay, marmots (*Marmota caligata*) were of secondary importance followed by mustelids and small rodents. The authors believed the low occurrence of deer in the scats reflected low deer density at their study sites.

Smith et al. (1987, pp. 9–11, 16) studied 511 scats from Revillagigedo Island, POW, and Dall Island and found deer in 70% of the scats, followed by beaver in 14% of the scats (Table 8). About 30% of the scats collected in summer contained remains of deer fawns. Beaver remains were about equally represented in the wolf scats during summer and winter. There was considerable variation in the frequency of occurrence of beaver remains in the scats from various packs. The authors observed that wolves fed on salmon during late summer but this use was not recorded in scat collections.

Milne et al. (1989, pp. 83–85) determined contents of 647 scats collected between 1983 and 1985 on northern Vancouver Island. Deer was the most frequent item found, followed by beaver, Roosevelt elk (*Cervus elaphus*), and red squirrel (*Tamiasciurus hudsonicus*). However, elk and deer contributed similarly to biomass of wolf diet. Not surprisingly, adult deer were more frequent in the diet during winter and fawns were more commonly observed in the diet during summer. We were unable to include results of this study in Table 8 because the authors reported relative occurrence instead of frequency of occurrence in their publication.

Klein (1995, p. 277) reported on the contents of 663 scats collected by Merriam on Coronation Island between 1961 and 1986 after wolves were experimentally introduced there in 1960. In the five years following introduction, deer were present in 78–97% of wolf scats, followed by harbor seals, which ranged from 8 to 53% occurrence (Table 9). As deer became less numerous on the island as a result of predation by the introduced wolves, birds, seals, marine invertebrates and small mammals constituted the major food remains in scats. With declining deer numbers, wolves even resorted to cannibalism. As deer declined on Coronation Island, the wolf population declined from a maximum of 13 to one individual. To the best of our knowledge, this study is the only one on Alexander Archipelago wolves that indicates an inability of wolves to maintain high densities in response to a declining deer herd.

Table 9. Percent occurrence by year of prey remains in wolf scats collected during spring and summer from Coronation Island between wolf introduction in 1960 and near extirpation in 1970 (only one wolf survived then; Klein 1995, p. 277).

	1961	1962	1963	1964	1965	1966[1]	1967	1968
Number of scats	146	18	45	77	213	110	44	3
Rodents								
Unidentified rodent	0	0	11	0	3	1	18	33
Carnivores								
Wolf	0	0	0	0	7	10	0	0
Seal	43	48	53	32	8	18	57	33
Hoofed mammals								
Deer	78	89	89	95	97	53	0	33
Other								
Marine invertebrates	1	0	2	0	3	28	23	33
Unidentified bird	2	0	0	8	5	30	25	0
Undetermined item	2	11[2]	27	14	17	66	5	0

[1]Scat collection in February shown; collection in August resulted in only seven samples.
[2]Not examined for bird, rodent, or marine invertebrates.

Kohira and Rexstad (1997, pp. 429–430) examined 182 wolf scats collected between autumn 1992 and summer 1994 on POW. They found deer remains in 90% of the scats and beaver in 31% of the scats; other prey items occurring less frequently included black bear, mink, river otter, small mammals, birds, and fish (Table 8). Significantly higher use of beaver occurred in the winter. Use of fish by wolves was distinctly higher in autumn.

Person et al. (1996, p. 8) combined data from POW (Kohira and Rexstad 1997) and Revillagigedo Island (Smith et al. 1987) and estimated the percentage of prey species by volume in the diet using a regression model. The authors estimated that 77% of the diet of wolves was composed of deer, 14% was beaver, and less than 10% was other prey species. They concluded that wolves inhabiting islands in southeastern Alaska depend on the availability of deer, although only one study (Klein 1995) has actually demonstrated this dependence.

Darimont et al. (2004, p. 1871) identified prey items in 595 wolf scats collected during summers 2000 and 2001 on the mainland and adjacent islands of northern and central coastal British Columbia. Deer was the most frequent item in the scats from the mainland (47%), but was even more frequently found in scats from the islands (75%). On the mainland, mountain goat was the second most frequent prey item (14%) followed by ermine (10%) and on the islands salmon (8%) and birds (7%) were of secondary importance compared to deer. The authors reported a large diversity of prey items (>17 species or groups of species), although deer comprised most of the diet in terms of frequency and biomass (Table 8).

Lafferty et al. (2014, pp. 143–145) studied 55 scats collected during early summer 2010 and 2011 in Glacier Bay National Park. Wolf scats contained on average 1.3 prey items (range=1–3) and by far, moose was the most frequent prey item found (80%; Table 8). This finding was contrary to a similar study conducted in 1993 and only 37 km away farther into the bay; Meikeljohn (1994, p. 8) reported that moose occurred in less than 3% of wolf scats and harbor seal was observed in 41% of wolf scats, although the latter species has declined considerably in recent years (Mathews and Pendelton 2006, p. 167). Lewis and Lafferty (2014, p. 8) also observed wolves feeding on a humpback whale carcass during summer (May–September) 2010 in Glacier Bay, indicating that at times wolves have access to substantial marine subsidies as part of their diet.

Stable isotope analyses.—Since 1997, several studies have assessed Alexander Archipelago wolf diet using stable isotope analyses. This method quantifies the relative proportions of identified food sources in wolf diet by measuring isotopic compositions of wolf tissues and comparing them to their prey. It is a useful technique because it allows for measurement of assimilated nutrients over time as opposed to scat analysis which reveals only an individual's last meal. The temporal inference of stable isotope results is related to turnover rates of the tissue analyzed. For example, hair contains isotopic values of food sources metabolized over a period of months (Darimont and Reimchen 2002, pp. 1640–1641) and bone tissue stores diet history over the individual's lifetime (Chrisholm et al. 1982, pp. 1131–1132). Additionally, stable isotope analysis avoids certain forms of bias inherent in scat analysis because of differences in prey size and digestibility; for example, fish may be more thoroughly digested by a wolf and therefore not detected easily in its scat (Szepanski et al. 1999, p. 328). However, evaluation of stable isotopes

requires attention to a different set of assumptions and potential biases (e.g., Gannes et al. 1997, pp. 1271–1276).

Szepanski et al. (1999) was the first stable isotope study of Alexander Archipelago wolves. Using bone collagen of wolves sampled at three sites in southeastern Alaska (Kupreanof Island, POW, and mainland) as well as a sample of wolves from interior Alaska (for context), they found that wolf diet was similar at all three southeastern Alaskan sites. Deer accounted for 44.7–49.0% of the diet, other herbivores (moose, beaver, mountain goats, and voles) for 34.4–36.2%, and salmon ranged from 15.3–20.0% (p. 331). The relative contribution in the diet of wolves from interior Alaska was 9.1%; caribou (55.2%; *Rangifer tarandus*) and moose (35.7%) composed most of the interior wolf diet. Variation among individual wolf diets was higher for southeastern Alaska than for interior wolves (p. 327).

Darimont et al. (2007, 2009), Semmens et al. (2009), and others have used stable isotope analyses of wolf hair, coupled with scat analyses (Darimont et al. 2008) to describe diet of wolves on the northern and central coasts of British Columbia. By sampling for wolf hair before and after molting periods, the authors detected seasonal shifts from a deer-dominated diet in spring and summer to a more varied diet that included larger proportions of salmon in late summer and fall when salmon were available (Darimont et al. 2008, pp. 7–8). Darimont et al. (2009, p. 130) reported estimates of assimilated biomass (%) from three prey groups (deer, salmon, marine mammals) to the diet of wolves on the mainland and inner and outer islands of coastal British Columbia; deer composed most of the biomass of wolf diet on the mainland (82%) decreasing to the outer islands (32%), while both marine mammals and salmon had the opposite pattern, i.e., higher percentages of biomass on the outer islands (52 and 16%, respectively) decreasing to the mainland (20 and -2%). We note here that this finding contradicts that of Darimont et al. (2004, p. 1871) based on frequency of occurrence in scat: deer occurred more frequently in wolf scats on the islands compared to the mainland (see *Scat analyses*). Many of these studies apply stable isotope results to assess individual variation and niche width of populations of wolves in coastal British Columbia (e.g., Semmens et al. 2009, p. 4). We provide a broad overview of their work here because much of it is beyond the scope of this document.

3.3.2. Space and habitat use

Because wolves occupy a variety of habitats across their range in North America, they are considered to be a habitat generalist (Mech and Boitani 2003, p. xv). It is generally believed that the presence or absence of wolves in an area is a function of the availability of their prey and the intensity of human-caused mortality (Mech 1995, p. 273; Mladenoff et al. 1995, p. 286).

Home range size.—In southeastern Alaska, minimum convex polygon (mcp) home ranges of wolf packs on Revillagigedo Island averaged 279 km^2 and ranged from 79 to 447 km^2 (n=7; Smith et al. 1987, p. 15). In the mid-1990s on POW and Kosciusko Island, pack home ranges of VHF radio-collared wolves averaged 280 km^2 with a range of 101–419 km^2 (n=7, estimates based on average of 95% kernel and mcp); core areas (75% kernel and mcp) where wolf activity was concentrated were about 55–60% smaller than total home ranges (Person et al. 1996, p. 7).

In recent years, researchers have equipped wolves with downloadable GPS collars resulting in more locations at finer spatial and temporal resolution, which can lead to larger estimates of

home range size. Based on wolves with GPS collars, 95% kernel density estimation (kde) home range size of wolves (n=11) on POW between 2012 and 2014 averaged 535 km^2 (range=292–644 km^2; ADFG 2015d, p. 2), a notable increase compared to wolves collared with VHF technology in the mid-1990s. However, it can be difficult to reconcile differences in data quality between VHF and GPS collars during analysis and therefore comparisons should be done with caution. On the northern mainland of southeastern Alaska, 95% kde pack home ranges were four times as large as those on POW (mean=3,926 km^2, range=2,969–4,884; n=3).

During denning and pup-rearing periods, pack home ranges were about 50% smaller than during other times of year (Person 2001, p. 55). For example, summer home ranges of five packs on POW averaged 100 km^2, where winter home ranges for the same packs averaged 240 km^2 (Person et al. 1996, p. 7). Summer home ranges for wolves on POW were similar to summer home ranges reported for Minnesota where wolves primarily rely on deer for food; however, winter home ranges of POW were substantially larger (Person et al. 1996, p. 7; see Fuller et al. [2003, pp. 172–174] for territory sizes of wolf populations in North America).

Resource selection.—We are aware of two studies with one being a subset of the other that directly examined habitat use of Alexander Archipelago wolves. Person and Ingle (1995) analyzed habitat use in proportion to its availability of radio-collared wolves on POW and Kosciusko Island. They classified forested habitat in their study area into four categories: non-commercial forest, low volume old-growth, high volume old-growth, and young-growth (p. 29). Only diurnal locations of three wolf packs from aircraft were used in the analysis.

Wolves occupied all habitat types in the study area. Analysis of all aerial locations showed that wolves were found in young-growth habitat 7.2% of the time (95% CI= ±3.4%, n=227), low volume old-growth 46.8% of the time (±6.2%), high volume old-growth 9.5% of the time (±3.8%), and non-commercial forest 34.7% (±6.2%) of the time (p. 30). Habitat use differed significantly from availability for all three packs (p. 30). All three packs in the study used high-volume forest in proportion to its availability. Two packs used low volume old-growth stands significantly more than expected and one pack used noncommercial habitat more than expected. All three packs used young-growth habitat significantly less than expected based on its availability. The authors concluded that wolves appeared to be selecting for unlogged habitat types during the daytime (p. 30).

Person (2001) completed a more comprehensive habitat analysis using data described in Person and Ingle (1995). He reported that wolves spent most of their time at low elevation, especially during the denning period, with 50% of radiolocations below 82 m and 95% below 400 m (p. 62). During pup-rearing wolves selected for open-canopy and closed-canopy forests, typically avoiding clearcuts and roads; otherwise, wolves did not appear to select strongly for or against other habitat types in other times of the year except they did show a strong affinity for habitats close to lakes and streams (pp. 62–64). He also found a strong, inverse relationship between home range size of wolves and the proportion of “critical winter habitat for deer” (p. 66), defined as productive old-growth forest less than 250 m in elevation with southern exposure.

Denning.—Alexander Archipelago wolves den in root wads of large living or dead trees in old-growth forests and near freshwater (Person and Russell 2009, p. 211). Person and Russell (2009,

p. 217) examined habitat characteristics of 25 active wolf dens on POW and adjacent islands between 1995 and 2004 and found that wolves select for relatively flat areas near lakes and streams at low elevations. Seventeen of 25 active dens (67%) were adjacent to ponds or streams with active beaver colonies (p. 216). Most used den sites were located farther from logged stands and roads than unused locations, although wolves used areas near clearcuts and roads for denning probably because suitable alternatives were not available (p. 220). The authors speculated that for many wolf packs in their study area, large proportions of the landscape were unsuitable for dens sites owing to logging and topography (p. 222).

We are not aware of any other studies of denning habitat used by Alexander Archipelago wolves. Garceau (1960, p. 487) found a wolf den on Kupreanof Island in 1959; it was located under a decaying western hemlock (*Tsuga heterophylla*) stump within a forest and was about 15 m from the forest edge near a mudflat. Across North America, characteristics of dens vary widely depending on what is available to wolves (e.g., caves, sandy bluffs; see Thiel et al. 1998 and Trapp 2004 for a summary of the various kinds of gray wolf dens).

Wolf-deer habitat relationships.—Alexander Archipelago wolves consume more deer than any other single prey species throughout most of their range (see *Food habits*). Thus, maintaining a viable, well distributed wolf population may depend on maintaining habitat to support a viable, well distributed, and available population of deer (Person et al. 1996, pp. 15–16). Alexander Archipelago wolf abundance may be especially linked to deer abundance and availability on the islands in the archipelago where other ungulate prey species are either lacking or less abundant. In general, wolf populations are expected to track the upward and downward fluctuations in deer populations in some time-lagged fashion (e.g., Van Ballenberghe et al. 1975, p. 40). Therefore, deer habitat will be the primary focus of the following discussion.

Several characteristics of old-growth forest make it valuable winter habitat for deer. High volume old-growth forest stands with multi-layered overstories intercept snow and moderate temperature and wind, creating microclimate favorable for deer (Bloom 1978, p. 108; Kirchhoff and Schoen 1987, pp. 30–32). Owing to the complex canopy structure of old-growth forest types, light penetrates to the forest floor, facilitating production of a diverse understory of shrubs and forbs, including several nutritious forage species for deer (Bloom 1978, p. 110–111; Hanley 1984, p. 4; Parker et al. 1999, p. 21; Hanley et al. 2014, p. 7). In addition, arboreal lichen, which is nutritious deer forage, is available in significant quantities only in old-growth stands (Hanley 1984, p. 8).

Silvicultural practices have affected deer habitat quality in southeastern Alaska and coastal British Columbia. The predominant method of timber harvest in this region has been clearcut logging on a prescribed rotation length of 90–120 years. Clearcut logging of forest stands initiates seral stage development, and continuing timber harvest on an approximately 100-year rotation perpetuates the recycling of early seral stages. This effectively replaces heterogenous older forest with a mosaic of even-aged, young-growth forest stands of various ages. Under natural succession, shrub and herb biomass production increases for up to 10–15 years after timber harvest. Although young clearcuts temporarily produce abundant forage for deer, typically it is of poorer nutritional quality than forage available in old-growth (Hanley et al. 1989, p. 16; Hanley 2005, p. 105). It also is apparent that in some areas, understory plant species

may never reappear on sites under intensive even-aged management without subsequent treatment (Alaback 1982, p. 1941; Hanley 2005, p. 104).

Following overstory removal, after 25 to 35 years of stand development, early seral plants (forbs, grasses, and shrubs) give way to young-growth coniferous trees. The canopies of these regenerating forests close over, intercepting sunlight and eliminating most understory vegetation (Alaback 1982, p. 1938), rendering the forests of little use to deer (Wallmo and Schoen 1980, p. 453; Yeo and Peek 1992, p. 257; Person et al. 2009, p. 5). Consequently, the decline in understory corresponds with a depression in deer carrying capacity that extends for many decades until the forest begins to develop old-growth condition at approximately 250 years of age (Alaback 1982, p. 1939). Person (2001, p. 96) described these circumstances as "succession debt," such that forest succession that was initiated by timber harvesting has long-term costs to the ecosystem.

Since 1997, with the realization that most of the even-aged stands harvested between the 1970s and 1990s were entering the closed canopy stage of succession, researchers began evaluating the value of intermediate treatments on even-aged forest stands specifically for deer. Hanley (2005, p. 104) found that thinned stands of 56–190-year-old even-aged forests produced roughly five times as many deer-days use, a metric for quantified value as food for deer, as unthinned stands. He also reported that including red alder (*Alnus rubra*) in regenerating stands facilitates secondary succession and increases the number of deer-days compared to no treatment of the stand (p. 105). However, the benefit of treatments (e.g., thinning, planting of red alder) decreased with increasing age of stand (Hanley et al. 2013, p. 27); in other words, if treatments were applied later (25+ year old stands) food resources for deer were lower than if treatments were done earlier (15–25 year old stands). This finding was relevant to deer because most even-aged stands on the Tongass already are 25+ years old (Sisk 2007, p. 13) and therefore, the value of intermediate treatments for deer in those stands is reduced. In addition, little research has documented whether or not deer select precommercially thinned stands despite the increased forage biomass in those stands.

Deer habitat use.—Many field studies have aimed to understand habitat use and selection of deer within the range of the Alexander Archipelago wolf. Researchers have used traditional methods such as radio-collared deer (e.g., Schoen and Kirchhoff 1990; Yeo and Peek 1992; Farmer et al. 2006; Gilbert 2015), counts of deer pellet groups (e.g., Wallmo and Schoen 1980), counts of deer tracks (e.g., Bloom 1978), and measurements of browse availability and use (e.g., Kirchhoff 1994b), as well as more sophisticated methods such as mark-recapture techniques with DNA from fecal pellets (Brinkman et al. 2011). Farmer and Kirchhoff (2007) proposed an ecological classification of deer habitat to assist managers in managing both habitat and deer populations.

Below, we briefly summarize key findings related to Sitka black-tailed deer and their habitats with an emphasis on recent field studies (Table 10). We refer the reader to Schoen and Kirchhoff (2007), Nelson et al. (2008), and Person et al. (2009) for more detailed overviews of deer and deer research in southeastern Alaska and coastal British Columbia.

Table 10. Select recent (post-1997) studies of Sitka black-tailed deer within the range of the Alexander Archipelago wolf.

Study	Location	Description and key findings
Doerr et al. 2005	Mitkof Island	• Tracked radio-collared deer during winters of deep snow and without deep snow • Deer selected for low elevation (<153 m), southerly slopes close to shoreline (<305 m) • Winter habitat use by deer differs during winters with low and deep snow conditions
Farmer et al. 2006	Heceta Island	• Tracked radio-collared deer to examine linkages between habitat use and fitness • Main causes of death for females and young were predation by wolves and malnutrition; hunting was primary cause of death for males • Use of level terrain was associated with fatalities at all spatial scales analyzed • During snow free months, deer selected for young clearcuts, but also they were at greater risk of death from predation and hunting in this habitat
Person et al. 2009	Meta-analysis	• Estimated survival and habitat selection of deer in winter and summer using data from Mitkof, Admiralty, Heceta, and POW islands • During winters with snow, deer selected old-growth forests on south-facing slopes; old young-growth forests avoided during all seasons • Use of level terrain increased fatalities from wolves, as did high densities of habitat edges
Brinkman et al. 2011	POW	• Developed technique for estimating deer abundance using DNA from fecal pellets • Detected 30% decline during 3-year study; attributed decline to severe winters • Deer densities in managed stands >30 years old were lower (7 deer/km^2) than in managed stands <30 years old (10 deer/km2) and unmanaged lands (12 deer/km^2)
Gilbert 2015	POW	• Tracked GPS-collared female and fawn deer through two mild and one severe winters • Fawn survival was low but variable, driven by black-bear predation in summer and malnutrition in winter; adult female survival was high • Deer habitat selection in summer driven by predation risk and forage availability; snow depth determined selection in winter • Snow interacted with habitat: deer selected for young clearcuts, medium-volume old-growth forest, and against old clearcuts at low snow but trends reversed as snow depth increased

Throughout the year, deer use a variety of habitats ranging from sea level to alpine ridges greater than 1,000 m in elevation. Although some deer migrate from low-elevation, forested winter range to high-elevation summer range in the alpine, other deer remain resident in their home ranges year round. Generally, during spring, summer, and fall, deer focus on maintaining or increasing body condition by selecting habitats with high availability of nutritional browse (Gilbert 2015, p. 88). As winter approaches and snow accumulates, they are increasingly confined to lower elevations and fewer habitats are available to them; for this reason, most research has focused on deer winter habitat use and requirements.

Most studies of deer in southeastern Alaska have found that deer use old-growth forests significantly more than young-growth forests, especially in winter (Bloom 1978, p. 110; Wallmo and Schoen 1980, p. 453; Rose 1982; Schoen and Kirchhoff 1990, p. 374; Kirchhoff 1994b, p. 34). However, some studies have reported that deer use of clearcuts less than 10 years old was similar to that of old-growth (Brinkman et al. 2011, p. 239), even in winter (Yeo and Peek 1992, p. 257; Doerr et al. 2005, p. 326). Doerr et al. (2005, p. 322) found that deer selected for habitats with southerly exposures near shoreline regardless of forest type during the winter, presumably to avoid accumulation of deep snow (Table 10). Gilbert (2015, p. 129) found that deer selected for young clearcuts, against old clearcuts, and against high-volume old-growth at lower snow levels, but decreased selection for young clearcuts and increased selection for old clearcuts and high-volume old-growth as snow depth increased. In addition, Gilbert (2015, p. 130) documented that as local availability of young and old clearcuts increased for individual deer, deer increasingly selected for those habitats (i.e., a functional response), but that deer decreased selection for clearcuts of all ages when old-growth was more available to them as an alternative.

Although winter habitat use of deer may be more ambiguous than previously considered, the effect of periodic, severe winters on deer populations in the region is well documented. Localized reductions in deer numbers have occurred during periods of deep snow (approximately once every 7–10 years) when survival is low (Schoen and Kirchhoff 2007, p. 2; Brinkman et al. 2011, p. 232), especially for fawns (Gilbert 2015, p. 55). In addition, winter severity may be compounded when multiple severe winters occur in sequence (Brinkman et al. 2011, p. 232).

A severe winter can affect deer primarily in two ways: (1) by reducing availability of forage (i.e., snow covers browse) and, (2) by increasing energy expenditure associated with movement (i.e., deep snow is difficult to move through; Parker et al. 1984, p. 474; Parker et al. 1999, p. 5). Hanley (1984) identified three thresholds of snow depths for deer in southeastern Alaska: the depth at which evergreen forbs and herb-layer shrubs become buried (approximately 10 cm), the depth at which deer sink beyond front knee height and energy costs for location increase greatly (25 to 30 cm), and the depth at which tall shrubs become buried (White et al. 2009, p. 484); he recommended that snow deeper than 25 to 30 cm be considered “deep snow”. Similarly, Parker et al. (1999, p. 25) found that when maximum snow depths were >30 cm energy costs associated with movement of an average-sized deer (25–30 cm carpus height) increased significantly. Hanley et al. (1989, p. 29) later suggested that another threshold occurs when snow reaches brisket height (approximately 55 cm) and energy costs for location again increase dramatically.

Snow depth and duration are typically lower in the southern portion of southeastern Alaska than in the northern portion (Figure 9 in Albert and Schoen 2007, p. 15) and this pattern extends

southward into British Columbia (Shanley et al. 2015, p. 6). Decreasing amounts of snow also occur as one moves from the mainland westward to the outer islands. Despite the generally lighter snow conditions found in the southern and western edges of southeastern Alaska, deer populations in these areas are still subject to population declines following severe winters (e.g., Farmer et al. 2006, pp. 1404, 1412; Brinkman et al. 2011, p. 232).

The effects of a given quantity of snow on deer depend upon several factors, including physical condition of the deer going into the winter, forage availability during and following the winter, the effectiveness of both thermal and escape cover, and the duration the snow persists on the ground (Wallmo and Schoen 1980, pp. 457–458; Hanley et al. 1989, p. 32; Doerr et al. 2005, pp. 327–329). Population declines after heavy snow events have been attributed primarily to direct mortality from starvation, followed the next year by depression of fecundity among survivors caused by malnutrition (Hanley 1984, p. 13; Gilbert 2015, p. 56). Recovery often occurs within four or five years where ranges are in good condition and predation is not excessive (Klein 1979).

The negative effects of natural patchiness of habitats on deer connectivity in southeastern Alaska and coastal British Columbia are intensified when clearcut logging converts large forest stands into a patchwork of smaller old-growth stands that are isolated or semi-isolated as a result of snow-filled clearcuts (Kirchhoff and Schoen 1987, p. 32; Person et al. 1996, p. 22). Kirchhoff (1994b) stressed the importance of what he termed ‘effective areas’, or the total area of habitat available to deer. If deer can move freely in response to changing snow conditions, effective area would be essentially unlimited. However, should snow accumulation or lack of forage in surrounding managed stands concentrate deer in residual patches of old-growth, effective area may be limiting. During periods of deep snow, deer confined to isolated stands, especially those of forage-poor habitat, consume the available food resources and may suffer higher rates of mortality from malnutrition than deer in unfragmented landscapes (Kirchhoff 1994b, p. 19; Farmer et al. 2006, p. 1412). Further, deer concentrated by deep snow into small patches of winter cover appear to be especially vulnerable to predation by wolves (Farmer et al. 2006, p. 1412; Person et al. 2009, p. 8), which can accelerate declines and delay recovery of deer populations. McNay and Voller (1995, p. 138) reported that forest harvesting, road building, and spatial isolation of winter habitats, may intensify predation on deer populations, impede recruitment, and contribute to an overall loss of population resiliency. Both Schoen and Kirchhoff (1985, p. 99) and Doerr et al. (2005, pp. 326–327) showed that Sitka black-tailed deer generally remain within habitual use areas even if local conditions are adverse. Based on these studies, it appears unlikely that deer will move outside of their home ranges to seek better habitat conditions if important habitat within that home range is degraded.

CHAPTER 4: DYNAMICS OF MULTIPLE POPULATIONS (AMONG-POPULATIONS AND RANGEWIDE LEVELS)

4.1. Connectivity

Connectivity is a broad and vague term referring to movement of individuals among populations and interactions between demes, subpopulations, and populations. Given the naturally-fragmented landscape within the range of the Alexander Archipelago wolf, connectivity among populations is of considerable relevance when assessing the status of the rangewide population. From a conservation perspective, the distinction between demographic and genetic connectivity is important (Lowe and Allendorf 2010, p. 3038). If a lot of interchange among Alexander Archipelago wolf populations occurs, especially between mainland and island populations, then reduction or loss of wolves for any island or island groups poses less risk to the overall population than if interchange of wolves is limited. One major limitation to our understanding of the Alexander Archipelago wolf is the lack of immigration and emigration rates between and among populations and other related processes such as colonization and recolonization. Below, we summarize the available information on demographic and genetic connectivity of the Alexander Archipelago wolf.

4.1.1. Demographic connectivity

Demographic connectivity depends on relative contribution of immigration and emigration compared with within-population vital rates of birth and death; in other words, it does not depend on dispersal or movement alone, but instead considers how migration rates relative to local recruitment affects dynamics within and among populations (Lowe and Allendorf 2010, p. 3039; Mills 2013, p. 177). We are not aware of any field studies that have measured demographic connectivity explicitly or opportunistically and therefore, in this section, we describe among-population dispersal and movements of Alexander Archipelago wolves.

The fact that wolves do not exist on Admiralty, Baranof, and Chichagof islands, even though those islands support high numbers of deer, indicates that wolf movements may be restricted by water barriers. Potential crossing distances to these islands at some locations are not greater than confirmed crossing points elsewhere in the archipelago (Person et al. 1996, p. 4); however, recent glaciation, the shape and distribution of land masses, and tidal currents likely combine with over-water distances to impede successful wolf dispersal. Also, lower densities of wolves on the mainland, a potential source population, may influence chance dispersal events to these islands. In terms of distance, avenues of dispersal are limited, and most of the feasible dispersal routes involve multiple swims. Generally, as the larger straits between land masses become constricted into channels and passes, the greater the influence of tidal currents.

As described above under *Within-population dispersal*, movements of wolves among nearby islands probably are common. Yet, wolves that were radio-collared on POW and Kosciusko Island did not disperse out of the population, which would require at least five swims with the longest being only about 2 km in length. Alexander Archipelago wolves in coastal British Columbia apparently can swim as far as 13 km (Darimont and Paquet 2002, p. 418), although we presume that this lengthy distance is on the extreme end. Nonetheless, we assume that wolves are capable of swimming the short distance from POW to West Island and onward to Zarembo Island (i.e., between GMUs 2 and 3). Using remote camera systems, a wolf was documented on

Shrubby Island between POW and Zarembo Island (ADFG 2015d, p. 2), suggesting that wolves explore and occupy this route, although concrete evidence of successful dispersal is lacking.

The degree of insularity probably varies among island groups. Interchange between POW and nearby islands (GMU 2) and the mainland (GMU 1) may be limited most, in part due to the time required to travel the distance and the low survival rates of dispersing wolves (see *Survival*), and therefore could be inconsequential from a demographic perspective. However, it may be sufficient between the mainland and the islands within GMU 3 via Dry Strait, a relatively narrow waterbody between Mitkof Island and Dry Island that occasionally goes dry during extreme low tides. At least one male wolf that was radio-collared on Kupreanof Island in March 1999 was trapped on Revillagigedo Island in January 2002, providing evidence of movement from GMU 3 to GMU 1A (USFS 2015a).

4.1.2. Genetic connectivity

Genetic connectivity is the degree to which gene flow affects evolutionary processes within populations (Lowe and Allendorf 2010, p. 3042). The consequences of differing levels of genetic connectivity are poorly understood and depend critically on the ecological and genetic history of the associated populations (e.g., Lande 1999, pp. 11–16). Average levels of gene flow are estimated by the number of migrants per generation (N_m) between populations. Unfortunately, it is difficult to measure gene flow over longer time frames directly and therefore indirect methods often are used to estimate it. For example, F_{ST} can be used to estimate N_m, although see Whitlock and McCaughley (1999) for caveats associated with this approach. Another indirect method for assessing N_m is determining the frequency of private alleles (i.e., one found in only one population); for example, if N_m is low, the frequency of private alleles will be high due to mutation.

Since 1997, several genetic studies of the Alexander Archipelago wolf have been conducted (see *Taxonomy* for overview), but not all are relevant for assessing genetic connectivity between and among populations. As noted above, the scope of inference of these studies depends on the type of genetic marker used and the spatial and temporal extent of the samples analyzed. Generally, genetic studies involving nuclear DNA are more informative about contemporary gene flow between and among populations; mtDNA reflects only a single genealogy and maternal inheritance and it does not undergo recombination, making it more useful in phylogenetic studies aimed to resolve questions about evolutionary, historical relationships within and among species. For this reason, we primarily describe gene flow between Alexander Archipelago wolf populations as determined by studies of nuclear DNA, drawing on results of mtDNA analyses only when appropriate. We present results in a similar format as in *Taxomony* above; refer to Table 2 for descriptions of sampling beyond southeastern Alaska and coastal British Columbia.

Of the four mtDNA studies of the Alexander Archipelago wolf, only Weckworth et al. (2011) commented on gene flow among coastal wolf populations. The authors essentially combined data from two of the other studies in coastal British Columbia (Munoz-Fuentes et al. 2009) and southeastern Alaska (Weckworth et al. 2010) and found that only one population (GMU 1C) within the range of the Alexander Archipelago wolf was distinct from all the others (p. 2). Wolves sampled from this population were the only ones to have Haplotype I, which may

indicate mixed refugial origins of coastal wolves or contemporary gene flow between interior continental wolves and coastal wolves (p. 3).

We are aware of four nuclear DNA studies with results relevant to gene flow between populations of Alexander Archipelago wolves. Weckworth et al. (2005) sampled wolves from GMU 1A (Mainland Coast South, n=9; Revillagigedo, n=24), GMU 2 (POW, n=42), and GMU 3 (Kupreanof, Mitkof, and Woewodski islands, n=26). Private alleles were found in wolves in GMU 3 as well as both POW and Revillagigedo Island but in each case these alleles were restricted to a single individual (p. 921). Pairwise estimates of F_{ST} between southeastern Alaskan populations ranged from 0.02 (Mainland Coast South and Revillagigedo) and 0.20 (GMUs 2 and 3). The authors concluded that significant genetic structure within southeastern Alaska relative to other populations in the Pacific Northwest, and lack of significant correlation between genetic and geographical distances (i.e., no evidence of isolation by distance) suggest that differentiations of southeastern Alaskan wolves may be caused by geographical disruptions to dispersal and gene flow.

Breed (2007) included wolves primarily from GMU 1A and GMU 2 in southeastern Alaska and from Regions 5 and 6 in coastal British Columbia (considered one population in this paper). Number of private alleles in Regions 5/6, GMU 1A, and GMU 2 (and their frequency) was 18 (0.76), 4 (0.07), and 2 (0.02), respectively (p. 18). Pairwise F_{ST} between Regions 5/6 and GMU 1A was 0.087 and GMU 2 was 0.149, and between and GMU 1A and GMU 2 was 0.122 (p. 19). An interesting aspect of this study was the authors' ability to describe directionality of gene flow using a genetic assignment test. By estimating and comparing ratios of immigrants to residents, they found that gene flow was mostly uni-directional with most wolves in Region 5/6 being residents and wolves in GMUs 1A and 2 expressing higher degrees of mixed ancestry (pp. 22–23). However, of these three units, GMU 2 was the most differentiated, although it was subtle and gene flow did not appear to be limited (p. 32). The authors concluded that wolf populations in Regions 5/6 serve as a source population for GMU 1A (p. 34).

Stronen et al. (2014) studied genetic differentiation of wolves on the central coast of British Columbia (Region 5) using microsatellite markers to examine data obtained from wolf fecal samples. Their results from 116 individual wolves indicate a genetic cline between coastal mainland and island wolves (p. 8); however, this study was conducted at too small of a spatial scale to detect meaningful population differentiation. Nonetheless, they found that even though wolves have been observed moving between the mainland and islands in their study area, a genetic cline was apparent, perhaps suggesting that natal habitat-biased dispersal may contribute to genetic differentiation (pp. 1, 8).

Cronin et al. (2015a) analyzed SNPs from wolves in six GMUs in southeastern Alaska in which they occur (i.e., GMUs 1A, 1B, 1C, 1D, 2, and 3; only GMU 5A was not represented). The authors conducted many comparisons and estimated mean F_{ST} values among all six GMUs (0.1268, SE=0.0184), among all GMUs except for GMU 2 (0.1147, SE=0.0225), and for GMU 2 versus all other GMUs (0.1511, SE=0.0326; p. 7); they did not find any statistical significance when comparing means (p. 6). Pairwise F_{ST} between populations was lowest for wolves in GMUs 1B and 3 (0.0344) and highest for wolves in GMUs 1D and 2 (0.2811; Supplemental Table 3 in Cronin et al. 2015a). The authors concluded that wolves in southeastern Alaska are

not a genetically homogenous group (i.e., some population structure exists) and that although wolves in GMU 2 show a degree of differentiation, as also shown by Weckworth et al. (2005), they are not particularly differentiated compared to the overall differentiation among wolves in other southeastern Alaskan GMUs (p. 8). These data and interpretations were not contested by (Weckworth et al. 2015).

4.2. Population processes

Mills (2013, p. 185) emphasizes that not all populations are equal. Because of varying effects of stressors within and among populations, different populations play different roles in dynamics across the landscape. When a continuous population becomes fragmented by an intervening matrix, four potential outcomes can occur (along a continuum dependent on the natural history of the species and the extent to which dispersal is influenced by the potential barrier): multiple isolated populations, metapopulations, source–sink dynamics, and ecological traps. We posit that these same processes can occur in naturally-fragmented systems such as island archipelagos and that two in particular (metapopulations, source–sink dynamics) may be relevant to the Alexander Archipelago wolf.

Alexander Archipelago wolves probably exist in a metapopulation, defined here as sets of spatially distributed populations among which dispersal and turnover are possible but do not necessarily occur (Harrison 1994, p. 117). However, we lack data from which to test this hypothesis. We include it here to emphasize that, for wolves in particular, both among-population processes and within-population movements are key components of wolf persistence.

Further, some populations of Alexander Archipelago wolf may be strong contributors (i.e., sources) to metapopulation growth while others are drains (i.e., sinks), and still others have no consistent influence on neighboring population units. Breed (2007, p. 34) hypothesized that wolves in coastal British Columbia served as a source population for wolves in southeastern Alaska, specifically GMU 1A, and that hunting of southeastern Alaskan wolves contributed to its role as a sink population. His findings have not been substantiated with demographic data, and doing so would require additional field effort and careful interpretation of population processes.

CHAPTER 5: CURRENT AND FUTURE HABITAT AND RESOURCE CONDITIONS

5.1. Environment

The range of the Alexander Archipelago wolf comprises a narrow strip of mainland and several island complexes found between the Coast Mountain Range of Canada and the Pacific Ocean. The region is dominated by coniferous temperate rainforests, interspersed with other habitat types such as sphagnum bogs, sedge-dominated fens, alpine areas, and numerous lakes, rivers, and estuaries. The largest island complex, the Alexander Archipelago in southeastern Alaska, spans over 500 km in latitude and includes more than 22,000 islands, ranging in size from several m^2 to over 6,000 km^2. South of the Alexander Archipelago, the Haida Gwaii Islands lie approximately 80 km west of mainland British Columbia (no wolves occupy these islands; see *Distribution*). Moving further south, many smaller island groups occur adjacent to the mainland, especially near the outflows of major river systems. At the far southern end of the range, Vancouver Island is separated from the mainland by only a narrow ocean channel at several points.

The topography of mainland southeastern Alaska and coastal British Columbia is rugged with numerous deep, glacially-carved fjords, some of which penetrate the Coast Mountain Range. A narrow band of forest grows between the ocean and steep mountains to the northeast (Albert and Schoen 2013, pp. 775–776). Several major rivers transect the Coast Mountain Range, connecting coastal Alaska to interior British Columbia and Yukon Territory. Outside of these river corridors, glaciers and ice fields dominate the higher elevations, separating the coastal forests from the adjacent inland forest in continental Canada (Albert and Schoen 2007, p. 2).

The climate in southeastern Alaska and coastal British Columbia is generally wet and cool, although with considerable geographic variation. Average annual precipitation varies from 50 to 600 cm near sea level, with more precipitation at higher elevations (Albert and Schoen 2007, p. 2; Tillmann and Glick 2013, p. 22). Summers tend to be drier than winters, when much of the precipitation falls as snow in northern portions of the region and at higher elevations (Tillmann and Glick 2013, pp. 21–22). Generally, temperatures are warmer in the southern portions of the range, and precipitation decreases from west to east (Shanley et al. 2015, p. 5), often resulting in rainshadows on the eastern sides of some of the larger islands (MacKinnon 2003, p. 475).

The coastal forests of southeastern Alaska and coastal British Columbia are part of the temperate rainforest ecosystem that extends along the Pacific coast from northern California to southcentral Alaska. In southeastern Alaska, the lowland forests are composed primarily of western hemlock and Sitka spruce (*Picea sitchensis*), although mountain hemlock (*Tsuga mertensiana*), western redcedar (*Thuja plicata*), and yellow cedar (*Chamaecyparis nootkatensis*) are also present. Currently, these coniferous forests cover roughly 26% of the regional landmass (Figure 5; Shanley 2015). Further south in coastal British Columbia, conifer forest continues to dominate, but Douglas-fir (*Pseudotsuga menziesii*), western redcedar, and other fir species (*Abies* spp.) are increasingly common; about 55–68% of coastal rainforest remains as old-growth, with about 30% logged and reforested, 2% logged and converted to human habitation, and the remainder naturally unforested (MacKinnon 2003, p. 479; Service 2010, p. A-12). With increasing elevation, forests grade into subalpine and alpine vegetation zones; treeline increases in elevation southward, ranging from about 700 to 900 meters (USFS 2008b, p. 3-7; Albert and Schoen 2013,

pp. 775–776). At the highest elevations rock, snow, and ice dominate the land surface. In southeastern Alaska, these non-vegetated areas constitute approximately half of the total land surface (Figure 5), particularly along the mainland and on higher mountains on some of the large islands.

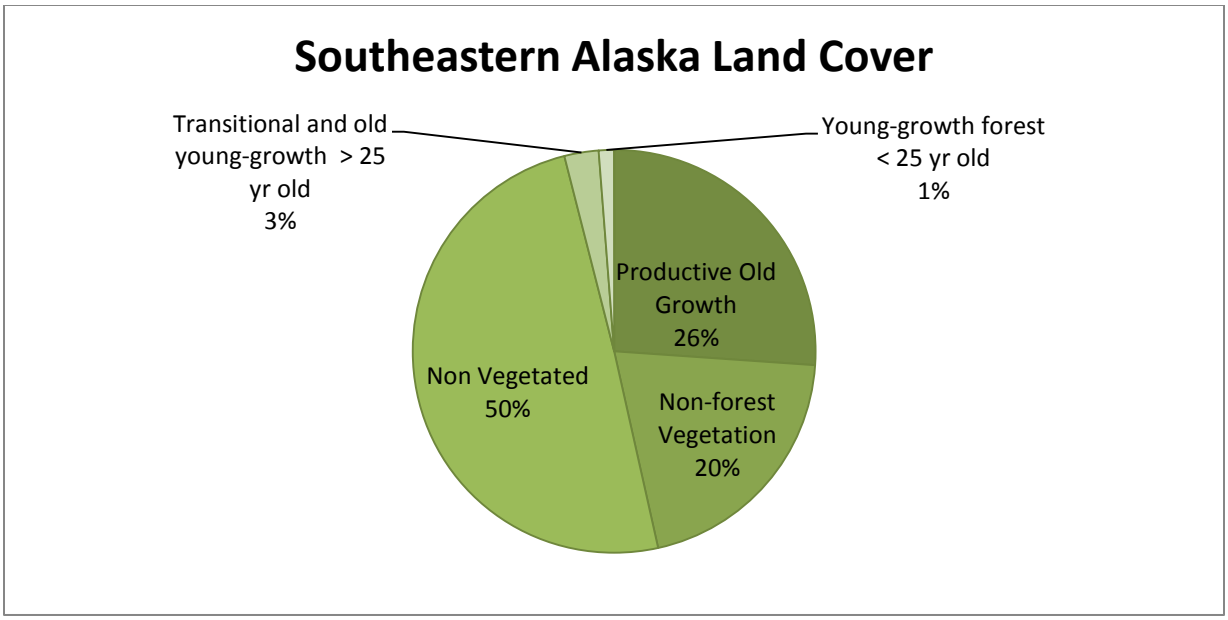

Figure 5. Land cover across southeastern Alaska south of Yakutat (Shanley 2015).

Conifer forests in the northern temperate rainforest are influenced by fine-scale habitat heterogeneity created by underlying geology, topography, and resulting drainage patterns, and various disturbance regimes. Well-drained sites generally have higher forest productivity (often expressed in terms of volume of wood produced per unit area per year, or as a standing volume of wood) compared to poorly-drained sites with deep organic soils, which often produce bogs and fens rather than forest. Forests of intermediate or low productivity occupy transitional ecotones between well-drained productive forests and poorly drained, non-forested areas (Alaback 1982, pp. 1932–1934; USFS 2008b, pp. 3-7–3-8; Albert and Schoen 2013, pp. 775–776). Therefore, local landform diversity and drainage patterns contribute to fine-scale habitat heterogeneity.

Disturbance also plays an important role in the natural fragmentation of the landscape. Fire is rare due to the abundant year-round precipitation, and thus does not play a major role in forest succession at the landscape scale. Instead, wind is the primary disturbance agent, although landslides, avalanches, debris flows, tidal waves, insects, fungi, and disease also influence forest structure and thus contribute to fine-scale habitat heterogeneity. Disturbances generally occur at a small scale, where individual or small groups of trees die or are blown down by wind, creating canopy gaps. Occasional severe wind storms cause extensive damage up to several hundred square kilometers (Nowacki and Kramer 1998, pp.4–14).

5.2. Land ownership

In southeastern Alaska, the majority (76%) of land area lies within the Tongass and is managed by the USFS (Table 11; Shanley 2015). The National Park Service (NPS) is the next largest

landholder (about 12% of land area), mostly within Glacier Bay National Park, although there are several smaller parks near Skagway and Sitka (Figure 6). The State of Alaska (State) manages roughly 4% of the land area in southeastern Alaska, with the majority located in the Haines State Forest, which is managed for timber production. Native Corporations established under the Alaska Native Claims Settlement Act (ANCSA) own about 3% of the land area; these lands are managed largely for timber production and are concentrated in the central and southern portions, especially in GMU 2 (Figure 6). All other ownerships, including private, municipal, and tribal reservation lands, amount to about 5%, with land use varying considerably among these landowners.

Table 11. Land ownership and management (km^2; percent in gray-shaded cells) by Game Management Unit (GMU) across southeastern Alaska south of Yakutat Bay and within the range of the Alexander Archipelago wolf (i.e., minus GMU 4; Shanley 2015). Land owners and managers include U.S. Forest Service (USFS), National Park Service (NPS), State of Alaska (State), Native Corporations, and other private, municipal and tribal lands.

	USFS	NPS	State	Native Corporations	Other
GMU 1	33,571	8,430	2,534	263	3,017
	70%	18%	5%	1%	6%
GMU 2	7,232	0	236	1,573	340
	77%	0%	2%	17%	4%
GMU 3	7,133	0	202	226	261
	91%	0%	3%	3%	3%
GMU 4	14,094	0	79	429	573
	93%	0%	<1%	3%	4%
GMU 5A	4,840	2,444	30	79	134
	64%	33%	<1%	1%	2%
Total	66,871	10,874	3,082	2,571	4,325
	76%	12%	4%	3%	5%
Within the range of the wolf	52,777	10,874	3,003	2,142	3,752
	73%	15%	4%	3%	5%

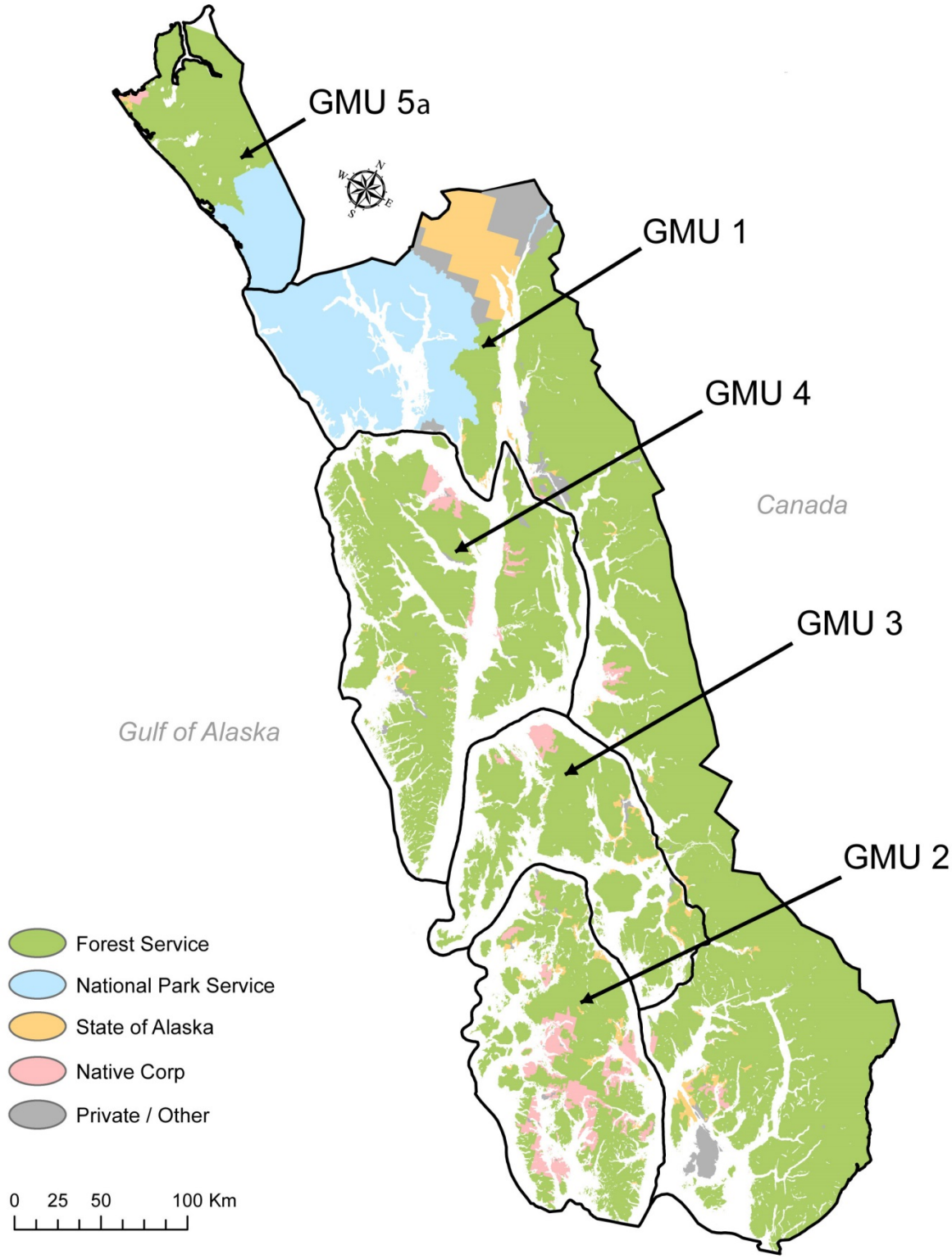

Figure 6. Map depicting land ownership and management across southeastern Alaska south of Yakutat (Shanley 2015). The Alexander Archipelago wolf does not occur in Game Management Unit (GMU) 4.

In British Columbia, most (94%; 895,126 km^2) of the land and forest are owned by the Province of British Columbia (i.e., Crown lands), 4% is privately owned (41,883 km^2), 1% is owned by the federal government (10,371 km^2), and the remaining 1% is owned by First Nations and others (1,349 km^2; British Columbia Ministry of Forests, Mines, and Lands [BCMF] 2010, p. 121). Issues of Aboriginal rights, title, and interest affect land use decisions on public and private land, although little of the total land is owned by First Nations. Roughly 14% of the forests in British Columbia are protected in provincial and national parks, recreation areas, and reserves (BCMF 2010, p. 44).

5.3. Cause and effect analysis

In this section, we describe deterministic stressors that influence environmental conditions experienced by Alexander Archipelago wolves. For the purpose of this assessment, we consider a stressor to be a process or event that may have a negative impact on the target taxon. We use the term deterministic to refer to factors that affect population dynamics in mostly predictable ways, as opposed to stochastic or random factors. We aimed to understand how these stressors may influence the future status of the Alexander Archipelago wolf. A key feature of our analysis was a characterization of the effect of anthropogenic and natural deterministic stressors to wolves at the individual, population, and rangewide levels

GMUs in southeastern Alaska and Regions in coastal British Columbia are both comprised of smaller analysis units, referred to as Wildlife Analysis Areas (WAAs) and Wildlife Management Units (WMUs), respectively. Mean area of WAAs is smaller than WMUs (532 km^2 and 5,624 km^2); for comparison, the home range of Alexander Archipelago wolf is between 500 and 4,000 km^2 depending on location (see *Home range size*). In this section, we conducted analyses at the most appropriate spatial scale given the question at hand and the available data. For example, wolf harvest is managed in southeastern Alaska at the GMU level, so we report harvest statistics by GMU, but we calculated road densities at the WAA level because some GMUs contain water and protected areas (e.g., national parks) that would result in biased or skewed road densities.

For the purpose of our analysis, we considered the future to be about 30 years from present (i.e., 2045). We chose this period of time because it constitutes multiple (roughly 3–6) wolf generations (Fuller et al. 2003, p. 175; Von Holdt et al. 2010, p. 4422) and because it was reasonable in terms of projecting future resource conditions. For example, the Tongass Land and Resource Management Plan (USFS 2008a; hereafter Tongass Forest Plan) is expected to guide management of the Tongass for a period of 10 to 15 years, allowing for 2–3 cycles of plan review and amendment within our defined period of analysis. Further, the Tongass Transition Framework, which outlines a planned shift from old-growth to young-growth harvest, is scheduled through 2040 (Exhibit 6 in USFS 2014a) and therefore is consistent with our time period of analysis for Alexander Archipelago wolf.

5.3.1. Wolf population model

Several deterministic stressors that are known or expected to affect Alexander Archipelago wolves are correlated with one another or interact (e.g., timber harvest and road development). To understand these complex relationships better and to quantify the relative strength of each stressor in isolation, we updated a spatially-explicit population model for wolves based on hypothetical wolf packs in GMU 2, the area for which we have the most data on Alexander

Archipelago wolves and where the three primary stressors on wolves occur at comparatively high levels (compared to other GMUs and to coastal British Columbia) and interact with a fourth stressor. The four stressors (i.e., parameters) included in the model were vegetation condition (i.e., timber harvest), road density, wolf harvest, and frequency of severe winters. Each parameter was assigned 3–5 conditions that described the range of possible future conditions for wolves in GMU 2. We informed the model from 1995 to 2014 with actual data when possible (i.e., hindcasting) and predicted rate of change in wolf abundance between 2015 and 2045 under six scenarios with different combinations of conditions for each of the four stressors (see *Chapter 6*). Our modeling effort allowed us to examine cumulative effects to wolves in GMU 2 within the constraints of the model and therefore under the explicit assumptions of the model. The model also provided an approach to assess response of wolves to each factor individually; in this chapter, we briefly summarize results from our sensitivity analysis, but refer the reader to Gilbert et al. (2015) for details.

To ensure proper interpretation of the model results presented in this chapter, we highlight a few key points about the model. First, although many parameters in the model were informed with empirical data, we modeled a hypothetical wolf population using a wolf pack as a sampling unit; wolf pack status was determined as a function of deer abundance, which was estimated in a sub-model of deer habitat capability based on forest developmental stage and environmental features. Because our model was based on deer habitat capability and not empirical estimates of deer abundance, we present results as percent change in wolf and deer abundance over a specified period of time. Second, model results, including those of the sensitivity analysis, are comparable only to each other. For example, we conducted sensitivity analyses, i.e., where only one variable was perturbed and the remainder was held constant (see Gilbert et al. 2015). In this scenario, wolves (and deer) were predicted to decline and therefore, wolf and deer abundance also declined in the sensitivity analyses; thus, it is critical to interpret the sensitivity analysis results presented in this chapter relative to one another for that particular parameter. In other words, the reader should evaluate the relative change (emphasis added) among conditions, not the absolute values themselves. Third, because the model was developed for wolves in GMU 2 only, the predictions are limited to the GMU 2 population, which is not representative of the other populations of the Alexander Archipelago wolf.

5.3.2. Timber harvest

Timber harvest and associated development has altered the landscape within the range of the Alexander Archipelago wolf more than any other human activity, and probably will continue to do so in the future. Therefore, timber harvest is an obvious deterministic stressor considered in this assessment. In this section, we briefly review timber management and practices in southeastern Alaska and coastal British Columbia, then describe past timber harvest, current conditions on the landscape, and projections for future timber harvest. For simplicity, we assess road development separately, although we recognize that these two stressors are interconnected. We close this section by summarizing the potential effects of timber harvest on Alexander Archipelago wolves and their prey.

Overview of timber management and practices

Southeastern Alaska.—In southeastern Alaska, regulation of timber harvest and associated activities is carried out primarily by the USFS via the Tongass Forest Plan, which partitions the

landscape into various Land Use Designations (LUDs). Each LUD allows specified levels of timber harvest and other development activities, ranging from no development to management primarily for timber production, with intermediate levels of development allowed in some LUDs. Under the current Tongass Forest Plan, timber harvest and other development are allowed on approximately 14,000 km^2 of the Tongass, equivalent to 21% of total Tongass land area (USFS 2008c, p. 4). Given the large percentage of the land managed by the USFS (76%), the Tongass Forest Plan is the single most important regulatory/management framework influencing future habitat and resource conditions of the Alexander Archipelago wolf in southeastern Alaska.

Timber harvest on State, private (including Native Corporation), and municipal land is governed by the Alaska Forest Resources and Practices Act. This State law requires retention of unharvested buffers along anadromous fish-bearing water bodies and establishes standards to minimize erosion of soil. These regulations and their implementation are generally less restrictive than the Tongass Forest Plan that applies to National Forest System lands only. Therefore, on State and private lands that are managed for timber production, harvest is often more intensive than on the Tongass. On NPS lands, timber harvest is not permitted and only limited development is allowed.

Across all land ownerships, clearcut logging has been the primary timber harvest method. This method uses ground-based cable yarding systems to move logs to landings where they can be transported by truck to a processing facility, or to a barge for further transport. Clearcutting removes all trees from a logged unit and results in regeneration of an even-aged young-growth stand. Logging costs for a given volume of wood are typically lowest with this method and regeneration of preferred tree species such as Sitka spruce is favored. In some cases, single trees or small groups of trees may be left to provide wildlife habitat or reduce visual impacts (USFS 2008b, p. 3-328).

In recent years, various forms of uneven-aged management have been used as alternatives to clearcutting in some areas. These approaches include group selections and diameter-limit harvests and are best suited for areas where helicopters can be used to yard logs, rather than ground-based cable systems. Costs typically are higher with these “partial harvest” systems than with clearcutting, so higher-value trees often are targeted for harvest to help offset higher costs (USFS 2008b, pp. 3-328–3-329). Harvest also is spread over a larger area to produce the same timber volume that clearcutting could produce. While this methodology does not result in complete removal of tree cover from an area, nevertheless considerable slash and debris can result at the site and persist for some time. This approach results in retention of forest canopy that captures some snowfall (reducing snow accumulation) and increases heterogeneity during stand development, which favors retention of forage plants.

Coastal British Columbia.—In British Columbia, approximately 50% of the timber volume is located on land suitable for harvesting (BCMF 2010, p. 127). Rights to harvest timber on Crown lands, which is most (94%) of the land in British Columbia, are granted to various parties through timber harvesting licenses. As of 2009, roughly half (52%) of the timber harvesting rights were held in long-term licenses, which under most circumstances the rights to harvest timber and associated responsibilities continue indefinitely; medium-term licenses generally confer rights for 5 to 20 years (26% of licenses) and short-term licenses last 1 to 4 years (22% of

licenses; BCMF 2010, p. 123). The provincial government is shifting away from long-term licenses (75% in 1999 and 52% in 2009).

Timber harvest on Crown lands is regulated by allowable annual cut quota (as determined by the provincial government) and is subject to the Forest and Range Practices Act passed in 2004. For major forest tenure holders, this Act requires two levels of plans and one of these, the Forest Stewardship Plan (FSP), is submitted to the provincial government for approval (BCMF 2010, p. 25). This plan identifies forest development units within which development can occur, and must provide measureable results or verifiable strategies consistent with government objectives. The government typically consults regional- or watershed-based land use plans, which outline long-term management goals and objectives for public lands and include input from a variety of stakeholders and the public, when evaluating FSPs, as well as existing regulations. The FSP has a 5-year term that can be extended to 10 years. Other requirements include consultation with First Nations, the public, and other resource users. In addition, tenure holders must also prepare a site plan that identifies intended roads, cutblocks, and other site-specific details. These plans do not need to be approved by the government, but must be available to the public on request. On private forest land (about 4% of all forested land), planning is the owner's responsibility.

Historically, clearcutting has been the most common silvicultural method for harvesting timber in British Columbia with partial harvest composing a small percentage of the total cut. In the late 1990s, silvicultural practices shifted and since then on public land, 44% of the harvested area was clearcut and the remaining 56% was harvested under clearcutting with reserves, variable retention, and other partial cutting systems (BCMF 2010, p. 144). Since 1987, holders of timber harvesting licenses have been required to reforest the areas that they harvest (p. 143).

Past timber harvest and current conditions

Southeastern Alaska.—Commercial logging was initiated in southeastern Alaska in the late 1800s, primarily to encourage local economic growth and support development of mining, fishing, and local communities. In 1955, following completion of a major pulp mill in Ketchikan, industrial-scale logging began, dramatically increasing the rate of timber harvest. From 1909 to 1952, an average of 41 million board feet (mmbf) per year was harvested, increasing to 380 mmbf per year from 1955 to 1995 (Iverson et al. 1996, pp. 7–8; USFS 1997, p. 3-259). Timber harvest then declined to 89 mmbf per year from 1996 to 2004, and further declined to 32 mmbf per year from 2008 to 2013 (USFS 2014b, p. 220).

Across southeastern Alaska, nearly 3,000 km^2 of forest has been logged. Timber harvest was near or above 500 km^2 per decade during the 1960s through the 1990s, peaking in the 1980s when approximately 780 km^2 of productive forest was logged (Figure 7). Recent declines in the rate of logging have been linked to several factors, including changes in market conditions, more restrictive standards and guidelines in the 1997 Tongass Forest Plan, and litigation (Brackley et al. 2006, pp. 4–5, 27; USFS 2012, p. 13); additionally, vast amounts of the easily accessible productive forest has been logged.

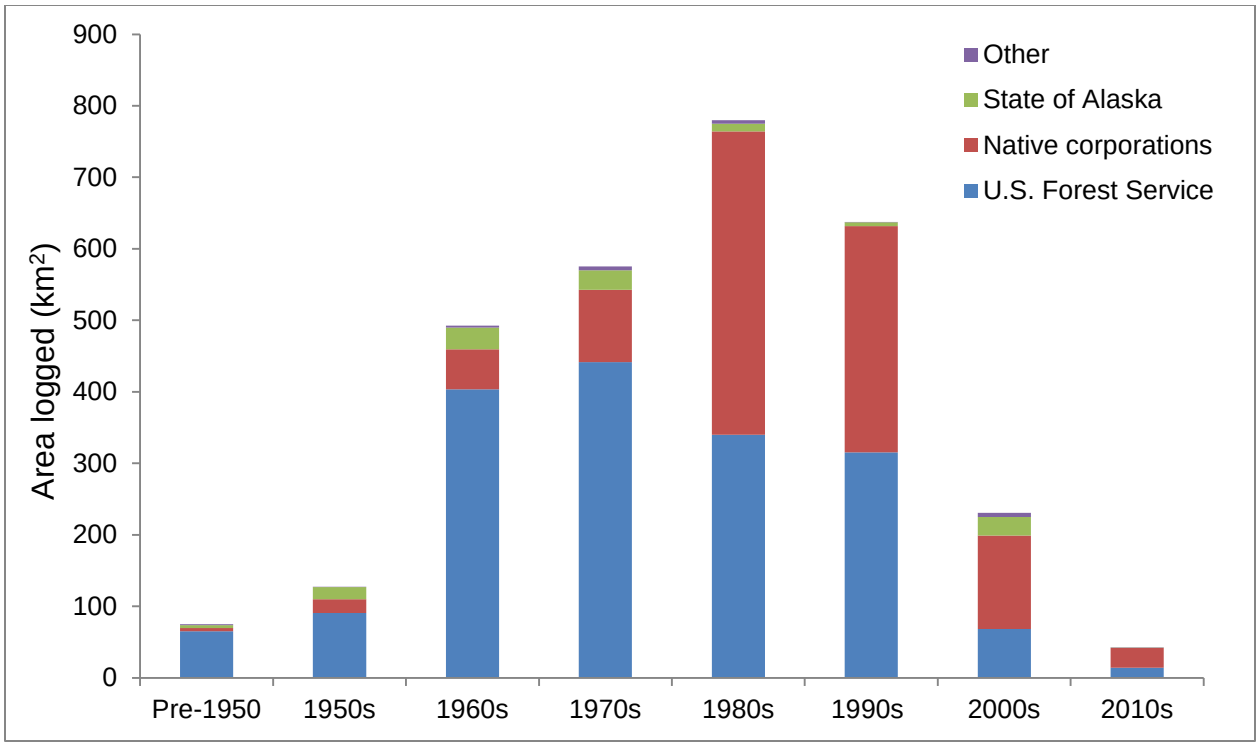

Figure 7. Age distribution of logged forest across all land ownerships in southeastern Alaska (Shanley 2015). Data from 2010s reflects harvest through 2013.

Although most (58%) of the logging in southeastern Alaska has occurred on USFS land, Native Corporations, which own only 3% of the land area, account for roughly one-third of the logging based on area harvested (Table 11, Figure 7). This reflects the higher rates of harvest on lands owned by Native Corporations (56% of their productive forest harvested to date) compared to USFS land (8% of the productive forest harvested; Table 12). These data are based on current ownership of the land and may overestimate the amount of logging accomplished by Native Corporations if young-growth now in Native Corporation ownership was originally logged while managed by the USFS or others. Nonetheless, combined USFS and Native Corporation lands currently account for over 95% of the area logged in southeastern Alaska (Figure 7).

Table 12. Current condition (km^2) of forest stands by land ownership and management, southeastern Alaska (Shanley 2015). Land owners and managers include U.S. Forest Service (USFS), National Park Service (NPS), State of Alaska (State), and Native Corporations.

Land owner or manager	Current forest condition (km^2)			% of forest logged
	Productive old-growth	Young-growth	Total forest	
USFS	19,903	1,739	21,642	8.0
NPS	827	1	828	0.1
State	799	120	919	13.1
Native Corporations	854	1,080	1,934	55.8

Intensity of timber harvest has not occurred evenly across southeastern Alaska (Figure 8). Initially, harvest was concentrated along marine shorelines near mines and towns to support early industry (primarily mining and fishing) and community development. However, after mills were built in Ketchikan, Sitka, and Wrangell in the 1950s, areas designated specifically for timber harvest were targeted in order to supply those mills. As a result, substantial timber harvest occurred on POW, Revillagigedo, and surrounding islands for delivery to the Ketchikan pulp mill, on northern Baranof and eastern Chichagof islands to support the Sitka pulp mill, and portions of Wrangell, Etolin, and Mitkof islands for the Wrangell sawmill. Native corporations have logged on many islands including POW and surrounding islands, Revillagigedo, Kupreanof, Kuiu, Admiralty, Baranof, and Chichagof, as well as portions of the mainland (e.g., Hobart Bay, Port Houghton). In addition, logging has occurred on State lands on the northern mainland near Haines and Yakutat and on islands in the southern portion of the region, including POW, Gravina, and Revillagigedo (Figure 8).

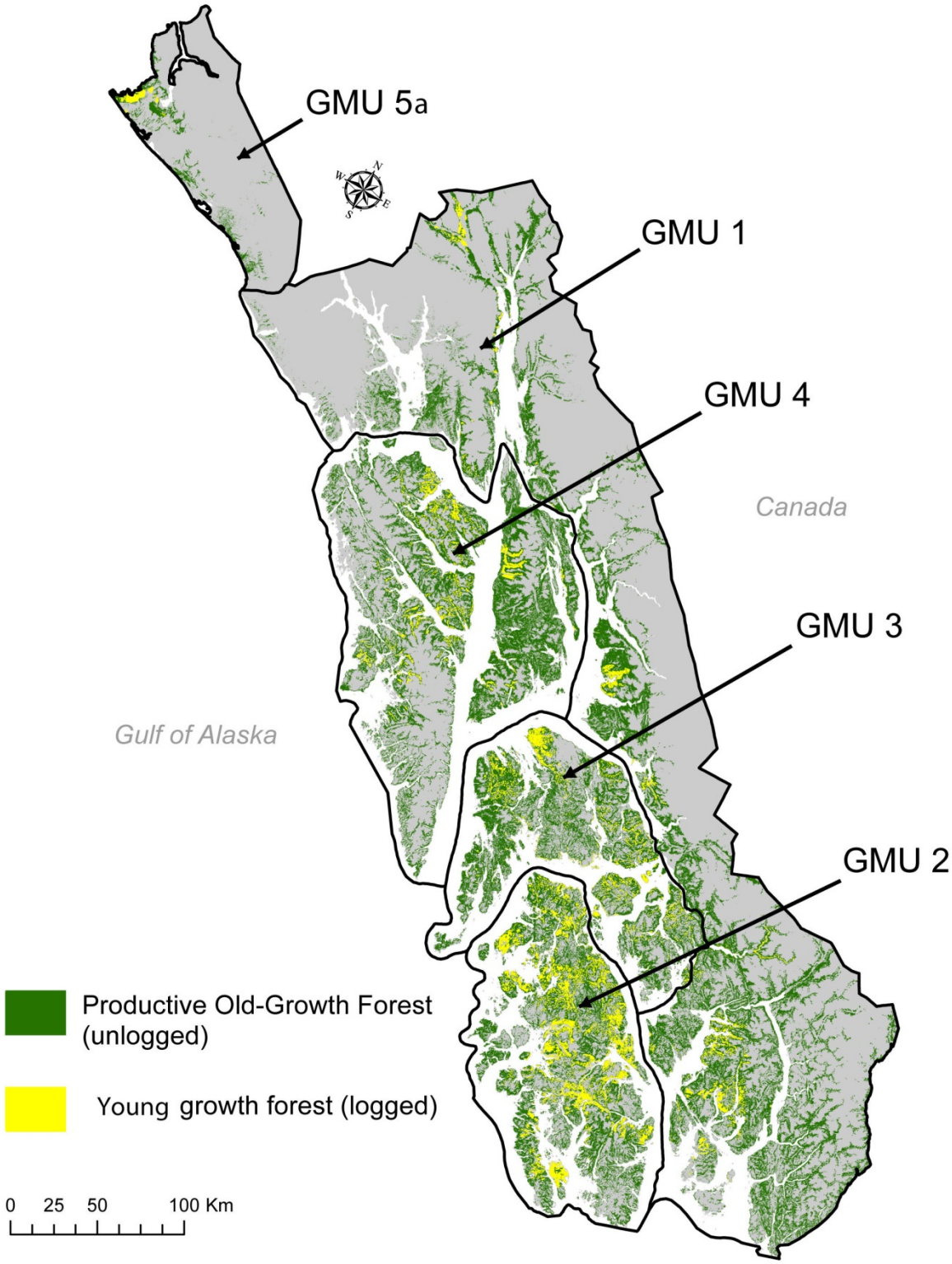

Figure 8. Current distribution of (unlogged) productive old-growth forest and (logged) young-growth forest across southeastern Alaska with Game Management Unit (GMU) boundaries (Shanley 2015). Gray areas are unforested.

Across all of southeastern Alaska, the highest rates of logging (% of productive forest harvested) have occurred in GMU 2 where about 30% of the productive old-growth forest has been logged (Figure 8, Table 13). POW was one of the primary sources of timber for the pulp mill in Ketchikan (which is now closed), as well as a sawmill in Klawock (which continues to operate), in addition to supporting most of the Native Corporation lands devoted to timber production (Figure 6). Overall, logging rates in GMU 2 are at least twice those in all other GMUs and over the range of the Alexander Archipelago wolf in southeastern Alaska (Table 13).

Table 13. Current condition (km^2) of forest stands by Game Management Unit (GMU) and within the range of the Alexander Archipelago wolf (i.e., minus GMU 4), southeastern Alaska (Shanley 2015).

Land owner or manager	Current forest condition (km^2)			% of forest logged
	Productive old-growth	Young-growth	Total forest	
GMU 1	9,800	582	10,382	5.6
GMU 2	5,560	1,639	7,199	22.8
GMU 3	4,177	603	4,780	12.6
GMU 4	6,331	584	6,915	8.4
GMU 5A	512	83	595	13.9
Total	26,380	3,491	29,871	11.7
Within the range of the wolf	20,049	2,907	22,956	12.7

The age distribution of logged stands is of particular importance to deer, the primary prey of the Alexander Archipelago wolf (see *Deer habitat use*). Generally, stands less than 25 years of age are used by deer because they produce abundant forage, but young-growth stands greater than 25 years of age provide little forage for deer due to canopy interception of sunlight and are avoided. These low-forage conditions can last for another 150 years, until natural disturbances or further timber harvest disrupt the uniform structure of the forest canopy (Alaback 1982, pp. 1936–1942). In GMU 2, where the vast majority of timber harvest occurred, harvest rates were high from the 1960s and the 1990s with a notable peak in the 1980s (Figure 9); therefore, most of the young-growth stands in GMU 2 currently are roughly 15 to 55 years of age, with the large 1980s cohort currently entering the old young-growth age that is poor habitat for deer. Although other GMUs were logged over a similar time period (Figure 9), the rate of harvest in those GMUs was considerably lower (Table 13), underscoring the compromised current condition of GMU 2.

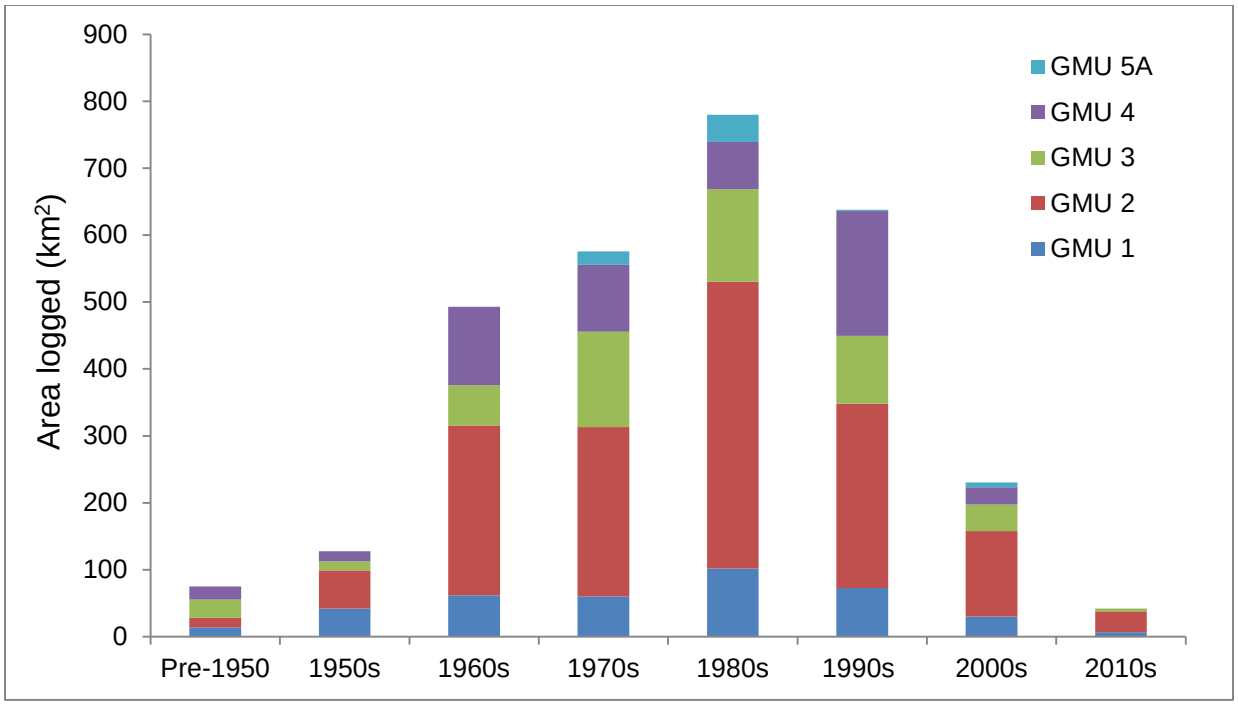

Figure 9. Age distribution of logged forest by Game Management Unit (GMU), southeastern Alaska (Shanley 2015). Data from 2010s reflects harvest through 2013.

Regeneration of a forest stand following logging typically results in dense stands of young trees that compete with each other for light and nutrients. Removal of some trees in these stands (i.e., precommercial thinning), is a common silvicultural practice used to encourage growth in fewer, larger trees, improving lumber quality and reducing time until subsequent harvest. While precommercial thinning also stimulates the growth of understory (i.e., shrub and forb) biomass, it produces dense slash as a byproduct of thinning, which may reduce use of thinned stands by deer and other wildlife. In addition, as the canopy closes in regenerating stands following precommercial thinning, understory vegetation is shaded and declines; in approximately 10 years, most understory browse once more is eliminated unless additional thinning or other intermediate treatments are conducted (Alaback 1982, pp. 1936–1942; USFS 2008b, pp. 3-329–3-330; Hanley et al. 2013, pp. 1–3).

Typical "precommercial" thinning (done before the trees are large enough to be commercially valuable) reduces stem densities (trees per unit area) to a predetermined spacing (e.g., 4 m by 4 m) or to a variable spacing (depending on distribution of dominant trees). Slash produced by thinning usually is left to decompose in the stand where it was cut. Heavy slash accumulations probably interfere with movement of deer (and other wildlife) through thinned stands (Hanley et al. 2013, p. 20), suggesting that the value of thinning to improve deer habitat may be overestimated. Importantly, deer utilization of precommercially thinned stands in southeastern Alaska has not been studied.

Alternative young-growth treatments include pruning (removal of lower branches to improve light penetration and grow knot-free lumber), creation of gaps (removal of small patches of young-growth trees to create openings), and girdling (cutting through the inner bark of live trees

to kill them but leave them standing). In some cases, slash may be cut into smaller pieces to improve access through the stand. Planting alder among regenerating conifers has also been suggested as a method for increasing understory shrub and forb production. Some of these alternative treatments are being evaluated in the Tongass-Wide Young-Growth Studies, with early results (4–8 years post-treatment) suggesting that forage production is improved by thinning and pruning, especially in younger stands, by girdling, but not by alder planting (Hanley et al. 2013, pp. 36–37).

Response of understory browse species to young-growth treatments was much lower in treated stands greater than 35 years old than it was in younger stands (Hanley et al. 2013, pp. 24–29). Approximately 43% of the young-growth on the Tongass is older than 35 years (Figures 7, 9). We do not know how much of this has been thinned (and therefore might produce more browse than unthinned stands), but it is likely that future thinning would have limited benefits for deer in most of the older young-growth in southeastern Alaska. Accumulations of thinning slash that limit availability of forage by interfering with deer movement would further reduce the short-term potential forage benefits of stands treated by traditional precommercial thinning (Hanley et al. 2013, p. 20).

The creation of canopy gaps is a promising technique for stimulating growth of the understory to improve forage for deer and other herbivores. Canopy gaps, unlike precommercial thinning, create small openings in the forest that persist for several decades (Alaback 2010, p.16), and thus could improve forage for deer over a longer timescale. In addition, deer utilization of forage in canopy gaps was high (based on browse surveys, Alaback 2010, pp.7–8), indicating that deer use gap habitats. However, canopy gaps currently are not widely implemented, although precommercial thinning is common.

Since 1979, over 400 km^2 of young-growth on the Tongass has been precommercially thinned, primarily to promote timber production, but also with the intention of improving conditions for deer. In recent years, an average of 23 km^2 has been thinned annually (USFS 2008b, p. 3-329). In addition, young-growth treatments designed to improve habitat have been implemented across a limited area, and include 15 km^2 of riparian thinning, 2.6 km^2 of created corridors, 25 km^2 of created canopy gap openings, and 18 km^2 of upland wildlife thinning (USFS 2015b, p. 3). Approximately 26 to 38 km^2 of young-growth are scheduled for precommercial thinning annually between 2015 and 2019 (USFS 2014c).

Sealaska, the regional Native Corporation established by ANCSA, also has an active thinning program that targets young-growth stands at an early age of development, resulting in less slash and higher retention of the understory compared to stands on the Tongass. Since 1993, Sealaska has treated over 200 km^2 of young-growth on their timber lands and, over the next 5 years, the corporation intends to thin approximately 12 km^2 annually. In addition, Sealaska has “pruned”, i.e., removed the lower branches of the trees, to reduce competition and improve understory development, on approximately 17 km^2 of young-growth forest, with plans to prune approximately 2.8 km^2 annualy over the next 5 years (Kleinhenz 2015, p. 1).

Coastal British Columbia.—Between the 1900s and 1990s, timber harvest on public and private lands in British Columbia increased 10-fold, levelling off in the 1990s (BCMF 2010, p. 137).

Beginning in 1949, the government set allowable annual cut limits in an attempt to regulate the growing timber industry on public lands and some private lands. Over the last 10 years, the average total timber harvest across the province was 78 million cubic meters per year and most (89%) came from forests that were regulated by allowable annual cut limits. On these forests, actual harvest typically is below the cut limit; over the last 10 years, average annual harvest was 69 million cubic meters per year, but the allowable cut was 78 million cubic meters per year, roughly 12% below the permissible level (p. 138). However, the provincial harvest in 2005 peaked at 90 million cubic meters per year, which was well above the average annual harvest and the allowable cut. Harvest levels rapidly decreased since then and are now below the average due to market conditions (pp. 140–141).

More than half of the old-growth forest in coastal British Columbia remains intact, although the percentage is much lower in Regions 1 and 2, especially in productive Douglas-fir forests (MacKinnon 2003, p. 483; Figure 10). Using an integrated land cover developed for the transboundary area by the North Pacific Landscape Conservation Cooperative (available at http://www.nplcc.databasin.org), we estimated percent of forest logged in each Region of coastal British Columbia. Based on that data layer, we determined that across all of coastal British Columbia, 24% of the forest was harvested with a larger percentage harvested in Region 1 (34%) than all other regions (Region 2=12%, Region 5=14%, and Region 6=17%). Most of the offshore islands adjacent to the mainland remain unharvested (Figure 10).

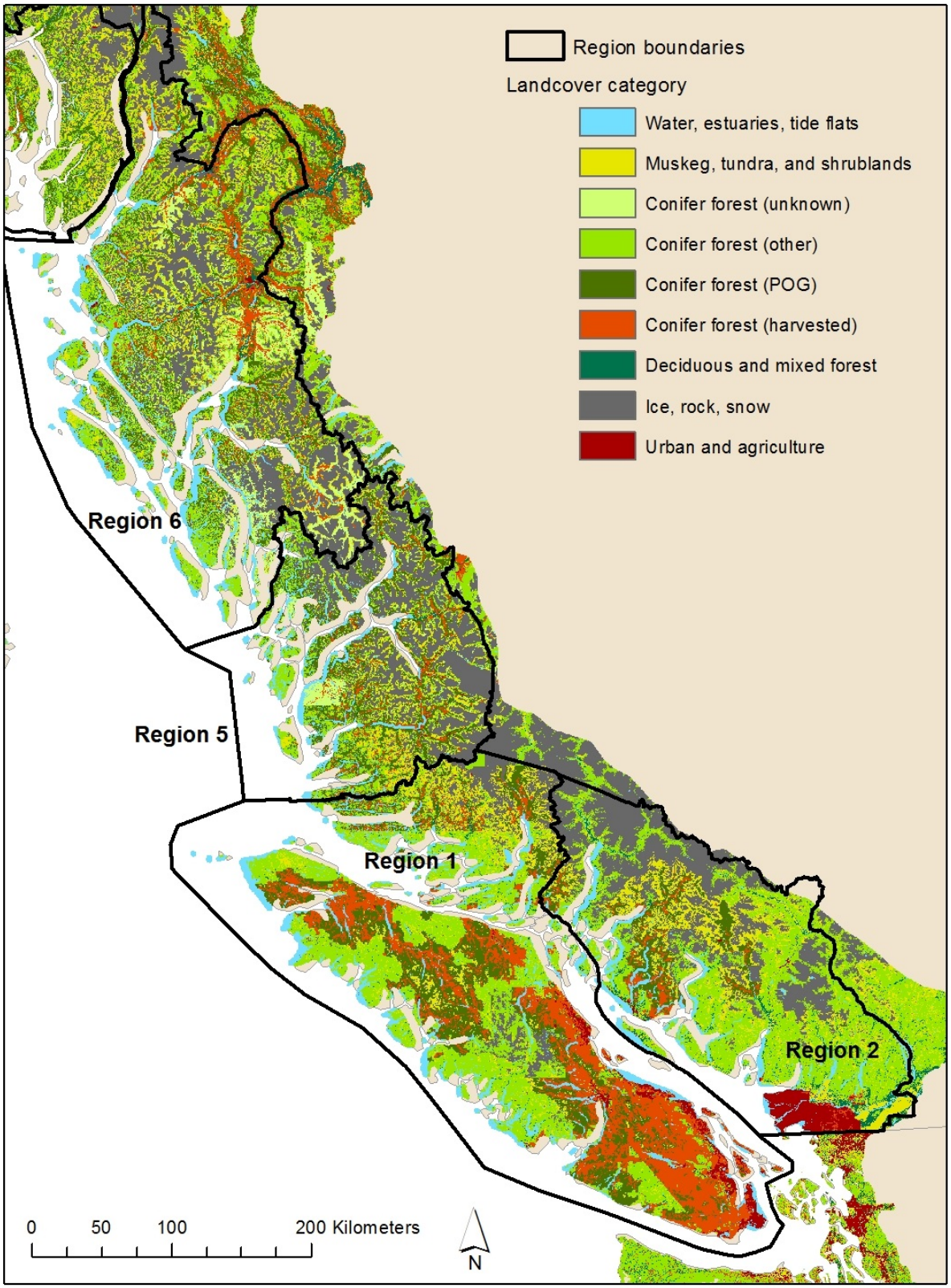

Figure 10. Map depicting current land cover in coastal British Columbia (available at: https://sciencebase.gov/catalog/item/558474dae4b023124e8f5969; accessed July 10, 2015).

Future timber harvest

Southeastern Alaska.—In an effort to meet demand for timber, the USFS aims to keep an adequate volume of timber available for sale to operators in southeastern Alaska (USFS 2008d, pp. G-1–G-3). The current Five Year Sale Schedule and Contract Plan produced by the USFS for Tongass identifies 31 timber sales that will provide an estimated 331 mmbf of timber between 2015 and 2019. Most of this timber is scheduled to be sourced from GMUs 2 and 3 (Table 14; USFS 2014d).

Table 14. Timber volume (mmbf) scheduled to be for sale on the Tongass National Forest between 2015 and 2019 by Game Management Unit (GMU), southeastern Alaska (USFS 2014d).

Year	GMU 1	GMU 2	GMU 3	Total
2015	15.00	24.88	10.00	49.88
2016	10.00	18.00	35.00	63.00
2017	12.00	20.00	44.00	76.00
2018	2.00	36.50	45.50	84.00
2019	28.00	25.00	5.00	58.00
Totals	67.00	124.38	139.50	330.88

Before the USFS can offer timber for harvest, it must first evaluate and disclose the potential effects of proposed logging in an environmental assessment (for smaller projects) or an environmental impact statement (for large projects with more significant impacts), under the authority of the National Environmental Policy Act (NEPA). After this analysis is complete, approval is documented in a Record of Decision and the timber is referred to as “NEPA cleared.” At this point, unless the USFS is challenged legally, the timber may be sold. As of June 2015, timber totaling an estimated 205 mmbf from 12 different NEPA project decisions remained NEPA cleared but unsold (Table 15; Sever 2015). It is difficult to convert this volume of wood accurately to an area that will likely be logged because many of these projects involve partial harvest.

After the timber is sold, it is considered to be “under contract” and may be cut by the purchaser. As of April 2015, the Tongass had 56 contracts in place with approximately 150 mmbf of timber remaining that was not yet cut (Table 15; USFS 2015c). Most (78%) of the projected harvest (including volume under contract, scheduled volume, and NEPA-cleared volume) is located in GMUs 2 and 3 where roughly 64% of the past harvest occurred in southeastern Alaska (Table 13). GMUs 1 and 4 are projected to contribute proportionately less to the total future harvest compared to the past. GMU 5A will continue to play a minor role (Tables 11, 12).

Table 15. Timber volume (mmbf) by Game Management Unit (GMU) and status on the Tongass National Forest, southeastern Alaska, as of June 2015 (USFS 2014d; USFS 2015c). Timber cleared under the National Environmental Policy Act (NEPA) has been reviewed and approved, but not sold. Uncut timber under contract has been sold and may be cut at any time.

GMU	NEPA-cleared volume of timber (unsold)	Uncut volume of timber under contract (sold)	Total projected harvest
1	31.5	4.5	36.0
2	54.9	110.5	165.4
3	76.7	26.6	103.3
4	41.8	8.8	50.6
5A	0.0	0.0	0.0
Total	204.9	150.5	355.3

We acknowledge a large degree of uncertainty associated with planning, selling, and cutting timber on the Tongass. Between 2008 and 2013, an average of 28.29 mmbf of timber was sold, roughly 11% of the annual allowable sale quantity under the current Tongass Forest Plan (267 mmbf). Timber sales on the Tongass often have been delayed during the planning process and due to litigation surrounding individual project decisions. In some cases, timber is offered for sale, but not sold due to a lack of bidders. Thus, with respect to future timber harvest on the Tongass, it is likely that the projected harvest described in this section will not be implemented fully or on schedule; alternatively, sales and projects currently not on the schedule could be prioritized in the future.

We did not find data on future timber harvest planned for private lands. In December 2014, Congress passed legislation authorizing transfer of 18 parcels totaling 283 km^2 of USFS land on the Tongass to Sealaska. Most of this land (approximately 277 km^2; 98%) reportedly will be managed for natural resource development (primarily timber harvest), with the balance to be preserved as cultural sites or used for small economic development opportunities (Sealaska 2014, p. 1).

Across all land ownerships, nearly all timber harvested to date has been from old-growth forests. In July 2013, the Secretary of Agriculture issued a memorandum directing the Tongass to transition to a young-growth-based timber program in 10–15 years (U.S. Department of Agriculture 2013), much sooner than outlined in the Tongass Forest Plan. To implement this direction, the Forest Service currently is developing and evaluating alternatives to accelerate harvest of existing young-growth forest and reduce harvest of old-growth substantially, while providing adequate timber to support existing industry. An amendment of the Tongass Forest Plan is underway and is expected to be completed by the end of 2016 (80 Federal Register 35934, June 23, 2015).

Most of the oldest young-growth forest, which provides the first available harvest under this transition, is located at low elevations along marine shorelines. Under the current Tongass Forest Plan, timber harvest is not allowed in these areas because of their high value to wildlife (e.g., deer winter habitat; see *Deer habitat use*). The USFS is considering alternatives as part of the Tongass Forest Plan amendment process that would permit commercial harvest in these older young-growth stands along the beach. Because these stands tend to be effective at intercepting

snow and providing thermal cover and forage for deer during winter, harvest of these low elevation, young-growth stands along the beach may impact deer negatively, particularly in deep-snow winters.

Coastal British Columbia.—Forests with government-regulated allowable annual cuts in British Columbia are forecast to be stable over the long term. However, in the shorter term, some units in the interior part of the province are experiencing widespread tree mortality due to the mountain pine beetle (*Dendroctonus ponderosae*) epidemic. Therefore, the provincial government predicts reduced timber supply from the interior forests and potential increased supply in some coastal forests. For now, the actual timber harvest is occurring at reduced levels throughout British Columbia and allowable annual cut limits and forecasts will be revisited in 2020 (BCMF 2010, p. 141).

Between 2005 and 2100, an additional 17% of old-growth forest was projected to be harvested on Vancouver Island and additional 39% was expected to be logged on the mainland of coastal British Columbia (Service 2010, p. A-12). These rates equate to roughly 1% per year across coastal British Columbia. However, some of this timber volume would be harvested from old young-growth stands. Regardless, based on the information we found, the timber industry in British Columbia is faced with substantial uncertainty in the near future due to market conditions and insect infestations.

Effects of timber harvest on wolves.— The only potential direct effect from timber harvest to Alexander Archipelago wolves for which some evidence exists is the modification of and disturbance at den sites. Person and Russell (2009, p. 220) found that most used den sites were located farther from logged stands and roads than unused locations; on average, dens were located 988 m from logged stands and 1,351 m from roads (p. 217). Wolves never located dens in clearcuts or young-growth forests (p. 221). Although wolves were tolerant of short periods of researcher disturbance, the authors believed that wolves avoided logged areas and roads because of regular and long-term use by humans. To minimize destruction of and disturbance at den sites, the USFS developed standards and guidelines specific to active wolf dens in or near areas where timber harvest is occurring (summarized in *Existing conservation mechanisms*). These efforts are required to be implemented on federal lands in southeastern Alaska only (roughly 74% of land; Figure 6, Table 11). We are not aware of similar conservation guidelines for wolf den sites in coastal British Columbia.

Other potential direct effects from timber harvest may exist, such as loss of rendezvous sites and movement corridors, but we found no evidence suggesting that these effects are impacting individuals or populations of Alexander Archipelago wolf. Nonetheless, we acknowledge that wolves in southeastern Alaska and coastal British Columbia may be impacted directly by timber harvest in undocumented ways, but we have no basis from which to evaluate them.

Throughout their circumpolar distribution, gray wolves exhibit a high degree of plasticity in their use of different habitats. As a species, their presence is thought to be linked to a sufficient supply of prey, primarily ungulates, rather than a preference for specific habitat types. On POW, Person and Ingle (1995, p. 30) found that wolves used young-growth habitat significantly less than expected based on its availability and appeared to be selecting for unharvested forests,

presumably due to high cost of movement and low visibility, resulting in poor hunting conditions for wolves. Wolves also preferentially use low elevation areas, i.e., below 400 m (Person 2001, p. 62). Based on these findings and others summarized above (*Resource selection* and *Wolf-deer habitat relationships*), the effect of timber harvest on wolves probably is mostly indirect and is driven by the presence and availability of deer and other prey at low elevations and, for forest-associated prey, in unharvested forests. Therefore, below, we consider potential functional and numerical responses of Alexander Archipelago wolves to habitat modifications from timber harvesting, and to changes in the abundance of deer and other prey.

Deer.—Sitka black-tailed deer are found on all islands within the range of the Alexander Archipelago wolf and the mainland except in GMU 5A (other than a small introduced population; MacDonald and Cook 2007, p. 102; Nelson et al. 2008, p. 7). Many field studies have established that deer selectively use productive old-growth forests in winter, especially during periods of deep snow (e.g., Schoen and Kirchhoff 1990, p. 374), although physical site characteristics may be better predictors of use in some areas and during some winters (e.g., Doerr et al. 2005, p. 322). Early seral stage forests provide some benefits to deer as the result of increased production of shrub biomass, but these benefits are short-term; additionally, this forage may be buried in snow in winter and may be of lower quality for deer (Hanley 2005, p. 105). Once regenerating forests are >25 years old, they provide fewer benefits to deer (e.g., Person et al. 2009, p. 5), and this condition extends for more than 100 years until the understory returns fully (Alaback 1982, p. 1939). Populations of deer in those areas of intensive timber harvest are expected to decline as the result of long-term reduction in the carrying capacity of their winter habitat; for example, in GMU 2, Person (2001, p. 79) predicted a 28% decline in deer between 1995 and 2045. During winters with deep snow, extreme levels of mortality from malnutrition also is predicted, as well as increased susceptibility to wolf predation as deer concentrate in smaller patches of winter range (e.g., McNay and Voller 1995, p. 138; Farmer et al. 2006, p. 1412; Person et al. 2009, p. 8). We describe deer habitat use in more detail above (see *Deer habitat use*).

We are not aware of any long-term data that document declines of deer in southeastern Alaska or coastal British Columbia at the watershed or landscape scale relative to timber harvest, yet projections of long term declines in deer numbers, based on an evaluation forage, are well founded. These projections have been generated using several models developed over the last 30 years aimed to estimate carrying capacity of deer (e.g., Fagen 1988; Hanley and Rogers 1989; Kirchhoff et al. 1990) and more models continue to be developed (e.g., Forage Resource Evaluation System for Habitat; Hanley et al. 2015). The model most often used in conservation planning and management for deer originally was developed by Suring et al. (1993), although it has undergone some revision since then (e.g., Schoen and Kirchhoff 2007, p. 9; hereafter we refer to it as the deer habitat model). This model estimates deer habitat capability, which is an index of carrying capacity, during winter when deer populations are assumed to be most limited. Variables included in the model are elevation, slope, aspect, and stand age and size. The model was not intended to predict actual populations or densities of deer in the future, but instead to estimate the maximum number or density of deer that a specific habitat (or defined area) can support indefinitely. These estimates can be useful in assessing the current and future conditions for deer and therefore wolves, given that deer are their primary prey, assuming that deer habitat capability as expressed in the deer habitat model is a reliable indicator of deer abundance.

Using the latest version of the deer habitat model, Albert and Schoen (2007, p. 31) modeled and mapped deer habitat capability in two time periods (1954 and 2002) across all land ownerships in southeastern Alaska. As of 2002, 79% of the original deer habitat value still remained in southeastern Alaska (p. 2-15). Within the range of the Alexander Archipelago wolf, the highest deer habitat capability was in GMU 2 (47%), followed by GMU 3 (34%), and the remainder in parts of GMUs 1A and 1B (19%); most of the mainland of southeastern Alaska was not included in their analysis because it was considered as generally poor winter habitat for deer (p. 2-16). Between 1954 and 2002, deer habitat capability changed the most (62% of its original value) on northern POW and the least (89%) on southern POW. In GMU 3, habitat capability in 2002 was 77–87% of that in 1954, and in GMUs 1A and 1B it was 85% of its original value. To the best of our knowledge, their modeling effort provides the most current published estimates of deer habitat capability throughout all of southeastern Alaska.

We used the deer habitat model to predict habitat capability of deer in GMU 2 out to year 2045 and then used the output to model the GMU 2 wolf population over the same time period. Our primary goal was to understand the effects of past and future timber harvest on future wolf abundance. Across the range of the Alexander Archipelago wolf, GMU 2 has been disproportionately harvested for timber compared to other GMUs and Regions (Figure 8, Table 13) and therefore, our results should represent the apparent worst-case scenario for deer and wolves. We acknowledge that our wolf population model is subject to the assumptions of the deer habitat model, but in the absence of empirical data on deer abundance, we believe it is reasonable and logical to use deer habitat capability as an indicator of deer abundance.

We estimated deer carrying capacity annually under six possible future vegetation conditions in GMU 2 (Table 16): Steady K (constant carrying capacity beginning in 2015), No future harvest (referring to timber harvest, natural succession only), Transition SG (transition of timber harvest from old-growth to second-growth), Continued OG (continued old-growth harvest; comparable to recent rates of harvest between 2008 and 2014), Increased OG (increased old-growth harvest; comparable to rates of harvest between 1995 and 2000), and Max OG (maximum old-growth harvest; full implementation of the Tongass Forest Plan). We assumed a predation rate of 15 deer/wolf/year as estimated from Szepanski et al. 1999 (p. 331, calculated following Person et al. [1996, p. 42]) and a beginning deer abundance as 75% of the carry capacity in 1995. Our model also included other factors such as predation that may limit deer abundance. See Gilbert et al. (2015) for details about the wolf population model.

Table 16. Description of vegetation conditions and assumptions for rate of harvest by land ownership and management under which we modeled changes in wolf abundance between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Rate of harvest is in millions of board feet of timber (mmbf). See Gilbert et al. (2015) for more detailed description of vegetation conditions.

Vegetation condition	Land ownership and management					
	USFS	Sealaska Land Finalization Act	Mental Health Land Exchange	State Forest	Other ANCSA[1] Corporation Lands	Total harvested
Steady K	Not applicable – deer carrying capacity in 2015 assumed constant through 2045					None
No future harvest	Not applicable – natural succession only					None
Transition SG	Second-growth and old-growth projects as described in current USFS 5-year Schedule of Activities[2]	28 mmbf/year	No exchange (remains USFS land)	11 mmbf/year	14 mmbf/year	53.0 mmbf/year, plus projects included in USFS Transition Schedule
Continued OG	12.6 mmbf/year from GMU 2[2]	28 mmbf/year	15 mmbf/year	11 mmbf/year	14 mmbf/year	80.6 mmbf/year
Increased OG	47.6 mmbf/year from GMU 2[2]	56 mmbf/year	30 mmbf/year	22 mmbf/year	28 mmbf/year	183.6 mmbf/year
Max OG	69.2 mmbf/year from GMU 2[2,3]	84 mmbf/year	45 mmbf/year	33 mmbf/year	42 mmbf/year	273.2 mmbf/year

[1]Alaska Native Claims Settlement Act.
[2]Assumes that the Big Thorne Timber Sale proceeds as sold.
[3]Assumes that administrative protections applied under the 2001 Roadless Rule are repealed for the Tongass National Forest.

Based on our modeling effort, we found that impacts of past and future timber harvest were greater for deer than for wolves under all six vegetation conditions (Figure 11). Percent of mean population change of wolves between 2015 and 2045 ranged from -4% under Steady K to -10% under Increased OG, while deer ranged from -16% change under Steady K to -26% change under Max OG. Variance associated with all estimates was substantial (Figure 11) due to the stochastic structure of the model. When we held deer carrying capacity constant (Steady K), both wolf and deer abundance still were predicted to decline, indicating that current conditions on the landscape are insufficient for maintaining stable deer and wolf populations. Our results suggest that past timber harvest in GMU 2 will result in declines in deer and to a lesser extent wolves over the next 30 years, and that future timber harvest would exacerbate declines, especially for deer, but would have less of an impact compared to effects of past timber harvest.

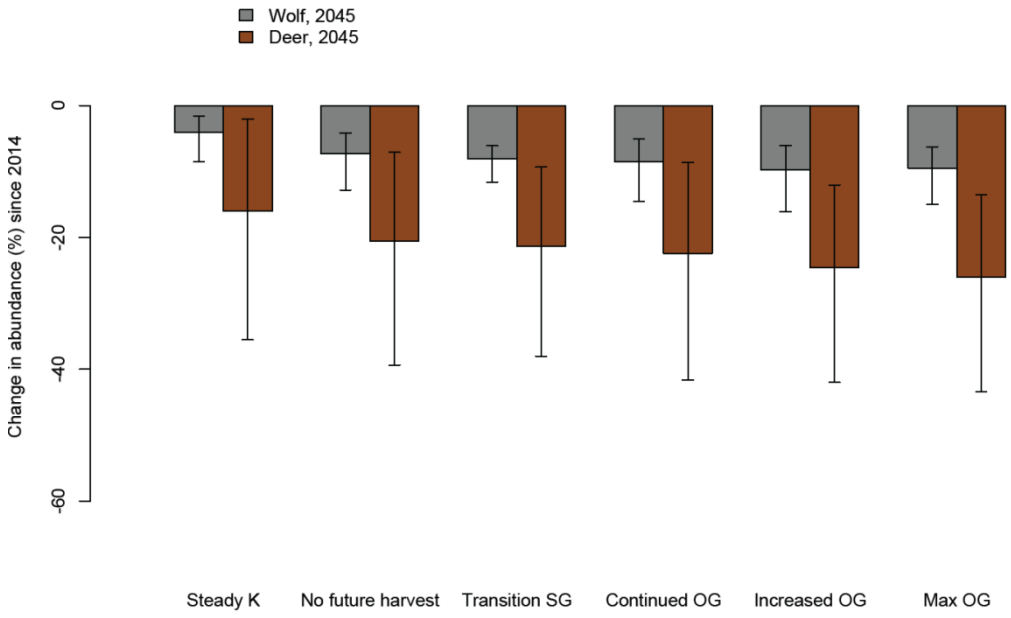

Figure 11. Estimated percent change in mean abundance of wolves and deer under six vegetation conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

Our wolf population model assumes a strong positive relationship between deer and wolf abundance, which is supported by information on wolf diet in GMU 2. Although wolves are opportunistic predators and are known to shift their diet based on prey availability (see *Food habits*), the relationship between deer abundance and wolf populations likely will remain. Given expected declines in deer abundance, we explored sensitivity of the model to variation in wolf predation rates. Specifically, we ran the model using 9.5 deer/wolf/year (equivalent to ~28% deer in wolf diet, following calculations by Person et al. 1996, p. 42), 15.0 deer/wolf/year (45% deer in wolf diet, based on stable isotope analysis by Szepanski et al. 1999), 20.5 deer/wolf/year (~60% deer in wolf diet), and 26.0 deer/wolf/year (77% deer in wolf diet, based on scat analysis by Person et al. 1996, p. 42).

We found that percent in mean population change in wolves was highly sensitive to wolf diet composition (Figure 12). When wolf diet was composed of only 28% deer, percent change in wolf abundance over the 30-year period was positive (35%), but when at least 45% of wolf diet was deer, then change in abundance was negative, ranging from -8% to -54% as deer increased in the diet of wolves. Likewise, as wolf predation rate on deer increased, percent change in mean population size of deer responded accordingly, with large changes in deer abundance across wolf diet compositions (Figure 12). Thus, although our underlying model relies on a strong deer–wolf relationship, our results demonstrate that these two species are intricately linked in GMU 2.

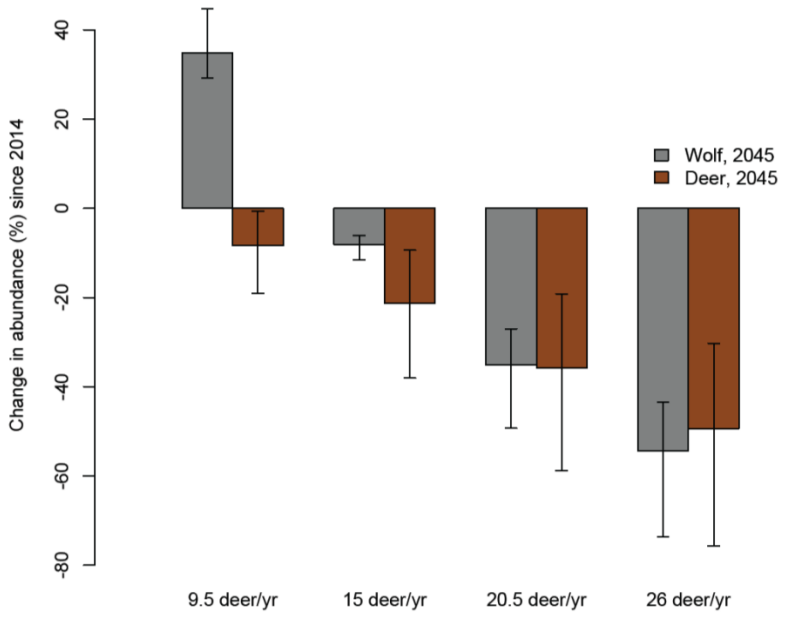

Figure 12. Modeled estimates of percent change in mean abundance of wolves and deer based on four rates of wolf predation on deer between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

Mountain goat.—Within the range of the Alexander Archipelago wolf, mountain goats are found naturally only on the mainland (MacDonald and Cook 2007, p. 104). However, recent genetic analyses suggest that they may have occupied Baranof Island (GMU 4) at one time prior to being introduced there in 1923 (Paul 2009, p. 16; Shafer et al. 2011, p. 1261). Additionally, mountain goats were successfully introduced to Revillagigedo Island in 1983 (GMU 1A; Paul 2009, p. 20). Wolves take mountain goats where the two species are sympatric, especially on the mainland where deer densities are low (Fox and Streveler 1986, p. 193).

During winter, snow forces mountain goats to forested areas at lower elevations (White et al. 2011, p. 1740). In old-growth forests, goats typically are found in close proximity to cliffs, which they use as escape terrain from predators, primarily wolves (Fox and Streveler 1986, pp. 192–194). Most of the mountain goats in southeastern Alaska occur on the mainland where the amount of old-growth forest is more limited than on islands and little of it has been harvested (Figure 8, Table 13). Thus, although forests adjacent to cliffs provide critical habitat for mountain goats during the winter, it is unlikely that timber harvest has had or will have a

population level effect on mountain goats within the range of the Alexander Archipelago wolf, but some individuals or local populations (e.g., Cleveland Peninsula) may be impacted.

Moose.—Moose migrated down the major river systems from Canada into southeastern Alaska during the early 20th century. All moose populations in southeastern Alaska are natural except for transplanted populations in Berners Bay north of Juneau in Lynn Canal (1958 and 1960) and the Chickamin River (1963 and 1964; MacDonald and Cook 2007, p. 187). Within both coastal British Columbia and southeastern Alaska, moose have expanded their range over the last 50 years and continue to do so (Darimont et al. 2005, p. 235; Hundertmark et al. 2006, p. 331). They now are distributed on the mainland and on Kupreanof, Mitkof, Wrangell, Zarembo, Etolin, and Kuiu islands as well as many of the other smaller islands and apparently a small part of POW (MacDonald and Cook 2007, p. 100). Moose likely are preyed upon by wolves (see *Food habits*), wherever they co-exist.

In southeastern Alaska and coastal British Columbia, moose are associated primarily with riparian and, where available, post-glacial, early successional vegetation types (e.g., White et al. 2014, p. 227). Therefore, although moose habitat is declining in some areas as a result of natural succession, timber harvest has resulted in early successional vegetation types favorable to moose; however, such habitat is ephemeral, diminishing as old second-growth forest (>25 years of age) becomes established. Nonetheless, moose abundance is increasing in British Columbia (Kuzyk and Hatter 2014, p. 880), including the coastal regions (BCMO 2015b), and in southeastern Alaska is thought to be stable or increasing (ADFG 2010, pp. 2, 12, 54, 66, 80), or is being managed through harvest (p. 29). For these reasons coupled with the fact that little timber harvest has occurred on the mainland (Figure 8, Table 13), it seems unlikely that timber harvest has affected moose populations negatively. In fact, given that the biomass per moose is greater than that per deer, it is possible that Alexander Archipelago wolves would benefit from an expanding and growing moose population, although capture efficiency or low rates of moose population growth may negate any realized benefit (Person et al. 2001, p. 264).

Beaver.—Beavers are found on most large islands and throughout the mainland within the range of the Alexander Archipelago wolf. They are taken as prey throughout the year by wolves on POW and Revillagigedo islands where, next to deer, their remains were the second most frequently observed in wolf scats; to a lesser extent, wolves also prey on beavers in Glacier Bay and coastal British Columbia (see *Food habits*). We found no information on whether or not beavers are affected directly by timber harvest in southeastern Alaska and coastal British Columbia.

Pacific salmon.—Salmon spawn in most freshwater streams and rivers throughout southeastern Alaska and coastal British Columbia. Wolves feed on spawning salmon when available, typically during the late summer and early fall. Timber harvest can impact physical stream environments by altering hydrologic regimes, reducing quantities of large wood, increasing width-to-depth ratios of stream channels, and reducing the size of stream sediments; all of these impacts can affect juvenile salmon rearing habitat (e.g., Burnett et al. 2007, p. 66; Keeton et al. 2007, p. 852; Tiegs et al. 2008, p. 4). Although timber harvest can affect physical characteristics of freshwater streams used by salmon, it is less clear whether or not these habitat alterations result in reduced survival, reproduction, or abundance of salmon.

5.3.3. Road development

Within the range of the Alexander Archipelago wolf, road development associated with urban development, timber harvest, and other types of resource extraction has modified the landscape. Some roads are permanent (e.g., federal highways), while others, such as those built to support the timber industry, are temporary. Roads not only alter habitats used by the Alexander Archipelago wolf and its prey, but also, importantly, provide access for subsistence and recreational users to previously unroaded and remote areas. Therefore, following removal of timber (or other natural resources), road management can be controversial because most local individuals and communities prefer to have continued access along temporary roads and can be expensive owing to maintenance and decommissioning costs.

Below, we describe the existing road systems in southeastern Alaska and coastal British Columbia to the best of our ability; few road databases seem to be complete and current. We estimated road densities by WAA in southeastern Alaska and WMU in coastal British Columbia and then summarized results by GMU and Region, respectively. For the purpose of this assessment, we considered all types of roads (e.g., sealed, unsealed) to be roads provided that they offer access to humans using any motorized vehicle (e.g., off-highway vehicle, all-terrain vehicle, snowmachine, passenger vehicle). We also reviewed plans for decommissioning of roads and new construction associated with current and planned timber sales. We urge the reader to be mindful of the fact that plans for road management (e.g., decommissioning, closure, new construction) are difficult to ascertain and are not certain to be implemented.

We acknowledge that timber harvest, road construction and management, and wolf harvest interact as stressors to the Alexander Archipelago wolf and that these interactions can be complex. In this subsection, we assess potential direct impacts of roads to coastal wolves only and separately examine hunter and trapper access afforded by roads as a possible indirect effect to wolves (see *Wolf harvest*). To avoid redundancies, we present results in this subsection with regard to a road density threshold of 0.9 km/km^2, following Person and Russell (2008, p. 1548) and refer to these results when assessing wolf harvest.

Southeastern Alaska.—In southeastern Alaska, roads occur on federal, state, and private lands with the majority of them administered by the USFS. Outside of population centers, nearly all roads originally were built to facilitate logging and forestry-related activities. Many of these roads remain, although their status, accessibility, ownership, and maintenance vary over time. For example, the USFS stores (i.e., closes with a gate or similar temporary barrier) some roads that may be used later; the period of storage must exceed one year for a road to be considered "stored." Similarly, the USFS authorizes construction of temporary roads by contract, permit, or lease for short-term operations, yet at the end of those operations, the road remains and the ownership or responsibility of it is not necessarily clear at times. The USFS and other transportation and land management agencies recognize the need to inventory and manage for the existing road system in southeastern Alaska. Recently, several travel plans have been developed for the region (e.g., USFS 2009; Department of Transportation and Public Facilities 2004), although implementation of these plans is expensive and ongoing.

The USFS adopted a system for describing National Forest System roads based on level of required maintenance and use. Roads categorized as Maintenance Level 1 are stored and used

only intermittently (i.e., closed to regular vehicular traffic); Maintenance Level 2 roads are open and used by high-clearance vehicles, but are not maintained; Maintenance Level 3 roads are open, maintained, and suitable for prudent drivers in standard passenger vehicles; and, Maintenance Levels 4 and 5 are maintained regularly and used by all vehicles. The USFS prepared Motor Use Vehicle Maps for all Ranger Districts to inform the public of road status and accessibility based on these maintenance levels. One goal of these maps was to discourage unauthorized road access, although we are uncertain of the effectiveness of their effort. Some "closed" roads are inaccessible to motorized traffic due to removal of culverts, alder planting, or other techniques; however, some roads are closed with gates, which can be circumvented by determined users with all-terrain vehicles or similar. In addition, closed roads often can be used via snow machine in winter, if snow cover is sufficient.

Currently, 10,975 km of roads exist within the range of the Alexander Archipelago wolf (72,930 km^2) in southeastern Alaska, resulting in an overall road density estimate of 0.23 km/km^2 (Albert 2015; Table 17). Most (52%) of these roads are located in GMU 2, followed by GMUs 1 and 3 (22 and 23%, respectively); GMU 5A has few of the roads (3%). However, estimates of road density, which are more meaningful and informative, are greatest in GMU 2 (0.62 km/km^2) and GMU 3 (0.26 km/km^2), and are negligible in GMUs 1 and 5A (0.08 and 0.04 km/km^2, respectively; Table 17). Within GMU 1, subunit 1A has a higher road density (0.14 km/km^2) than all of the other subunits (0.02–0.07 km/km^2).

Table 17. Mean estimates of road density and ranges calculated by Wildlife Analysis Area (WAA) with each Game Management Unit (GMU; Albert 2015). Shaded area indicates subunits of GMU 1.

GMU	Road density (km/km^2)		WAAs	
	Mean	Range	Total number	Percent with road density >0.90 km/km^2
1	0.08	0.00–1.25	74	1%
1A	0.14	0.00–1.25	26	4%
1B	0.02	0.00–0.19	17	0%
1C	0.07	0.00–0.40	26	0%
1D	0.02	0.00–0.08	5	0%
2	0.62	0.00–1.57	31	42%
3	0.26	0.00–1.06	25	4%
5A	0.04	0.00–0.25	7	0%
Total	0.23	0.00–1.57	137	11%

Across all GMUs, road density estimates in WAAs ranged from 0.00 to 1.57 km/km^2. Of 137 WAAs, 62 (45%) had no roads in them, 60 (44%) had estimated densities between 0.01 and 0.90 km/km^2, and 15 (11%) exceeded the 0.90 km/km^2 threshold above which wolf harvest rates can be problematic (Person and Russell 2008, p. 1548; Figure 13). Not surprisingly given the high road densities in GMU 2, most (13 of 15; 87%) of these WAAs are located in GMU 2; one each was located in GMU 1A and GMU 3.

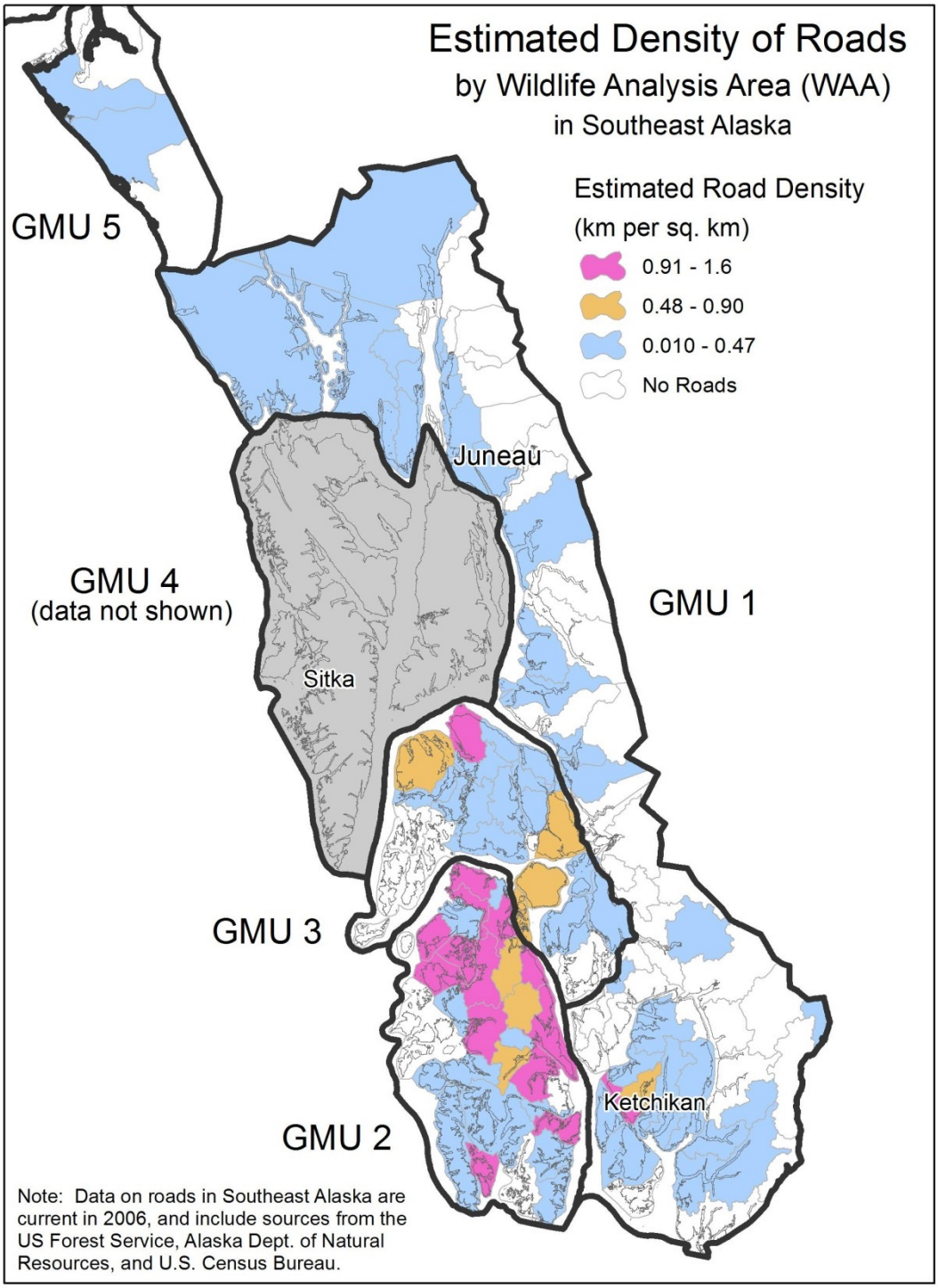

Figure 13. Map depicting road densities estimated by Wildlife Analysis Area (WAA) and presented by Game Management Unit (GMU) within the range of the Alexander Archipelago wolf in southeastern Alaska (not found in GMU 4; Albert 2015). Estimated road densities greater than 0.90 km/km^2 are considered to be problematic for wolves due to high rates of wolf harvest by humans (Person and Russell 2008, p. 1548; see *Wolf harvest*).

The USFS has been working to decommission or permanently close unused roads in southeastern Alaska. In some areas (e.g., GMU 2), the closure of roads is complex and controversial. Maintenance of roads is expensive, but so is decommissioning them. Further, many local residents are accustomed to using some of these roads for subsistence purposes including hunting, trapping, firewood collection, berry picking, etc. In 2009, the USFS drafted the POW Access Travel Management Plan that outlines a schedule for re-categorizing 2,283 km (1,419 miles; ~40% of all roads in GMU 2) of road based on Maintenance Levels 1–5, decommissioning roads, and converting roads to trails (USFS 2009, p. 2). This plan calls for decommissioning 129 km (80 miles) of road, converting 16 km (10 miles) to trail and 357 km (222 miles) to motorized trail, and storing an additional 237 km (147 miles) of road; the remainder of road will be divided into sub categories of Maintenance Level 2. Since 2009, the USFS has made progress on implementing this plan, including storage of 631 km (392 miles) of road and continued efforts are scheduled (Smith 2015).

We expect some new road construction associated with Tongass timber sales that have been sold (but not cut yet), NEPA-cleared, or are in the planning stages. By far, the biggest contributor is the Big Thorne Timber Sale in GMU 2, which requires 74 km (46 miles) of new road construction and 59 km (37 miles) of reconstruction of existing roads (USFS 2013a, p. 1). Other small sales such as Mitkof Island and Navy timber sales in GMU 3 will result in small amounts of new road (<2 km each), temporary road (<8 km), and reconstructed road (8 km). Planned sales such as Saddle Lakes Timber Sale in GMU 1A probably will require some road construction, although the total length should be less than 30 km. The USFS is aiming to shift to young-growth harvest and away from old-growth harvest, allowing for use of existing roads as opposed to constructing new ones in the future.

Coastal British Columbia.—In coastal British Columbia, roads often are described as being "connected" or "unconnected" to the main road system. In total, 67,612 km of road exist within the range of the Alexander Archipelago wolf, resulting in a mean road density of 0.47 km/km^2 (Table 18; Albert 2015). The majority of roads are located in Region 1 (41%) and Region 2 (31%), although Region 6 in the north supports 22% of the total road length; Region 5 has few roads (6% of the total). Mean road density estimates follow a similar pattern with the highest densities in Regions 1 and 2, followed by Region 6, then Region 5 (Table 18).

Table 18. Mean estimates of road density and ranges estimated by Wildlife Management Units and summarized by Region, coastal British Columbia (Albert 2015).

Region	Road density (km/km^2)		WMUs	
	Mean	Range	Total number	Percent with road density >0.90 km/km^2
1	0.53	0.05–1.07	15	27%
2	0.55	0.06–3.03	13	15%
5	0.13	0.09–0.17	3	0%
6	0.30	0.07–0.89	5	0%
Total	0.47	0.05–3.03	36	17%

Across all Regions, estimated road densities ranged from 0.05 to 3.03 km/km^2 (Table 18). Six of 36 (17%) WMUs exceeded the threshold of 0.90 km/km^2 presumed to be negative for wolves; all

of these WMUs were located in Regions 1 and 2 and surrounded the large cities of Victoria and Vancouver (Figure 14). One WMU in Region 6 had an estimated road density of 0.89 km/km^2, which was high compared to the other four WMUs in that region (0.07–0.21 km/km^2). We did not find data indicating planned road construction or future road management in coastal British Columbia.

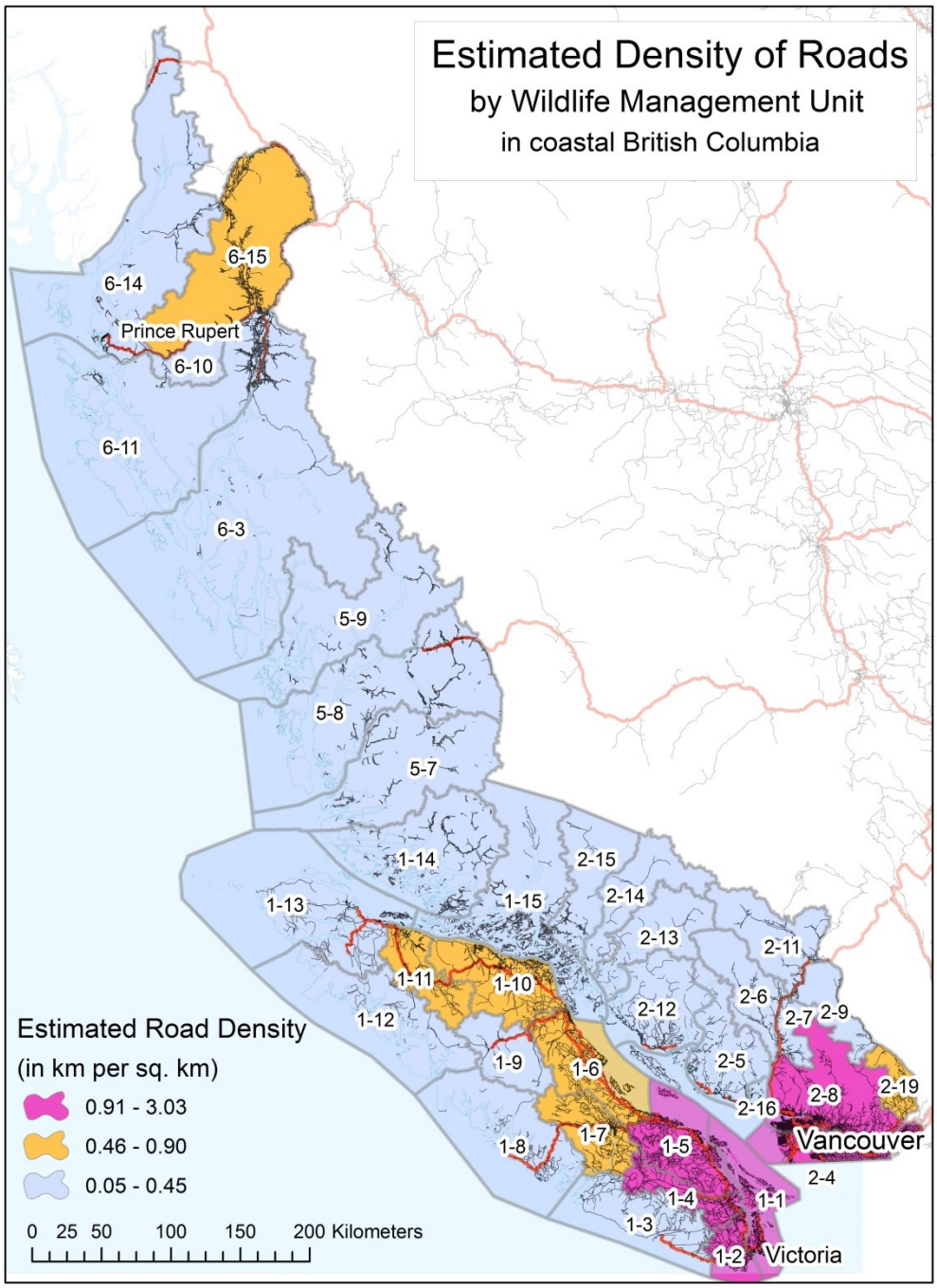

Figure 14. Map depicting road densities estimated by Wildlife Management Unit (identified on map with Region preceding the hyphen) within the apparent range of the Alexander Archipelago wolf in coastal British Columbia (Albert 2015). Estimated road densities greater than 0.90 km/km^2 are considered to be problematic for wolves due to high rates of wolf harvest by humans (Person and Russell 2008, p. 1548; see *Wolf harvest*).

Effects of road development on wolves.—Roads alone are not considered to be problematic for wolves, but instead it is the human access afforded by them that can affect individuals and populations of wolves; we examine road access as an indirect impact to wolves in a separate subsection (see *Wolf harvest*). Here, we consider two potential direct impacts to Alexander Archipelago wolves from road development: alteration of habitat and disturbance at den sites.

The Alexander Archipelago wolf is a habitat generalist, but prefers habitats below 400 m in elevation where most roads are located (e.g., Figure 10 in Person 2001). Gray wolves commonly use roads with little vehicular traffic as travel corridors, especially in winter, and occasionally as territory boundaries (Fritts et al. 2003, p. 301); we postulate that coastal wolves use roads similarly. Based on radio-collared wolves in GMU 2, Person (2001, p. 64) found that wolf packs typically were located nearer to roads than random locations regardless of season, but when the analysis was limited to wolf locations below 100 m in elevation, some packs avoided roads, although others selected for habitats near roads. These inconsistent findings suggest that roads probably are not a strong selection factor for Alexander Archipelago wolves. Furthermore, roads are located in a small percentage of the range of the coastal wolf; we estimate that <4% of the landscape is roaded (total roads=78,587 km), assuming that roads average 100 m in width. Thus, based on our review, we hypothesize that loss or alteration of habitat due to road development probably has little effect on Alexander Archipelago wolves.

Similarly, Person and Russell (2009, pp. 217–219) found that most used den sites of Alexander Archipelago wolves in GMU 2 were located farther from logged stands and roads than unused locations, but that other landscape features such as slope, elevation, and proximity to freshwater had a stronger influence on den site selection. This result was consistent at a fine spatial scale (100 m surrounding active dens) and at a broad spatial scale (1,000 m buffer). The authors reported that wolves denned within landscapes heavily modified by human development, but believed that they did so out of necessity given reduced availability of alternatives (p. 222). Nonetheless, the authors did not report any demographic consequences such as lower reproductive success or pup survival associated with denning closer to roads or logged stands. Therefore, while Alexander Archipelago wolves may prefer to den in unlogged, roadless areas, they will use dens sites in areas near roads and logged stands and, based on the available information, do not experience negative demographic impacts from doing so. More importantly, other natural landscape features appear to be better predictors of den site use of Alexander Archipelago wolves.

In summary, road development has altered a small proportion (<4%) of habitat within the range of the Alexander Archipelago wolf and may disturb wolves using den sites nearby, but we found little information indicating a negative and consistent demographic response of wolves to roads (although see *Wolf harvest*). Although the majority (86%) of roads are located in coastal British Columbia (67,612 km) where populations of Alexander Archipelago wolf are thought to be stable or slightly increasing, comparatively high road densities in GMU 2, especially in some WAAs, may be contributing to the observed apparent decline of that population (see *Abundance and trend*). Thus, based on our review, we believe that road development is not impacting Alexander Archipelago wolves directly at the population level; although some individual wolves may use den sites in undesired habitat owing to close proximity to roads, we found no evidence that breeding effort or reproductive output is being affected.

5.3.4. Wolf harvest

Of the stressors that affect Alexander Archipelago wolves, wolf harvest by humans is the only one that directly results in mortality. Generally, wolf populations in Alaska are managed for long-term sustainable use (ADFG 2015a, p. 6) while providing opportunities for hunting and trapping to the public (Alaska Board of Game 2011, p. 2). In British Columbia, objectives of wolf management are more varied, but include opportunities for cultural, economic, and recreational use (BCMO 2014, p. v).

Mortality of wolves due to human harvest may be compensated for via increases in survival, reproduction, or immigration (i.e., compensatory mortality) or harvest mortality may be additive, causing overall survival rates and population growth to decline. Most studies demonstrate that high rates of reproduction and immigration can compensate for human-caused mortality rates of 17–48% (±8%; Fuller et al. 2003, pp. 184–185; Adams et al. 2008 [29%], p. 22; Creel and Rotella 2010 [22%], p. 5; Sparkman et al. 2011 [28%], p. 5; Gude et al. 2012 [25%], pp. 113–116). However, results of other studies suggest that harvest of wolves by humans are at least partially additive (Murray et al. 2010, pp. 2519–2520), and therefore, sustainable mortality rates may be lower than expected (~22–25%; Creel and Rotella 2010, p. 5). Sustainable rates of human-caused mortality within a wolf population vary considerably based on population characteristics such as age and sex structure, but typically depend on productivity and immigration (Fuller et al. 2003, p. 185). In this regard, each population (or group of populations) is different and a universal human-caused mortality rate does not exist.

For Alexander Archipelago wolves in GMU 2, Person and Russell (2008, p. 1547) reported that total annual mortality >38% was unsustainable and that natural mortality averaged 0.04 (SE=0.05) annually (p. 1545). We did not find any other data on sustainable harvest rates specific to the Alexander Archipelago wolf. Because the biological circumstances of each wolf population are different, we assessed wolf harvest statistics of individual populations relative to 20% and 30% of the estimated population size in a given year. These thresholds were chosen based on findings presented by Person and Russell (2008, pp. 1545–1547), harvest guidelines applied in GMU 2 between 1997 and present (described in more detail below), and on relevant literature for gray wolf (e.g., Fuller et al. 2003, p. 182; Adams et al. 2008, pp. 19, 22). We note here that they are presented as guidelines only to aid in interpreting the wolf harvest data; we do not know what constitutes sustainable harvest levels for most populations of Alexander Archipelago wolf because populations are not monitored regularly.

Management authorities, regulations, and guidelines.—In southeastern Alaska, wolf harvest regulations are set by the Alaska Board of Game for all resident and non-resident hunters and trappers, and by the Federal Subsistence Board for federally-qualified subsistence users on Federal lands. ADFG implements regulations set by the Alaska Board of Game, whereas the USFS implements regulations set by the Federal Subsistence Board. These two management agencies work collaboratively to manage wolf populations and harvest, with public input from the Southeast Alaska Regional Advisory Council.

Although hunting and trapping regulations vary across GMUs (Table 19), generally the hunting season opens on August 1 followed by the trapping season on November 1, and both seasons

conclude in late April or May. The bag limit for hunters under both State and Federal regulations is five wolves annually; no bag limit is set for trappers under either set of regulations. In addition, bag limits for hunters and trappers are tallied separately; for example, if a hunter reaches their bag limit of five wolves, the individual can still trap wolves with no bag limit. Across GMUs, all harvested wolves must be sealed, which involves the placement of an official marker or locking tag on the skull or hide by an authorized representative of ADFG.

In GMU 2, wolf harvest is managed differently compared to all other GMUs. First, season length, timing, and sealing requirements are more restrictive (Table 19). Second, since 1997, ADFG and USFS annually determine a combined maximum number of wolves that can be hunted or trapped under either set of regulations (i.e., State and Federal regulations); if the annual harvest guideline is exceeded, both agencies issue an emergency order closing the hunting and trapping seasons. Starting in 1997, the allowable wolf harvest in GMU 2 was set as 25% (~90 wolves) of the fall population estimate. In 2000, the harvest guideline level was increased to 30% of the fall estimate, although the total number of wolves that could be harvested remained as 90 wolves; in 2011, this number decreased to 60 wolves because of suspected declines in wolf abundance. Based on the fall 2013 wolf population estimate (221 wolves; Table 3), wolf harvest for 2014 season was capped at 25 wolves. Since 1997, emergency closures were issued on three occasions (1999 with 96 wolves harvested, 2013 with 57 wolves harvested, and 2014 with 29 wolves harvested). In January 2015, the Board of Game lowered the harvest guideline level to 20% of the fall population estimate because of concerns about the status of wolves in GMU 2, which equates roughly to 18 wolves based on the 2014 population estimate of 89 wolves (Table 3). However, owing to concerns about the GMU 2 wolf population, ADFG and USFS set the harvest cap for the 2015 season at 9 wolves, or 10% of the 2014 population estimate; to date (November 18, 2015), one wolf has been sealed in the 2015 season. It is important to note that ADFG typically does not estimate wolf populations in GMU 2 (or any other GMU) on an annual basis; therefore, annual wolf harvest caps are determined using the most recent estimate (see Table 3) and knowledge of the local biologists, hunters, and trappers, while adhering to the guidelines established by the Board of Game.

In coastal British Columbia, the provincial-based Ministry of Forests, Lands and Natural Resource Operations manages wolf harvest according to an established management plan (BCMO 2014). Wolves can be hunted by residents and non-residents (designated as “big game”) and trapped (designated as “furbearers”). In Regions 1 and 2 (Figure 4), the hunting season extends from September 10 to June 15 and reporting is required within 30 days of the kill; in Regions 5 and 6, the hunting season is from August 1 through June 15 and reporting is not required. The hunting bag limit is three wolves annually. Under trapping regulations, wolves are considered a Class III species, meaning that they generally are not vulnerable to over-trapping and trappers are encouraged to trap these species. Most trapping seasons open in October and close in March; reporting is required in Regions 1 and 2 only within 15 days of the end of the trapping season. Similar to southeastern Alaska, regulations set no limit on the number of wolves that can be trapped in a season.

Table 19. Current hunting and trapping regulations for wolves implemented by the State of Alaska and U.S. Forest Service (with authority from the Federal Subsistence Board). For both management agencies, hunters can harvest a maximum of five wolves (i.e., bag limit) and trappers can harvest unlimited number of wolves (i.e., no bag limit) unless a harvest cap is instituted (e.g., GMU 2; see text). Bag limits for hunters and trappers are tallied separately, if applicable.

GMU	State regulations			Federal regulations		
	Hunting season	Trapping season	Sealing period	Hunting season	Trapping season	Sealing period[1]
1A	August 1–May 31	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
1B (south of Bradfield Canal)	August 1–May 31	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
1B (remainder)	August 1–April 30	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
1C	August 1–April 30	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
1D	August 1–April 30	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
2	December 1–March 31	December 1–March 31	14 days	September 1–March 31	November 15 – March 31	14 days
3	August 1–May 31	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days
4[2]	August 1–April 30	Not specified	30 days	August 1–April 30	November 10 – April 30	30 days
5	August 1–April 30	November 1 – April 30	30 days	August 1–April 30	November 10 – April 30	30 days

[1]Only if harvested wolves are transported out of Alaska.
[2]Although wolves do not occupy GMU 4, hunting and trapping regulations allow for harvest.

Hunter and trapper access.—Harvest rates of Alexander Archipelago wolves are associated with access (e.g., Person and Logan 2012, entire). In southeastern Alaska, successful hunters and trappers report type of transportation used when sealing a harvested wolf. Across all GMUs between 1997 and 2014, successful hunters and trappers reported using four types of transportation to harvest wolves: boats (58% of the trips), motorized vehicles including snow machines, all-terrain vehicles, and highway vehicles (28% of the trips), airplane (8% of the trips), and non-motorized transportation (e.g., walking skiing, sledding; 5% of the trips; ADFG 2012; ADFG 2015e). However, transportation preferences varied considerably across GMUs (Figure 15). Generally, hunters and trappers in GMUs with extensive road systems (e.g., GMUs 1D and 2) used motorized vehicles more regularly than hunters and trappers in largely unroaded GMUs (e.g., GMUs 1A and 1B; Figure 16). We did not find similar data for coastal British Columbia.

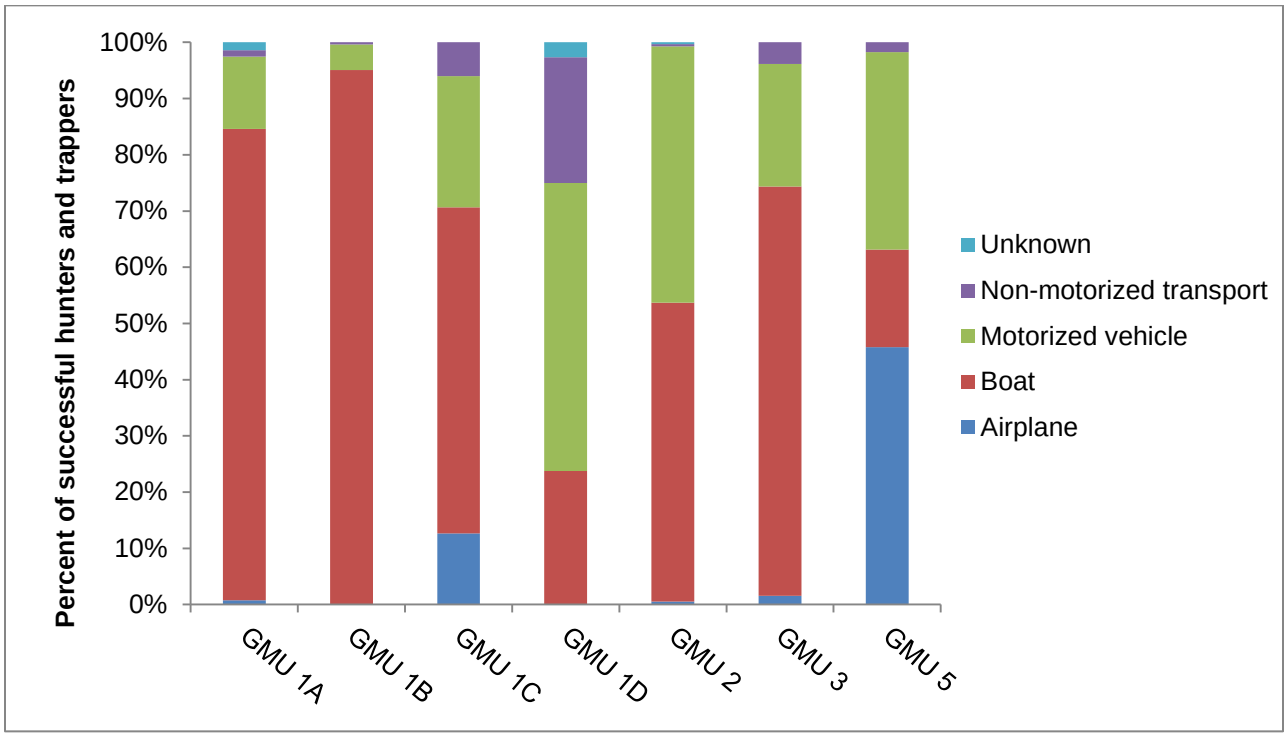

Figure 15. Mean percent of successful hunters and trappers of Alexander Archipelago wolves by type of transportation and Game Management Unit (GMU), southeastern Alaska, 1997–2014 (ADFG 2012; ADFG 2015e).

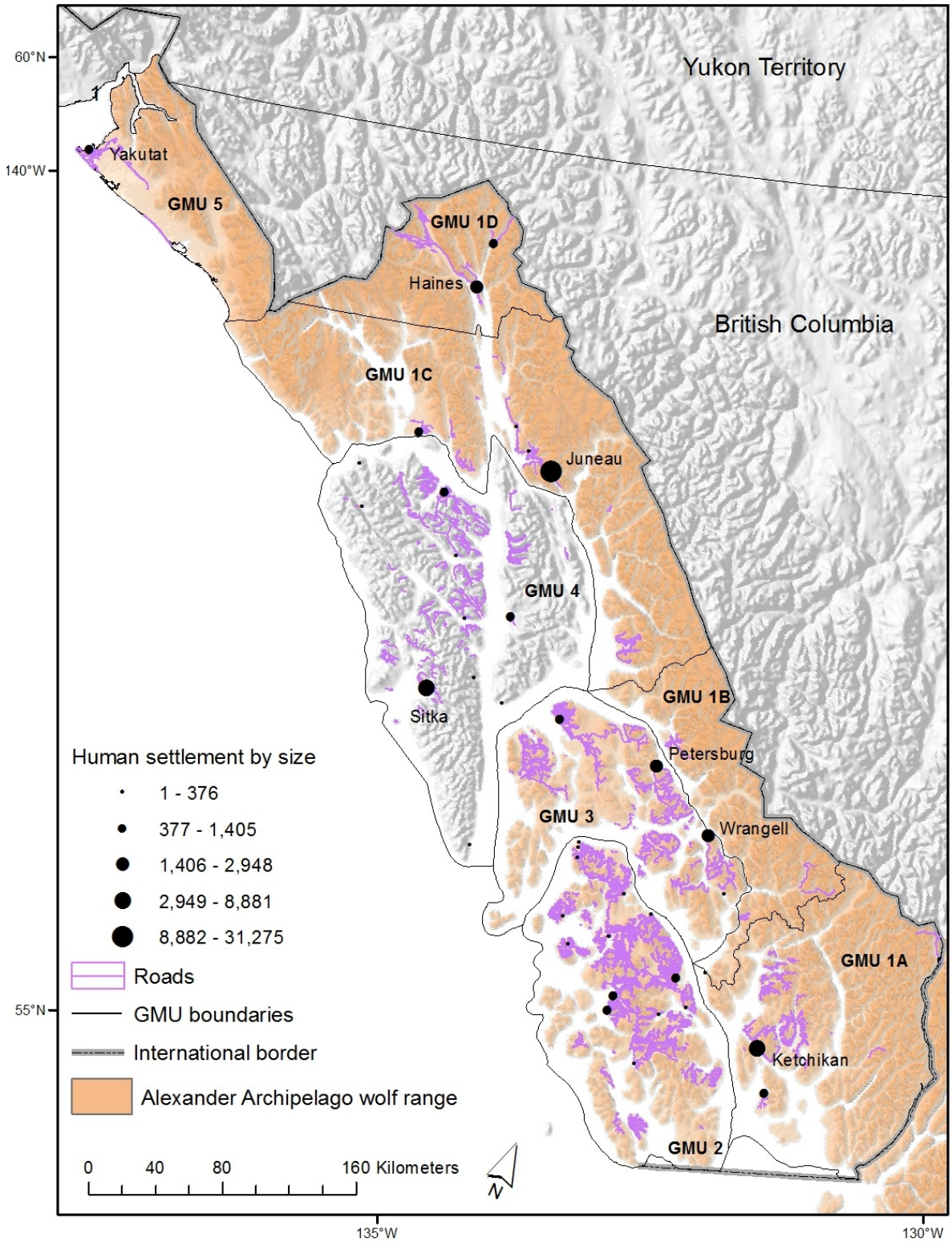

Figure 16. Map of human settlements by population size and roads to demonstrate variation in access (e.g., road, boat) for hunters and trappers within the range of the Alexander Archipelago wolf, southeastern Alaska.

We examined road and boat access in more detail because they served as the majority (86%) of transportation types used by hunters and trappers to harvest Alexander Archipelago wolves in southeastern Alaska where the only available data were collected. We did not find comparable data describing transportation access for coastal British Columbia, but we assume that most hunters and trappers use motorized vehicles given the extensive road system and perhaps boats in the more isolated areas of northern coastal British Columbia.

Road access.—Generally, most studies of gray wolves found that populations do not survive when road densities exceed 1.00 km/km^2 (e.g., Fuller et al. 2003, p. 181 and references therein), although densities of about 0.60 km/km^2 have been recommended as a threshold for wolf persistence (Thiel 1985, p. 405). In some cases, these studies were conducted in areas where legal hunting was not permitted because wolves were protected under the Act, but nonetheless, the thresholds are informative and applicable in areas where wolves are not protected. In recent years as attitudes toward wolves have improved, gray wolves are occupying areas successfully where road and human densities were thought previously to be too high (e.g., Merrill 2000, pp. 312–313, reported wolves breeding in an area where road density was >1.40 km/km^2). On POW, Person and Russell (2008, p. 1548) reported that road density was an important predictor of Alexander Archipelago wolf harvest rates, but when density exceeded 0.90 km/km^2, the relationship deteriorated, suggesting a threshold beyond which further increases in road density had little detectable effect on wolf harvest rates.

We reviewed mean road densities in relation to the threshold of 0.90 km/km^2 in southeastern Alaska and coastal British Columbia (Tables 17 and 18; see *Road development*). In summary, road density is lowest on the mainland of southeastern Alaska (GMUs 1 and 5A; mean=0.08 km/km^2), followed by northern coastal British Columbia (Regions 5 and 6; mean=0.23 km/km^2) and GMU 3 (mean=0.26 km/km^2) where only 0–4% of the WAAs and WMUs exceed the road density threshold. In southern coastal British Columbia (Regions 1 and 2), mean road density is 0.54 km/km^2, largely due to urban areas of Victoria and Vancouver (Figure 14), and 21% of the WMUs have densities greater than 0.90 km/km^2. GMU 2 had the highest road density (mean=0.62 km/km^2) and percentage of WMUs over the threshold (42%). Therefore road access for hunters and trappers is greatest in rural GMU 2, followed by the highly urban regions in southern coastal British Columbia; elsewhere in the range of the Alexander Archipelago wolf, road access is limited at the scale of our analysis (Table 20, Figure 16).

Boat access.—Within the range of the Alexander Archipelago wolf, harvest rates of wolves decrease with increasing ocean distance from towns and villages (Person and Russell 2008, p. 1546), although the relationship can be complicated because hunters and trappers likely choose the most efficient means of transportation to access a particular area. In some cases, a favored area for hunting or trapping could be accessible by road, boat, or more than one type of transportation (e.g., boat and all-terrain vehicle).

We examined boat access by calculating the ratio of shoreline to land area as a proxy of boat access for hunters and trappers of Alexander Archipelago wolves. Although Region 1 in coastal British Columbia has the greatest amount of shoreline, GMU 2 has the highest ratio of shoreline to land area, followed by GMU 3 (Table 20). The remaining areas within the range of the Alexander Archipelago wolf have comparable ratios of shoreline to land area ranging between

0.07 and 0.21, suggesting lower overall boat access to these areas compared to Region 1 and GMUs 2 and 3.

Table 20. Description of road and boat access for hunters and trappers by Game Management Unit (GMU) in southeastern Alaska and Region in coastal British Columbia within the range of the Alexander Archipelago wolf. We summarized road access using mean road density (km/km^2) and percent of Wildlife Analysis Areas (WAAs, southeastern Alaska) and Wildlife Management Units (WMUs, coastal British Columbia) and boat access using total shoreline (km) and the ratio of shoreline to land area, which is presented in Appendix I.

	GMU or Region	Mean road density (km/km^2)	Percent of WAAs or WMUs with road density >0.90 km/km^2	Total shoreline (km)	Ratio of shoreline to land area
Southeastern Alaska	1	0.08	1%	8,669	0.18
	2	0.62	42%	7,644	0.81
	3	0.26	4%	4,880	0.62
	5A	0.04	0%	932	0.12
Coastal British Columbia	1	0.53	27%	10,786	0.23
	2	0.55	15%	2,332	0.07
	5	0.13	0%	4,802	0.21
	6	0.30	0%	8,444	0.19

In considering road and boat access collectively, GMU 2 provides the greatest access for hunters and trappers within the range of the Alexander Archipelago wolf (Table 20, Figure 16). In GMU 3, boat access is somewhat high, but road access is comparatively low and, based on the low percent of WAAs exceeding the road density threshold, also is concentrated. These results are reflective of the transportation used to harvest wolves; in GMU 2, both roads and boats are commonly used, while in GMU 3, which favors boat access, boats are the preferred transportation type (Figure 15). Although road access is high in Regions 1 and 2 of coastal British Columbia, these roads primarily lie within the urban areas of Victoria and Vancouver; further, boat access is much lower than in GMUs 2 and 3.

Reported wolf harvest

Southeastern Alaska.—In southeastern Alaska, reported annual wolf harvest ranged from 103 to 224 wolves (mean=167) between 1997 and 2014 (data summarized from ADFG 2012 and ADFG 2015e). Harvest varied substantially across years and GMUs with no consistent or obvious trends (Figure 17). Following patterns in wolf abundance, annual wolf harvest was lower on the mainland (GMUs 1, including all subunits, and 5A) compared to the islands (GMUs 2 and 3). Across all years, harvest in GMUs 2 and 3 accounted for 63% of all reported harvest in southeastern Alaska.

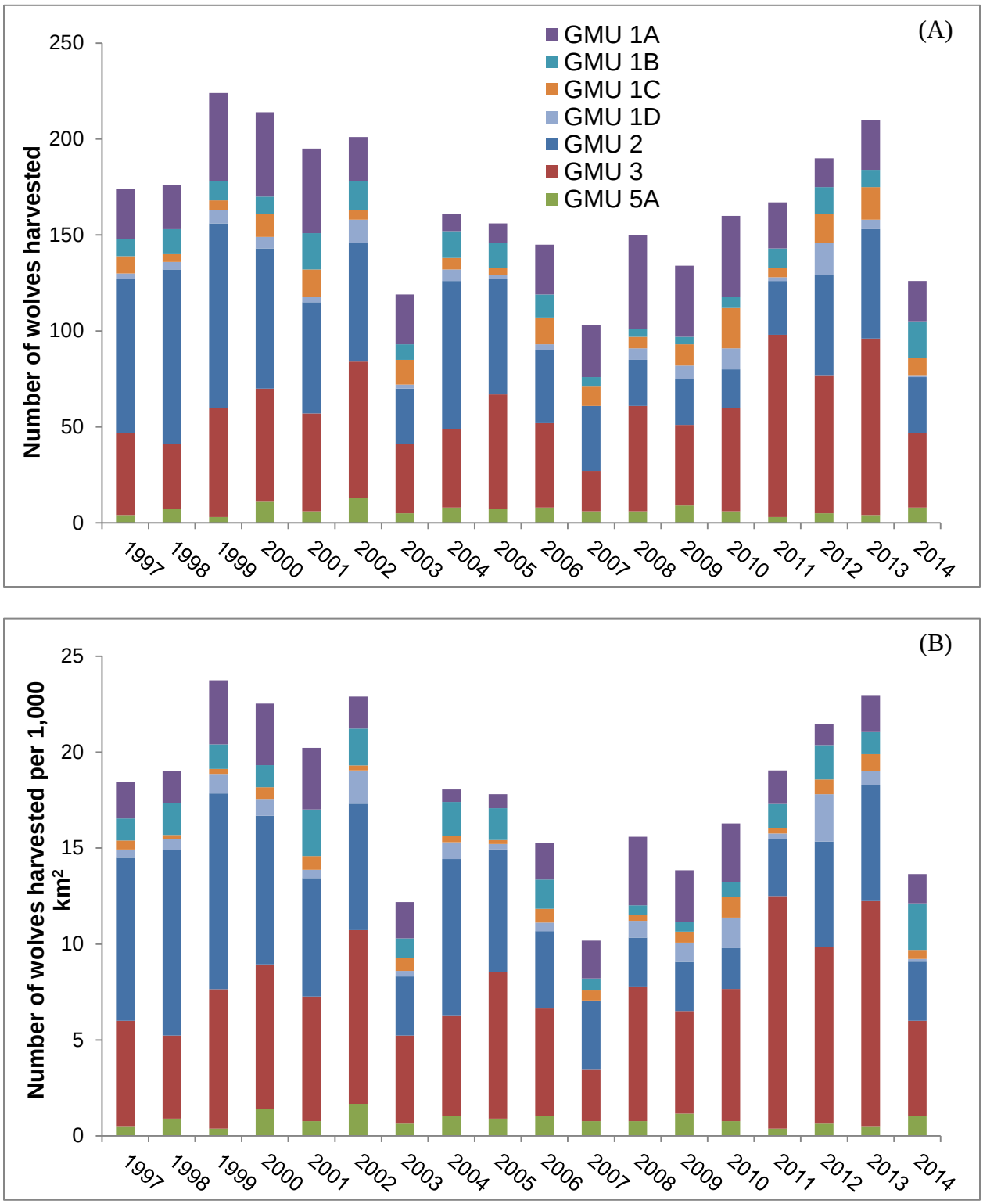

Figure 17. Number of Alexander Archipelago wolves harvested and reported by hunters and trappers (A) by Game Management Unit (GMU) and (B) after accounting for variation in size of GMU (per 1,000 km^2) between 1997 and 2014, southeastern Alaska (ADFG 2012; ADFG 2015e).

Based on the best available population estimates of Alexander Archipelago wolf (Tables 3 and 4), mean reported annual harvest between 1997 and 2014 represented 15–43% of the GMU-specific wolf population (Table 21). In GMUs with more than 50 wolves (i.e., GMUs 1A, 1B, 2, and 3), 15–21% of the population on average was harvested and reported annually. In GMUs with small populations (<50 wolves; i.e., GMUs 1C, 1D, and 5A), harvest rates relative to population size were higher (23–43%), but these values probably are unreliable because ratios of small numbers typically are biased. Thus, combining the wolf populations on the mainland of southeastern Alaska (i.e., GMUs 1 and 5A), mean reported annual harvest of wolves was 19% of the population, ranging between 11 and 27 percent, which is more consistent with the other populations. We emphasize that these values were based on reported harvest only; we address unreported harvest and other sources of human-caused mortality below (see *Unreported harvest*).

Table 21. Mean annual reported harvest of Alexander Archipelago wolves by Game Management Unit (GMU) between 1997 and 2014 relative to estimated population size (ADFG 2012; ADFG 2015e). We combined values across all GMUs on mainland southeastern Alaska (i.e., GMUs 1 and 5A) to avoid biases associated with estimating ratios of small numbers, but present all data here to inform the reader; gray-shaded rows identify reliable estimates of harvest rates relative to estimated wolf population size.

GMU	Population estimate[1]	Number of wolves harvested annually		Percent of population harvested annually	
		Mean	Range	Mean	Range
1A	182	29	9–49	16%	5–27
1B	73	11	4–19	15%	5–26
1C	23	10	4–21	43%	17–91
1D	23	5	0–17	23%	0–74
2	89–356[2]	52	20–96	17%	6–33
3	254	54	21–95	21%	8–37
5A	18	7	3–13	37%	17–72
Mainland (GMUs 1 and 5A combined)	319	62	36–86	19%	11–27

[1]Refer to Tables 3 and 4 for derivation and citations related to population estimates.
[2]Estimated population size varied between 1994 and 2014.

In GMU 2, annual reported wolf harvest is highly variable, but generally has declined (Figure 18), perhaps as a result of lower wolf abundance especially in recent years (see Table 3). In the three years when emergency orders to close the harvest seasons were issued (1999, 2013, and 2014), reported wolf harvest was high (>25% of the population estimated for that year) compared to years when the season remained open for its duration (mean=14%), indicating that the emergency closures were warranted. We emphasize here that we are presenting reported harvest only and unreported harvest can be substantial (38–45% of total harvest in GMU 2; see *Unreported harvest*). When reported and unreported harvests are combined, total harvest likely has been unsustainable in some years.

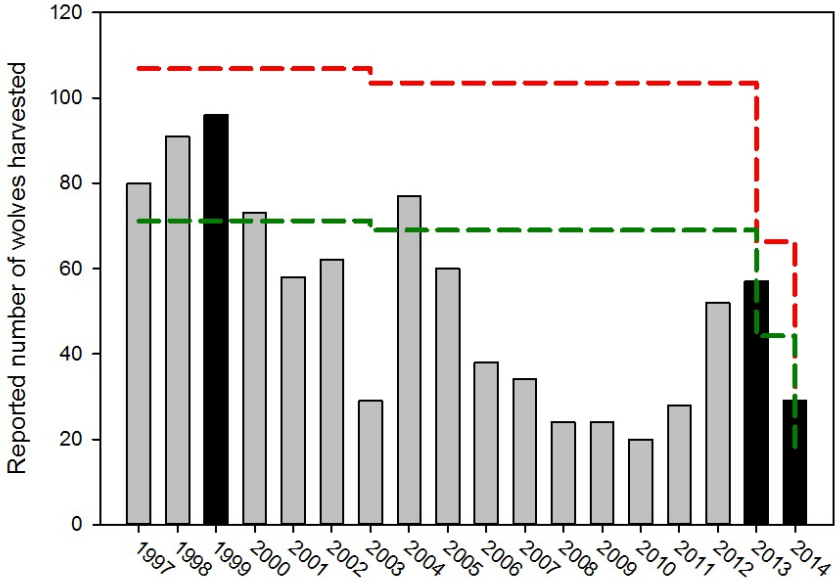

Figure 18. Reported number of wolves harvested by regulatory year in Game Management Unit 2, southeastern Alaska, 1997–2014 (ADFG 2012; ADFG 2015e). The black bars denote the years in which emergency orders were issued to close the hunting and trapping seasons. For context, the green dotted line indicates 20% of the estimated population size in 1994, 2003, 2013, and 2014 (as presented in Table 3) that was current for that year, and the red dotted line denotes 30% of the estimated population size.

Coastal British Columbia.—In the British Columbia portion of Alexander Archipelago wolf range, annual harvest of wolves between 1997 and 2012 from hunting and trapping ranged between 16 and 139 wolves (mean=62) with large variability among Regions (Figure 19; Wolowicz 2015). During this 16-year period, 919 wolves were harvested by hunters while only 76 wolves were trapped. We emphasize that these are minimum values because reporting is not required in all Regions.

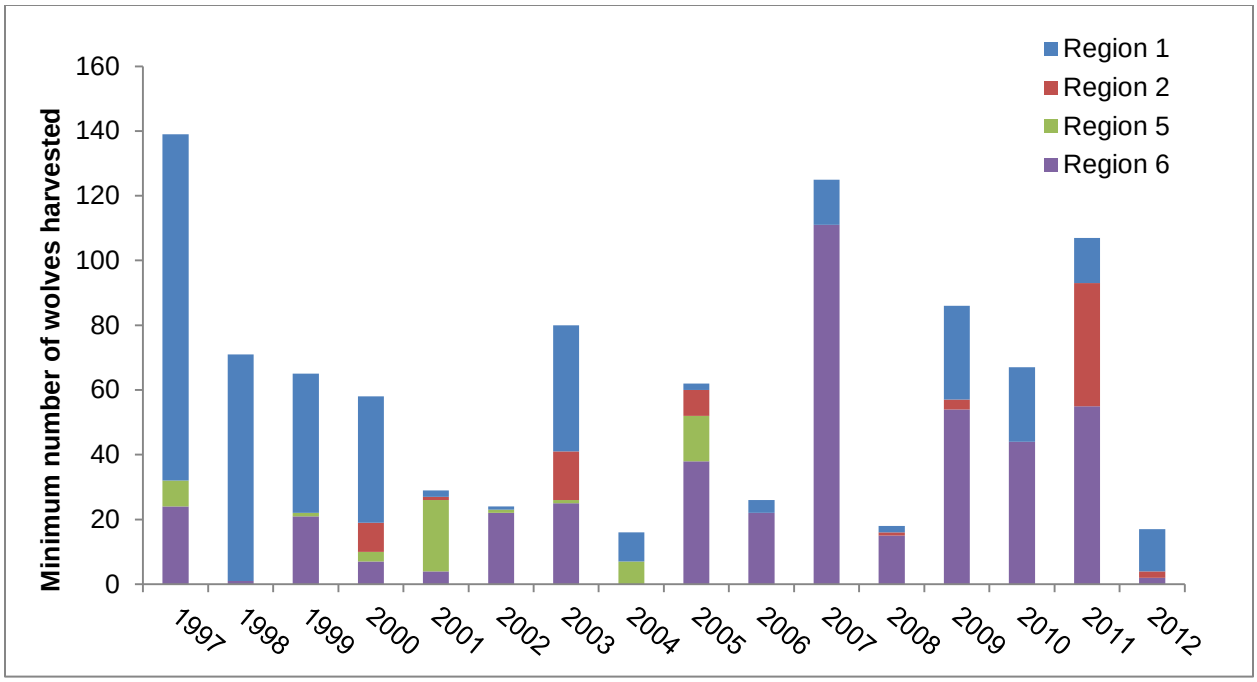

Figure 19. Minimum number of Alexander Archipelago wolves harvested by hunters and trappers by Region between 1997 and 2012, coastal British Columbia (Wolowicz 2015).

In Regions 1 and 2, where a compulsory reporting program is in place, annual wolf harvest was lower in recent years than in the late 1990s. In Regions 5 and 6, we are not able to separate trends in harvest from trends in reporting, although based on the available data, harvest appears to have declined recently in Region 5 (no harvest since 2005), but increased in Region 6, especially in some years (Figure 19). Nonetheless, across all Regions, the mean minimum percent of the population that was harvested annually between 1997 and 2012 was small (2–8%; Table 22), although we recognize that the harvest statistics presented here are incomplete because of the lack of reporting requirements in Regions 5 and 6. Further, we note that the population estimates may be biased high (see *Abundance and trend*) and therefore, the minimum percent of population harvested may be biased low; however, these data represent the only available information, to the best of our knowledge.

Table 22. Region-specific Alexander Archipelago wolf population estimates (specific to coastal area only) and minimum reported wolf harvest between 1997 and 2012 (Wolowicz 2015). These numbers were generated as a guideline and do not reflect absolute values (see *Abundance and trend* for further details).

Region	Population estimate[1]		Mean minimum number of wolves harvested annually between 1997 and 2012 (range)	Mean minimum percent of population harvested annually (range)
	BCMO (2014)[2]	Kuzyk and Hatter (2014)		
1	315	307	26 (1–107)	8% (0–35)
2	114	123	5 (0–38)	4% (0–33)
5	183	200	4 (0–22)	2% (0–10)
6	578	244	28 (0–111)	7% (0–40)

[1]See *Abundance and trend* section for description of methods for generating Region-based population estimates for the coastal areas of British Columbia only based on two sources.
[2]Midpoint of low and high estimates as described in *Abundance and trend* section, following British Columbia Ministry of Forests, Lands and Natural Resource Operations (BCMO) 2014, pp. 6–7.

Unreported harvest (and other human-caused mortality).—In southeastern Alaska and Regions 1 and 2 in coastal British Columbia, hunters and trappers are required to report their wolf harvest, yet not all harvest is reported (e.g., Person and Russell 2008, p. 1545; ADFG 2012, pp. 3, 12, 19, 43). Unreported harvest can result from a hunter or trapper unknowingly harvesting a wolf (e.g., wounded animal that dies and is not recovered, often referred to as wounding loss) or from a hunter or trapper choosing not to report harvest for whatever reason (e.g., killed outside of open season, exceeded bag limit, etc.). If this situation is common, over-harvest of the population can occur, resulting in population decline (e.g., Liberg et al. 2011, p. 1). We cannot distinguish between wolves that were killed and purposefully not reported and those that were killed and unknowingly not reported. Therefore, for the purpose of this assessment, we consider unreported harvest to be a trapping or shooting harvest that was not reported or sealed, but was required to be, regardless of when it occurred (i.e., during open or closed seasons) and includes wounded animals that later died and were not recovered.

Unreported harvest is inherently difficult to document and quantify. Person and Russell (2008, p. 1545) found that between 1993 and 2004, 16 of 34 (47%) radio-collared wolves harvested on POW were not reported. Most of these wolves were shot (13 of 16, 81%), as opposed to trapped, out of season or killed during legal season and not reported (p. 1545). Average annual rates of mortality attributed to legal harvest, unreported harvest, and natural mortality were 0.23 (SE=0.12), 0.19 (SE=0.11), and 0.04 (SE=0.05), respectively (p. 1545), indicating that unreported harvest on POW can be substantial (i.e., 0.45 of total annual harvest).

Between 2012 and 2014, researchers captured and radio-collared 12 wolves on POW (see *Abundance and trend* for more details). Subsequent to collaring, eight of these wolves were harvested; five wolves were harvested and sealed and three were categorized as unreported harvest (ADFG 2015a, p. 4; ADFG 2015c, p. 10; ADFG 2015d, p. 3). Assuming that these three wolves in fact were harvested and not reported and that harvest rates were equal across years, these data suggest that unreported harvest may be slightly lower (3 of 8; 38%) compared to data collected in the 1990s and 2000s by Person and Russell (2008), although the sample size was

small (n=8). Nonetheless, total harvest continues to be high and unreported harvest continues to account for a substantial portion of total harvest. We note here that 0.38 is a minimum proportion of unreported harvest to total harvest. Of the remaining four collars on wolves, one collar currently is retrievable (i.e., the signal has not moved recently) but has not been collected yet (ADFG 2015d, pp. 1–2), and therefore, we do not know the circumstances associated with that collar or wolf.

Collectively across these two studies, unreported harvest of radio-collared wolves on POW constitutes an estimated 38–45% of total harvest. We applied these proportions of unreported harvest (0.45 of total harvest between 1997 and 2011, and 0.38 between 2012 and 2014) to reported harvest for a given year to estimate total harvest of wolves in GMU 2 and found that in most years (13 of 18), total harvest exceeded 20% of the population estimated for that year and in some years (9 of 18), total harvest exceeded 30% of the population (Figure 20). In fact, these seemingly high rates (or proportions) of unreported harvest may have contributed to the recent observed decline in the wolf population in GMU 2 (see Table 3; ADFG 2015b, p. 2). We recognize that rates of unreported harvest probably vary across years and therefore assume that the proportions used in our calculations reflect the average within the two time periods.

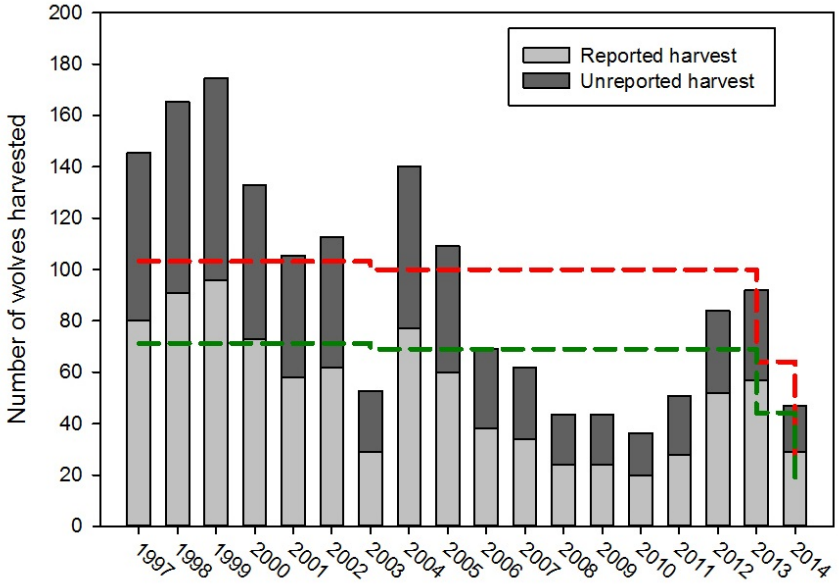

Figure 20. Estimated total number of wolves harvested by regulatory year in Game Management Unit 2, southeastern Alaska, 1997–2014 (ADFG 2012; ADFG 2015e). Unreported harvest was estimated using a rate of 0.45 of total harvest between 1997 and 2011 and a proportion of 0.38 of total harvest between 2012 and 2014 (see text for details and citations). For context, the green dotted line indicates 20% of the estimated population size in 1994, 2003, 2013, and 2014 (as presented in Table 3) that was current for that year, and the red dotted line denotes 30% of the estimated population size.

Outside of GMU 2, we found other reports of documented and suspected unreported harvest of wolves in southeastern Alaska, but not in Regions 1 and 2 in coastal British Columbia. In GMUs 1A and 1C, at least two wolves each have been taken illegally since 1996 (ADFG 2009, pp. 3, 19; ADFG 2012, pp. 3, 19). In GMUs 1B and 3, reported take of wolves is suspected to be below

actual take due to poaching (i.e., unreported harvest; ADFG 2012, pp. 12, 43). In GMU 5A, wolves were found dead in snares after the trapping season ended on two occasions (ADFG 2000, p. 41; ADFG 2006, p. 47); in one case, criminal charges were pressed against one of the trappers for failing to salvage a fur animal. Thus, unreported harvest of wolves is occurring throughout most of southeastern Alaska, but outside of GMU 2 we do not know the rate at which it is occurring. We found no information on unreported harvest in Regions 1 and 2 of coastal British Columbia where reporting is required.

We did not apply proportions of unreported harvest estimated for GMU 2 to the other GMUs in southeastern Alaska because GMU 2 has greater boat and road access than all other GMUs (Table 20), which likely results in higher rates of unreported harvest. In addition, although GMU 2 has a small human population size (about 3,400 people), people live in 14 communities that are distributed across GMU 2, facilitating their access to most parts of the unit; in contrast, the human population in the remainder of the GMUs, is more concentrated, leaving most of the units remote and difficult to access (Figure 16; based on 2010 census data, www.census.gov). For these reasons, we believe that GMU 2 is not representative of GMUs 1, 3, and 5, and that applying rates of unreported harvest from GMU 2 to the other GMUs is not appropriate.

In addition to unreported harvest, wolves may be killed accidentally by humans (e.g., vehicle collisions). Since 1996, eight Alexander Archipelago wolves were killed by vehicles in GMU 1A (ADFG 2000, p. 3; ADFG 2006, p. 3; ADFG 2009, p. 5), GMU 1C (ADFG 2006, p. 18), and GMU 5A (ADFG 2000, p. 41). In addition, on rare occasions, wolves can be aggressive, especially if conditioned to human food, and may be pursued by concerned home owners or community members (ADFG 2012, p. 49); we found only one record of two Alexander Archipelago wolves being killed by humans because of increasingly aggressive behavior (Vargas Island, coastal British Columbia; summarized in McNay 2002, p. 5). If a wolf is killed accidentally (or in defense) and is not reported, we consider it to be an unreported, human-caused mortality. It may be difficult to differentiate an unreported harvest event from an unreported, human-caused mortality event, but given the documented high rate of unreported harvest presented by Person and Russell (2008), we believe this distinction is important when assessing the status of the Alexander Archipelago wolf. The intent of these types of events is fundamentally different and should be acknowledged.

Intensive management of black-tailed deer, which includes the culling of wolves with the aim of increasing deer populations and deer harvest by humans, is authorized for GMU 1A (ADFG 2013a) and in GMU 3 (ADFG 2013b). Currently, these programs are inactive, but operational plans exist and could be implemented in the future. If activated, the treatment area in GMU 1A would be restricted to Gravina Island (about 2% of total land in GMU 1A) and all wolves would be eliminated from the treatment area over a 5-year period (ADFG 2013a, p. 6). In GMU 3, the treatment area constitutes 22% of the total land area and is located in the northern portion of the unit including Woewodski, Mitkof, and part of Kupreanof Island (ADFG 2013b, p. 6). Within the GMU 3 treatment area, up to 80% (or ~50 wolves in 5–6 packs) would be removed; duration of the culling effort would be a minimum of five years (ADFG 2013b, pp. 8–9).

Effects of wolf harvest on wolves.—Wolves can compensate for harvest through adjustments in dispersal, reproduction, survival, or a combination of these vital rates, although other factors

such as prey availability also may be limiting the population. Evaluating the effect of harvest on wolves requires information about the dynamics of the population, including social structure (e.g., Rutledge et al. 2010, p. 332); for example, if harvest rates are high, wolf density may be lower, resulting in increased prey abundance, which may trigger higher reproduction rates. Therefore, when assessing whether or not rates of harvest, or human-caused mortality, are sustainable, it is useful to understand which factors may be limiting the population and the thresholds at which those limitations apply. In the absence of data on ecological limitations, population trend can be used to evaluate sustainable harvest limits.

The Alexander Archipelago wolf is harvested throughout most of its range (with the principal exception of Glacier Bay National Park), yet we do not understand fully the demographic mechanism by which populations may compensate for harvest. Although individual wolves are affected by harvest, few data exist to assess population- or taxon-level response of Alexander Archipelago wolves to harvest. We found that, in most years, rates of reported harvest relative to estimated population size (mean=≤21% of the population; Tables 21 and 22) were within the sustainable harvest guideline for Alexander Archipelago wolf (~34%; Person and Russell 2008, p. 1547) and for gray wolf populations in continental North America (~20–30%; e.g., Adams et al. 2008 [29%], p. 22; Creel and Rotella 2010 [22%], p. 5; Sparkman et al. 2011 [28%], p. 5; Gude et al. 2012 [25%], pp. 113–116). However, population estimates of Alexander Archipelago wolf are rare temporally and spatially, increasing uncertainty in our estimates of percent of the population harvested. Further, unreported harvest in some areas may be substantial and may be having an undocumented impact on some populations, although outside of GMU 2, we found few data to examine.

In GMU 2, however, wolf harvest likely is contributing to an apparent population-level decline, especially in recent years (Table 3). Although reported annual harvest between 1997 and 2014 constituted <34% of the population (Table 21), when estimated unreported harvest is accounted for, total wolf harvest probably exceeded sustainable limits in most years (Figure 20). We lack a clear understanding of the demographic compensation of the GMU 2 population to wolf harvest, but we assume that the insularity of the population makes it more susceptible to over harvest (see *Connectivity*). Interestingly, however, even though the GMU 2 wolf population recently declined during a period of high total harvest (2013–2014), it appeared to be stable between 1994 and 2003 when reported harvest approached 30% of the population (Table 3, Figure 20). This finding suggests that population estimates are not correct for either period, we are overestimating unreported harvest in the late 1990s, or that the recent population decline is driven by a combination of factors including wolf harvest. We have little ability to predict response of Alexander Archipelago wolves to future harvest, although we can posit that if unreported harvest continues to occur at the documented rates (38–45% of total harvest), we anticipate further population declines of wolves in GMU 2.

To understand the influence of wolf harvest on future population size, we modeled a hypothetical wolf population in GMU 2 under three harvest guidelines (0%, 20%, and 30% harvest caps of the estimated fall population size), assuming a constant rate of unreported harvest (0.42; see Gilbert et al. 2015). Wolf harvest was predicted for each hypothetical pack as a function of road density (road access) and distance via ocean to the nearest human settlement (boat access); see Gilbert et al. 2015 for regression equations. We found that the percent of mean population change for

wolves between 2015 and 2045 varied little under the 0%, 20%, and 30% harvest regimes (-7%, -8%, and -8% change in wolf abundance, respectively; Figure 21) because realized harvest rates in the model over the same time period were 3.5%, 10.3%, and 10.5% for the three levels of harvest caps, respectively, even after including unreported harvest. Fall population estimates from the model were high relative to harvest estimates and therefore the model was not informative about the difference in the effects of 20% and 30% harvest caps because these caps were rarely if ever met. However, the model did indicate the following: (1) harvest between 1995 and 2014 affected the GMU 2 wolf population and harvest may explain most of the 2013–2014 observed decline in wolf abundance if unreported harvest was considered; (2) even at low rates of harvest, wolf abundance in GMU 2 probably will decline if other management action(s) are not applied (e.g., reducing access, deer management); and, (3) wolves are projected to decline at about -1% for every 7% increase in wolf harvest even given the current system state.

Modeled harvest rates likely declined quickly after 2014 and were lower than expected until 2045 because harvest rates are determined mostly by road and boat access. In the wolf model, packs in areas with high road densities or easy boat access are quickly reduced or eliminated. These packs are recolonized by dispersers, but they tend to remain at low levels with recurring pack-wide exterminations and therefore contribute little to overall wolf harvest. We did observe a strong influence of wolf harvest levels on deer abundance (-35%, -21%, and -21% change in deer abundance, respectively), especially when no legal wolf harvest occurred (Figure 21), which is expected given the low actual levels of wolf harvest. Our results suggest that wolf harvest did have a strong influence on past changes in wolf abundance based on the population model developed for GMU 2 and that future effects may be similar if these caps are maintained without acknowledging unreported harvest (see Gilbert et al. 2015 for details on this model).

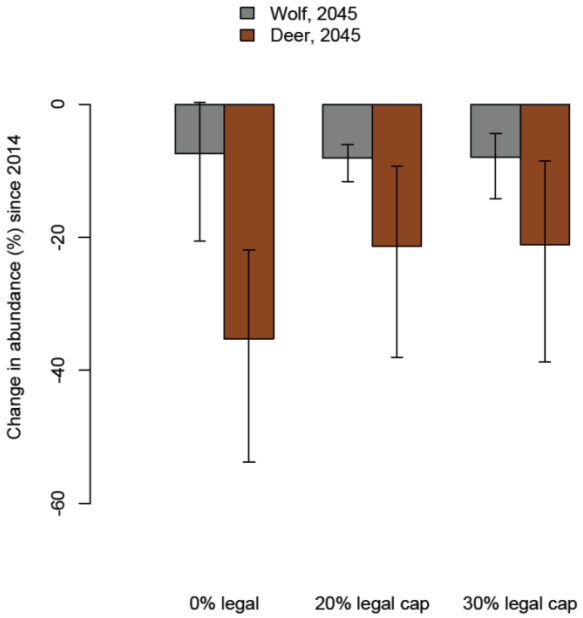

Figure 21. Estimated percent change in mean abundance of wolves and deer under three wolf harvest guidelines (i.e., 0% reported harvest, and 20% and 30% of the estimated fall population size) between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

Access and rates of wolf harvest.—Person and Russell (2008, pp. 1546–1548) found that risk of harvest to wolves increased with combinations of road access and open habitats (e.g., muskegs) and decreased with increasing ocean distance from towns and villages. Other habitat features positively influenced harvest risk (e.g., increasing distance from lakes and streams [Person and Russell 2008, p. 1545], and increasing proportion of alpine habitat [Person and Logan 2012, p. 14]), but, high road densities and short ocean distances from human population centers had the greatest effect on wolf harvest rates.

Person and Logan (2012) further evaluated the disproportionately high risk of harvest to Alexander Archipelago wolves in some WAAs compared to others in GMU 2. The authors predicted risk of chronic unsustainable harvest (annual harvest rates ≥3 wolves/300 km^2 for ≥5 years between 1985 and 2009) and pack depletion (annual harvest rates ≥7 wolves/300 km^2 for ≥2 years between 1985 and 2009) and found that over the time period analyzed 19 of 32 (59%) WAAs in GMU 2 were chronically over-harvested and most of those (16 of 32; 50%) also met the criteria for risk of pack depletion (pp. 12–13). Their analysis included only reported wolf harvest, yet data from GMU 2 suggests that unreported harvest can be quite high in some years (see *Unreported harvest*), which would exacerbate the status of wolves in the majority of WAAs on POW with roads being a primary factor facilitating wolf harvest.

Although roads increase risk of harvest to wolves, most wolves in southeastern Alaska, including GMU 2, are harvested by hunters and trappers using boats for transportation (Figure 15; no comparable data for coastal British Columbia). In fact, despite USFS efforts to store some roads on POW since 2009 (see above), emergency closures of the wolf hunting and trapping seasons in GMU 2 were issued in 2013 and 2014 (Figure 18) and the wolf population declined considerably

over this period (Table 3), suggesting that their efforts either were not effective or were not substantial enough to reduce wolf harvest. Person and Logan (2012, pp. 22–23, 25) predicted wolf harvest rates under planned road closures by the USFS on POW and found that in most WAAs, closing of those roads only had a modest effect on reducing wolf harvest because planned road closures represent a small percentage of the total road density in those WAAs and therefore access was not be reduced by a meaningful amount. In some WAAs, however, rates of harvest decreased substantially. Therefore, the efficacy of road closures to mitigate for possible over-harvest of wolves in GMU 2 is dependent on the roads selected for closure, timing and duration of the closure, and method by which the road is closed.

We modeled wolf abundance out to 2045 under five possible future road conditions in GMU 2. We considered the following conditions: (1) no change in road densities, (2) planned decommissioning of USFS roads (-2.2% of total road density), (3) mid-level of decommissioning of USFS roads (-27.8% of total road density), (4) maximum level of decommissioning of USFS roads (-38.2% of total road density), and (5) construction of new roads to accommodate the maximum old-growth harvest vegetation condition (estimated using the existing ratio of road density to harvested stands; roughly a 30% increase in current road density). We relied on the POW Access Travel Management Plan (USFS 2009, p. 2) for planned and possible decommissioning rates. Generally, mid-level decommissioning involves closing all roads except those suitable for off-highway and high-clearance vehicles, and maximum-level decommissioning closes all roads except those suitable for passenger vehicles only. We applied these decommissioning rates as well as new road construction uniformly across GMU 2.

We found that abundance of wolves was responsive relative to changes in road densities, especially when compared to response of deer (Figure 22). Under mid-level and maximum road decommissioning conditions, change in percent of mean wolf abundance was positive (4% and 8%, respectively); percent change was greatest for wolves under new road construction (-20%). Deer abundance was less responsive; percent change ranged between -20% and -22% for all of the decommissioning conditions and the no change condition, but was more pronounced under the new construction condition (-30%). These results suggest that future wolf abundance is sensitive to road densities and, in fact, decommissioning of roads at a higher rate than currently planned could result in positive changes in wolf abundance. However, we caution that the predictive relationships used in the wolf population model are simplifications of reality. Importantly, at road densities < 0.90 km/km^2, the regression relationship used in the model (see Gilbert et al. 2015 for details) does not use distance by ocean to community as a predictive variable of harvest, instead including only road density. As a result, continued high harvest via boat in some pack areas with easy shoreline access for hunters may not be fully captured in the model results.

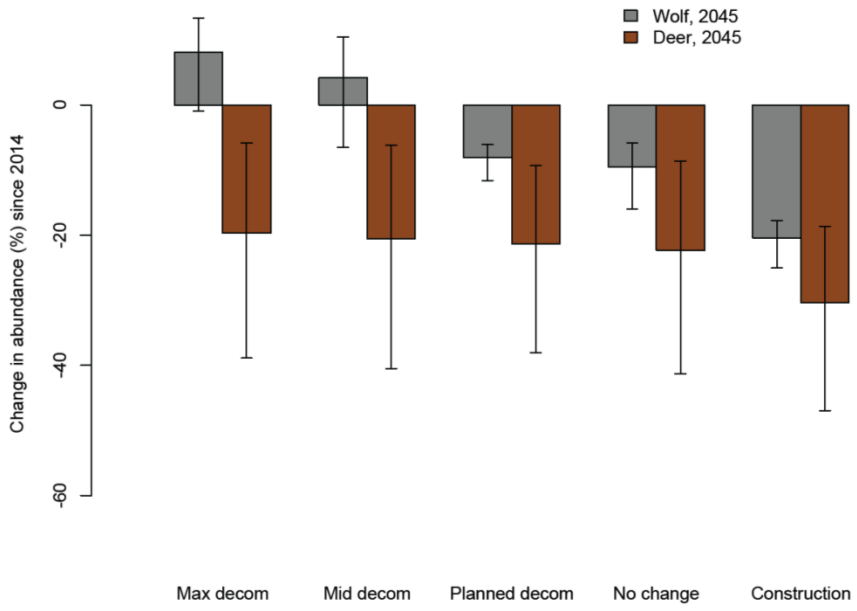

Figure 22. Estimated percent change in mean abundance of wolves and deer under five road conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

In our wolf population model, the number of deer harvested annually also is a function of road density because the same roads that provide access to hunters and trappers for wolf harvest also are used by deer hunters. The deer population in GMU 2 is estimated at approximately 60,000 to 75,000 individuals, and hunters legally harvest 2,800 to 3,600 deer annually (Person and Brinkman 2013, p. 155; ADFG 2013c, p. 35), or roughly 4% to 6% of the overall population annually. In addition, ADFG biologists believe that GMU 2 has the highest illegal and unreported harvest rates of deer in southeastern Alaska, largely due to the extensive road system and lack of law enforcement (ADFG 2013c, p. 37). Therefore, using our model, we explored the effect of deer hunting by humans on future wolf abundance. We found that removing legal deer harvest resulted in a 22% change in wolf abundance between 2015 and 2045; under current deer harvest rates, percent change in mean wolf population size was -8% (Figure 23). These estimates do not account for illegal or unreported take of deer.

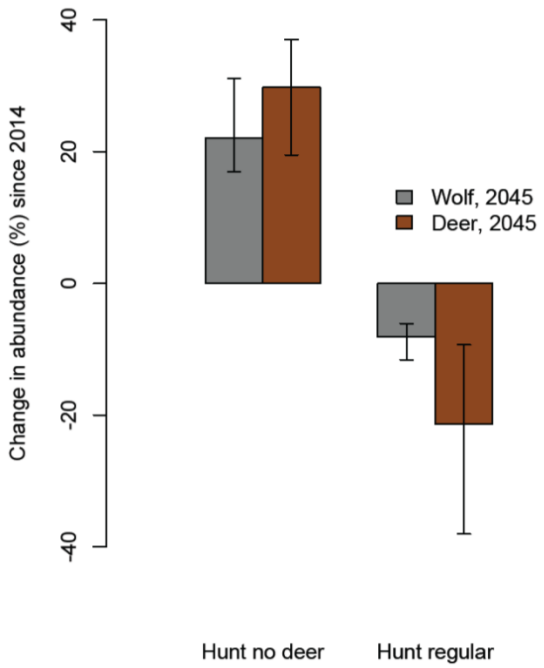

Figure 23. Estimated percent change in mean abundance of wolves and deer when no legal harvest of deer was permitted (Hunt no deer) and when current regulations were allowed (Hunt regular) between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals. Unreported harvest of deer is not included in either condition.

Given the strong influence deer harvest had on future wolf abundance in GMU 2 (Figure 23), we compiled the reported number of deer harvested in 2010 and 2011 (most recent management report available) in other GMUs in southeastern Alaska where reporting is required (data compiled from ADFG 2013c; Figure 24). In mainland GMUs, mean number of deer harvested was low, ranging between 41 (GMU 5A) and 448 (GMU 1C), and was commensurate with low deer densities (ADFG 2013c, pp. 3, 14, 23, 78). In GMU 3, reported deer harvest was 673 and 514, respectively, and has been declining steadily over the years (p. 50). The total number of reported deer harvested in GMU 2 was more than twice that of all other GMUs combined, averaging 3,439 deer over the 2-year period (ADFG 2013c, p. 35). Certainly, deer in GMU 2 are harvested at higher rates than all other GMUs, especially given the comparatively small size of GMU 2 (Figure 24).

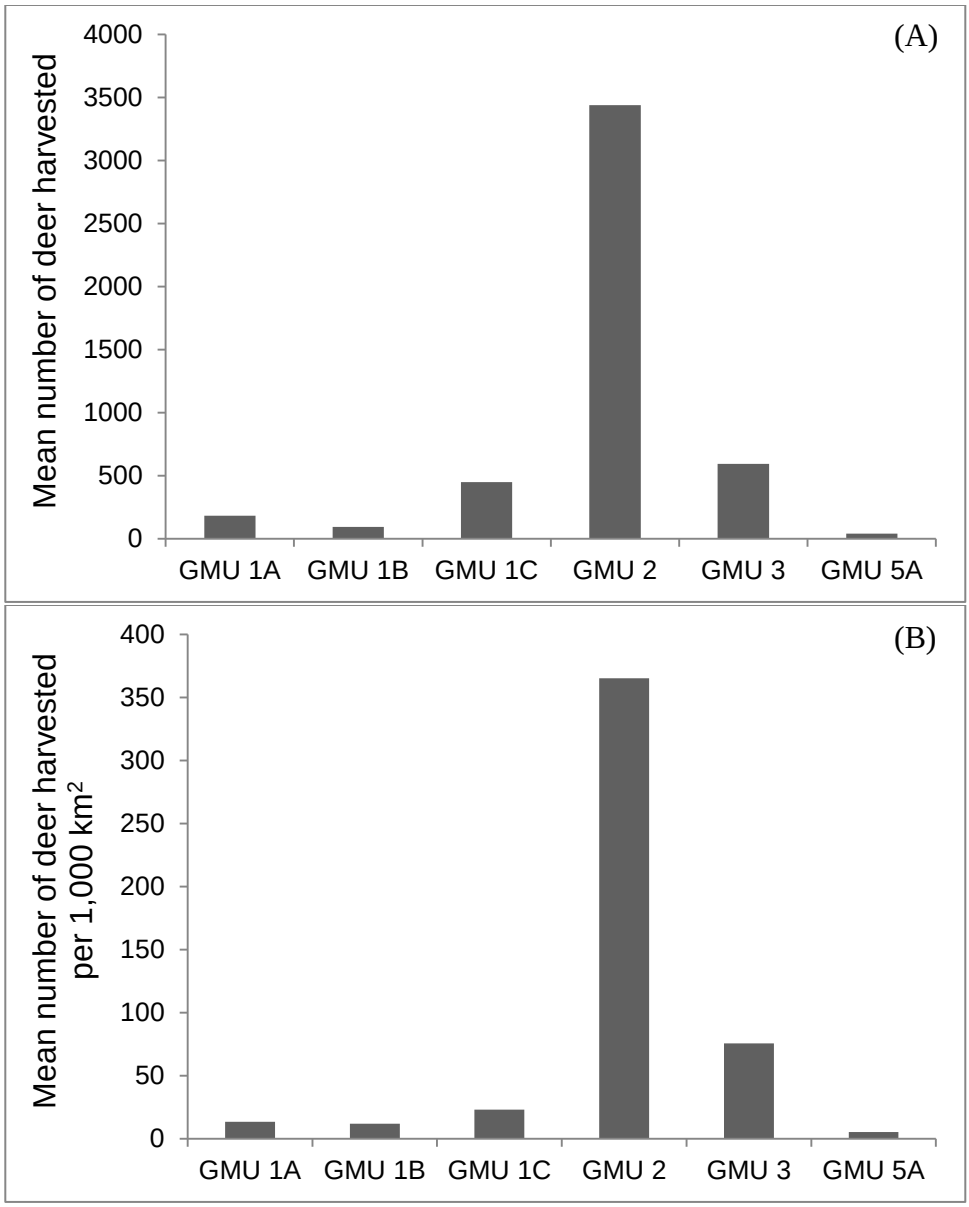

Figure 24. Mean number of reported deer harvested by (A) Game Management Unit (GMU) and (B) after accounting for variation in size of GMU (per 1,000 km^2) within the range of the Alexander Archipelago wolf, southeastern Alaska, 2010 and 2011 (ADFG 2013c). Unit 1B includes both legal and illegal harvest. There is no open season on deer in Unit 1D.

5.3.5. Disease

Several diseases have potential to affect Alexander Archipelago wolf populations. Wolves are susceptible to a number of diseases that can cause mortality in the wild including: rabies, canine distemper, canine parvovirus, blastomycosis, tuberculosis, sarcoptic mange, and dog louse (Brand et al. 1995, pp. 419–422). Many of these diseases impact individual wolves and the social structure of wolves may facilitate rapid spread of some diseases within packs. We are not aware of a disease monitoring program for wolves in southeastern Alaska or coastal British Columbia. Therefore, our assessment of potential disease occurrence and effects on populations of

Alexander Archipelago wolves was based on the prevalence of diseases in domestic dogs and from studies conducted elsewhere on wolves.

Rabies is caused by Rhabdovirid virus and infects all warm-blooded animals. Verified cases of rabies have been documented in wild wolves in other parts of Alaska (e.g., Johnson 1995, pp. 436–437; Weiler et al. 1995, p. 80; Ballard and Krausman 1997, p. 243). Further, rabies has been linked to declines in wolf abundance in Alaska; for example, in northwestern Alaska rabies was a significant factor in the decline of a wolf population and 21% of wolf mortality was attributed to rabies (Ballard et al. 1987, p. 22).

Common vector species of rabies in Alaska are Arctic fox (*Alopex lagopus*), which is not found in southeastern Alaska, and red fox (*Vulpes vulpes*), which is restricted mostly to mainland river valleys. Thus, the most likely vector for rabies in southeastern Alaska is the domestic dog. Prior to 1993, we found no documented cases of rabies in any terrestrial animal from southeastern Alaska (Alaska Division of Public Health 2015). However, since then, three individual bats tested positive for rabies in 1993 (Revillagigedo Island), 2006 (POW), and 2014 (POW), respectively (ADFG 2015f). Likewise, bats are reported to carry rabies in British Columbia (British Columbia Ministry of Environment 2003), but we found no documented cases of rabies in wolves from coastal British Columbia.

Canine distemper is a viral disease usually affecting pups between the age of three and nine weeks of age. Stephenson et al. (1982, pp. 420–421), reported finding wolves from northwestern and interior Alaska seropositive (i.e., positive result in a test of blood serum) for distemper. The low seropositive rate suggests either rare exposure or a high fatality rate. Peterson et al. (1984, p. 31) also reported deaths of two yearling wolves from distemper in 1978 and 1980 on the Kenai Peninsula, Alaska. Although distemper has largely disappeared in domestic dogs as a result of vaccination, rare cases do occur in southeastern Alaska. In 1996, canine distemper was confirmed in a domestic dog treated at the Juneau Veterinary Hospital (New 2015). Canine distemper has been reported in wolves from the Canadian Rockies (Nelson et al. 2012, pp. 71–72) and in Riding Mountain National Park in Manitoba, Canada (Carbyn 1982, p. 108; Stronen et al. 2011, p. 224). We did not find any reported cases of canine distemper from coastal wolves within British Columbia.

Canine parvovirus was discovered during the late 1970s in both domestic dogs and wild wolves. The disease spread rapidly through dog, coyote, and wolf populations in North America, resulting in considerable mortality. Death of captive and free-ranging wolves from parvovirus has been documented (Goyal et al. 1986, p. 1093; Mech and Goyal 1995, p. 567; Johnson et al. 1994, p. 271; Mech et al. 1997, p. 322; Mech et al. 2008, pp. 827–828). For a population of wolves in Minnesota, Mech and Goyal (1995, p. 567) found that the prevalence of the canine parvovirus antibody increased an average of 4% annually during 1979–1993 and reached 87% in 1993; they found a statistically significant inverse relationship between the prevalence of the canine parvovirus antibody and percent change in the wolf population. The authors hypothesized that the wolf population would decline when antibody prevalence consistently exceeds 76%, but below this level mortality from parvovirus was compensatory with natural mortality (pp. 568–569). A 30-year study on the demographic effects of parvovirus on free-ranging wolf populations in Minnesota concluded that compelling circumstantial evidence suggests parvovirus may be a

major determinant of the rate of wolf population increase and may restrict further recolonization within Minnesota (Mech et al. 2008, p. 834).

A controlled study of the effect of parvovirus on wolves revealed that 30% of the wolves developed clinical disease symptoms, and 10% would likely have died without supportive care (Brand et al. 1995, p. 421). The crash of the Isle Royale National Park wolf population during 1980–1982 from 50 to 14 individuals and the chronic decline through 1988 may have been related to parvovirus (Peterson et al. 1998, p. 834). This decline coincided with a parvovirus outbreak in domestic dogs in Houghton, Michigan, the main departure point for visitors to the island. Parvovirus presence on the island was confirmed by positive titers in several wolves during the late 1980s (Peterson et al. 1998, pp. 834–835).

Canine parvovirus occurs regularly in domestic dogs throughout Alaska and even with intensive care, high mortality still results. Within southeastern Alaska, canine parvovirus is not common, but some outbreaks have occurred, especially in remote villages that do not have immediate access to veterinarian care (New 2015). Additionally, parvovirus outbreaks in British Columbia have been reported in domestic dogs (Bryan et al. 2011, pp. 14–15). Although documented cases are rare, the transmission of parvovirus from domestic dogs to wild wolves is a conservation concern in southeastern Alaska and coastal British Columbia; vaccination of domestic dogs, control of feral dogs, and surveillance of wolf populations for the presence of positive parvovirus titers are preventive means of control.

Blastomycosis is a fungal disease characterized by granulomatous lesions in various tissues, primarily of the respiratory system in dogs. Blastomycosis has been reported mostly in humans and dogs, but death caused by blastomycosis has been documented in at least one wolf from Minnesota (Thiel et al. 1987, pp. 321–322), and serologic evidence of blastomycosis was found in wolves from Wisconsin (Thiel et al. 1987, p. 322) and Ontario (Krizan 2000, p. 492; Forshner et al. 2004, p. 100). Currently, this disease appears to be limited to the Great Lakes region and the Mississippi River drainage.

Tuberculosis is a disease primarily of cattle and other ungulates, although avian and human forms exist. Sitka black-tailed deer are potential hosts for this disease but we found no evidence of its occurrence in southeastern Alaska or coastal British Columbia. In Canada, the only reports of wolf fatalities related to tuberculosis were from Riding Mountain National Park, Manitoba (e.g, Wobeser 2009, p. 1173).

Sarcoptic mange is caused by the ectoparasitic mite, *Sarcoptes scabei.* In North America, mange is commonly found on red foxes and also occurs on coyotes and wolves throughout their ranges. Wolves with mange usually have severe hair loss, and severe infestations are manifested in crusted lesions and hairless thickened, slate-gray skin over much of the body (Brand et al. 1995, p. 427). Infested animals generally suffer from alopecia, hyperkeratosis, seborrhea, scabs, ulcerations, and lesions (Jimenez et al. 2010a, p. 1120). Severe mange infestations can result in wolf mortality, especially in pups and may play a role in regulating wild canid populations, with the number of cases increasing when wolf populations increase (Todd et al. 1981, p. 727). Sarcoptic mange has been reported in wolves from interior Alaska (Murie 1944, p. 16) and British Columbia (Miller et al. 2003, p. 183).

The dog louse (*Trichodectes canis*) has been reported on free-ranging wolves throughout much of their range in North America (Brand et al. 1995, p. 426; Jimenez et al. 2010b, p. 331). Dog louse can cause skin irritations, matting, and secondary bacterial dermatitis. Although dog louse was documented in domestic dogs, Schwartz et al. (1983, p. 372) was the first to report it in wolves in Alaska (Kenai Peninsula) in 1981. Since then, dog louse has been documented in wolves from the Matanuska-Susitna Valley (Golden et al. 1999, p. 4), interior Alaska (Woldstad 2010, pp. 240–241), and north of the Alaska Range (Gardner et al. 2013, p. 630). Dog louse has also been documented in wolf populations from coastal British Columbia, in areas where wolf densities are high (Hatler et al. 2008, pp. 88–91). We found no evidence that dog louse affects wolves at the population level, but survival of individual pups may be reduced (Brand et al. 1995, p. 426).

Several researchers have hypothesized that coastal wolves in British Columbia may be isolated from pathogens common in other wolf populations by evolving resistance to disease associated with marine food resources (e.g., Darimont et al. 2003, p. 352; Darimont et al. 2008, pp. 9–10; Munoz-Fuentes et al. 2009, pp.1526–1527). The trematode *Neorickettsia helminthoeca*, which is responsible for "salmon poisoning disease" and can be fatal to canids, is thought to concentrate in kidney and muscles of infected fish. Darimont et al. (2003, pp. 350–351) was the first to propose that coastal wolves may have adapted to avoid exposure to *N. helminthoeca* primarily by consuming salmon heads, thereby avoiding infected tissue. Thus, interior-born wolves that disperse to coastal areas may be more vulnerable than coastal wolves to suffer acute symptoms from this disease (Munoz-Fuentes et al. 2009, pp.1526; Stronen et al. 2014, pp. 2, 7). We are not aware of field studies or evidence to test this hypothesis.

The role of disease in limiting wolf populations remains largely unknown. Both canine distemper and canine parvovirus are known or suspected to have affected gray wolves at the population level in other parts of North America (Brand et al. 1995, p. 420 and citations therein). If populations of Alexander Archipelago wolf decline to small numbers or become highly localized, then their vulnerability to disease may increase. Primary defenses against disease include regular vaccination of domestic dogs for rabies, distemper and parvovirus, control of feral dog populations, and preventing the introduction of new diseases. Even though disease is rare in both southeastern Alaska and coastal British Columbia wolf populations, disease outbreaks can have strong influences on the population dynamics of wolves (Bailey et al. 1995, p. 445). Further, Bryan et al. (2011, p. 12) suggested that the potential for introduction of new pathogens and susceptibility of wolf populations to existing pathogens could be influenced by changes in climate and increased economic activities, especially in coastal wolf populations. However, we found few data from which to assess potential impacts of disease to Alexander Archipelago wolves currently or in the future given possible changes in disease dynamics.

5.3.6. Climate-related events

Of the stressors that may be affecting Alexander Archipelago wolves, climate-related events and projected changes in climate is the only one that is primarily stochastic. As discussed above (see *Deer habitat use*), severe winters can strongly affect deer populations, which in turn impacts wolves by reducing available prey. Therefore, it is important to attempt to understand the frequency and influence of severe winters on wolf and deer population dynamics. In this section,

we consider possible effects of climate-related events on wolves in southeastern Alaska and coastal British Columbia, primarily by evaluating effects of severe winters on deer populations.

Most studies of deer in southeastern Alaska have investigated their habitat use during the winter when deer populations are thought to be most limited (e.g., Schoen and Kirchhoff 1990; Doerr et al. 2005; Brinkman et al. 2011). These short-term field studies have provided useful information on immediate response of deer to varying degrees of winter severity (summarized in Deer habitat use), but we lack reliable estimates of deer population trends over longer periods of time (>10 years) in southeastern Alaska. ADFG and partners have been conducting deer pellet surveys as an index of deer abundance for decades, but generally these surveys are not done routinely in space or time and, more importantly, recent research has deemed them to be unreliable (Brinkman et al. 2013, p. 444). Without longer term data on trends in deer abundance, our analysis of possible effects of climate-related events on deer populations within the range of the Alexander Archipelago wolf largely was limited to modeling exercises.

A severe winter can affect deer primarily in two ways: (1) by reducing availability of forage (i.e., snow covers browse) and (2) by increasing energy expenditure associated with movement (i.e., deep snow is difficult to move through; Parker et al. 1984, p. 474; Parker et al. 1999, p. 5). Researchers often refer to severe winters and their impacts on deer (e.g., Brinkman et al. 2011, p. 233), but we are not aware of a standard definition of a “severe winter” with regard to the response of deer populations in southeastern Alaska or coastal British Columbia. For example, Farmer et al. (2006, p. 1404) described a moderately severe winter as one when snow accumulation reached 67 cm at sea level by February, with depths exceeding 150 cm at higher elevations, and Doerr et al. (2005, p. 325) considered a winter with deep snow to be one when maximum snow depth was about 85 cm. Person (2001, p. 54) used temperature and precipitation data from local weather stations to estimate that six winters per century may result in general declines in deer numbers in the southern portion of southeastern Alaska.

For the purpose of this assessment, we considered a severe winter to be a combination of >160 cm total winter snowfall (October–March) and >25 cm maximum monthly snow depth in any given month during that winter. In a population model for wolves on POW, Person (2001, p. 54) identified two winters (1969, 1970) as being severe for deer; we used these winters as benchmarks to define a threshold of total winter snowfall (>160 cm). Because deer can be affected by single, extreme snowfall events, we also considered snowfall at a finer temporal scale, i.e., maximum monthly snow depth. Parker et al. (1999, p. 25) found that when maximum snow depths were >30 cm energy costs associated with movement of an average-sized deer (25–30 cm carpus height) increased significantly. During the first winter, fawns weigh ~40% less than adults (Parker et al. 1999, p. 17) and their carpus height is ~10% shorter than that of adults (Parker et al. 1984, p. 481); thus, our criterion of maximum monthly snow depth of 25 cm should account for fawn energy expenditure with locomotion. In addition, most evergreen forbs are covered when snow depths >10 cm (Parker et al. 1999, p. 37) and most larger *Vaccinium* spp. plants are buried when snow >30 cm (White et al. 2009, p. 484).

We modeled the effect of severe winters on deer and wolf abundance in GMU 2 through 2045. Using our definition of severe winter, we determined that two severe winters occurred in GMU 2 over the last 20 years (frequency=0.10) based on data from the Annette Island Weather Station

(National Climatic Data Center, NOAA); this frequency was slightly higher than that estimated by Person (2001, p. 54; frequency=0.06). In our wolf model, we treated winter severity as a binomial variable (i.e., each winter either met the definition of being a severe winter or it did not). We estimated projected frequencies of a severe winter occurring by downscaling regional models of snowpack developed by Littell et al. (2015), following methods outlined in McAfee et al. (2014), to GMU 2 specifically. This approach involved projecting annual precipitation as snow to a 30-year window of 2030–2059 (centered around 2045, total projection length of our population model) using five global climate models, then estimating the percent change in annual snowfall between the future projections (2030–2059) and recent data (1970–1999). The greatest percent change in annual snowfall (-28.6%) among climate model predictions translated to a low frequency of severe winter (0.07) and the lowest percent change in annual snowfall (0%) translated to a high frequency of severe winter (0.10), equivalent to the historical record; the average across all five climate models was a -19.2% change in annual snowfall and served as average frequency of severe winter (0.08; Littell 2015). See Gilbert et al. 2015 for details about the wolf population model.

Results of our wolf population model demonstrated that both deer and wolf abundance were affected by frequency of severe winters, although wolves were affected more than deer (Figure 25). Over the 30-year modeling period, change in abundance of wolves ranged from -6% under low frequency to -13% under high frequency, doubling the effect on wolves with only a small change in the frequency of severe winters (0.07 versus 0.10, respectively). Relative change in abundance was smaller overall for deer, i.e., -20% change under low frequency and -25% under high frequency. This result is consistent with our understanding of the wolf-deer system; as fewer severe winters occur over time, the deer population benefits through increased survival rates, which also benefits wolves through increased deer availability. However, it is likely that the benefits of fewer severe winters would reach capture efficiency limits, as healthy, free-roaming deer are more difficult to catch and kill than under-nourished deer restricted to small patches of snow-free habitat.

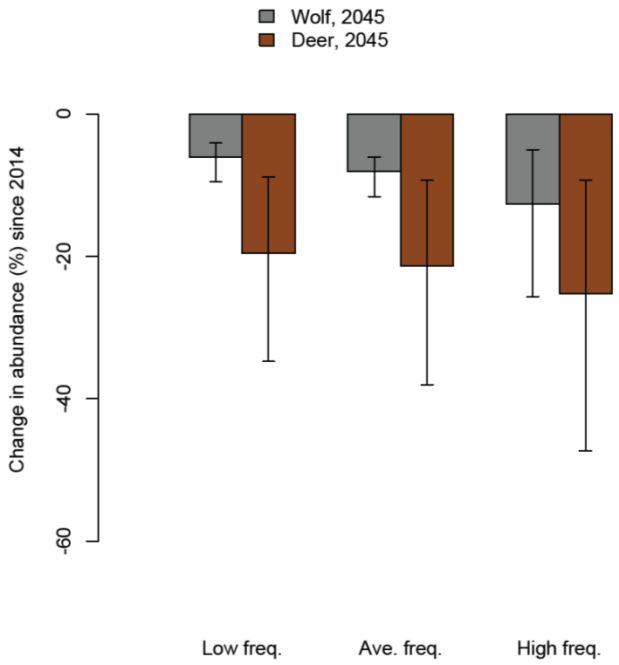

Figure 25. Estimated percent change in mean abundance of wolves and deer under three frequencies of a severe winter occurring (0.07, 0.08, and 0.10, respectively) between 2015 and 2045, as projected by downscaling regional climate models (Littell 2015) to Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

Several researchers recently modeled current and projected climate conditions in southeastern Alaska and coastal British Columbia. Under current climate conditions, snowfall is greatest along the mainland of southeastern Alaska (GMUs 1 and 5A), decreasing as one moves south into northern coastal British Columbia (Regions 5 and 6; Albert and Schoen 2007, p. 15; Shanley et al. 2015, p. 6). In southern coastal British Columbia (Regions 1 and 2), persistent snowfall is rare except at higher elevations. On the islands of southeastern Alaska (GMUs 2 and 3), precipitation as snow is driven largely by local conditions and elevation, but tends to be periodic in frequency (Albert and Schoen 2007, p. 15; Shanley et al. 2015, p. 6).

Based on the average of five global climate models, Shanley et al. (2015, pp. 5–6) projected that precipitation as snow will decrease up to 58% in southeastern Alaska and northern British Columbia over the next 80 years, which should improve winter conditions for deer. McAfee et al. (2014, p. 3944) found that most changes in snow (measured as snow-day fractions, or the percent of precipitation days that receive snow) will occur in February and March, suggesting an earlier onset of spring conditions and longer growing season, which also should benefit deer (although this also could result in a mismatch between peak forage nutrition and birth of fawns as forage plants mature more quickly). Thus, although severe winters affect both deer and wolves at the individual and population levels, future projections indicate that fewer severe winters will occur in southeastern Alaska and coastal British Columbia. These projected future conditions should have an overall positive influence on deer and wolf populations rangewide.

Other climate-related changes that are occurring or are expected to occur within the range of the Alexander Archipelago wolf include reduction or loss of yellow cedar as a result of warmer winters and reduced snow cover (Hennon et al. 2012, p. 156). Decline in yellow cedar occurs at several thousand locations, cumulatively affecting about 2,500 km^2, or <6%, of the forested portions of southeastern Alaska and coastal British Columbia (Hennon et al. 2012, p. 148). Although these changes on the landscape have been observed, we do not know their impact to the Alexander Archipelago wolf. We hypothesize, however, that effects (negative or positive) will be negligible because the wolf is a habitat generalist and an opportunistic predator (see *Resource selection* and *Food habits*). Further, yellow cedar is a minor component of the temperate rainforest, which is dominated by Sitka spruce and western hemlock and neither of these tree species appears to be impacted negatively by reduced snow cover (e.g., Schaberg et al. 2005, p. 2065). In addition, any potential effects on deer as a result of loss of yellow cedar and possible cascading changes in landscape composition are speculative at this point. We are not aware of research that has measured changes in deer abundance with regard to loss of yellow cedar in forests of southeastern Alaska or coastal British Columbia.

We also found evidence that changes in climate are predicted to result in hydrologic changes that may reduce salmon productivity within the range of the Alexander Archipelago wolf (e.g., Edwards *et al.* 2013, p. 43; Shanley and Albert 2014, p. 2). Warmer winter temperatures and extreme flow events are predicted to reduce egg-to-fry survival of salmon, resulting in lower overall productivity. It is unclear whether or not these changes will result in reduced salmon abundance and availability to wolves, but we assume that some wolves will be impacted if that is the case.

5.3.7. Other

In addition to the primary stressors reviewed above, we acknowledge that other factors may influence the status of the Alexander Archipelago wolf at the individual, population, and rangewide levels. We briefly review other possible stressors below.

Endemism.—In the petition to list the Alexander Archipelago wolf, the petitioners raised island endemism as a possible stressor (CBD and Greenpeace 2011, pp. 51, 84–85). An endemic is a distinct, unique organism found within a restricted area or range; a restricted range may be an island, or group of islands, or a restricted region (Dawson et al. 2007, p. 6-1). Although smaller populations are more vulnerable to extinction than larger ones (Lande 1993, p. 921) due to demographic stochasticity, environmental variability and catastrophic events, endemism or "rarity" alone are not stressors. Therefore, we instead considered possible effects associated with small and isolated populations of the Alexander Archipelago wolf.

Based on the best available information, we estimated the current rangewide population to be about 850–2,700 wolves within perhaps 10 or more individual populations, although we have little data to use for defining a population (see *Abundance and trend*). Movement across populations does occur, albeit at low levels (see *Connectivity*), and therefore, none of the populations appear to exist in complete isolation. However, owing to the island geography and steep, rugged terrain within the range of the Alexander Archipelago wolf, some populations are small (less than 150–250 individuals, following Carroll et al. 2014, p. 76) and are more insular

(e.g., GMU 2) than others (e.g., coastal British Columbia). These small, partially isolated populations are susceptible to possible negative genetic consequences.

The primary genetic concern of small, isolated wolf populations is inbreeding, which, at extreme levels, can reduce litter size and increase incidence of skeletal effects (e.g., Liberg et al. 2005, p. 17; Raikkonen et al. 2009, p. 1025). We found only one study that examined inbreeding in the Alexander Archipelago wolf. Breed (2007, p. 18) tested for inbreeding using samples from Regions 5 and 6 in northern British Columbia and GMUs 1 and 2 in southern southeastern Alaska and found that inbreeding coefficients were highest for wolves in GMU 1, followed by GMU 2, then by Regions 5 and 6. This finding was unexpected given that GMU 2 is the smaller, more isolated population, yet it indicates that inbreeding probably was not affecting the GMU 2 population at the time of the study despite its comparatively small size and insularity. We found no evidence of historical or recent genetic bottlenecking in the Alexander Archipelago wolf (Weckworth et al. 2005, p. 924; Breed 2007, p. 18), although Weckworth et al. (2011, p. 5) speculated that a severe bottleneck may have taken place long ago (over 100 generations).

Oil development.—Also in the petition, the petitioners listed oil development in coastal British Columbia as a potential stressor to the Alexander Archipelago wolf (CBD and Greenpeace 2011, p. 83). Specifically, the petition identifies a proposed oil pipeline project (i.e., Northern Gateway Project) intended to transport oil from Alberta to the central coast of British Columbia, covering about 1,177 km in length. If the proposed project is approved and implemented, there will be a risk of oil spills on land and on the coast within the range of the Alexander Archipelago wolf. However, we hypothesize that given its dispersal capability and opportunistic food habits, the wolf probably would not be affected negatively by the pipeline project even if an oil spill occurred. Oil development occurs throughout the range of the gray wolf (e.g., Trans Alaska Pipeline System) and is not thought to be impacting wolf populations negatively (e.g., BCMO 2014, p. 11).

Over exploitation of salmon runs.—The petitioners raise concern over the status of salmon runs in coastal British Columbia due to over exploitation and disease transmission from introduced Atlantic salmon (*Salmo salar*; CBD and Greenpeace 2011, pp. 83–84). In coastal British Columbia, only 0–16% of the diet of the Alexander Archipelago wolf is salmon (Darimont et al. 2004, p. 1871; Darimont et al. 2009, p. 130; see *Food habits*). Therefore, we postulate that given the opportunistic food habits of the Alexander Archipelago wolf, reduction or even complete loss of salmon as a food resource may impact individual wolves in some years, but probably would not result in a population level effect. However, loss of salmon in the diet probably would result in a greater dependency on deer and other prey items (see *Food habits*), potentially altering predator-prey dynamics to some extent in affected areas.

Hybridization with domestic dogs.—In the petition, hybridization with domestic dogs was presented as a stressor to the Alexander Archipelago wolf (CBD and Greenpeace 2011, p. 84). Based on microsatellite analyses, Munoz-Fuentes et al. (2010, p. 547) found that at least one hybridization event occurred in the mid-1980s on Vancouver Island where wolves were probably extinct at one point in time, but then recolonized the island from the mainland. Although hybridization has been documented and is more likely to occur when wolf abundance is

unusually low, most of the range of the Alexander Archipelago is remote and unpopulated by humans, reducing the risk of interactions between wolves and domestic dogs.

5.3.8. Summary of stressors

In this section, we summarize stressors within the range of the Alexander Archipelago wolf by considering the magnitude (scope, intensity, and immediacy) and level of exposure and possible biological response of wolves to each stressor (Table 23). In our summary, we did not consider interactions or cumulative impacts of stressors, but instead aimed to distill some of the key information presented in this chapter; it is not intended to be a comprehensive list of stressors or their possible impacts to the Alexander Archipelago wolf.

Table 23. Summary of selected stressors within the range of the Alexander Archipelago wolf. Gray-shaded cells include definitions and categories of evaluation factors. We present this table as a summary only and not as a complete list of stressors or their possible impacts; see text for more detailed discussion of each stressor.

Stressor	Possible ecological impacts	Possible biological response	Scope	Intensity	Immediacy	Exposure
Process or event with negative impacts on target taxon	Process or event that occurs as a result of the stressor	Level of response of target taxon due to the stressor	Geographic extent of the stressor	Strength of the stressor relative to the scope	Action time frame of the stressor	Degree of overlap between target taxon and stressor
		Behavioral, Basic need inhibited, Mortality	Localized, Moderate, Widespread	Low, Moderate, High	Historical, Imminent, Future, Ongoing	Low, Moderate, Significant
Timber harvest	Reduced den site availability	Basic need inhibited	Localized	High	Ongoing	Low
	Disturbance at den sites	Behavioral	Localized	Low	Ongoing	Low
	Reduced forage for deer	Basic need inhibited	Widespread	Moderate	Ongoing	Moderate
Road development	Disturbance at den sites	Behavioral	Localized	Low	Ongoing	Low
Wolf harvest	Direct mortality	Mortality	Localized	High	Ongoing	Moderate
	Change in pack dynamics	Behavioral	Widespread	Low	Ongoing	Low
Disease	Increased transmission	Basic need inhibited	Localized	High	Future	Low
Climate-related events	Reduced snowfall, increased rainfall	Behavioral	Widespread	Low	Future	Significant
Endemism (small populations)	Increased inbreeding depression and genetic bottlenecking	Basic need inhibited	Moderate	Low	Future	Low
Oil development	Reduced prey	Basic need inhibited	Localized	Low	Future	Low
Overexploitation of salmon runs	Reduced salmon as prey	Basic need inhibited	Localized	Low	Future	Moderate
Hybridization with dogs	Loss of adaptation and taxon	Behavioral	Localized	Low	Future	Low

5.4. Existing conservation mechanisms

We reviewed relevant existing conservation mechanisms that directly or indirectly benefit, or are intended to benefit, the Alexander Archipelago wolf in southeastern Alaska and coastal British Columbia. We did not evaluate the efficacy of these mechanisms, but instead briefly review their intended purpose and any pertinent limitations to them.

5.4.1. Southeastern Alaska

Tongass Conservation Strategy.—During development of the 1997 Tongass Forest Plan, the Forest Service worked with scientists and managers from a variety of agencies and institutions to design a conservation strategy for old-growth dependent species on the Tongass (hereafter Strategy). Elements of the Strategy were developed after synthesis and consideration of the state of knowledge on many topics, including landscape-scale conservation science, island biogeography, and natural history of several species, including the Alexander Archipelago wolf, and species groups. Primary components of the Strategy include a Tongass-wide network of old-growth habitat reserves linked by connecting corridors of forested habitat, and a series of standards and guidelines that direct management of lands available for timber harvest and other activities outside the reserves. The Strategy developed as part of the 1997 Tongass Forest Plan was retained in the current (2008) Tongass Forest plan with a few modifications. Below, we briefly review key elements of the Strategy with emphasis on provisions directly related to conservation of wolves and their primary prey, deer.

Old-growth reserve network.—The foundation of the Strategy is a series of large, medium and small old-growth reserves, protected from timber harvest and most other human development, and distributed across the Tongass. It is intended to function as a “coarse filter” that provides adequate habitat for most species. Design considerations for reserves specify that they are to be circular rather than linear to maximize interior forest conditions rather than edge conditions, that inclusion of early seral habitats be minimized, and that features such as the largest remaining blocks of productive old-growth, some of the highest-volume remaining forest stands, nesting habitat for Queen Charlotte goshawk (*Accipiter gentilis laingi*) and marbled murrelet (*Brachyramphus marmoratus*), and important deer winter range be included (USFS 2008d, pp. D-6–D-10).

Large reserves are contiguous landscapes of at least 160 km^2, with a minimum of 80 km^2 of productive old-growth forest and 40 km^2 of high volume strata old-growth (defined by canopy coarseness, soils, and aspect). These reserves are spaced no greater than 32 km (20 miles) apart. Many of the 38 large reserves are in non-development LUDs such as Wilderness, Remote Recreation, or Municipal Watershed. Where necessary to achieve spacing requirements, additional large reserves were designated using the Old-growth Habitat LUD. Management prescriptions specify that lands with this designation be managed for maintenance of old-growth forest characteristics.

There are 112 medium reserves of approximately 40 km^2 each with a minimum of 20 km^2 of productive old-growth and 10 km^2 of high volume strata old-growth. They are spaced a maximum of 13 km (8 miles) apart and include a variety of non-development LUDs. All large and small reserves should be linked by corridors of unharvested forest, using existing protected landscape features such as riparian and beach buffers where available.

Small reserves are included in each "value comparison unit" (equivalent to a medium-size watershed or a WAA) that does not already include non-development LUDs over at least 16% of its area. Each of the 237 small reserves should be composed of at least 50% productive old-growth forest.

Matrix management.—Outside of the old-growth reserve network, standards and guidelines apply to the matrix of lands that are open to development on the Tongass. For example, beach and estuary fringe within 305 m (1,000 ft) of saltwater shorelines and riparian habitat along streams are protected as wildlife habitat and movement corridors; these forested buffers benefit deer, especially in winter. Additionally, legacy forest structure standards require retention of residual trees and snags in timber harvest units larger than 0.08 km^2 (20 acres) and in heavily logged watersheds. These standards and guidelines are intended to improve the function of the matrix as a whole and support the reserve network.

For some species, including wolf and deer, the Strategy also includes "fine filter" elements to alleviate species-specific conservation concerns not addressed adequately with the coarse filter reserve network (USFS 2008a, pp. 4-90–4-100). For the Alexander Archipelago wolf, fine filter elements address disturbance at and modification of active wolf dens and elevated mortality of wolves. Buffers of 366 m (1,200 feet) are required around active dens (when known) to reduce risk of abandonment, although if a den is inactive for at least two years, this requirement is relaxed. However, most wolf packs are not monitored, and may switch dens between years, making it probable that many den sites are not identified, monitored for activity, or protected. In areas where wolf mortality concerns have been identified, the Strategy requires development and implementation of a Wolf Habitat Management Program; despite concerns for wolves in GMU 2, no such plan has been developed yet. In addition, when road access and human-caused mortality are thought to be contributing significantly to unsustainable wolf mortality, planning processes associated with road management and wolf harvest regulations are supposed to incorporate measures to reduce risks to wolves in that area. Total road densities of 0.40–0.60 km/km^2 (0.70–1.00 $mile/mile^2$) are suggested, yet in areas of past timber harvest on POW specifically, road densities exceed this recommended level (Table 17, Figure 13) and recent timber sale decisions will result in even higher road densities in some areas of GMU 2 (e.g., USFS 2013a, pp. 29–30).

The Tongass Forest Plan directs the USFS to provide sufficient deer habitat capability on the Tongass first to maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. Using the deer habitat model (described above in *Timber harvest*), biologists analyze trends in deer habitat capability and other local information to evaluate the extent to which a management area can support wolf populations and human demands for deer. The recommended guideline of deer habitat capability is 7 $deer/km^2$ (18 $deer/mile^2$). Many localized areas on POW and elsewhere are currently below this habitat capability guideline due in large part to past timber harvest activities and subsequent forest succession (e.g., USFS 2013b, pp. 3-114–3-115) and implementation of recent timber sale decisions on POW is expected to reduce deer habitat capability further (e.g., USFS 2013a, pp. 26–28). In addition to the deer habitat capability guideline, habitat needs for deer should be considered during project planning and analysis, but no specific standards are identified (USFS 2008a, p. 4-92).

Roadless Rule.—In January 2001, the USFS published a final rule prohibiting road construction and timber harvesting in "inventoried roadless areas" on all National Forest System lands nationwide (hereafter Roadless Rule; 66 Federal Register 3244, January 12, 2001). On the Tongass, the USFS has inventoried 109 roadless areas covering approximately 38,000 km^2 (USFS 2008b, p. 3-444). These roadless areas include approximately 1,200 km^2 of "suitable forest land", which is the land base where timber production is believed to be possible without irreversible resource damage to soils, productivity, or watershed conditions; forests can be adequately restocked; and Tongass management has determined that timber production is an appropriate use (USFS 2008a, p. 7-42; USFS 2008b, p. 3-449). The balance of the inventoried roadless areas (36,800 km^2) are not subject to timber harvest because they are either non-forested, in LUDs that do not allow timber harvest, or on lands too steep, unstable, or otherwise environmentally sensitive to allow logging. Thus, the Roadless Rule effectively protects about 1,200 km^2 from timber harvest.

The Roadless Rule was challenged in U.S. District Court by the State of Alaska in 2001, and in 2003 the USFS and the State reached a settlement. The USFS issued a rule temporarily exempting the Tongass from the 2001 Roadless Rule. This exemption was set aside by the District Court in 2011, which reinstated the prohibitions on roadbuilding and logging. That judgment was overturned by the Ninth Circuit Court of Appeals in 2014, potentially reinstating the exemption, and eliminating the logging and roadbuilding prohibitions. At this time, the Court of Appeals ruling has not been finalized, and additional legal challenges are pending. Therefore, the Tongass is subject to the provisions in the 2001 Roadless Rule (i.e., no logging and roadbuilding is permitted in roadless areas), although the outcome of these legal challenges is uncertain.

5.4.2. Coastal British Columbia

Forest and Range Practices Act.—The Forest and Range Practices Act and its regulations govern the activities of forest and range licensees in British Columbia (see *Timber harvest*). The statutes set the requirements for planning, road building, logging, reforestation, and grazing. The Act does not include provisions specifically for coastal wolves.

Wildlife Act of British Columbia.—The Wildlife Act of British Columbia is the legislative foundation for the interaction of people and wildlife in British Columbia. This Act authorizes the government to declare a species as threatened or endangered. Wildlife is defined as all native and some non-native amphibians, birds, and mammals that live in British Columbia; the gray wolf is included under this Act where it is classified as "big game." It was amended with the Environmental Amendment Act in 2008, authorizing management of alien species and increasing fines for wildlife violations, among other minor changes.

Federal Fisheries Act.—The Federal Fisheries Act provides the regulatory framework for protecting the productivity of commercial, recreational, and Aboriginal fisheries. Fisheries and Oceans Canada, a division of Environment Canada, is the regulatory agency that oversees implementation of this Act. It allows the federal government to manage and reduce threats to the fisheries and the habitat that supports them. Pacific salmon are protected under this Act.

Convention on International Trade in Endangered Species.—The gray wolf is listed as a furbearer and protected under the Convention on International Trade in Endangered Species. Therefore, a permit is required before exporting wolf pelts across international boundaries. For a permit to be issued authorities must determine that such export will not be detrimental to the survival of the species and that specimens to be exported have not been obtained by violation of the laws for their protection.

Regional land use and management plans.—We found over 20 regional- and watershed-based land use and management plans active within the range of the Alexander Archipelago wolf (e.g., Central Coast Land and Resource Management Plan, Vancouver Island Land Use Plan). These land use plans are developed with public and stakeholder input and are considered in decisions pertaining to timber harvest (see *Timber Harvest*). These plans can be found at https://www.for.gov.bc.ca/tasb/slrp/.

CHAPTER 6: CURRENT AND FUTURE STATUS OF THE ALEXANDER ARCHIPELAGO WOLF

The purpose of this document is to synthesize scientific information relevant to assessing the current and future status of the Alexander Archipelago wolf. In this chapter, we summarize information presented in Chapters 2–5 with the goal of projecting future status of the Alexander Archipelago wolf. Owing to the variation in quantity and quality of available data across the range of the wolf, we first assess current status of each population separately and evaluate the potential impact of stressors, individually and cumulatively, to that population by examining its resiliency. We then project future status by considering all populations collectively using the principles of redundancy, resiliency, and representation. For the purpose of this assessment, we define resiliency as the ability of a population or taxon as a whole (whichever is applicable) to withstand stochastic disturbance events; redundancy as the ability of the taxon as a whole to withstand catastrophic events; and, representation as the ability of the taxon as a whole to adapt to changing environmental conditions. Thus, resiliency is assessed at the population level as well as the rangwide level while redundancy and representation are evaluated at the rangewide level only; this approach follows the Service's framework for conducting a Species Status Assessment (Service 2015).

6.1. Biological considerations

Our concern for the future population status of the Alexander Archipelago wolf is tempered to some degree by the extraordinary resilience of wolves to high levels of take and the activities of humans (Mech and Boitani 2003), and their adaptability to man-altered landscapes (Mech 1995). In fact, as wolf populations recover elsewhere in the United States, wolves are inhabiting areas with higher road densities than earlier thought possible and more open and populated areas. Weaver et al. (1996, p. 964) describe three mechanisms that influence the resilience of large carnivores to disturbances that may affect their persistence: 1) behavioral plasticity in foraging behavior that ameliorates flux in food availability; 2) demographic compensation that mitigates increased exploitation; and, 3) dispersal that provides connectivity between fragmented populations. Wolves, with high potential annual productivity and long dispersal abilities, are considered among the most resilient of carnivores to human activities (e.g., Weaver et al. 1996, pp. 966–968). If food is available and wolves are not unduly persecuted, they can survive in highly altered areas; ultimately, it is human attitudes and values that will limit the number and distribution of wolves in North America (e.g., Mech 1995, p. 275), including southeastern Alaska and coastal British Columbia.

Wolves exhibit behavioral plasticity in foraging behavior by having access to a variety of prey and the ability to switch from one prey species to another depending on their availability and susceptibility to wolf predation. Alexander Archipelago wolves are opportunistic predators and take a variety of prey species, although on islands in southeastern Alaska, most of their diet appears to consist of deer and beaver (Tables 8 and 9). Wolves on POW apparently can kill beavers and other prey throughout the year (e.g., Kohira and Rexstad 1997, p. 430), which certainly could ameliorate the effects of reduced deer availability to some extent. However, it is uncertain, but probably unlikely, that beaver and other prey could sustain high wolf densities on islands in southeastern Alaska in the absence of deer.

Because of their high reproductive rates, wolves are able to capitalize on increases in prey biomass and compensate for increased mortality. Generally, gray wolves can sustain human-caused mortality rates of roughly 17–48% (e.g., Fuller et al. 2003, pp. 184–185; Adams et al. 2008, p. 22; Creel and Rotella 2010, p. 5; Sparkman et al. 2011, p. 5; Gude et al. 2012, pp. 113–116;). Human exploitation of wolves may increase the amount of prey biomass per wolf, which may increase productivity and survival. Under conditions of high prey availability, wolves may lower their age of first reproduction, have larger litters, and a greater proportion of females in an area may reproduce. Provided prey biomass is high enough, wolves are able to rapidly repopulate areas that have been depleted by hunting and trapping (e.g., Ballard et al. 1987, p. 20).

In parts of the range of the Alexander Archipelago wolf, total mortality of wolves through hunting and trapping may be occurring at unsustainable rates. Although wolves are able to sustain high levels of human take, unreported harvest probably has contributed to decline of the GMU 2 wolf population and may be having an undocumented impact on other populations. Recently, for GMU 2, the Alaska Board of Game reduced the cap for hunting and trapping mortality from 30% of the fall wolf population to 20%, demonstrating their ability to respond to changing conditions. However, it remains to be seen whether or not the change in the harvest guideline level will result in population stabilization given the high rates of unreported harvest and the predicted declines in deer habitat capability due to past timber harvest in GMU 2.

Because wolves are capable of dispersing hundreds of kilometers, often across inhospitable terrain, problems associated with inbreeding and genetic variability are uncommon. Alexander Archipelago wolves are known to disperse more than 160 km and swim up to at least several kilometers between islands (Person and Ingle 1995, p. 23); in coastal British Columbia, wolves occupy islands up to 13 km away from the nearest island or mainland (Darimont and Paquet 2002, p. 418). Nonetheless, water barriers may limit the ability of wolves to disperse among some islands in southeastern Alaska especially. Inter-island movements may be sufficient to prevent loss of heterozygosity in populations of Alexander Archipelago wolves, but may not be sufficient to buffer wolves on some islands from declines. Because wolves in southeastern Alaska have been studied little (outside of GMU 2), few data exist on the amount of interchange among wolves on various island groups and mainland, and between southeastern Alaska and British Columbia, although evidence suggests that low rates of migration occur (see *Within-population dispersal*). Generally, although widely debated, 1–10 migrants per generation are necessary to maintain sufficient gene flow among populations; Von Holdt et al. (2010, p. 4423) found that a minimum of 5.4 migrants per generation was necessary for gray wolves in the Rocky Mountains. Within the range of the Alexander Archipelago wolf, POW and the adjacent islands are among the most isolated and therefore the GMU 2 population likely experiences the least amount of interchange with the mainland populations (i.e., GMU 1/5A, Region 1/2, and Region 5/6).

Even in complete or nearly complete isolation though, wolves have demonstrated a remarkable ability to persist at low population levels. For example, wolf populations numbering less than a few hundred individuals have persisted for decades in Isle Royale National Park (Michigan), Riding Mountain National Park (Manitoba), northern Italy, and in parts of Norway and Sweden (summarized in Fuller et al. 2003, p. 190). We recognize that not all of these populations are stable or will persist into perpetuity, but they demonstrate that wolves can persist for many

generations at low numbers. Furthermore, reintroductions in the Rocky Mountains demonstrate the capacity for rapid population growth for populations below 100 wolves. Regardless, it is widely accepted that small, isolated populations have a higher probability of extinction than large, connected populations and that as populations become small, they become susceptible to random events and may experience negative genetic consequences.

We are not aware of an established population threshold or minimum viable population estimate for the Alexander Archipelago wolf. Generally, most minimum viable population estimates for gray wolves seem to range between 100 and 500 wolves. For example, the Scandinavian wolf population, which has similar characteristics to some populations of the Alexander Archipelago wolf (e.g., partial isolation and high rates of unreported harvest), is assumed to be secure at a minimum of roughly 150–200 individuals (Liberg 2005, p. 39). In addition, the recovery of gray wolves in the Northern Rocky Mountains called for 100 wolves and 10 breeding pairs for at least three years in each of the three recovery areas (i.e., northwestern Montana, Yellowstone National Park, and central Idaho). It is unclear how these thresholds for other wolf populations apply to the Alexander Archipelago wolf, but they do provide some general guidance.

6.2. Assessment by population

For each population, we assessed range and population characteristics (e.g., % of range, population size, trend) and magnitude and exposure of stressors to the population (Table 24). We used our assessment to project resiliency of the population to future resource conditions, while acknowledging uncertainty. For GMU 2, the population for which the most data exist, we developed a spatially-explicit model to examine future population change of a hypothetical wolf population under several scenarios. For all other populations, our assessment is qualitative and should be viewed as a synthesis of available information and not as a quantitative risk or viability assessment.

Given the paucity of data available on wolves and similarities in stressors, we combined subunits A–D of GMU 1 and all of GMU 5A into one population of wolves that occupies the mainland of southeastern Alaska. For the same reasons, we combined Regions 1 and 2 and Regions 5 and 6 into two populations (southern and northern, respectively) in coastal British Columbia. Therefore, below we evaluate the potential for decline in five wolf populations: mainland southeastern Alaska (GMU 1/5A), GMU 2, GMU 3, northern coastal British Columbia (Region 5/6), and southern coastal British Columbia (Region 1/2). We began with GMU 2 because it is the population for which the most information on wolves exists and it harbors the greatest concentration of deterministic stressors; the remainder of populations is presented from north to south.

Table 24. Summary of range and population characteristics and primary stressors facing populations of the Alexander Archipelago wolf by Game Management Unit (GMU) in southeastern Alaska (SEAK) and Region in coastal British Columbia (BC). Estimates provided reflect the best available information; see text for details on estimate derivation, assumptions, and citations. Gray-shading provided for readability only.

Category		Metric	GMU 1/5A Mainland SEAK	GMU 2 POW in SEAK	GMU 3 Middle islands of SEAK	Region 1/2 Southern coastal BC	Region 5/6 Northern coastal BC
Range or population characteristic	Physical	Land area (km^2)	55,672	9,414	7,844	79,074	67,097
		% of wolf range	25%	4%	4%	36%	31%
		% of wolf range <400 m in elevation	18%	9%	8%	35%	30%
		Shoreline (km)	9,601	7,644	4,880	13,119	7,134
		Ratio of shoreline to land area	0.17	0.81	0.62	0.17	0.13
	Demographic	Estimated population size (95% CIs)	318[1] (170–466)	89[2] (50–159)	255[1] (136–373)	429[1] (212–646)	670[1] (297–1,043)
		% of rangewide population	18%	6%	14%	24%	38%
		Change in population size (SE)	Unknown	-6.7%[2] (2.8) per annum	Unknown	Stable	Stable
		Estimated predicted trend	Unknown	~-8–11% in 30 years[3]	Unknown	Unknown	Unknown
		Relative degree of insularity	Low	High	Intermediate	Low	Low
	Ecological	# of ungulate prey species present	3	1	3	3	3
Stressor	Timber harvest	% of forest logged	6%	23%	14%	30%	16%
		% reduction in deer habitat capability	~15%[4]	11–38%	13–23%	Unknown	Unknown
		Projected future logging (mmbf)	36.0	165.4	103.3	17–39%[5]	17–39%[5]
	Road development	Total roads (km)	2,795	5,712	2,467	48,632	18,980
		Mean road density (km/km^2)	0.08	0.62	0.26	0.54	0.23
		% of WAAs/WMUs over threshold	1%	42%	4%	21%	0%
	Wolf harvest	Mean annual reported wolf harvest (range)	62 (36–86)	52 (20–96)	54 (21–95)	15 (1–107)	16[6] (1–111)
		Mean percent of annual reported harvest to population size (range)	19% (11–27)	17% (6–33)	21% (8–37)	7% (1–25)	5%[6] (1–21)
		Estimated unreported harvest	Documented	38–45% of total harvest	Suspected	Unknown	Unknown
	Winter severity	Relative snow accumulation	Highest	Lowest	Intermediate	Lowest	Intermediate

[1]Based on the midpoint of range; [2]Empirical estimates from ADFG 2015b, pp. 1–2; [3]Based on Gilbert et al. 2015; [4]Available only for GMUs 1A and 1B, following Albert and Schoen (2007, p. 31); [5]Estimated percent loss of old-growth forest and mature young-growth forest between 2005 and 2100; comparable estimate for all of southeastern Alaska is 12% (Service 2010, p. A-12); [6]Minimum mean annual wolf harvest; reporting is not required.

6.2.1. Game Management Unit 2 wolf population

GMU 2 constitutes 4% of the range of the Alexander Archipelago wolf and 9% of its range below 400 m in elevation where wolves spend most of their time (see *Space and habitat use*; Table 24). Currently, the GMU 2 wolf population is estimated as 89 wolves (95% CI=50–159), based on the most recent field effort in fall 2014 (ADFG 2015b, p. 2). Using this estimate, the GMU 2 wolf population currently is roughly 6% of the overall estimated population of Alexander Archipelago wolves and 15% of the southeastern Alaska portion only. However, the highest population estimate for GMU 2 was 356 wolves (95% CI=148–564) wolves in 1994; using this value, the GMU 2 wolf population is roughly 18% of the overall population and 25% of the southeastern Alaska population. The wolf population in GMU 2 has declined by 75% (SE=15) since 1994, or an average of -6.7% (SE=2.8) per annum, based on population estimates, although the variance surrounding these estimates is substantial and the confidence intervals overlap.

Using a spatially-explicit model, we predicted future population change of a hypothetical wolf population in GMU 2 under six possible scenarios that involved perturbations of four primary stressors: vegetation, wolf harvest, road density, and frequency of severe winters (Table 25). Each stressor (or parameter) had several conditions, which are briefly described in Chapter 5 and in more detail in Gilbert et al. (2015). We developed the scenarios and defined conditions during a 2-day technical model review workshop with experts on wolf biology and management, population modeling, spatial analysis, and forest management in March 2015. At the workshop, we also received constructive feedback on the model itself; after revising the model based on that feedback and generating the necessary spatial data, we ran these six scenarios, and the sensitivity analyses described above, through the final model.

Table 25. Description of scenarios evaluated using population model to estimate percent change in mean wolf abundance in Game Management Unit 2 between 2015 and 2045. We used Scenario B (*) as a base model to conduct the sensitivity analyses described above in Chapter 5.

Scenario	Parameter	Condition	Description
No Change	Vegetation	No change	Natural succession only.
	Roads	No change	Current road densities.
	Wolf harvest	20% harvest cap	Harvest of 20% of fall population estimate, plus unreported harvest.
	Frequency of severe winter	Predicted average	Frequency of 0.08.
Scenario A	Vegetation	No change	Natural succession only.
	Roads	Planned decommission	Reduction of 2.2% of current road densities.
	Wolf harvest	No legal harvest	Unreported harvest only.
	Frequency of severe winter	Predicted low	Frequency of 0.07.
Scenario B*	Vegetation	Young-growth transition	Harvest of 53.0 mmbf/year[1].
	Roads	Planned decommission	Reduction of 2.2% of current road densities.
	Wolf harvest	20% harvest cap	Harvest of 20% of fall population estimate, plus unreported harvest.
	Frequency of severe winter	Predicted average	Frequency of 0.08.
Scenario C	Vegetation	Continued harvest of old-growth	Harvest of 80.6 mmbf/year.
	Roads	No change	Current road densities.
	Wolf harvest	20% harvest cap	Harvest of 20% of fall population estimate, plus unreported harvest.
	Frequency of severe winter	Predicted average	Frequency of 0.08.
Scenario D	Vegetation	Increased harvest of old-growth	Harvest of 183.6 mmbf/year.
	Roads	No change	Current road densities.
	Wolf harvest	30% harvest cap	Harvest of 30% of fall population estimate, plus unreported harvest.
	Frequency of severe winter	Predicted high	Frequency of 0.10.
Scenario E	Vegetation	Maximum harvest of old-growth	Harvest of 273.2 mmbf/year.
	Roads	Road construction	Construction of 30% more roads above current densities.
	Wolf harvest	30% harvest cap	Harvest of 30% of fall population estimate, plus unreported harvest.
	Frequency of severe winter	Predicted high	Frequency of 0.10.

[1]Million board feet (mmbf).

Of the six scenarios, Scenario A resulted in the smallest percent change in mean wolf abundance between 2015 and 2045 (-5%), although this same scenario also resulted in the largest percent change in mean deer abundance (-33%; Figure 26). Scenario E ranked worst in terms of change in wolf abundance (-20%) and next to last for change in deer abundance (-32%). Overall, Scenario B seemed to serve as the most optimistic model for both wolf and deer abundance, resulting in -8% and -21% change, respectively, as well as the lowest associated variance, and based on the conditions used in this model, it also seems to be the most probable to occur over the next 30 years.

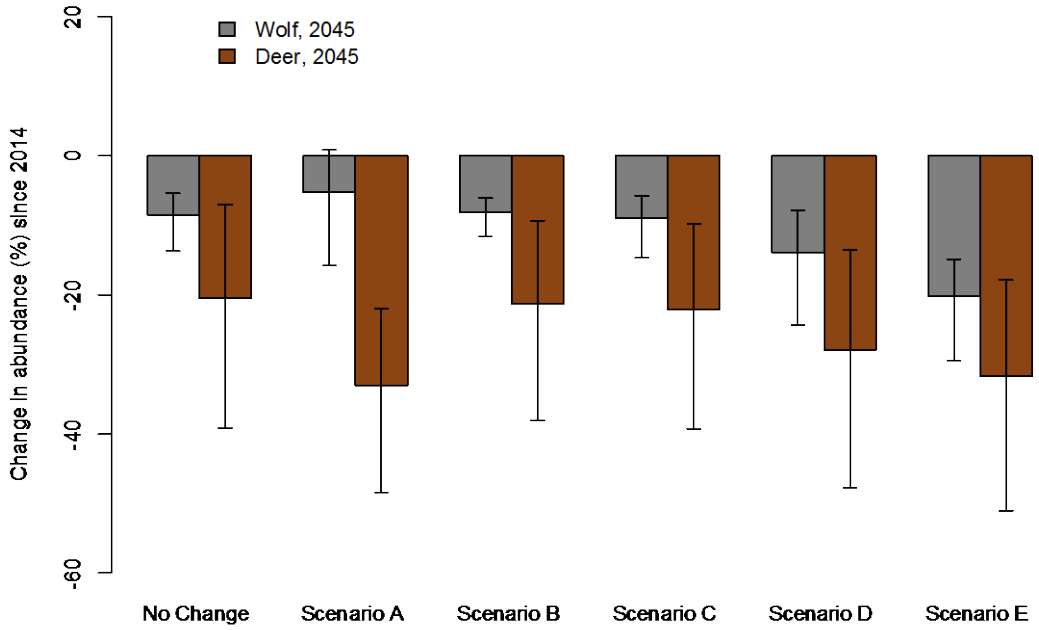

Figure 26. Estimated percent change in mean abundance of wolves and deer under six scenarios with variations of vegetation, wolf harvest, road density, and frequency of severe winter conditions between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals.

Consistent with knowledge of predator–prey dynamics, change in wolf abundance was not uniform over the time period modeled, but instead wolves were responsive to their primary prey, deer. Between 2000 and present, we used actual (empirical) wolf harvest and winter severity data to inform the model. Results demonstrate that following severe winters deer abundance declines sharply and immediately with a corresponding increase in wolf abundance, which then declines several years later in response to low deer numbers (Figure 26). Presently, wolf abundance is predicted to be at a low point, but is expected to increase within the next few years owing to stabilizing deer abundance. Over the 30-year future period, however, both wolf and deer abundance are predicted to decline with a larger percent change occurring for deer than wolves, primarily due to reduced carrying capacity for deer, under all scenarios (Figure 27). See Gilbert et al. (2015) for model assumptions and evaluation of how well they were met.

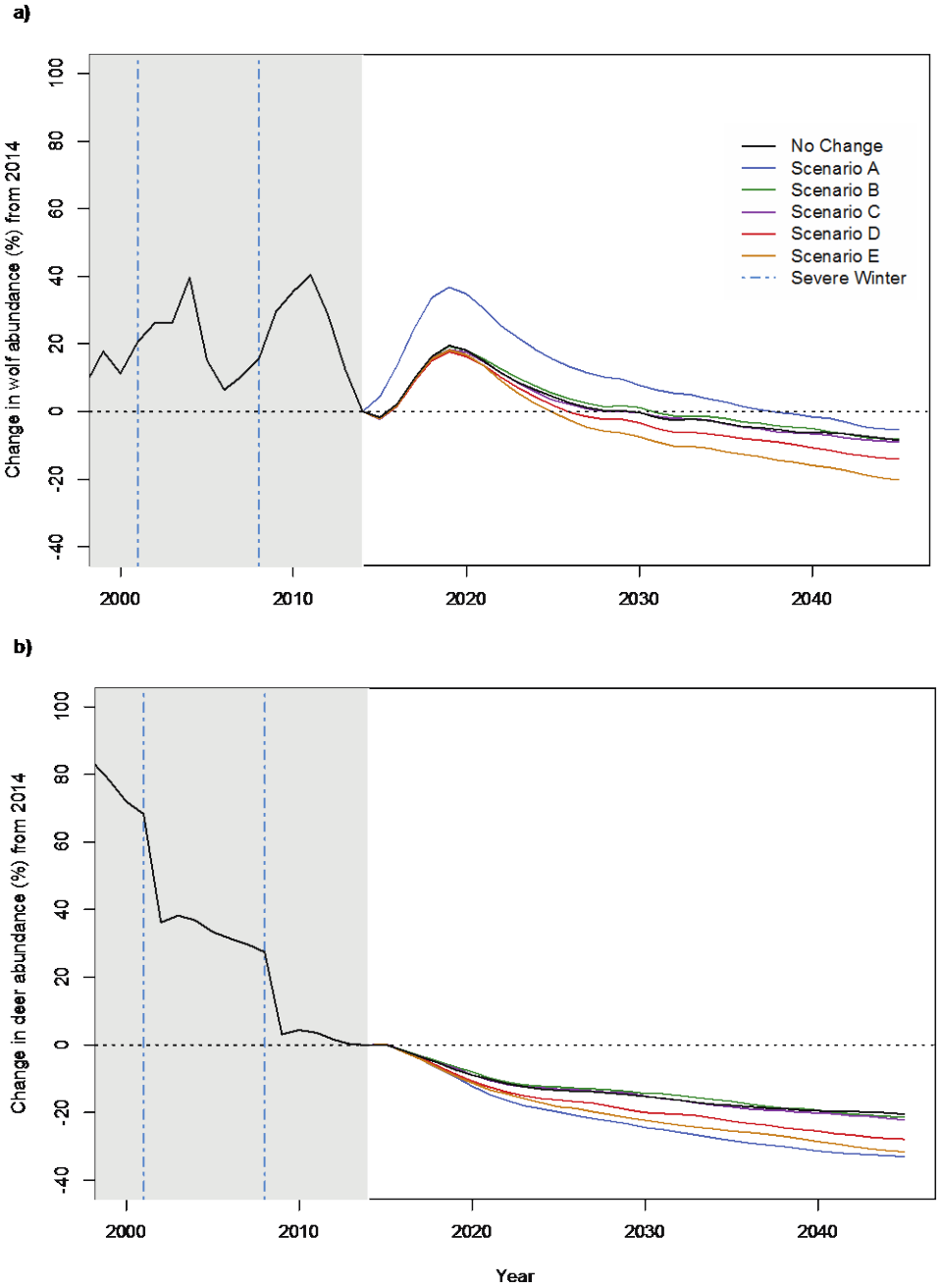

Figure 27. Percent change in (A) wolf abundance and (B) deer abundance across model scenarios from 2014 levels, shown from the year 2000–2045, in Game Management Unit 2. The grey box represents the years in the model (before 2015) where actual severe winters (dotted blue line) and reported wolf harvest were used as model inputs, while the white portion represents mean model predictions. See Gilbert et al. (2015) for details.

The GMU 2 wolf population based on empirical data apparently has declined by about 75% (SE=15) between 1994 and 2014 with the steepest decline occurring over a 1-year period between 2013 and 2014 when the population was reduced by about 60% (see Table 3 for point estimates and associated variance). Although our model results indicate that the current wolf

population is at its lowest point since 2000, the steep decline observed over a 1-year period suggests that the GMU 2 wolf population may be at more elevated risk of decline than was predicted by our model. Only a few possible explanations exist that can explain that level of decline between 2013 and 2014, assuming that the trend estimate is reliable, and its inconsistency with our model results. First, actual rates of unreported wolf harvest were higher between 2013 and 2014 than were included in the model (42% of total harvest); we believe this explanation is most likely given our knowledge of unreported harvest in GMU 2 (see *Unreported harvest*). Second, we did not account for unreported harvest of deer in our model, but given the high sensitivity of wolf abundance to reduced deer harvest (Figure 23) and apparent high levels of unreported take of deer in GMU 2 (ADFG 2013c, p. 37), it is possible that actual deer abundance over the last few years was much lower than predicted by the model. Other possible explanations include widespread disease in the population, although no evidence of this situation exists, overall reduced deer availability, and decreased ability of wolves to catch and kill deer.

In summary, based on information regarding primary stressors evaluated with the GMU 2 wolf model, observed population decline, and model-predicted population declines, we project that GMU 2 wolf population likely will decline in the future. Given that this wolf population relies on only one ungulate species as prey (i.e., deer; Table 7), it is especially susceptible to changes in deer abundance. Roughly 23% of the forests in GMU 2 have been logged (Table 13), resulting in a reduction of 11–38% of the deer habitat capability, and another 165.4 mmbf is slated for harvest (47% of the future harvest in all of southeastern Alaska; Table 15). Despite efforts by the USFS and others to improve habitat for deer with intermediate treatments, the majority of previously logged stands has entered an age range (>25 years old; Figures 7, 9) when restoration techniques are less effective. Therefore, we believe that for the short-term (approximately the next 30 years) deer abundance will decline (unless deer harvest is eliminated or sharply curtailed, which is highly unlikely; Figure 23) and wolf abundance probably will respond similarly, but at a slower rate (Figure 27).

However, declines in wolf abundance could be mitigated for through reduced wolf and deer harvest, which both could be managed somewhat by restricting access of hunters and trappers. Current rates of reported wolf harvest appear to be sustainable (mean=52 wolves, or about 17% of the population; Table 21), but a substantial amount of unreported wolf harvest has been documented in GMU 2 (38–45% of total harvest). These high rates of total harvest in GMU 2 are facilitated by greater access for hunters and trappers; GMU 2 has the highest road density (mean=0.62 km/km^2) and ratio of shoreline to land area (0.81; proxy to boat access) across the entire range of the Alexander Archipelago wolf (Table 24). Therefore, we consider the GMU 2 wolf population to demonstrate low resiliency and, as predicted by our model, we anticipate further declines in wolf abundance in GMU 2 over the next 30 years (an average decline of 8–14% of current population), largely owing to reduced deer abundance due to timber harvest, high rates of total wolf harvest, and a combination of these factors.

6.2.2. Mainland of southeastern Alaska wolf population (GMU 1/5A)

The combined population estimate of wolves in GMU 1/5A on the mainland in southeastern Alaska is 318 wolves, ranging between 170 and 466, approximately 18% of the rangewide population of Alexander Archipelago wolves and 47% of the southeastern Alaska portion (Table 24). GMU 1A supports the majority (57%) of the mainland wolf population in southeastern

Alaska. We found no data to estimate the trend of the wolf population in GMU 1/5A. Therefore, we evaluated characteristics of the range and population and the primary stressors that appear to have the greatest relative strength on wolf abundance (informed by the sensitivity analysis conducted using the GMU 2 wolf population model).

Primary stressors to the mainland wolf population in southeastern Alaska (GMU 1/5A) are comparatively low (Table 24). Across the entire area, only 6% (total=665 km^2) of the productive forest has been logged and only 36 mmbf is projected to be logged in the future (10% of planned future timber harvest across all of southeastern Alaska; Tables 14 and 15). Further, given that deer (and wolves) occur naturally at low abundance on the mainland, we anticipate low levels of impact to the wolf population in GMU 1/5A from past and future timber harvest; in addition, wolves in GMU 1/5A have access to ungulate species other than deer (Table 7). Likewise, reported wolf harvest rates between 1997 and 2014 appear to be sustainable across the entire mainland (mean annual harvest=62 wolves, or ~19% of the population), although harvest is higher in the southern portion of the mainland (GMU 1A; Table 21) where wolves are presumably more abundant (Table 4). Unreported harvest of wolves has been documented on a few occasions in GMUs 1A and 1C and suspected in GMU 1B, but has not been quantified in any subunit along the mainland; given the low level of road and boat access for hunters and trappers (Tables 20 and 24), we suspect that rates of unreported harvest in GMU 1/5A also are low compared to GMU 2.

In summary, we found no reliable data to indicate population trend of the wolf on the mainland of southeastern Alaska, yet we believe that resiliency of this wolf population likely is high based on its similarities with populations in coastal British Columbia. Although the mainland receives higher snowfall compared to the islands, snowfall is predicted to decrease in the future, resulting in improved conditions for deer and wolves (see *Climate-related events*). Further, wolves on the mainland have access to ungulate species other than deer and are less insular than island wolf populations. GMU 1A presents the greatest potential for local population decline along the mainland, but even still, in this subunit only 6% of the forest has been logged (Table 13), mean annual reported harvest appears to be sustainable (mean=16% of the population annually; Table 21), and hunter and trapper access is the lowest across the range of the wolf (Table 20). Nonetheless, the value of the mainland to the Alexander Archipelago wolf should not be under estimated; it connects the coastal populations with the interior populations via transboundary river corridors and the southeastern Alaska populations with the coastal British Columbia populations along the rugged coastline. Therefore, high resiliency of the GMU 1/5A population benefits the rangewide population of Alexander Archipelago wolf.

6.2.3. Game Management Unit 3 wolf population

The GMU 3 wolf population is estimated to be 255 wolves, or between 136 and 373 wolves, constituting ~14% of the current rangewide estimated population of Alexander Archipelago wolves and 36% of the southeastern Alaska portion. We found no data to estimate trend of the wolf population in GMU 3. Therefore, similar to the mainland population (GMU 1/5A), we evaluated characteristics of the range and population and the primary stressors that appear to have the greatest relative strength on wolf abundance.

In GMU 3, primary stressors occur at intermediate levels compared to other GMUs and Regions (Table 24). Although only 14% of the forest has been logged in this area (Table 13), reducing deer habitat capability by 13–23% since 1954 (Albert and Schoen 2007, p. 16), nearly 30% of the projected timber harvest is scheduled to occur in GMU 3 (Table 15). However, ungulate species other than deer occur in GMU 3 (Table 7), relaxing dependency of wolves on deer. Rates of reported wolf harvest appear to be sustainable (mean=21% of the population annually) and although managers suspect that unreported harvest is occurring, it has not been confirmed or quantified. We determined that boat and road access is lower in GMU 3 than in GMU 2 (Table 20) and therefore, we postulate that rates of unreported harvest likely are lower also, but not zero; in addition, wolves in GMU 3 probably have greater dispersal capability compared to wolves in GMU 2, which likely improves their ability to compensate for intermediate rates of harvest.

In summary, we have no information on the status or trend of the GMU 3 wolf population, but when the population characteristics and primary stressors are considered collectively, we believe that the GMU 3 population has intermediate resiliency compared to other wolf populations. An operational plan for intensive management for deer in GMU 3 has been developed and involves the culling of ~50 wolves, or 20% of the current estimated population (ADFG 2013b, pp. 8–9; Table 4). Although the program currently is inactive, if implemented the GMU 3 wolf population would be reduced, given that it is the goal of the program, potentially having an effect on the GMU 2 population because GMU 3 provides the most reasonable transit path for wolves to move or disperse between the mainland and GMU 2 (Figure 2). Therefore, maintaining or reducing current rates of wolf harvest in GMU 3 would benefit the rangewide population of Alexander Archipelago wolves; an increase in mortality rates likely would lower immigration rates to GMU 2, which apparently are uni-directional (Breed 2007, p. 22), thereby increasing the vulnerability of the GMU 2 wolf population.

6.2.4. Northern coastal British Columbia wolf population (Region 5/6)

We estimate that the wolf population in northern coastal British Columbia, Region 5/6, is 670 wolves, ranging from 297 to 1,043 wolves, representing ~38% of the overall population of the Alexander Archipelago wolf. Of all of the estimates presented in this section, this estimate is the least precise and may be the least accurate (biased slightly high; see *Abundance and trend* for details). Nonetheless, we generated it using the best available scientific data, to the best of our knowledge. We found that the wolf population in Region 5/6 is thought to be stable or slightly increasing (Kuzyk and Hatter 2014, p. 881; BCMO 2015a), as is true of the provincial wolf population (BCMO 2014, p. 25). Therefore, we assume that stressors facing this population are not having a population-level impact, indicating that the population shows high resilience to the magnitude of stressors currently present.

The magnitude of primary stressors to the Region 5/6 wolf population (northern coastal British Columbia) appear to be low relative to other populations (Table 24), although data on wolf harvest represent minimum values only. Based on voluntary reporting of wolf harvest, we estimated annual minimum take of 16 wolves (5% of the population annually) with higher rates of annual harvest reported in Region 6 (mean=28 wolves) compared to Region 5 (mean=4 wolves) where estimated road density is more than two times lower (Tables 18 and 22). Across Region 5/6, mean road density is 0.23 km/km^2 with only one WMU near the recommended road

density threshold (Figure 14, Table 18). Timber harvest in Region 5/6 is lower than in GMU 2 and Region 1/2 and is spatially concentrated (Figure 10); across all of Region 5/6 approximately 16% of the forest has been logged, although additional logging at a loss of about 1% per year is expected in the future if market conditions allow (Service 2010, p. A-12). However, despite these stressors, the wolf population in Region 5/6 has remained stable for the last 15 years.

In summary, we believe that the Region 5/6 wolf population demonstrates high resiliency, as evidenced by its apparent stability since 2000. We hypothesize that access to ungulate species other than deer, an apparently high degree of connectivity with other wolf populations, and low levels of boat and road access for hunters largely are responsible for the current stability and high resiliency of the Region 5/6 wolf population. This conclusion is favorable to the GMU 1 wolf population given that the Region 5/6 population may serve as a source population to GMU 1A (Breed 2007, p. 34).

6.2.5. Southern coastal British Columbia wolf population (Region 1/2)

The southernmost population of Alexander Archipelago wolf in Region 1/2 of coastal British Columbia is estimated to be 429 wolves, ranging between 212 and 646, approximately 24% of the rangewide population. Similar to the Region 5/6 wolf population, the Region 1/2 wolf population has been stable or slightly increasing since 2000 (Kuzyk and Hatter 2014, p. 881; BCMO 2015a). Therefore, we presume that the stressors to the Region 1/2 wolf population are not having an impact at the population-level and that this population is resilient to the current magnitude of stressors.

We found that primary stressors to the Alexander Archipelago wolf in Region 1/2 occurred at low to intermediate levels compared to other wolf populations (Table 24). Although boat access was low compared to GMUs 2 and 3, road access was somewhat high (Table 20), but we attribute the high road densities to the cities of Victoria (Region 1) and Vancouver (Region 2), which likely are not resulting in increased wolf harvest. In fact, unlike Region 5/6, wolf harvest reporting is compulsory in Region 1/2 and, based on those data, mean annual reported harvest composed only 7% of the population annually; we found no reports of unreported harvest occurring in this region. In Region 1, timber harvest has been intensive; 34% of the productive old-growth forest has been logged, but harvest is expected to decline over the next 35 years (Service 2010, p. A-11) presumably because fewer trees are left to harvest. In contrast, in Region 2, only 12% of the forest has been logged. Timber forecasts indicate that additional logging at the rate of about 1% per year may occur by 2100 provided that the market remains stable. Nonetheless, despite the intensive and extensive timber harvest and the high road densities, the Region 1/2 wolf population has been stable over the last 15 years.

In summary, similar to Region 5/6, the Region 1/2 wolf population demonstrates high resiliency in the face of stressors to the population. We postulate that access to alternative ungulate species (other than deer), comparatively low levels of reported wolf harvest, and high levels of connectivity with other wolf populations likely results in a resilient wolf population even though other stressors such as timber harvest occur at a high magnitude. We suspect that of all the populations assessed in this document, wolves in Region 1/2 probably interact more frequently with other gray wolves (i.e., not *C. l. ligoni*, as assumed in this assessment; see *Taxonomy* and *Connectivity*), which may enhance demographic compensation and stability.

6.2.6. Summary of individual populations

In our assessment of each population, we determined that three populations of the Alexander Archipelago wolf demonstrate high levels of resiliency (GMU 1/5A, Region 5/6, and Region 1/2), one population exhibits an intermediate level of resiliency (GMU 3), and one population shows a low level of resiliency (GMU 2; Table 26). For populations in coastal British Columbia, key evidence in determining level of resiliency was the stable (or slightly increasing) population trend even though stressors to those populations were somewhat high (e.g., road development, timber harvest). Similarly, we relied largely on estimates of population change and vital rates (e.g., survival) relative to the magnitude of the stressors to categorize resiliency as being low for this population. In GMUs 1/5A and 3 where trend information is not available, we compared the evidence with populations for which trend information is available (i.e., coastal British Columbia and GMU 2) and found that, for the most part, these populations were more similar to coastal British Columbia than GMU 2. Overall, lack of empirical abundance and trend estimates, as well as low precision of existing estimates, were the primary sources of uncertainty. In addition, we found little information, scientific or observational, on individual movements of Alexander Archipelago wolves across populations.

Table 26. Relative level of resiliency of individual populations of the Alexander Archipelago wolf, southeastern Alaska and coastal British Columbia (order follows north to south).

Wolf population	Level of resiliency	Key evidence	Uncertainties
GMU 1/5A	High	• Low percent of forest logged • Reported wolf harvest appears to be sustainable • Boat and road access is limited • Ungulate species other than deer available as prey • Few disruptions to demographic and genetic connectivity	• No empirical abundance or trend data • Severe winters likely will affect population more so than others • Unreported harvest documented on few occasions, but not quantified • Southern portion of GMU may be sink population
GMU 3	Intermediate	• Intermediate level of timber harvest • Reported wolf harvest appears to be sustainable • Boat access is high, but road access is low • Ungulate species other than deer available as prey • Intermediate insularity of population	• No empirical abundance or trend data • Connectivity may be more limited than for mainland populations due to island geography • Unreported harvested suspected, but not quantified • Distribution and abundance of ungulate prey species are not uniform across GMU
GMU 2	Low	• Reduction wolf population over last 20 years • High percent of forest logged with expected declines in deer • High rates of unreported harvest documented • Boat and road access for hunters and trappers is highest across range of taxon • Deer serve as only ungulate species for prey • High insularity of population	• Confidence intervals of abundance estimates overlap; decline not statistically significant • Abundance estimated in portion of GMU and extrapolated uniformly to entire GMU • Unreported harvest is highly variable and difficult to document • No information on immigration rates; emigration appears to be low
Region 5/6	High	• Wolf population stable since 2000 despite intermediate levels of timber harvest • Ungulate species other than deer available as prey • Few disruptions to demographic and genetic connectivity • Appears to serve as source population	• Assume wolf trend in entire Region is representative of coastal portion • Reporting of wolf harvest is not required; assume harvest is occurring at sustainable levels • No information on movements
Region 1/2	High	• Wolf population stable since 2000 despite high rates of timber harvest • Ungulate species other than deer available as prey • Few disruptions to demographic and genetic connectivity	• No information on impacts of urbanization • Likely to interact with gray wolves (*C. l. nubilus*) from continental North America, which may increase taxonomic uncertainty • No information on movements

6.3. Characterizing future status

In this section, we characterize the future status of the rangewide population of Alexander Archipelago wolf. To do so, we used the conservation biology principles of redundancy, resiliency, and representation (Table 27). Together, these principles and their core autecologic parameters of abundance, distribution, and diversity, comprise the key characteristics that contribute to the Alexander Archipelago wolf's ability to sustain a healthy rangewide population over time.

6.3.1. Redundancy

We defined redundancy as the ability of the taxon as a whole to withstand catastrophic events and evaluated it qualitatively using the geographic scope of the range and the number and spatial distribution of populations (Table 27). The current range of the Alexander Archipelago wolf is broad, encompassing ~219,000 km^2 in area and is similar to its recent historical range. As defined in this assessment, multiple populations (at least about 10) occur within its current range. Although some island-based populations, especially GMU 2, are more insular than mainland populations, they occupy only 8% of the range and 17% of the range below 400 m in elevation where Alexander Archipelago wolves tend to spend time (see *Resource selection*). Therefore, we believe that the Alexander Archipelago wolf has the ability to withstand catastrophic events given its broad range with multiple populations distributed across it and the degree of connectivity among most of those populations.

6.3.2. Resiliency

We defined resiliency as the ability of the taxon as a whole to withstand stochastic disturbance events and assessed it by considering the collective resiliency of the individual populations (Tables 26 and 27). In the previous section, we found that three populations of the Alexander Archipelago wolf demonstrate high resiliency (GMU 1/5A, Region 5/6, and Region 1/2), one population exhibits intermediate resiliency (GMU 3), and one population shows low resiliency (GMU 2; Table 26). We considered the numerical contribution of these populations to the rangewide population and found that overall 80% of the rangewide population exhibits high resiliency, 14% demonstrates intermediate resiliency, and 6% shows low resiliency. Although one population (i.e., GMU 2) of the Alexander Archipelago wolf may not contribute significantly to the resilience of the rangewide population, we conclude that the taxon as a whole has the ability to withstand stochastic disturbance events.

6.3.3. Representation

We defined representation as the ability of the taxon as a whole to adapt to changing environmental conditions and evaluated it by reviewing the breadth of the ecological and genetic diversity (Table 27). Given that the Alexander Archipelago wolf is a habitat and diet generalist with a variable diet across seasons and throughout its range, it exhibits ecological diversity at the rangewide level. In our review, we did not find evidence of unique or rare behaviors specific to wolves within a specific population or group of populations; Alexander Archipelago wolves appear to be highly adaptive to their environment. Although continental wolves harbor higher genetic diversity than their coastal counterparts (e.g., Weckworth et al. 2010, p. 372), we did not find evidence of recent genetic bottlenecking (Weckworth et al. 2005, p. 924; Breed 2007, p. 18; Weckworth et al. 2011, p. 5). The populations in coastal British Columbia exhibit higher genetic diversity compared to those in most of southeastern Alaska, especially GMU 2, and appear to

serve as source populations to southern southeastern Alaska (Breed 2007, p. 34). We believe that the Alexander Archipelago wolf has the ability to adapt to changing environmental conditions owing to its high level of behavioral plasticity in foraging, general lack of preference for habitat use, and a comparatively high degree of genetic diversity in the majority of the rangewide population (62% occurs in coastal British Columbia).

Table 27. Characterization of future status of the Alexander Archipelago wolf using the conservation biology principles of redundancy, resiliency, and representation.

Principle	Definition	Metric	Key evidence
Redundancy	Ability of the taxon to withstand catastrophic events	Geographic scope of the range and spatial distribution and number of populations	• Geographic scope of range is large (about 217,000 km^2) and is similar to recent historical range • Multiple populations occur throughout current range indicating high redundancy • One population (GMU 2) is more insular than others, but it occupies only 4% of the range and 9% of the range below 400 m in elevation • Two island-based populations (GMUs 2 and 3) probably experience the least connectivity with other populations; they occur within 8% of the range and 17% of the range below 400 m in elevation • Mainland populations with fewer disruptions to connectivity with one another occupy 92% of range and 83% of range below 400 m in elevation
Resiliency	Ability of the taxon to withstand stochastic disturbance events	Synthesis of resiliency of individual populations	• One population (GMU 2) exhibits low resiliency (6% of rangewide population) • One population (GMU 3) shows intermediate resiliency (14% of rangewide population) • Remainder of populations (GMU 1/5A and coastal British Columbia) demonstrate high resiliency (80% of rangewide population) • Overall, 80% of the rangewide population is exhibits high resilience
Representation	Ability of the taxon to adapt to changing environmental conditions	Breadth of genetic and ecological diversity	• Habitat and diet generalist and high variation in food habits across seasons and range indicate high ecological diversity • Genetic diversity of Alexander Archipelago wolves appears to be lower than for interior continental wolves, but no evidence of recent genetic bottlenecking • Genetic variation exists among populations with the greatest diversity exhibited in populations in coastal British Columbia and lowest in the highly insular GMU 2 population • Representation appears to be high across range of taxon, especially in coastal British Columbia where most of the rangewide population occurs

6.4. Summary

Across its range, the Alexander Archipelago wolf encounters anthropogenic and environmental stressors, although they are not uniformly distributed, nor does the wolf respond similarly to all stressors. Generally, coastal wolves are resilient, feeding on a variety of prey items and using most habitat types throughout their annual cycle. This ecological and behavioral plasticity permits them to endure conditions that other species with narrow biological niches may not be able to tolerate. However, some populations of Alexander Archipelago wolf are more insular than others, lowering their resiliency and increasing their vulnerability to stressors.

In our review, we found that all but one population (i.e., GMU 2) exhibited intermediate or high resiliency to stressors. Collectively, these resilient populations occupy 96% of the range of the Alexander Archipelago wolf and 91% of the range below 400 m in elevation where wolves tend to spend their time; in addition, they comprise 94% of the rangewide population of the Alexander Archipelago wolf. In coastal British Columbia where 62% of the rangewide population occurs, trends in wolf abundance have been stable or slightly increasing since 2000 even though substantial timber harvest has occurred and road access for hunters and trappers is somewhat high. Although uncertainty regarding the status of wolf populations in GMUs 1, 3, and 5A is greater than for those in coastal British Columbia, population characteristics and magnitude of stressors tend to be more similar to coastal British Columbia than to GMU 2, based on the best available information (Tables 24 and 26).

In GMU 2, however, we found that the wolf population demonstrated low resiliency to stressors. In fact, this population apparently has declined considerably from past abundance already and is predicted to decline further over the next 30 years (Figure 27). The GMU 2 wolf population has been disproportionately impacted by timber harvest, which has reduced deer habitat capability, for two reasons. First, wolves in GMU 2 rely heavily on deer as the only ungulate prey species available, and second, rates of timber harvest in GMU 2 are among the highest within the range of the Alexander Archipelago wolf (Table 24). In addition, although reported wolf harvest is occurring within sustainable limits (Figure 18, Table 21), high rates of unreported harvest result in unsustainable total wolf harvest in some years (Figure 20). GMU 2 offers the highest levels of boat and road access to hunters and trappers (Table 20), which facilitates harvest of wolves. Further, the GMU 2 wolf population is more insular than the others, probably due to difficult water crossings and to the geographic position of this GMU; it is not on a transitory pathway, but instead likely is a destination for dispersing wolves. Although this population exhibits low resiliency, it occupies only 4% of the range and 9% of the range below 400 m in elevation and composes only 6% of the rangewide population.

In conclusion, we believe that the future status of the rangewide population of the Alexander Archipelago wolf likely will be stable or perhaps slightly lower than its current status based on its resiliency, redundancy, and representation (Table 27). Owing to predicted declines in the GMU 2 wolf population, it is possible that the rangewide population may decrease slightly, but we expect the overall effect to be minor given that the GMU 2 population constitutes only 6% of the rangewide population, is geographically peripheral to the other populations, and appears to serve as a sink population. Nonetheless, the persistence of the GMU 2 population is desired and requires careful management actions and decisions to ensure its future health.

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APPENDIX I. Land area (km^2) of Game Management Units (GMU) in southeastern Alaska and portion of Regions in coastal British Columbia, within the range of the Alexander Archipelago wolf.

Location	Identifier	Land area (km^2)
Southeastern Alaska	GMU 1	47,904
	1A	13,727
	1B	7,828
	1C	19,451
	1D	6,898
	GMU 2	9,414
	GMU 3	7,844
	GMU 5A	7,768
Coastal British Columbia	Region 1	46,507
	Region 2	32,567
	Region 5	23,194
	Region 6	43,903
Total		219,101

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Second summer sawfly outbreak browns hemlock trees around Southeast

Posted by Joe Viechnicki | Jul 16, 2019

Two sawfly larvae munch on hemlock needles near Ohmer Creek on Mitkof Island. (Joe Viechnicki/KFSK)

The U.S. Forest Service in Southeast Alaska is recording more wide-spread tree damage from a bug called a hemlock sawfly on the Tongass National Forest. For the second summer, these native, defoliating insects are leaving behind reddish brown tree tops, this year stretching from Prince of Wales Island to Juneau.

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From afar, the most visible damage to hemlock trees is the brown needles, especially toward the top. But up close, there's another widespread sign that sawflies are eating and digesting hemlock needles.

"It's like, it's the poop," said Elizabeth Graham with a laugh. She's an entomologist who works with the U.S. Forest

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Service in Juneau in a division called forest health protection. This bug poop has a fancier name, frass. It looks like light brown dirt and in places it's covering everything in the forest. When the wind is still, you may even be able to hear it raining down from the forest canopy.

Frass, or the digested hemlock needles, looks like light brown pepper and can be seen covering devil's club leaves and many surfaces in the forest. (Joe Viechnicki/KFSK)

Graham and biological science technician Isaac Davis shake the branches of trees at Ohmer Creek on Mitkof Island south of Petersburg, catching hemlock needles and bugs in a square sheet.

Elizabeth Graham and Isaac Davis count sawflies on the Ohmer Creek trail. (Joe Viechnicki/KFSK)

Graham was surveying some of these same areas a year ago. She's been in the Ketchikan area and on Prince of Wales Island, Kupreanof and Mitkof Islands. Graham said it's a more intense outbreak than last year.

"The damage is much more extensive than last year and we're seeing it in some areas that we didn't see it last year either," she said. "So up in Juneau where we're from we

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hardly saw any damage last year but there's heavy defoliation this year."

At this stage in their life, the young sawfly larvae look a little bit like a number of other small green inchworms or caterpillars you might find in the forest in the summer. They eat a portion of the older needles of hemlock trees and leave behind a brown, bare branch.

"They're called wasteful feeders because they only eat halfway through the needle and then leave like a little rib kind of," Graham said. "And so you'll see this sort of discolored reddish, and that's what we're seeing in the crowns now and then eventually those are going to fall. And then they're just going to look very thin crowns, there's not going to be much inner foliage they'll look kind of brown. And you know people may be concerned the trees are going to die. There may actually be some mortality. We are seeing some trees that are hit so hard that they may not be able to recover. Another thing that we see is heavy feeding at the top. And so that'll result in top kill but the rest of the tree will survive."

Some of the hemlock trees under attack are also being eaten by another insect, the western black-headed budworm. When both are eating needles, that can kill a tree. Surveying has turned up some budworm, but not a lot. Most of the damage this year can be blamed on the sawfly.

"So you see a little bit of tips on there that are kind of bent over," Graham said pointing to a tree branch. "And so the budworm turns into a moth, whereas the sawflies turn into a small wasp."

There are some benefits to these hard-eating insects. They open up the forest canopy helping shorter plants. Rodents, mammals and birds can feed on the bugs and the digested needles fall everywhere, recycling that material to the forest floor. The sawflies are always around, but they flourish in some years and their damage is much more visible. And Graham's main message is that this outbreak happens on the forest from time to time.

"This is a native pest," she said. "It's a natural part of our forest. It's not something that's invasive and has never been here before. So there are natural controls that eventually will catch up."

In fact, Graham's survey of areas that were damaged last summer is turning up one of those natural controls. It's a fungus that kills the young sawflies and can limit these outbreaks.

"So my thoughts are that areas that have been hit last year and then again this year, those populations are probably about to crash," Graham said. "And so hopefully next year we won't see as much activity but right now it's in the thick of it."

Wet weather can help that fungus and drive down insect numbers, so the ongoing drought could be playing a part in this outbreak, helping the sawfly numbers to boom. More ground surveys were also planned around Wrangell and

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Zarembo islands along with aerial surveys later this summer to document the tree damage from above.

Isaac Davis counts sawfly larvae and other bugs near Ohmer Creek on Mitkof Island. (Joe Viechnicki/KFSK)

Reddish brown hemlock tree tops are one sign of the sawfly damage documented around Southeast this summer. (Joe Viechnicki/KFSK)

The U.S. Forest Service provided this aerial photo of sawfly damaged trees, browned on this hillside. (Photo courtesy of the U.S. Forest Service)

Here's a better photo of the sawfly (Photo courtesy of the U.S. Forest Service)

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Report

Current Biology

Catastrophic Declines in Wilderness Areas Undermine Global Environment Targets

Highlights

- Globally important wilderness areas are ignored in conservation policy
- We reveal that extensive losses of wilderness have occurred in the last two decades
- Efforts aimed at protecting wilderness areas are failing to keep pace with its loss
- International policy must recognize the actions needed to maintain wilderness areas

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In Brief

Watson et al. discover that the Earth's wilderness areas are disappearing at a rate that has significantly outpaced their protection over the past two decades. Despite their ecological, climatological, and cultural importance, wilderness areas are ignored in multilateral environmental agreements, highlighting the need for urgent global policy attention.

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Catastrophic Declines in Wilderness Areas Undermine Global Environment Targets

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SUMMARY

Humans have altered terrestrial ecosystems for millennia [1], yet wilderness areas still remain as vital refugia where natural ecological and evolutionary processes operate with minimal human disturbance [2–4], underpinning key regional- and planetary-scale functions [5, 6]. Despite the myriad values of wilderness areas—as critical strongholds for endangered biodiversity [7], for carbon storage and sequestration [8], for buffering and regulating local climates [9], and for supporting many of the world's most politically and economically marginalized communities [10]—they are almost entirely ignored in multilateral environmental agreements. This is because they are assumed to be relatively free from threatening processes and therefore are not a priority for conservation efforts [11, 12]. Here we challenge this assertion using new comparable maps of global wilderness following methods established in the original "last of the wild" analysis [13] to examine the change in extent since the early 1990s. We demonstrate alarming losses comprising one-tenth (3.3 million km^2) of global wilderness areas over the last two decades, particularly in the Amazon (30%) and central Africa (14%). We assess increases in the protection of wilderness over the same time frame and show that these efforts are failing to keep pace with the rate of wilderness loss, which is nearly double the rate of protection. Our findings underscore an immediate need for international policies to recognize the vital values of wilderness and the unprecedented threats they face and to underscore urgent large-scale, multifaceted actions needed to maintain them.

RESULTS AND DISCUSSION

Contemporary Wilderness Loss

We mapped decline of wilderness areas, defining "wilderness" as biologically and ecologically largely intact landscapes that are mostly free of human disturbance [2–4, 11]. These areas do not exclude people, as many are in fact critical to certain communities, including indigenous peoples [14, 15]. Rather, they have lower levels of impacts from the kinds of human uses that result in significant biophysical disturbance to natural habitats, such as large-scale land conversion, industrial activity, or infrastructure development. We measured temporal change in wilderness extent by producing a global map of wilderness and assessing it against a spatially comparable map for the early 1990s (Figures 1 and S1). Both maps were devised using the same methodological framework as the original "last of the wild" map published in 2002 [13], but taking advantage of recently available datasets of in situ anthropogenic pressures. Following established practice, we exclude Antarctic and other "rock and ice" and "lake" ecoregions [16, 17].

We discovered that a total of 30.1 million km^2 (or 23.2% of terrestrial areas) of the world's land area now remains as wilderness, with the majority located in North America, North Asia, North Africa, and the Australian continent (Figures 1 and S1). An estimated 3.3 million km^2 has been lost since the early 1990s (approximately a 9.6% loss in two decades; Figure 2), with the most loss occurring in South America (experiencing 29.6% loss) and Africa (experiencing 14% loss).

Encouragingly, the majority of wilderness (82.3%, or 25.2 million km^2) is still composed of large contiguous areas of at least 10,000 km^2. Although this is an arbitrary threshold, wilderness areas of this size are often considered as globally significant wilderness blocks [2, 11]. This is also the size threshold for identifying sites hosting intact ecological communities, adopted in the International Union for Conservation of Nature and Natural Resources (IUCN) standard for Key Biodiversity Areas [18]. Yet there was substantial erosion of these large wilderness areas over the past two decades, with losses amounting to 2.7 million km^2 (Figure 1). A total of 37 of the 350 wilderness blocks that

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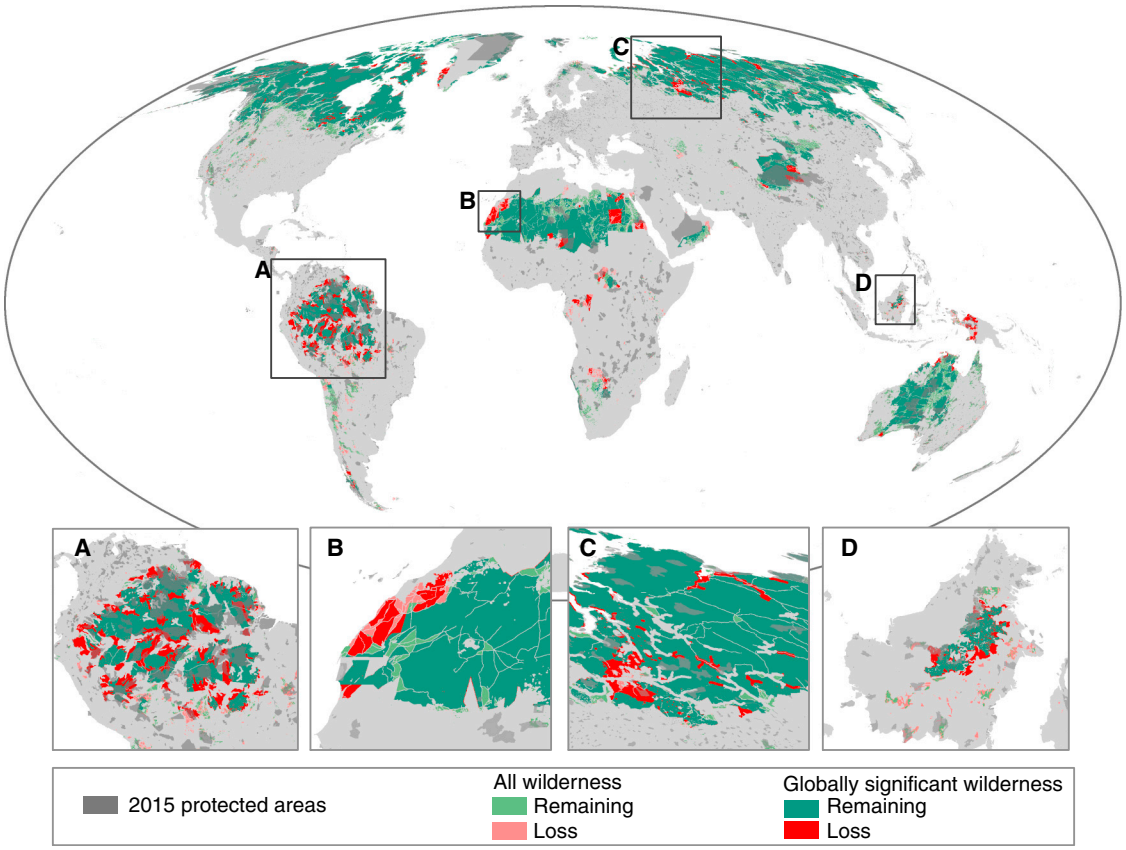

Figure 1. Change in the Distribution of Wilderness and Globally Significant Wilderness Areas since the Early 1990s

Globally significant wilderness areas are defined as wilderness areas >10,000 km^2. The insets are focused on the Amazon (A), the western Sahara (B), the west Siberian Taiga (C), and Borneo (D). See also Figures S1 and S2.

were present in the early 1990s have fallen below the area threshold used here for categorization as globally significant, and 74% of all blocks experienced erosion in areal extent. A total of 27 ecoregions (environmentally and ecologically distinct geographic units at the global scale [19]) have lost all of their remaining globally significant wilderness areas since the early 1990s, including those areas in the Northwestern Congolian Lowland Forests and the Northern New Guinea Lowland Rain and Freshwater Swamp Forests ecoregions. South America suffered particularly high losses in the Amazon basin, with the largest wilderness block being reduced from 1.8 million km^2 to 1.3 million km^2 (a loss of over 30% in extent; Figures 1 and S1), and wilderness areas in the Ucayali Moist Forests and Iquitos Varzeá ecoregions dropping below the globally significant threshold. This trajectory of wilderness loss in the Amazon is particularly concerning, given that overall deforestation rates reportedly dropped significantly across the Amazon Basin between 2005–2013 [20].

These recent losses have contributed further to existing biases in the geographical distribution of globally significant wilderness. Of Earth's 14 terrestrial biomes, three located mostly in the tropics (Tropical and Subtropical Coniferous Forests, Mangroves, and Tropical and Subtropical Dry Broadleaf Forests) now have no globally significant wilderness area remaining, with the last areas disappearing from two of these biomes over the last two decades. A further five biomes now have less than 10% wilderness remaining (Figure 2).

Disparity between Wilderness Protection and Loss

Protected areas spearhead global efforts to conserve nature, and when properly managed they are particularly effective for combating the effects of habitat loss and degradation [21]. Since its inception, and through work plans such as the Aichi Targets of The Strategic Plan for Biodiversity 2011–2020 [22], the Convention on Biological Diversity (CBD) has promoted protected areas as a vital conservation mechanism. Consequently, there has been a pronounced expansion of the global protected area estate over the past two decades, with its extent being an almost doubled since the Rio Earth Summit in 1992 [16]. However, despite this growth, the increase in protection of wilderness has lagged significantly behind losses over the past two decades: 2.5 million km^2 of wilderness areas (including 2.1 million km^2 considered globally significant) was newly protected, whereas 3.3 million km^2 (including 2.7 million km^2 considered globally significant) was lost. In some biomes, there has been a stark contrast between the area lost and the amount protected (Figure 2). For example, the Mediterranean Forests, Woodlands, and Scrub biome lost 37% of its globally significant wilderness extent since the early 1990s, yet there was no reciprocal protection of the remaining wilderness areas. Similarly, 23% of the

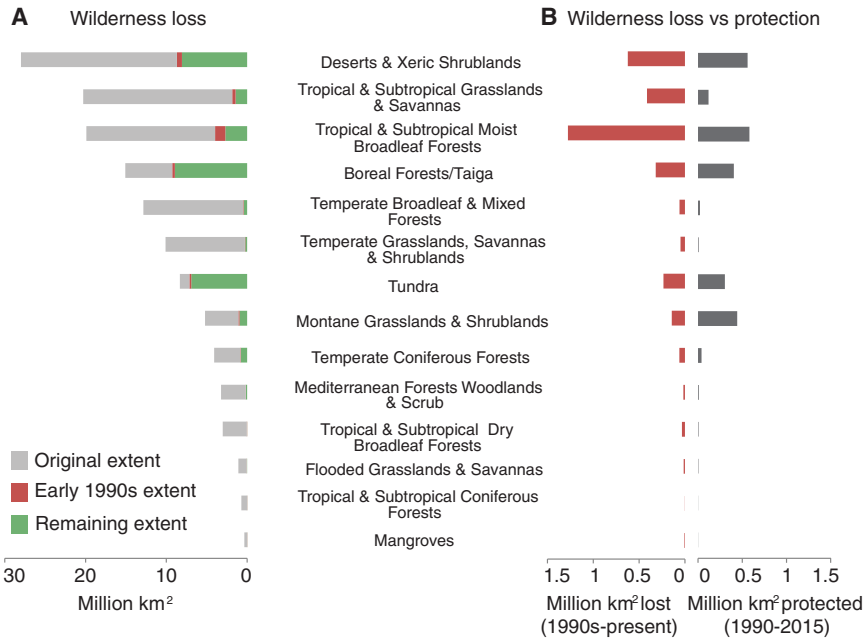

Figure 2. Historic and Current Extent of All Wilderness Area and the Degree to which It Is Protected

(A) Historic (gray) and current (green) extent of all wilderness area, as well as the area lost since the early 1990s (red) across the world's terrestrial biomes.

(B) The wilderness area lost (red) and protected (gray) during 1990–2015.

See also Figure S2.

globally significant wilderness was lost from the Tropical and Subtropical Grasslands, Savannas, and Shrublands, with only 8.5% protected in the last two decades.

Consequences of Continued Wilderness Loss

The current levels of non-protection and consequent loss of wilderness areas across the planet have important ramifications for achieving global climate mitigation goals [8]. For example, the total stock of terrestrial ecosystem carbon (~1,950 petagrams of Carbon [Pg C]) is greater than that of oil (~173 Pg C), gas (~383 Pg C), coal (~446 Pg C), or the atmosphere (~598 Pg C) [23], and a significant proportion of this carbon is found in the globally significant wilderness areas of the tropics and boreal region [8, 24]. It is estimated that 32% of the total global stock of forest biomass carbon is stored in the boreal forest biome [24] and that the Amazon region stores nearly 38% (86.1 Pg C) of the carbon (228.7 Pg C) found above ground in the woody vegetation of tropical America, Africa, and Asia [25]. Thus, avoiding emissions by protecting the globally significant wilderness areas of the boreal and Amazon in particular will make a significant contribution to stabilizing atmospheric concentrations of CO_2. Protection of intact forest ecosystems from industrial land uses is particularly important, given that they store more carbon than degraded forests and are more resilient to external perturbations, including climate variability, fire, and illegal logging, poaching, and mining [8, 26].

Although both the boreal and Amazon have suffered significant forest loss and degradation, these landscapes still support globally significant wilderness areas and are increasingly threatened by industrial forestry, oil and gas exploration, anthropogenic fire, and rapid climate change. If allowed to continue unchecked, these impacts will result in depletion of ecosystem carbon stocks and significant CO_2 emissions, converting the biome into a large carbon source [27]. For example, on Borneo and Sumatra in 1997, human-induced fires burned into recently converted wilderness areas harboring large peat carbon stores, causing the release of over 1 Pg C [28], which is equivalent to about 10% of all annual anthropogenic CO_2 emissions [29].

In terms of biodiversity values, an analysis of the IUCN Red List for terrestrial mammals—one of the taxonomic groups that has been most completely assessed—shows that Earth's remaining wilderness areas also sustain the last strongholds of many imperiled species (see Table S1). The geographic ranges of one-third of all terrestrial mammal species overlap with globally significant wilderness areas, including extensive parts of the distribution of 12% (143) of all threatened mammal species. Thus, ongoing and rapid loss of wilderness increases the risk of extinction for species that are already highly threatened. It is also well established that wilderness areas are critical for wide-ranging and migratory species reliant on intact ecosystems (and their associated ecological processes) and represent residual habitats for disturbance-sensitive species and for those that have a conflictual coexistence with humans, such as many of the world's large carnivores [30].

Wilderness areas also provide benefits derived from their large-scale and self-organization [13], and in many instances they are likely to operate as entire systems, where losses in one area inevitably affect long-term environmental outcomes in another [31–33]. For example, in the Amazon, it is thought that at least 60% of the forest cover is required to maintain the hydrological cycle [34], and so conservation action at the scale of the whole ecosystem is required to ensure that this large wilderness area is maintained. In Australian rangeland and desert ecosystems, the ecological influence of large spatial-scale surface-groundwater hydrological dynamics is pervasive, and losses in one area can degrade habitat quality elsewhere, with significant, long-term implications for biodiversity [35, 36]. In the Anthropocene era, where the human footprint is now altering many of Earth systems processes [37], wilderness areas serve as natural observatories where we can study the ecological and evolutionary impacts of global change. They also serve as natural controls for comparison with areas where intensifying land use and land cover changes are occurring. As intact, large-scale ecosystems become rarer, their value is increasingly appreciated. For instance, we are already seeing growing efforts to "rewild" some human-dominated ecosystems in Europe and North America [38]; remaining

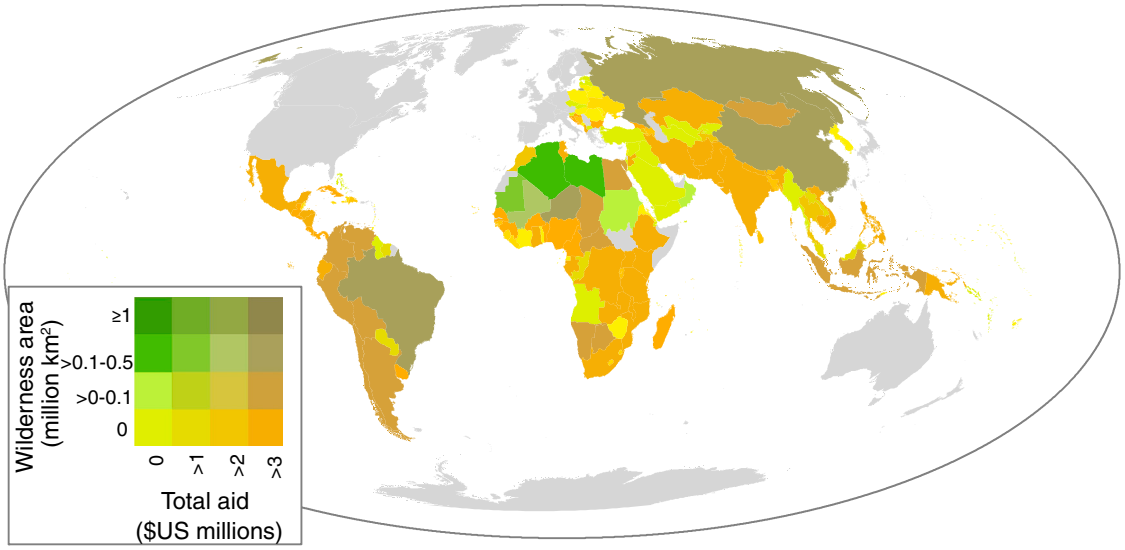

Figure 3. Amount of Conservation Aid and Extent of Wilderness Now Remaining per Country

Amount of conservation aid is shown in millions of US$, and extent of wilderness is shown in million km^2. Gray areas indicate countries that received no aid. See also Figure S3.

wilderness areas provide the reference points and biological feedstock for these initiatives. Without concerted preservation of existing wilderness areas, there will be a diminished capacity for large-scale ecological restoration.

Implications for Multilateral Environmental Agreements

The recent severe loss of wilderness is impacting options for achieving strategic goals outlined in key multilateral environmental agreements, including the CBD's 2020 Aichi Targets and the United Nations Framework on Climate Change (UNFCCC) Paris Agreement [22, 39]. There are a number of reasons why globally significant wilderness areas are ignored in policy deliberations. International definitions of forests have not differentiated between types of forests and in some cases actually treat primary forests, degraded forests, and plantations as equivalent [40]. International polices do not acknowledge the special qualities and benefits that flow from ecosystem processes operating at large scales. For example, there is no formal text within the UNFCCC, United Nations World Heritage Convention (WHC), or CBD that prioritizes or even recognizes the benefits derived from large intact landscapes for nature and people. An emphasis on degraded, fragmented, and altered ecosystems has ramifications for national environmental strategies. The tendency is to focus national biodiversity conservation plans on remnant habitats and endangered populations [3, 41], with few nations clearly articulating conservation goals for wilderness area.

The lack of recognition of wilderness in global accords and national policy also has implications for international funding programs such as the Global Environment Facility, Green Climate Fund, and Critical Ecosystems Partnership Fund, which are distributing billions of dollars in support for programs to help achieve the goals of multilateral environmental agreements. Within the CBD funding mechanisms, for example, 80% of funds have been allocated to nations with <20% of all wilderness area (Figures 3 and S2). The neglect of wilderness is arguably even more acute in funding under the UNFCCC and Paris Agreement finance discussions. Although there is strong financing for forest conservation under the UNFCCC REDD+ mechanism to reduce emissions from deforestation and degradation, the rules stipulate that this financing must target areas with high baseline levels of deforestation [42]. Such efforts, though valuable for other purposes, serve to direct funds away from forested wilderness areas that are presumed safe from deforestation and degradation. As our results demonstrate, however, wilderness is under immense land use pressures, and there is an urgent need for greater conservation effort in these areas to help maintain their ecological intactness and integrity of function.

What would it take to halt the rapid loss of wilderness and of globally significant areas in particular? Achieving meaningful changes in policy at the global level is more likely if there is first a critical mass of support at the national level. Ideally, this should be evidenced through national strategies and plans that recognize the values of wilderness areas and specify policies for their protection. In any case, by creating clear text within operational guidelines, work plans, and ongoing negotiations of key multilateral environmental agreements, international conservation investments can then be mobilized and focused in a manner that can fund activities to help protect wilderness areas. These activities will vary based on the specific context of different nations and regions, but there is a clear need to focus on halting current threatening activities that have been leading to the recent erosion of wilderness areas, including limiting road expansion [43]; preventing industrial mining, forestry, and other large-scale agricultural operations [43]; and enforcing existing legal frameworks considering that half of all tropical forest clearing between 2000 and 2012 was illegal [44–46]. A key goal could be to proactively fund conservation interventions in wilderness areas where degrading activities are currently absent but are projected to occur in the near future.

Conservation actions should include (1) creating large and, where necessary, multi-jurisdictional protected areas; (2) establishing mega-conservation corridors between protected areas; and (3) enabling indigenous communities to establish community conservation reserves [15]. Funding could also be used to establish payments for ecosystem service programs that recognize the direct and indirect economic benefits that wilderness areas provide, such as being a secure source of fresh water, reducing disaster risks, and storing large carbon stocks [9]. There are some encouraging examples where these types of activities are being undertaken. For example, in Brazil, the Amazon Region Protected Areas (ARPA) program supports the creation and management of protected areas and sustainable natural resource management reserves [47]. The overarching aim of these protected areas and reserves is to maintain forest carbon stocks, protect large-scale ecological processes, and establish sustainable use by local peoples. This program is now extending beyond Brazil to Peru and Colombia. The Canadian Boreal Forest Conservation Framework is a similar example, with an overall aim of conserving the long-term integrity of the boreal forest biome by protecting at least 50% of the Boreal in a network of large interconnected protected areas and supporting sustainable communities via ecosystem-based resource management and stewardship practices across the remaining landscape [48].

These positive examples are too few, and we argue that immediate action to protect the world's remaining wilderness areas on a large scale is now necessary, including in global policy platforms. All wilderness areas, regardless of their size threshold, warrant immediate scrutiny for conservation action, especially in regions with low levels of remaining wilderness areas. The continued loss of wilderness areas is a globally significant problem with largely irreversible outcomes for both humans and nature: if these trends continue, there could be no globally significant wilderness areas left in less than a century. Proactively protecting the world's last wilderness areas is a cost-effective conservation investment and our best prospect for ensuring that intact ecosystems and large-scale ecological and evolutionary processes persist for the benefit of future generations.

SUPPLEMENTAL INFORMATION

Supplemental Information includes Supplemental Experimental Procedures, three figures, and one table and can be found with this article online at http://dx.doi.org/10.1016/j.cub.2016.08.049.

AUTHOR CONTRIBUTIONS

Conceptualization and Methodology Development, J.E.M.W., D.F.S., M.D.M., J.A., W.F.L., E.S., B.M., and O.V.; Formal Analysis, J.E.M.W., D.F.S., M.D.M., J.A., and O.V.; Writing – Original Draft, J.E.M.W., D.F.S., M.D.M., J.A., O.V., and B.M.; Writing – Review & Editing, J.E.M.W., D.F.S., M.D.M., J.A., W.F.L., E.S., B.M., and O.V.

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Mapping vulnerability and conservation adaptation strategies under climate change

James E. M. Watson[1,2]*†, Takuya Iwamura[2,3]† and Nathalie Butt[2]

Identification of spatial gradients in ecosystem vulnerability to global climate change and local stressors is an important step in the formulation and implementation of appropriate countermeasures[1,2]. Here we build on recent work to map ecoregional exposure to future climate, using an envelope-based gauge of future climate stability—defined as a measure of how similar the future climate of a region will be to the present climate[3,4]. We incorporate an assessment of each ecoregion's adaptive capacity, based on spatial analysis of its natural integrity—the proportion of intact natural vegetation—to present a measure of global ecosystem vulnerability. The relationship between intactness (adaptive capacity) and stability (exposure) varies widely across ecoregions, with some of the most vulnerable, according to this measure, located in southern and southeastern Asia, western and central Europe, eastern South America and southern Australia. To ensure the applicability of these findings to conservation, we provide a matrix that highlights the potential implications of this vulnerability assessment for adaptation planning and offers a spatially explicit management guide.

Anthropogenic climate change is impacting ecosystems globally, causing changes in phenology, species composition and range shifts[5], while increasing environmental degradation is leading to habitat fragmentation or loss. These two factors in concert are likely to result in exacerbated biodiversity decline and extinction in the near future[6]. As rates of both biodiversity loss and threats are growing[7], the identification of spatial gradients of ecosystem vulnerability to both global and regional drivers is required for the development of effective conservation measures.

There are three shortcomings in present conservation-oriented climate change assessments, regardless of their spatial scale. The first concerns vulnerability assessments, which until recently have been focused solely on the system's (extrapolated from species') exposure to future climate change, without considering that vulnerability to climate change is influenced by the system's (species') sensitivity and adaptive capacity, as well as exposure[1,2,8,9]. For conservation planning purposes, this sole focus on exposure does not always equate to the identification of areas that have the most pressing needs for adaptation, particularly those that may be relatively stable climatically but are far more vulnerable to climate change owing to other reasons (for example, present levels of vegetation intactness). The second shortcoming is that most climate change assessments have been conducted on species-specific responses, and therefore have been largely unable to inform conservation actions in terms of ecosystem-focused adaptation[10,11]. The third shortcoming is that few species or ecosystem assessments have attempted to identify (and map) the specific adaptation action needed to overcome the threats posed by climate change, especially as related to land use and land use change, the other significant driver of ecosystem change. Most research so far provides generic, non-spatially explicit adaptation recommendations (such as corridor development, managed translocations, adaptive management[1,12]), without considering the size and location of each threat. Although generic recommendations are useful, climate change is going to affect ecosystems directly and indirectly in a myriad of non-uniform ways[8,9]. Research is thus needed to identify not only which adaptation activities are necessary above and beyond present conservation activities, but also where they are most appropriate.

Here we produce a methodology to overcome these shortcomings by undertaking an ecoregional assessment at the global scale that integrates an ecoregion's adaptive capacity, based on a spatial analysis of the ecoregion's natural integrity (defined as the proportion of intact natural vegetation found in each ecoregion, and thus a function of land use), with its relative exposure to future climate change, to help inform spatially explicit adaptation guidance for conservation practitioners. Ecoregions were used as the spatial unit of assessment as they are the most relevant environmental and ecologically distinct spatial unit at the global scale[13], and are used widely to guide global conservation investments, assessments and action.

We mapped ecoregional exposure to future climate by using an envelope-based gauge[14] of future climate stability, defined as the similarity between present and future climate[3,4] (2050s; equation (1)). The global distribution of climate stability varied largely among ecoregions (Fig. 1a,b), with a mean climate stability of 42.3% (s.d. = 19.8) and a median of 44.8%. Ecoregions with relatively low climate stabilities tended to be located at high latitudes, such as North America and Europe and southern Patagonia, or at uniformly high altitudes such as the northern Tibetan Plateau (Fig. 1a and Supplementary Information), whereas ecoregions that are climatically more stable showed greater variation in elevation and were located predominantly in low latitudes[4] (Fig. 1a). However, some ecoregions located close to the Equator (for example, northeastern South America) and at low altitudes (for example, southern Australia) were found to have relatively low climate stability (Fig. 1a). Close examination of the relationship between bioclimatic variables and the ecoregional climatic envelopes showed that precipitation of the driest quarter and precipitation seasonality were significant determinants of climate stability (Supplementary Table S1 and Fig. S1a–c). When

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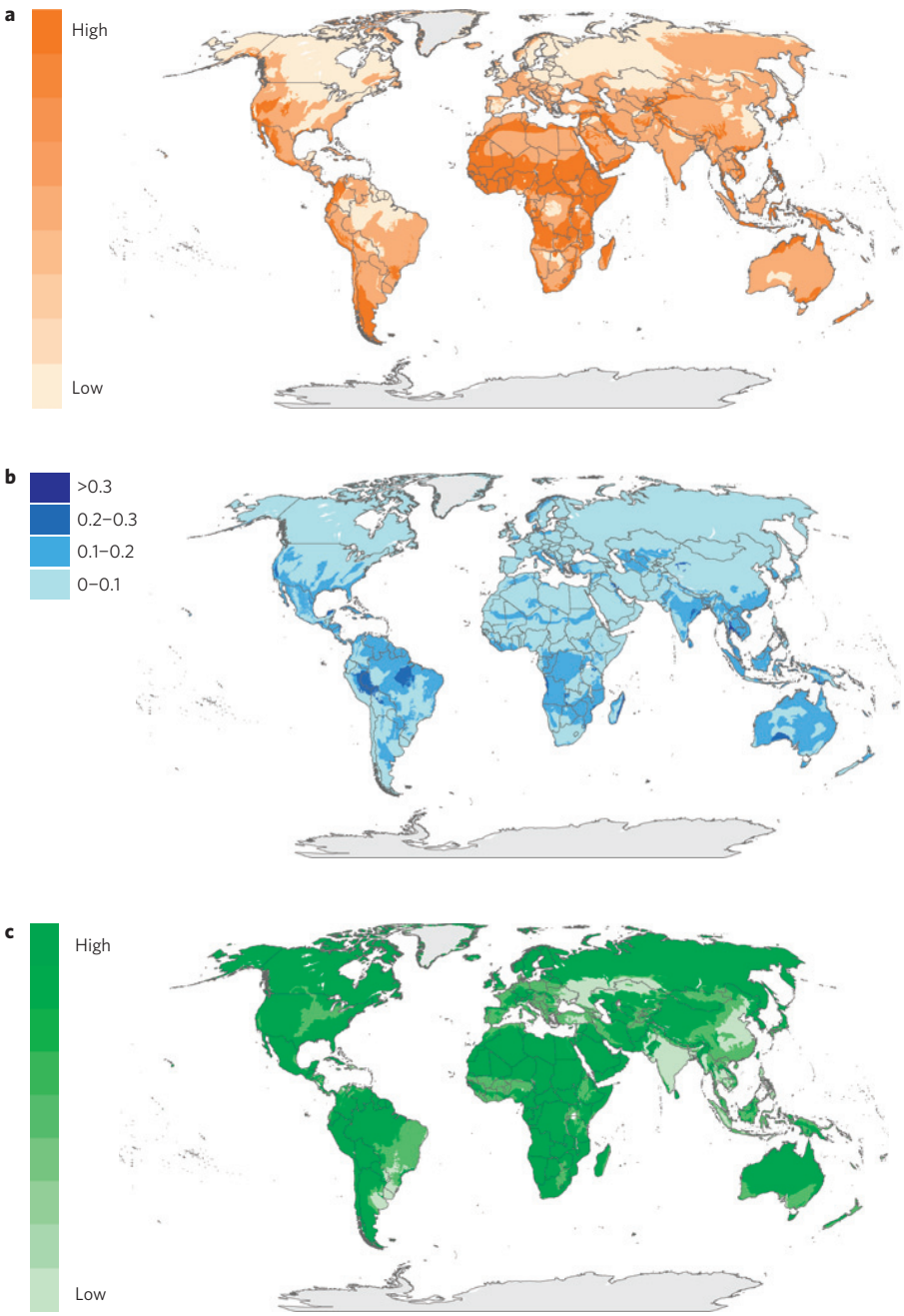

Figure 1 | Terrestrial global distribution of ecoregional climate stability and vegetation intactness. a–c, Terrestrial global distribution of ecoregional climate stability (**a**), standard deviation distribution of ecoregional climate stability (**b**) and vegetation intactness (**c**). Climate stability was defined as a measure of how much of an ecoregion will remain suitable (that is, climatic conditions will remain within present parameters) for the species and ecosystems it contains at present[3,4]. It is therefore a relative scale. The darker colours represent more relatively stable climates (that is, regions more suitable for existing ecosystems). The climate stability shown here is the average over the results from the seven GCMs. The standard deviation allows for an assessment of agreement between the seven GCMs. Light blue colours indicate high agreement between the seven GCMs used and darker blue colours indicate less agreement. Vegetation intactness was calculated using the GlobCover 300 data set[26]. The proportion of areas where native vegetation has been transformed through agricultural development and urbanization in each ecoregion was determined and a measure of vegetation intactness of the ecoregion was calculated. This is a conservative measure of intactness as it does not take into account vegetation degradation. As the data were not normal they have been transformed to a normal distribution by taking the square root values. The darker colours represent more intact ecoregions. As resolution is a problem with global maps, we have provided the same maps at the continental scale in the Supplementary Information.

ecoregional vegetation intactness was assessed, we found that the most degraded ecoregions were located in western Europe, North America, eastern South America, China, India, and southern and southeast Asia (Fig. 1c and Supplementary Information). The relationship between vegetation intactness and relative climate stability varied widely across ecoregions (Fig. 2). The relationship between these two variables was significant ($n = 803$, $p < 0.01$) but weakly negative (Spearman's $\rho = -0.176$).

The degree to which an ecoregion was vulnerable to climate change changed substantially across all inhabited continents when ecoregional integrity was considered (Figs 1a and 2b). This shows the importance of integrating assessments that highlight

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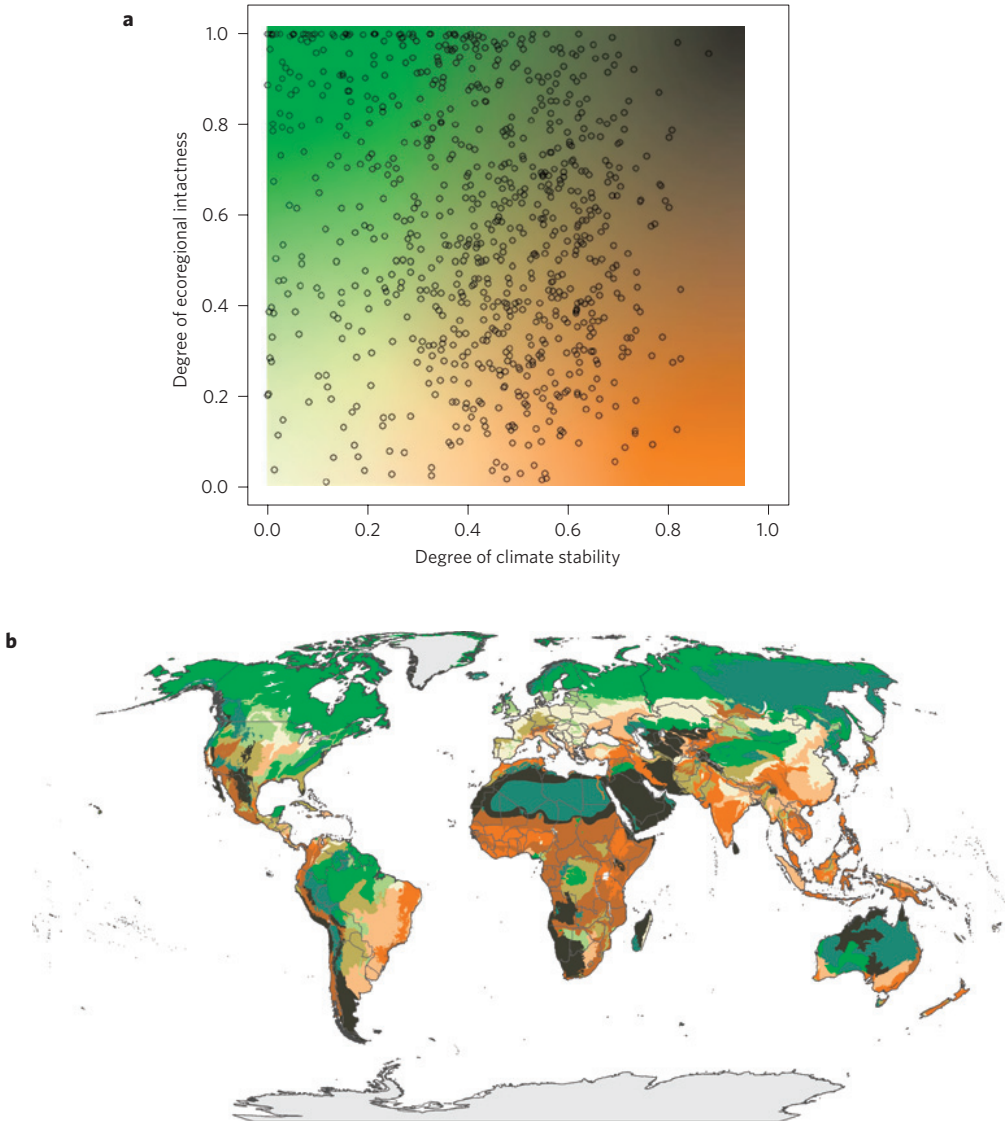

Figure 2 | The relationship between ecoregional climate stability and vegetation intactness. a,**b**, The relationship between ecoregional climate stability and mean ecoregional intactness ($n = 803$; **a**) and the global distribution of the relationship (**b**). Ecoregions that have high relative climate stability and high vegetation intactness are depicted as dark grey. Ecoregions that have relative high climate stability but low levels of vegetation intactness are depicted in dark orange. Ecoregions that have low relative climate stability but high vegetation intactness are depicted in dark green. Ecoregions that have both low relative climate stability and low levels of vegetation intactness are depicted in pale cream. The intactness axis has been transformed to a normal distribution for presentation purposes by taking the square root values. The colours match the map in **b** and are a combination of the colours in Fig. 1a,b.

future exposure to climate change with those that consider other elements of ecosystem vulnerability (that is, adaptive capacity and sensitivity). For example, when climate stability (as a measure of exposure) is combined with vegetation intactness (as a measure of adaptive capacity), ecoregions located in southwest, southeast and central Europe, India, China and Mongolia, southeast Asia, central North America, eastern Australia and eastern South America were found to be relatively climatically unstable and degraded (Fig. 2b and Supplementary Information). This contrasts sharply with other global assessments (based only on exposure to climate change) that show that central Africa, northern South America and northern Australia are most vulnerable to climate change[3,15,16].

There is strong evidence that climate change is negatively interacting with habitat loss and synergistically contributing to the degradation of biological diversity[17]. We identified, according to our model, ecoregions likely to be future hotspots for biodiversity loss when considering both present levels of landscape transformation and future climate change (Fig. 2b). Owing to their low levels of vegetation intactness and high levels of fragmentation, ecoregions expected to experience very different future climate will probably witness changes in their species assemblages due to loss of the habitat necessary for rapid dispersal or refugial retreat[18].

Beyond identifying future vulnerability based on present ecoregion intactness and climate stability, the approach outlined in this analysis, demonstrated using one scenario and time step, will be better able to help inform adaptation planning than previous global analyses, which assessed vulnerability based solely on predicted exposure to future climate[3,15,16]. By integrating present land use (ecoregional vegetation intactness) into climate change vulnerability assessments, we are able to provide a spatially explicit framework for different broad-scale management strategies and interventions[12] (Table 1 and Fig. 2). Highly intact ecoregions predicted to have a relatively stable climate are unlikely to contain a large suite of species that would require new and radical conservation interventions, such as translocations of species, before the middle of the present century. In these ecoregions, a focus on

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Table 1 | Examples of different conservation strategies aimed at increasing ecosystem adaptive capacity, based on the degree of ecoregional intactness and future relative climate stability.

Degree of ecoregional intactness and relative climate stability	Future of ecoregional biodiversity if present land use and non-climate change threats are abated	Example of appropriate ecoregional level science-based strategies, incorporating active adaptive management
High levels of vegetation intactness, high relative climate stability (grey in Fig. 2)	Low numbers of threatened and declining species Low turnover of species within ecoregion due to climate change Functioning ecological processes that will sustain adaptive capacity of species	Identify and manage present direct threats to ensure vegetation remains intact and functional to maintain populations of extant viable species Less emphasis on identifying and protecting/restoring climate refugia, as climate is stable Monitor extant viable species against present threatening processes
High levels of vegetation intactness, low relative climate stability (green in Fig. 2)	Low numbers of threatened and declining species High turnover of species within and beyond ecoregion as species track their climate niche Functioning ecological processes will allow some species to persist in changing climate but adaptive capacity of other species may be exceeded owing to degree of climate change: chance of extinction unless preventative action taken	Manage present direct threats to ensure vegetation is intact to maintain populations of species and their dispersal pathways as they track their climate niche and adapt to changing climate Emphasize the identification and protection of climate refugia Manage present direct threats to ensure vegetation is intact to allow emigrating populations of species to establish themselves Monitor potentially climate-sensitive species and feed this into translocation plans
Low levels of vegetation intactness, high relative climate stability (orange in Fig. 2)	High numbers of threatened and declining species Small turnover of species within ecoregion Reduction in the number of functioning ecological processes, which will severely impact the adaptive capacity of species	Identify and manage present direct threats to ensure vegetation does not lose even more intactness and function to maintain populations of extant viable species Habitat restoration activities aimed at connectivity to increase population size and dispersal capacity of these species. Monitor extant viable species against present threatening processes
Low levels of vegetation intactness, low relative climate stability (cream in Fig. 2)	High numbers of threatened and declining species High turnover of species within and beyond ecoregion as species track their climate niche Reduction in the number of functioning ecological processes, which will severely impact the adaptive capacity of species that may already be exceeded owing to degree of climate change	Manage present direct threats to intact vegetation to maintain populations of species and their dispersal pathways, as they track their climate niche and adapt to changing climate Habitat restoration activities aimed at connectivity to increase population size and dispersal capacity of extant viable species Emphasize the identification and protection of climate refugia Manage present direct threats to ensure vegetation is intact to allow emigrating populations of species to establish themselves Identify the species most vulnerable to climate change and assess translocation options Monitor potentially climate-sensitive species and feed this into translocation plans

management options (for example, the establishment of protected areas) that deal with present threatening processes (for example, invasive species, industrial logging) is sensible, as these processes are likely to have the most serious impact on biodiversity in the short and mid-term[1]. Within ecoregions that are highly intact but are predicted to have a very different climate to the one experienced today, it will be important to reduce threatening processes to ensure that species can take advantage of their capacity to adapt ecologically, albeit retreating to refugia, undergoing a range change as they track the climate, or exhibiting some form of phenotypic plasticity or micro-evolution[19]. However, it is not known how most species will respond to rapid climate change, and in intact but climatically unstable ecoregions, monitoring (linked with adaptation management protocols) is crucial, as it will inform

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practitioners which species are unlikely to cope with the changes, and are therefore candidates for more aggressive adaptive action (for example, translocation, *ex situ* conservation).

Conversely, in ecoregions that are highly degraded and are likely to have a very different future climate, a strategy that deals only with present threatening processes is short-sighted (Table 1). The identification of potentially vulnerable species and ecosystems in these ecoregions (despite the uncertainty involved) will probably lead to a greater chance of long-term conservation success. It may be appropriate to use a mixture of more proactive management strategies; such as species translocation[20], habitat engineering[6], and restructuring the priorities among conservation options[21]. In those ecoregions that are highly degraded but are predicted to be less affected by large baseline shifts in climatic conditions in the future, there is a need to strengthen efforts aimed at restoration and the removal of other threatening processes.

We do not advocate that no climate adaptation action should be carried out in those ecoregions considered to be relatively highly climatically stable. Indeed, climate change is occurring everywhere on the planet, and there remains large uncertainty around all climate models. All conservation planning must consider the impacts of future climate change: our adaptation matrix highlights the fact that land use and climate change are not spatially uniform and thus different adaptation priorities are needed for different places, depending on the degree of change they have experienced and are likely to experience in future. Although our present analyses are at the ecoregional level, this type of analysis is not limited to this scale (for example, see ref. 22 for a similar biome-scale, multi-thematic analysis). Indeed, as land use decisions are often made at landscape and local scales, and as species track climate change within an ecoregion, these types of assessment could be carried out at much finer scales and include local and regional climatology[23]. It is important to note that although there have been large improvements in climate models over the past decade, associated uncertainty remains high. The climate stability and landscape intactness analyses should be updated for future work as more accurate climate models, emission scenarios and global land use models become available and the analyses can be extended beyond the 2050s. Incorporation of some measure of vegetation change (related to the rate of land degradation), as a function of climate vulnerability, would add great value to future analyses, as such changes are driven by human demography and are very difficult to model.

As biodiversity disruption and loss increase along with intensified climate-change impacts, conservation planners need to move beyond focusing on the long-term future and only on elements of exposure to climate change. Within the context of conservation practice, vegetation intactness is more significant than climate stability for ecosystem vulnerability: in terms of ecosystem degradation or species extinctions, reduction in vegetation intactness is a greater threat than climate change at present, and is likely to be in future, especially in tropical regions[24]. This analysis takes account of the fact that conservation today proceeds in the context of pronounced, and in some places overwhelming, human influence. The development of effective conservation strategies needs to rely not only on improving the knowledge of how species and ecosystems will react to climate change, but also on predicting how humans are going to respond: conservation practitioners will have a much greater chance to influence the intactness of an ecosystem rather than its robustness to future climatic conditions (which can only be changed through international mitigation efforts), and therefore a focus on maintaining ecosystem integrity should always be a primary conservation objective.

Methods

Ecoregions are geographic units based on delineations in taxonomic compositions, inferred evolutionary histories, and shared climatic domains[25]. Here we used spatial information on ecoregional boundaries for the terrestrial ecoregions of the world[13]. Our analysis covered 803 ecoregions (97% of terrestrial ecoregions). The remaining 22 ecoregions were omitted from the analysis as they lacked sufficient GlobCover data or climate data points to conduct a statistically rigorous vegetation intactness assessment (for example, mangrove ecoregions).

Our definition of adaptive capacity relates purely to vegetation intactness, as we are concerned with ecosystem-scale vulnerability. We followed the approach of previous studies[8] and used a very conservative measure of the degree of vegetation intactness in an ecoregion, by quantifying the proportion of areas where native vegetation has been totally transformed through agricultural development and urbanization. This was achieved using the GlobCover data set, a global land cover model that provides land-cover classification[26]. We used GlobCover version 2.1, which has a spatial resolution of 300 m (ref. 27). The GlobCover data set comprises global terrestrial data that define 65 land cover types, categorized into Cultivated Terrestrial Areas and Managed Areas, Natural and Semi-natural Terrestrial Vegetation, Natural and Semi-natural Aquatic Vegetation, Artificial Surfaces and Associated Areas, and Inland Water Bodies. We excluded all areas classified as Cultivated Terrestrial Areas and Managed Lands, and Artificial Surfaces and Associated Areas, with the remaining cells within the ecoregion defined as intact. We then calculated the proportion of an ecoregion that contains these cells against the total number of cells within an ecoregion, and used this to calculate the total proportion of vegetation intactness of the ecoregion (hereafter referred to as ecoregional intactness).

We used a downscaled spatial data set for climate variables at the resolution of 2.5 arc min (approx. 4.6 km at the Equator). Observed spatial databases of bioclimatic variables for present climate were obtained from the WorldClim database[28], which provided 8.48 million data points across all of the ecoregions. From the 19 bioclimatic variables, six variables (annual mean temperature, mean diurnal temperature range, mean annual temperature range, annual precipitation, precipitation seasonality and precipitation of the driest quarter) were used to represent general climate patterns, seasonality, and limiting factors of climatic patterns based on global-scale research. Estimated spatial databases of the same climate variables for the 2050s were downloaded from the International Centre of Tropical Agriculture Downscaling data set[29]. This data set provides high-resolution maps for seven major global circulation models (GCMs) from the Intergovernmental Panel on Climate Change Fourth Assessment Report[30], A1b greenhouse gas emission scenario (see Supplementary Information for discussion). This scenario represents technology-focused rapid economic growth with mixed (fossil and non-fossil) fuel sources, and reflects present economic and developmental activity.

A relative climatic stability index was calculated using the recently introduced method for estimating the overlap between present and future climate envelopes for each ecoregion[4,14]. The two-dimensional envelopes were determined on the basis of the six bioclimatic variables from the present and future climate data sets using principal component analysis. The distribution of the probability density was estimated for each climate using kernel density estimation, where each cell value of the density space represents a unique vector of climatic condition[4]. The degree of overlap between present and future climate was estimated using a niche overlap measurement technique[4,14].

The climatic stability S_i of an ecoregion i was calculated for each of the seven GCMs as follows[4]:

$$S_i = 1 - \frac{1}{2}\left(\sum_{jk} |z_{1ijk} - z_{2ijk}|\right) \quad (1)$$

where z_{1ijk} and z_{2ijk} indicate the probability of climatic condition occurrence, and j and k refer to the cell corresponding to the jth and kth bins of the environmental variables of ecoregion i.

We used Spearman's ρ to run a correlation analysis for the two variables, climate stability and vegetation intactness. The vulnerability assessment for each ecoregion was derived by incorporating the two variables, and therefore includes any uncertainty related to the climate stability model. To understand the nature of the principal component analysis axes, the loadings of the bioclimatic variables were analysed (see Supplementary Information, Table S1 and Fig. S1a–c).

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Author contributions

J.E.M.W. and T.I. designed the analysis; J.E.M.W. and T.I. performed the analysis; J.E.M.W., T.I. and N.B. analysed the results and wrote the paper.

Additional information

Supplementary information is available in the online version of the paper. Reprints and permissions information is available online at www.nature.com/reprints. Correspondence and requests for materials should be addressed to J.E.M.W.

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The exceptional value of intact forest ecosystems

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As the terrestrial human footprint continues to expand, the amount of native forest that is free from significant damaging human activities is in precipitous decline. There is emerging evidence that the remaining intact forest supports an exceptional confluence of globally significant environmental values relative to degraded forests, including imperiled biodiversity, carbon sequestration and storage, water provision, indigenous culture and the maintenance of human health. Here we argue that maintaining and, where possible, restoring the integrity of dwindling intact forests is an urgent priority for current global efforts to halt the ongoing biodiversity crisis, slow rapid climate change and achieve sustainability goals. Retaining the integrity of intact forest ecosystems should be a central component of proactive global and national environmental strategies, alongside current efforts aimed at halting deforestation and promoting reforestation.

While Earth has lost at least 35% of its pre-agricultural forest cover over the past three centuries[1], forests are still widely distributed, covering a total of 40 million km^2 (~25%) of Earth's terrestrial surface[2]. Of the remaining forests, as much as 82% is now degraded to some extent as a result of direct human actions such as industrial logging, urbanization, agriculture and infrastructure[3,4]. This figure is likely an underestimate of the true level of anthropogenic impact as it does not incorporate other, more cryptic forms of degradation, such as over-hunting[5]. As the human footprint continues to expand[4], remaining forest free of significant anthropogenic degradation is in rapid decline (Fig. 1).

Over the past decade, there has been increasing international concern around the loss of forest and the impact this has on climate change, the loss of biodiversity and the provision of ecosystem services[1]. The 2015 Paris Agreement, together with earlier agreements under the United Nations Framework Convention on Climate Change (UNFCCC), acknowledges the importance of forests for limiting a future temperature increase to well below 2°C above pre-industrial levels[6]. The United Nations' Sustainable Development Goals (adopted in 2016) have the ambitious goal of fully halting deforestation by 2020[7]. However, while these targets are clearly warranted, they fall short of specifically prioritizing the crucial qualities of a forest

86 that contribute most to achieving each convention's specific goals[1]. For example,
87 indicators tracking progress towards the 2015 New York Declaration on Forests –
88 among the most significant global forest conservation targets to date – focus on forest
89 extent and make almost no acknowledgement of forest condition[8].

90 In this Perspective, we argue that to achieve the goals of global international
91 environmental accords it is insufficient to treat all forests as equal regardless of their
92 condition. Instead, forest that is free of significant anthropogenic degradation (which
93 we term 'intact forest') should be identified and accorded special consideration in
94 policy-making, planning, and implementation. Anthropogenic degradation here
95 includes all human actions that are known to cause physical changes in a forest which
96 lead to declines in ecological function[9,10]. Well studied examples include forest
97 fragmentation, stand-level damage due to logging, over-harvesting of particular
98 species (such as over-hunting) and changes in fire or flooding regimes.

99 We first summarize published evidence that intact forests support an
100 exceptional confluence of globally significant environmental values relative to forests
101 which have experienced those damaging human actions. We show that intact forests
102 are indispensable not only for addressing rapid anthropogenic climate change, but
103 also for confronting the planet's biodiversity crisis, providing critical ecosystem
104 services, and supporting the maintenance of human health. We then show that the
105 relative value of intact forests is likely to become magnified as already-degraded
106 forests experience further intensified pressures (including anthropogenic climate
107 change). While it is beyond the scope of this paper to set thresholds for acceptable
108 forest fragment size and configuration, logging intensity or any other measure of
109 damage, we provide evidence that human activity that exceeds the natural range of
110 variation in a forested system reduces key ecological functions, and the greater the
111 level of alteration the greater the reduction in function is. Here we outline the
112 significant, and likely intensifying, threats to intact forests and argue that action is
113 required to halt and reverse their loss. Such action requires explicit consideration at
114 global, national, and sub-national scales, and we conclude by identifying specific
115 policy mechanisms where intact forests should be addressed.

116 Our call for an increased emphasis on intact forests does not imply that other
117 forms of forest are unimportant. Given the scale of the environmental challenges

facing humanity, there is also an undoubted need to cease deforestation and degradation at forest frontiers[11] and to promote large-scale reforestation[12]. We believe coherent environmental policy should give due weight to intact forests, clearance frontiers and restoration opportunities, since all three have crucial and complementary roles to play. The primary reasons we focus on intact forests are two-fold. First, they are overlooked in international policy. Second, intact forest protection can typically secure very high environmental values with often relatively low implementation and opportunity costs[13], which serves to reinforce the need for their direct inclusion in global environmental accords.

Evidence for the exceptional value of intact forests compared to degraded ones

There has been rapid growth in our understanding of the link between anthropogenic pressures on forest and impacts on ecosystem service values across a range of forest types (Table 1). Anthropogenic pressures, especially at industrial intensities and large spatial scales, have been shown to alter forest characteristics, including physical structure, species composition, diversity, abundance and functional organization compared to their natural state, and as a result, to reduce a wide range of environmental values[14–17]. These pressures also interact with natural disturbance regimes such as fire and pests to perturb forests beyond their capacity to regenerate[18]. The following sections show how the loss of forest intactness leads to declines or changes in key environmental values: global and regional-scale climate regulation, local climate and watershed regulation, biodiversity conservation, indigenous cultures and human health.

Climate mitigation

Climate change is causing pervasive and potentially irreversible impacts on ecosystems and people[19]. Of the anthropogenic contribution to atmospheric CO_2 since 1870, 26% is due to emissions from deforestation and forest degradation[20]. It is now accepted that actions that avoid emissions from the land sector, especially forests, and maximize removals of greenhouse gases, are critical if the goals of the UN Framework Convention on Climate Change Paris Agreement are to be achieved[12,21].

Degradation typically causes fewer emissions per hectare than deforestation, but is much more widespread[3,4,9]. In the tropics, where most net forest emissions occur, degradation may account for 10-40% of total emissions of above-ground carbon[22].

150 Industrial-scale logging (i.e. large-scale market-orientated logging using heavy
151 machinery, with offtakes that exceed natural rates of tree mortality) directly reduces
152 carbon stocks through a combination of tree removal, collateral damage to non-target
153 trees, decomposition of logging waste and wood fiber products[23] and the depletion of
154 soil and peatland carbon stocks[24,25]. Industrial logging creates forested systems
155 dominated by regenerating stands of younger, smaller trees, and while some regrowth
156 does occur during each logging cycle, the cyclical peaks in biomass typically do not
157 return to pre-logging levels, and the time averaged carbon stocks can be expected to
158 decline progressively over subsequent cutting cycles in many cases[26]. Reported
159 carbon losses through industrial logging vary widely across forest types and due to the
160 different types of logging undertaken (Fig. 2).

161 As forest patches are fragmented by agriculture and infrastructure, the area
162 exposed to edge effects increases disproportionately; already 70% of the world's
163 forests lie within one km of a forest edge and this proportion is rising[27]. Globally,
164 locations up to 500 m from a forest edge average 25% less biomass carbon than
165 locations remote from forest edges, and even locations up to 5 km from an edge can
166 have >10% less biomass carbon[28]. These edge effects are mediated by a wide range of
167 ecological changes, including increased windthrow and evaporation, and increased
168 access for people, fire and invasive species[27]. Another form of degradation is loss of
169 fauna through over-hunting, which can significantly disturb vegetation composition
170 and the long-term carbon storage potential of tropical forests by depriving key, high-
171 carbon tree species of their seed dispersal agents, and through other ecological
172 disruptions[29,30] (see Box 1). Such effects can extend over vast areas (e.g. at least 36%
173 of the Amazon[31]) because over-hunting is pervasive where human access is facilitated
174 by new infrastructure, and can also occur even in very remote areas[32,33].

175 Degradation reduces the capacity of forests to function as major net carbon
176 sinks, actively sequestering carbon into soils and living biomass[34,35]. The global
177 residual terrestrial sink, much of which is considered to take place in intact forests,
178 removes an extraordinary 25% (2.4 $PgCyr^{-1}$) of anthropogenic emissions from all
179 sources, and hence greatly slows the pace of climate change[36,37]. This aspect of global
180 carbon dynamics is often under-emphasized in climate policy because it is seen as
181 part of the background of natural fluxes. However, the large-scale degradation of
182 intact forests would result in a major anthropogenic reduction in this critical

ecosystem service[38]. The intact forest sink is distinct from the sink resulting from reforestation and forest recovery following cessation of degradation. Both are large and both are likely to be indispensable in efforts to meet global climate targets[36,39].

Regulating local climate regimes and providing watershed services

There is increasing evidence that forests are a key factor in the regulation of local and regional climate regimes through the exchange of radiation, moisture and wind energy between the land and atmosphere. Local and regional weather patterns are therefore a function not just of the amount of forest cover but also its state and condition[40].

Intact tropical forests are critical for rain generation because air that passes over these forests produces at least twice as much rain as air that passes over degraded or non-forest areas[41]. When intact forests are degraded, there is a resulting reduction in convective cloud cover and rainfall[42]. The influence of intact forests on precipitation, temperature and surface hydrology is particularly relevant in reducing the risks of drought imposed by climate extremes[42]. In Australia, the degradation and loss of intact forest can increase the number of dry and hot days, decrease daily rainfall intensity, and increase drought duration during El Niño years[43]. The latter pattern also has been shown in Amazonia, where deforestation and forest degradation produce warmer and drier conditions that favor more frequent and intense droughts than in the past[44]. Importantly, the local climate benefits of tropical and sub-tropical forests occur primarily during the dry season and in regions with low rainfall and during heat waves where the temperature is buffered by the cooling effects of evapotranspiration[45].

Intact forests also have a direct influence on water availability through the redistribution of runoff, water table levels and soil moisture by altering soil permeability[46]. These processes interact with physiography to regulate the flow distribution of energy and materials across the land surface and help stabilize slopes, prevent water and wind erosion, and regulate the transport of nutrients and sediments[46]. Several studies have shown that when forests are degraded, the soil infiltration rates and water infiltration capacity are decreased because of changes in soil structure and aggregation by organic matter and plant litter production[47]. For example, intact Mountain Ash (*Eucalpytus regnans*) forested ecosystems of southern Australia have been shown to produce > 12 Ml ha^{-1} yr^{-1} more water than equivalent

forested ecosystems that have been degraded through logging[48]. In many cases, intact forests also buffer the negative effects of heavy rainfall events by reducing peak discharge and regulating runoff and by diminishing the negative consequences of climate extremes[49,50].

Conservation of biodiversity

The global biodiversity crisis is heavily driven by anthropogenic threats to forests[51], since forested ecosystems support the majority of global terrestrial biodiversity[52]. Biodiversity has intrinsic value and there is also increasing evidence that diverse, intact species assemblages underpin ecosystem functions like tree productivity, nutrient cycling, seed dispersal, pollination, water uptake and pest resistance that are critical for human well-being[53].

Intact forests have particular value for the conservation of biodiversity[54]. Beyond outright forest clearance (which is the greatest threat facing biodiversity[51]), forest degradation from logging is the most pervasive threat facing species inhabiting intact forests[3]. Many species are sensitive to logging, and studies across many taxonomic groups have shown impacts increasing with the intensity of logging, and with the number of times a forest has been logged[17,55]. Fragmentation of intact forest blocks (and associated edge effects) is also a severe threat to forest-dependent species, especially those requiring large areas to maintain viable populations (e.g., wide-ranging predators and tree species that occur naturally at very low densities)[27,56]. In temperate, boreal and tropical forests regions, the loss of large contiguous tracts of forest has meant wide-ranging forest-dependent species have either retreated to the last remaining intact forest systems or are extinct[57–60]. Furthermore, there is evidence that, even for some forest species that may persist for a time in degraded fragments, intact forests are necessary to ensure their persistence over the long term[18,61,62].

Defaunation resulting from commercial and subsistence hunting is a critical threat for large-bodied forest vertebrates, especially in the tropics[5,63]. Many large carnivores and ungulates that play important roles as ecosystem engineers (e.g., Sumatran serow (*Capricornis sumatraensis*), gaur (*Bos gaurus*) and forest elephant (*Loxodonta cyclotis*), are now found only as remnant populations in the remaining intact tropical forests[33,64]. The synergistic interaction of stand damage, fragmentation and hunting is an increasingly significant challenge for biodiversity conservation[65,66]

as it is well known that forest fragmentation increases access for hunters[67], and logging damage has more severe impacts when combined with fragmentation[17]. Forest biodiversity is best conserved by minimizing the encroachment of productive activities that promote forest loss and fragmentation because the initial intrusion leads to rapid degradation of intact forests, not only via the direct effects of habitat loss, but also the coinciding effects of wildfires, overhunting, selective logging and biological invasions, alongside other stressors[65,68]. For example, a recent global analysis of nearly 20,000 vertebrate species showed that even minimal initial deforestation within an intact landscape had severe consequences for vertebrate biodiversity in a given region, emphasizing the special value of intact forests in minimizing extinction risk[68]. Moreover, those forest ecosystems that are more affected by humans support less genetic diversity than those systems that are still intact, which has potentially significant ramifications for evolutionary change[69].

Indigenous peoples

At least 250 million people[70] live in forests, and for many of them, their cultural identities are deeply rooted in the plant and animal species found there[71]. Archaeological and ethnographic evidence indicate forests have been inhabited by people for millennia: in Latin America records go back 13,000 years[72], in Asia some 40,000 years[73] and in central Africa over 250,000 years[74]. Forest-dwelling indigenous peoples have tended to do so at very low population densities distributed in dispersed settlements[75]. Today, tropical forest societies that almost exclusively depend on the direct use of natural resources to meet their basic needs seldom exceed population densities of 1-2 people per km^2 [76], and tend to change location from time to time to ensure that their taking of food and other products will not permanently deplete an area of key resources. Through their selection and management for useful plants and animals, these communities have significant and long-lasting impacts on the structure and composition of the forests in which they live[77,78].

Industrial-scale degradation of intact forest erodes the material basis for the livelihoods of indigenous forest people, depleting wildlife and other resources[79]. It also renders traditional resource management strategies ineffective, and undermines the value of traditional knowledge and authority[80]. Fragmentation and degradation of the forest makes a traditional life style no longer tenable, pushing indigenous people

off their land[81], and driving people to adopt production systems that are incompatible with the maintenance of intact forests[82–85]. As traditional forest peoples become increasingly sedentary and connected to urban markets, gender roles, diets, and cultural values also change[86–88]. These changes in the life styles of indigenous and traditional peoples, create greater dependence on urban markets for provisioning, which can lead to effects that erode their cultural identities[89]. Indeed, for many indigenous forest people their cultural sense of self is inextricably linked to intact forests[80].

Forcible alienation from their territories has even more severe impacts, with the forest homes of many indigenous and traditional peoples being taken from them, often by force, by more powerful state, corporate and private actors, whose interests often involve forest conversion for cattle pasture, agricultural fields, oil-palm plantations[90], and mining concessions[91–93]. This can serious impacts on the health of these peoples as they are often exposed to new disease vectors and hostile settlers and ranchers. As many indigenous and traditional peoples are motivated to conserve their forests (because they are the foundation of their economic and cultural wellbeing), there is now mounting evidence (that we discuss below) that strengthening the land tenure of indigenous people is a powerful way to protect intact forests[94,95].

Human health

Forested ecosystems are major sources of many medicinal compounds that supply millions of people with medicines worldwide[96,97]. Degradation and outright forest loss compromise the supply of these benefits as medically-relevant species decline or are lost[98]. Degradation can also cause substantial negative health impacts. For example, during the 2015 human-caused forest fires in Indonesia, the haze generated after 261,000 ha of degraded forest and peatland was burned caused over 100,000 premature deaths across Indonesia, Malaysia and Singapore[99]. Fragmented forests experience more numerous and intense edge-related wildfires in comparison to intact forests[100], which severely exacerbates the extent of health impacts of both intentional and unintentional burning of forests.

Forest degradation may also lead to infectious disease impacts. Against a backdrop of declining overall burden of infectious diseases at a global scale[101], an

increasing rate of novel disease emergence and an increase in the incidence of some endemic diseases in forested landscapes have been, at least in part, attributed to increasing human presence in, and degradation of, these habitats[102,103]. For example, deforestation and resultant environmental changes are considered key drivers of zoonotic malaria in Malaysian Borneo[104]. Although wildlife and arthropod vector species within forests are natural sources of potential human infections[105], increasing human presence and anthropogenic land-use changes often promote opportunities for disease transmission, as human-reservoir/vector contact rates increase or as impacts on host or vector distributions or community composition perturb natural disease dynamics[106]. Numerous infectious diseases associated with forests, including Ebola virus[103], dengue fever[107], Zika virus[108], several hantaviruses[109], yellow fever[110] and malaria[111] are undergoing changes in risk to humans due to deforestation, forest degradation and human encroachment.

The increasing significance of intact forests

The differences in important environmental and social values of intact forests relative to degraded forests are likely to become magnified in the future due to two negative processes in degraded areas – progressive anthropogenic damage and reduced resilience to environmental change.

Vulnerability of degraded forests to further degradation

Once initiated, forest degradation often intensifies over time[112]. This is mediated by: (1) increased levels of human accessibility, (2) successive cycles of logging of often progressively lower value trees[113], (3) increased hunting pressure[5], (4) forest clearance and fragmentation due to colonization by farmers and loggers facilitated by new roads[114]; and, (5) the entry of new extractive development projects such as mining[55]. For example, in the Brazilian Amazon, 16% of logged areas are cleared for agriculture within the first year following logging, with further losses of over 5% per year for the next four years[115]. This cycle is exacerbated if conversion becomes more politically acceptable once a forest has been labeled ‘degraded’[116]. Once identified as ‘lower value’ for conservation, degraded forests can mistakenly be considered to have ‘no value’ by some stakeholders, despite extensive evidence to the contrary[17,117].

Degraded forests also have increased risk of, and susceptibility to, natural disturbances such as fire, as forests are drier along their edges[118]. There is clear

evidence that forests that are logged are at high risk of burning at uncharacteristically high severity[119] with an elevated fire proneness lasting for decades[120]. Degraded forests are also at higher risk from invasion by exotic invasive species[18] when compared to non-degraded forests. With fire frequency in many forest areas predicted to increase under climate change scenarios[121–123], intact forests might become refuges from fire in many landscapes where degraded forests burn too frequently to support the persistence of plant and animal communities dependent on old forests. This cascade of damage, referred to as a 'landscape trap'[124], is becoming more common and many forests are now subject to repeated disturbances that lock them in early successional states.

Loss of resilience following forest degradation

In addition to current direct anthropogenic threats, forested ecosystems also have to adapt to large-scale environmental changes, including changes in climate[19], which interact with the myriad of current threats that they already face[125]. Intact forest ecosystems have greater capability to overcome these regional and global stressors than degraded ones as they have inherent properties that enable them to maximize their adaptive capacity[126]. For example, intact forested ecosystems often house important populations of forest-dependent species and high intraspecific genetic diversity which both provide options for the local adaptation and phenotypic plasticity[127] which facilitates species' ability to survive changing environmental conditions[128]. Large, connected and functionally intact forest ecosystems also enable species to undertake adaptive responses like dispersal or retreating to refugia[129], which will be critical as the climate changes and species react[130]. Moreover, the connectivity provided by large, contiguous areas spanning multiple environmental gradients, such as altitude, latitude, rainfall or temperature, will maximize the potential for key processes such as gene flow and genetic adaptation to play out naturally, while also allowing species to track shifting climates in space[131,132]. Intact forests have been shown to be more resilient in response to short-term climatic anomalies (e.g. droughts and wildfires during drought) than degraded forests[133].

Intact forest ecosystems sustain large-scale ecological processes, such as natural disturbance regimes, which maintain disturbance-adapted species that influence native community composition[18,127]. For example, the biodiversity of boreal

and temperate forests includes evolutionary lineages that are uniquely adapted to survive major seasonal temperature changes and landscape-level disturbances over time such as large fires and insect infestations[134].

The future of intact forests

Increasing pressures on ever-decreasing intact forests

The capacity to map human pressures on the environment at global scales is rapidly improving[135] and published results to date show that not only has global forest cover loss accelerated since the 1990s[8,136,137] but there are also higher levels of degradation within the shrinking forest estate. The recently updated global Human Footprint[138], a composite index of eight human pressures that is believed to be a good proxy for overall intactness, found that in 2009 18% of forests had no detectable human pressure, a 35% decline since 1993 (Fig. 1b). According to a related but distinct metric, Intact Forest Landscapes covered 24% of the world's forests in 2013, a decline of 7.2% since 2000[3]. Recent mapping of roadless forest[139] and hinterland forest[140] show similar declines using alternate data sources.

These assessments under-estimate the total loss of intactness as they do not fully take into account other forms of forest degradation, including invasive species, some forms of logging, over-hunting, and altered fire and flood regimes, nor do they address the impacts of climate change. For example, vast areas of Central Africa that are mapped as 'intact' by both satellite imagery and the Human Footprint have lost their forest elephant (*Loxodonta cyclotis*) populations in the past 20 years due to poaching. This causes dramatic long-term ecological changes, given the role of this species as an 'ecosystem engineer' though seed dispersal, trampling and herbivory[33].

These figures suggest that even if existing global targets to halt deforestation are achieved, much of what is saved will no longer be intact. Outright deforestation is currently concentrated in the tropics and sub-tropics[136], but the loss of intactness is a pervasive global forest phenomenon[3]. It seems likely that this rapid decline in forest intactness will accelerate in line with the underlying drivers of change (including human economic demands, which are growing rapidly as a result of rising population and even more quickly-rising per capita consumption[141]). One stark forecast is that 25 million km of new roads will be built globally by 2050[142], threatening many intact areas.

Focal mechanisms for action on intact forests

It is clear that many intact forests are under severe and rising pressure, and there is an urgent need for greater conservation efforts[3]. Below, we offer some potential avenues for enhanced action, whilst acknowledging that the scale of the challenge is very significant, and will only achieve long-term success if nations turn away from 'business as usual' activities that extract natural resources without appropriately valuing the cost of lost natural capital. An essential first step towards greater success is achieving widespread recognition that rapid loss of forest intactness represents a major threat to sustainable development and human well-being. Policy makers need to understand the challenge that the loss of forest intactness represents for achieving strategic goals outlined in key multilateral environmental agreements, including the CBD, the UNFCCC and the UN Sustainable Development Goals[139,143], and this recognition needs to be translated into meaningful changes on the ground.

A fundamental constraint to progress is the fact that international definitions of forests have not differentiated among types of forests and, in most policy settings, they treat all forests, regardless of their condition, as equivalent[1,144]. As such, international policy processes seldom acknowledge the special qualities and benefits that flow from intact ecosystems as compared to those that are degraded. The consequence is that few policy processes (or participating nations) clearly articulate conservation goals for intactness, forest quality or integrity[143]. There is an emerging, critical role for the science community to develop policy-relevant metrics of forest intactness that account for the different forms and levels of forest degradation and assess how they impact on different globally important social and environmental values. The lack of recognition of the varying qualities and condition among forest types has implications for targeting by international funding programs such as the Global Environment Facility, Green Climate Fund, and Critical Ecosystems Partnership Fund, which are distributing billions of dollars annually in support of programs in developing countries to help achieve the goals of multilateral environmental agreements. All three of these mechanisms could adjust their criteria for funding so as to explicitly recognize the value of investments that protect intact forests.

A number of emerging policy opportunities for the global community to recognize the special values intact forests preserve, when compared to degraded ones, are within the UNFCCC. Because the scientific community have not worked out a practicable definition for emissions from Land Use, Land Use-Change and Forestry (LULUCF) that would separate direct human-induced effects from indirect human-induced and natural effects, parties to the UNFCCC in reporting on LULUCF in their Greenhouse Gas inventories (GHGI) may choose to apply the Managed Land Proxy[145]. Under the MLP, land where human practices have been applied is considered "managed" and included in reporting under the UNFCCC. However, by definition, many intact forest landscapes are located on 'unmanaged lands' and therefore their contribution to meeting mitigation goals is not quantified or understood. Increased attention to unmanaged lands, and to transitions between the managed and unmanaged lands categories, through key venues such as the IPCC Special Reports and the Global Stocktake and Facilitative Dialogue will not just improve understanding of the climate mitigation role of intact forests but support nations in articulating interventions, targets, and funding needs for protecting these forests in formulating and implementing their Nationally Determined Contributions (NDCs).

Further policy enhancements could be identified in existing frameworks and programs for financing for tropical intact forest conservation, such as the UNFCCC REDD+ process, the Green Climate Fund and the Forest Carbon Partnership Facility. To date, these processes have been focused on rewarding countries and jurisdictions with performance-based payments for reducing near-term threats of deforestation and (to a much lesser extent) degradation, based on a historical emissions baseline. Given this goal of achieving near-term climate mitigation results (i.e., typically within 5 to 10 years), program rules often directly limit the eligibility or amount of support for conservation of intact forests that have, by definition, low historical emissions from deforestation and degradation, and that may be under threat over one or more decades. For example, so-called "high forest, low deforestation" (HFLD) nations have relied upon projections that implicitly or explicitly assume higher rates of emissions in the future. A more straightforward approach would focus on existing stocks and reservoirs of forest carbon, which could be elaborated within the "+" in REDD+ ("the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries"). Such an approach may require new incentive

472 approaches that differ from and are complementary to existing results-based payment
473 approaches; instead, they would reward the long-term maintenance of existing carbon
474 stocks and the other + activities, and bypass rules stipulating that this financing must
475 target areas with high historical ('baseline') levels of emissions[146]. Additional
476 climate-related policy approaches are also clearly needed for temperate and boreal
477 intact forests, especially those in developed countries which would not expect to
478 receive finance support under the Paris Agreement and related UNFCCC
479 mechanisms.

480 There are current efforts underway in generating new 2030 Global
481 Biodiversity Targets, and operationalizing a clear, mandated target on preserving
482 ecosystem intactness is critical to this[143]. The first steps are underway, with the
483 International Union for the Conservation of Nature recently adopting a new Key
484 Biodiversity Area (KBA) criterion (Criterion C) covering those sites that contribute
485 significantly to the global persistence of biodiversity because they are exceptional
486 examples of ecological integrity and naturalness[147]. If the KBA standard becomes
487 formally recognized within the 2030 strategic plan for biodiversity, this would be a
488 very positive step in proactively conserving intact forests.

489 Change in policy at the global level should be reflected in the design and
490 implementation of effective national and sub-national policies and forest management
491 plans that recognize the value of intact forests to the host nation and specify policies
492 for their protection and restoration. National and sub-national policies can be
493 supported by longer-term planning that is incentivized by climate funding streams
494 (e.g. conditional targets in NDCs, the Green Climate Fund) that recognize the
495 mitigation contribution of intact forest landscapes. These policies will vary based on
496 the specific context of different nations, but there is a clear need to focus on halting
497 degrading activities, including limiting road expansion[142], reducing negative impacts
498 of hunting through legal controls coupled with sustainable resource use strategies[5],
499 preventing large-scale developments such as mining, forestry, and agriculture in intact
500 forests[51] and investing in restoration activities. One obvious intervention that nations
501 can prioritize is the creation of large protected areas, including transboundary areas.
502 When well designed, financed, and enforced, protected areas have been shown to be
503 effective in slowing the impacts of industrial logging[3], land clearance[148] and over-
504 hunting[33,148].

A range of other designations exists beyond protected areas that can prevent the loss of intactness or promote its restoration. There is evidence that the designation of 'roadless areas' in the USA, for example, has led to a effective expansion in degree of ecoregional representation under protection and increases in the number of areas large enough to provide refugia for species needing large tracts relatively undisturbed by people[149]. There is a need for mechanisms relating to the private sector that prioritize the protection and restoration of intact forest, including specific investment and performance standards for lenders and investors (e.g. World Bank, International Finance Corporation, and regional development banks) and increasing the effectiveness of existing forest and extractive industry certification standards. Recent initiatives to make supply chains deforestation-free need to be strengthened, and to include measures to protect intact forests. While there are some signs of success (e.g., the Brazil Soy Moratorium[150]), implementation is lagging well behind pledges and it is too early to demonstrate lasting impacts[151].

One emerging strategy that can be effective in slowing the degradation of intact forests is enabling indigenous communities to establish title and management over their traditional lands. Although comprehensive global analyses are lacking, some regional data reveal the remarkable contribution of stewardship by forest peoples to sustaining high integrity forest systems, often in the face of substantial pressures to liquidate forest timber or mineral resources. For instance, the creation and management of indigenous territories has reduced (although, as with protected areas, not halted) deforestation across the Amazon Basin[152–154]. It is believed over half of the Amazon Basin's 7 million square kilometers are under some form of protection, and nearly 1.8 million square kilometers are indigenous lands[155]. In the boreal north of Canada, First Nations peoples have been able to sign formal agreements with government and the private sector to ensure that national economic develop policies and practices respect their rights and commit to conserving their lands and waters. For example, the Final Recommended Peel Regional Land Use Plan, co-developed by the Government of Yukon and four First Nation governments, has an explicit goal of "managing development at a pace and scale that maintains ecological integrity", and has placed 81% of the 67,000 km^2 area under protection[156]. These examples are drawn mostly from regions where indigenous peoples live at very low densities and have made cultural choices not to exploit the territories they own

538 for timber or minerals; where population densities are higher, or where communities
539 make different cultural choices, levels of forest degradation associated with
540 subsistence and income-generating activities will also tend to be proportionately
541 higher, as with non-indigenous communities.

542 Funding for protection and restoration of intact forests could also be used to
543 establish payments for ecosystem services. The approach has many challenges, but
544 there are some encouraging examples where these types of activities are being
545 undertaken. For example, in Brazil, the Amazon Regional Protected Areas program,
546 partly funded by international performance-based payments under a prototype
547 REDD+ framework, supports the creation and management of protected areas and
548 sustainable natural resource use[157]. This is being accomplished in collaboration with
549 local peoples with the overarching aim to maintain forest carbon stocks and protect
550 large-scale ecological processes[158].

551 There is also a need for increased efforts to restore the intactness of degraded
552 systems. This should not be seen as a substitute for conserving fully intact systems in
553 their current state, as forest degradation can often only be partially reversed over
554 reasonable time scales[112], and it is generally more cost-effective to conserve at-risk
555 intact forests than to protect or restore fragmented and degraded ones. If the goal of
556 restoration is to achieve sustainably managed production forests, this may serve to
557 alleviate pressure on intact forests, whist also providing some biodiversity and
558 ecosystem service benefits[159]. Further intensifying production systems in previously
559 degraded land may allow even more intact forests to be spared. Such a "land sparing"
560 approach has been shown to achieve biodiversity benefits in agricultural landscapes
561 relative to "land sharing" (integrating biodiversity and production objectives on the
562 same land)[160], and emerging evidence suggests the same is true in timber production
563 landscapes[161]. In both cases, it is imperative that strong regulation and governance
564 systems are in place to ensure intact forests are actually spared in practice; otherwise,
565 the higher economic returns that come from intensifying production may create
566 incentives for further forest degradation[162]. Nonetheless, in already-degraded systems,
567 partial restoration will clearly bring significant environmental benefits in many
568 cases[112]. Important efforts are being undertaken worldwide, for example through UN-
569 REDD and the Bonn Challenge, ranging from enabling natural regeneration, active
570 replanting of native forests, removal of invasive exotic species[163], fire management[164],

reconnecting landscapes through the establishment of corridors[165], and 'rewilding' initiatives to re-establish top predators and large-scale ecosystem processes in regenerating forests[166].

Conclusion

There are still significant tracts of forest that are free from the damaging impacts of large-scale human activities. These intact forests typically provide more environmental and social values than forests that have been degraded by human activities. Despite these values, it is possible to envisage, within the current century, a world with few or no significant remaining intact forests. Humanity may be left with only degraded, damaged forests, in need of costly and sometimes unfeasible restoration, open to a cascade of further threats, and lacking the resilience needed to weather the stresses of climate change. The practical tools required to address this challenge are generally well understood and include well-located and managed protected areas, indigenous territories that exemplify sound stewardship, regulatory controls and responsible behavior by logging, mining, and agricultural companies and consumers, and targeted restoration. Currently these tools are insufficiently applied, and inadequately supported by governance, policy and financial arrangements designed to incentivize conservation. Losing the remaining intact forests would exacerbate climate change effects through huge carbon emissions and the decline of a crucial, under-appreciated carbon sink. It would also result in the extinction of many species, harm communities worldwide by disrupting regional weather and hydrology, and devastate the cultures of many indigenous communities. Increased awareness of the scale and urgency of this problem is a necessary pre-condition for more effective conservation efforts across a wide range of spatial scales.

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Supplementary Information is available in the online version of the paper.

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List of Figures, Tables and Boxes

Figure 1. **The global extent of intact forest.** There are many ways to map intact forest, (1a) is mapped as defined by Intact Forest Landscape methodology[3] and (1b) by the global Human Footprint methodology[4] (1b) and for both measures, by biome (1c). The definition of overall forest estate was based on Hansen et al. 2012[121], with forests were defined as > 75% tree coverage.

Figure 2. **Forest degradation and carbon loss.** Examples of published case studies that have examined the effects of forest degradation on carbon loss. Table S1 provides in depth summaries of each study.

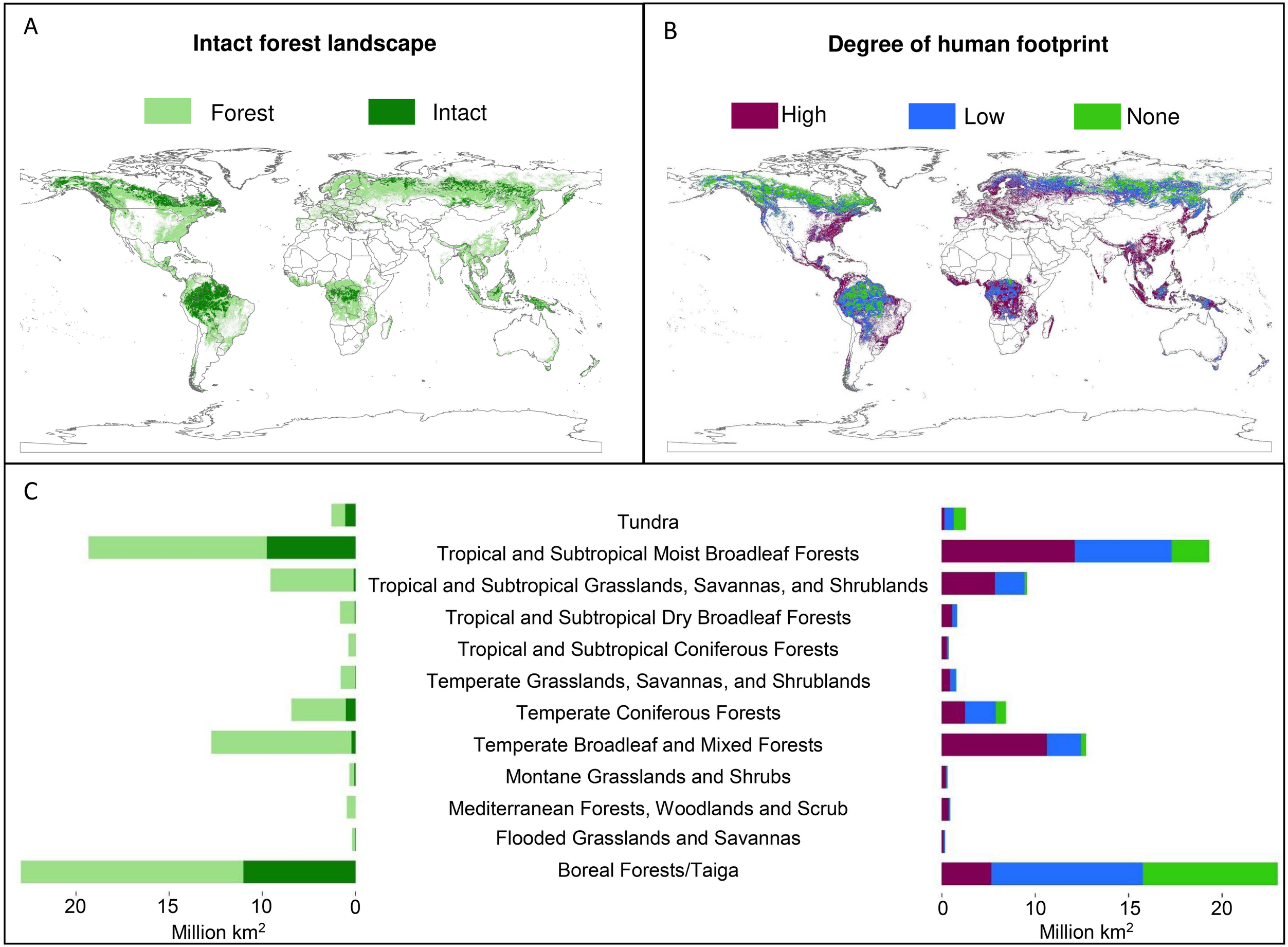
Box 1. The effect of defaunation on carbon storage and sequestration in intact forests.

Table 1. Evidence of the exceptional values intact forest ecosystems have when compared to degraded ecosystems.

List of Supplementary Tables and Appendix

Table S1. In-depth description of each study represented in Figure

1127


A
Intact forest landscape
Forest
Intact
B
Degree of human footprint
High
Low
None
C
Tundra
Tropical and Subtropical Moist Broadleaf Forests
Tropical and Subtropical Grasslands, Savannas, and Shrublands
Tropical and Subtropical Dry Broadleaf Forests
Tropical and Subtropical Coniferous Forests
Temperate Grasslands, Savannas, and Shrublands
Temperate Coniferous Forests
Temperate Broadleaf and Mixed Forests
Montane Grasslands and Shrubs
Mediterranean Forests, Woodlands and Scrub
Flooded Grasslands and Savannas
Boreal Forests/Taiga
20
15
10
0
Million km2
0
10
15
20
Million km2

1. Canada. A decline of 10 - 51% was modelled over 250 years within coastal forest ecosystems in British Columbia[167]

1. Canada. A decline of 7 - 25% was modelled over 250 years within forest ecosystems in the interior of British Columbia[167]

1. Canada. A decline of 12% was modelled over 250 years within a boreal forest[167]

2. Malaysia. A decline of 53% was measured at a maximum of 19 years since disturbance in a dipterocarp forest[117]

3. Philippines. A decline of 50% was measured in a dipterocarp forest. Measurements were taken in a using a chronosequence of 1-21 years[168]

4. Indonesia. A decline of 15% was measured after various years of disturbance in a lowland tropical forest[169,170]

5. Papua New Guinea. A decline of 24 - 37% was measured over various lowland tropical forest within a year after logging[171]

6. Papua New Guinea. A decline of 31% was measured in a medium-crowned rainforest within 4 years of logging[113,172]

7. Australia. A 55% decline was measured in a montane ash forest repeatedly logged since before the 1930's[23]

8. Australia. A 50% decline over 100 years was modelled in a Tasmanian wet eucalypt forest[23,174,175]

9. Republic of Congo. A decline of 3% was measured after one year since logging within a rainforest[113,176]

10. Gabon. A decline of 6% was measured after logging within a dense humid evergreen rainforest[113,177]

11. Brazil. A decline of 24% was measured in Paragominas. Time since last disturbance was 2 years[178]

12. Brazil. A decline of 37% was measured within within various areas of the Amazon, Disturbance ages varied[113,179]

13. Brazil. A decline of 35 - 57% was measured in Santarem.Time since last disturbance unknown[180]

14. French Guiana. A decline of more than 50% was measured in a lowland tropical rainforest immediately post-logging[181]

15. United States. A decline of 50% was modelled over 57 years in a temperate coniferous forest[23,182]

Table 1. Evidence of some of the exceptional values intact forest ecosystems have when compared to degraded ecosystems.

Climate change	
Mitigation	**More above and below-ground carbon stored**. Intact forests store more carbon than logged, degraded or planted forests in ecologically comparable locations. Industrial logging and conversion of forest to cropland causes heavy erosion and to the loss of belowground carbon[21,22,144] (see Fig. 2 and Table S1).
	More faunal complexity which helps carbon storage and sequestration. Defaunation can significantly erode the long-term carbon storage potential of forests by depriving key, high-carbon tree species of seed-dispersal agents, and through other ecological disruptions such as reduced vegetation diversity and composition or increased herbivory by non-hunted species (see Box 1)[29,31].
	Major carbon sequestration. Intact forests continue to function as major net carbon sinks, actively sequestering carbon into soils and living biomass[12,34,37].
Weather and watershed regulation	
Regulating local and regional weather regimes	**Effects on weather**. Local and regional weather patterns are partly a function of the amount of intact forest cover and its condition [40,42,198].
	Generation of rain and reduced risk of drought. When intact forests are cleared or degraded, there is a reduction in cloud cover and rainfall. Degradation and loss of intact forest can increase the number of dry and hot days, decrease daily rainfall intensity and wet day rainfall, and increase drought duration during El Niño years[41,199,200].
Ensuring hydrological services maintained	**Effects on water run-off availability.** Intact forests have a positive effect on the redistribution of runoff, stabilize water table levels and retain soil moisture by altering soil permeability. These processes interact with physiography to regulate the flow distribution of energy and materials across the land surface and help stabilize slopes, prevent water and wind erosion, and regulate the transport of nutrients and sediments[48,50].
	Buffer human settlements against negative effects of extreme climatic events. Non-degraded forests diminish the impact of heavy rain events by decreasing runoff and reducing the negative consequences of climate extremes[50,201].

Biodiversity	
Conserving biodiversity	**Consistently higher numbers of forest-dependent species.** More forest-dependent species are found in intact ecosystems than degraded ones. In some regions, the loss of large tracts of forest has meant wide-ranging forest-dependent species have either retreated to the last remaining intact forest systems or gone extinct[14,68,202].
	More effectively sustain important large scale ecological processes. Key functions supported by intact forests include natural disturbance regimes that sustain habitat resources, constitute selective forces to which species are adapted, or otherwise influence community composition[17,203,204].
	Intact forests have higher functional diversity. Degrading activities such as selective logging lead to trait shifts in communities that can affect ecosystem functioning, in addition to taxonomic diversity[5,33,204](see also Box 1).
	Higher intra-species genetic diversity. Intact forests provide greater options for local adaptation and phenotypic plasticity for forest-dependent species given they will larger populations (be definition), which will facilitate species' potential for evolutionary and plastic responses to the rapidly changing environmental conditions[69,126,128].
	Higher ability for species to undertake dispersal or retreat to refugia. The connectivity provided by large, contiguous areas spanning environmental gradients, such as latitude, altitude, rainfall or temperature, maximize the potential for key processes such as gene flow and genetic adaptation to play out, while also allowing species to track shifting climates[131,152].
	Refuge for forest species from increased fire frequencies in degraded landscapes under changing climates. Intact forests act as fire refuges in landscapes where non-intact forests burn too frequently to support persistence of plant and animal communities dependent on long time intervals between burning[100,124].
	Increased likelihood of providing key pollination and dispersal processes. Direct logging and secondary effects of degradation such as loss of vertebrate seed dispersers or pollinators leads to reduced ecosystem functions, such as seed dispersal and pollination services, e.g., reduced fruit set due to reduced pollinations in fragmented forests[31,205].
Indigenous Cultures	

	Increased basis for the material and spiritual aspects of traditional indigenous cultures to function. Long-established cultural norms intricately linked to the ecology of intact areas, and vulnerable to damaging change[80,91,92].
Human health benefits	
	Reduced health impacts of wildfires. Fires attributed to forest degradation activities such as burning for land clearing result in premature deaths due to generation of haze. Lower burning rates in intact forests mean that health effects of wildfires are lower than in degraded landscapes with larger, more frequent fires[99].
	Reduced infectious disease risks. The emergence of novel diseases from forests and the increase of endemic disease impacts in forested landscapes are thought to be related to encroachment and degradation arising from increasing human presence in these habitats[96,97,206].

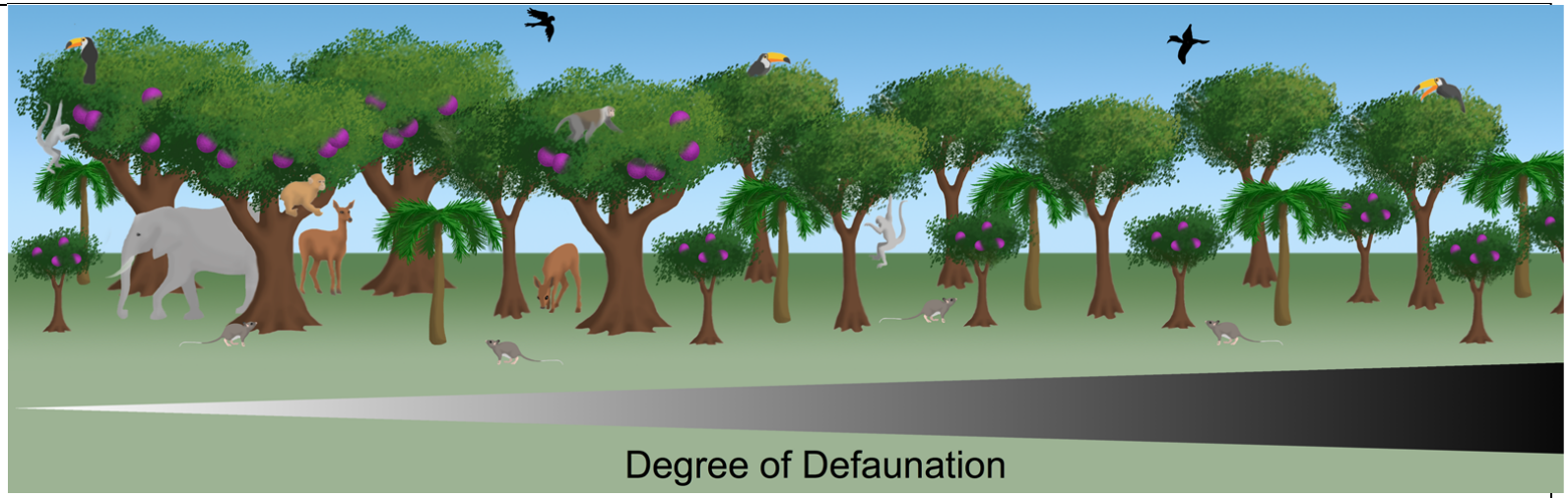
Box 1. The effect of defaunation on carbon storage and sequestration in intact forests.

Even where forests have not been cleared, many are not functioning as they once were[166]. Species like the Asian and South American tapirs (*Tapirus* spp), forest elephant (*Loxodonta africanus cyclotis*) and the great apes have disappeared across much of their ranges. Habitat degradation and fragmentation are major causes of this defaunation, as many large-bodied species depend on large expanses of high quality forest to sustain viable populations[5,183]. Increased human accessibility to forests is another, with unsustainable hunting now affecting greater areas of tropical forest than the combined extent of deforestation, selective logging and wildfires[184]. Wildlife species are not equally affected by hunting with stronger impacts of hunting pressure on larger-bodied primates and ungulates compared with smaller-bodied vertebrates such as birds and rodents [31,75,185].

Defaunation significantly erodes key ecosystem services and functions through direct and indirect cascading effects on species diversity and trophic webs[186–188]. There is evidence for negative effects on pollination, seed dispersal, pest control, nutrient cycling, decomposition, water quality and soil erosion[183,189]. Studies across the African and Atlantic tropical forests indicate that the disappearance of large frugivores and subsequent loss of seed dispersal reduces recruitment and natural regeneration of large-seeded hardwood plant species, which are key contributors to carbon storage[190–192]. By simulating the local extinction of trees that depend on large frugivores in 31 Atlantic Forest communities, Bello and colleagues[29] found that defaunation has the potential to significantly erode carbon storage even when only a small proportion of large-seeded trees are extirpated. This is because of strong functional relationships between seed diameter, wood density and tree height, which are traits related to carbon storage[193]. Similar results have been shown for the Amazon[31] and other parts of the tropics[194].

There is also likely to be an another link between defaunation and lowered carbon storage in tropical forests; lower herbivory rates in defaunated forests allow fast-growing herbivore-sensitive plants to outcompete slower-growing animal-dispersed trees that have better defence mechanisms against hunted frugivores[31,195,196]. In defaunated forests, carbon storage is potentially reduced when these fast-growing carbon-poor plants replace an equal basal area of carbon-rich animal-dispersed trees[197]– a process that may be irreversible once the seed stock is lost.

Figure. Schematic representation of the transition (from left to right) of a non-hunted, faunally intact tropical forest to an overhunted, defaunated forest. Shows the degree to which large arboreal or terrestrial forest frugivores such as elephants and apes decline in abundance and, with these declines, the associated replacement of large-fruited high biomass trees by smaller-fruited and wind-dispersed trees that have lower biomass and carbon storage.


Degree of Defaunation

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Letter to the Editor

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Genetic Distinctiveness of Alexander Archipelago Wolves (*Canis lupus ligoni*): Reply to Cronin et al. (2015)

Byron V. Weckworth, Natalie G. Dawson, Sandra L. Talbot, and Joseph A. Cook

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Cronin et al. (2015) examined genetic variability in North American canids, with a primary focus on wolf (*Canis lupus*) populations in southeast Alaska. After exploring broad patterns of variation for single nucleotide polymorphisms (SNPs) in wolves across North America, the authors addressed the taxonomy of selected subspecies of wolves. Their conclusions have implications for conservation of this species in southeast Alaska and elsewhere, as well as management of high-volume old growth forests of the Tongass National Forest. Cronin et al. (2015) discovered significant genetic differentiation between coastal wolves of southeast Alaska and wolves interior to the Pacific coastal mountain ranges of North America. They acknowledge their data are consistent with earlier studies of coastal wolves, including the Alexander Archipelago subspecies (*C. l. ligoni)*, which supported their distinctiveness (mitochondrial DNA sequences and microsatellite loci; Muñoz-Fuentes et al. 2009, 2010; Weckworth et al. 2005, 2010, 2011). Surprisingly, however, they conclude their SNP data do not support a subspecies designation of wolves in southeast Alaska. We disagree that the data and analyses presented in Cronin et al. (2015) logically lead to that conclusion.

Cronin et al.'s (2015) demonstration that coastal wolves are distinctive, and that a substantial portion of the genetic variability for this species across North America resides only in these coastal populations, is indicative of a largely independent historical trajectory for these populations. Nevertheless, Cronin et al. (2015) assert that wolves occupying southeast Alaskan habitats are not a subspecies. First, they note that criteria used for subspecies designations are subjective (a criticism of taxonomy generally, and not based on their data). Second, the authors contend that subspecies are expected to be genetically homogenous; that is, the level of population genetic structure within southeastern Alaskan wolves is too high to represent a single subspecies. Finally, although not actually measuring levels of gene flow, Cronin et al. (2015) state that there is gene flow between wolves in one segment (Game Management Unit 1 [GMU1]) of the range of the subspecies *C. l. ligoni*, and wolves within the range of other proposed subspecies. Thus, despite assertions that subspecies designations are subjective, Cronin et al. (2015) have adopted complete isolation between, and lack of population structure within, proposed subspecies as requisite criteria for subspecies designation. Given that systematists (to our knowledge) require neither of these criteria for subspecies recognition, there exist significant inconsistencies in Cronin et al.'s (2015) taxonomic conclusions. The cumulative scientific evidence demonstrating the distinction of coastal (including island) wolves of southeast Alaska from other wolf populations of North America now includes Cronin et al. (2015); their data are consistent with the early hypothesis (Goldman 1937, 1944) that these coastal wolves were distinctive. Their data also identify considerable genetic structure in wolves within this coastal region that may be consistent with distinctive populations, not surprising given the fragmented nature of the archipelago and studies of other organisms in the region (Cook and MacDonald 2013).

In the *Taxonomy and Management* section (Cronin et al. 2015), the authors suggest *C. l. ligoni* is invalid due to taxonomic revision by Nowak (1995). Nowak's (1995) work (later extended and summarized in 2002) used discriminant function analyses of 10 skull measurements to create a simplified taxonomic framework (many fewer subspecies) for North American wolves. However, Nowak's (1995) characters differed from those shown to be diagnostic in the original description of *C. l. ligoni* (Goldman 1937, 1944). Among the many taxonomic changes suggested for *C. lupus*, Nowak (2002) placed coastal southeast Alaska wolves into a single wide-ranging subspecies, C. *l. nubilus*, which hypothetically extends from the Atlantic to the Pacific coasts. This conclusion is surprising as Nowak's own analyses show the southeast coastal wolves to be morphologically intermediate between *C. l. occidentalis* and *C. l. nubilis*. We note that across a large number of subsequent studies, minimal empirical support exists for the hypothesis that coastal wolves are synonymous with subspecies found east of the coastal cordillera, contrary to Chambers et al. (2012). If a goal of infraspecific classification is to recognize substantive geographic variation (e.g., O'Brien and Mayr

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1991; Avise 2004), then genetic, behavioral, and ecological data from coastal wolves (Weckworth et al. 2005, 2010, 2011; Muñoz-Fuentes et al. 2009, 2010; Stronen et al. 2014) refute Nowak's (1995, 2002) proposition that *C. l. ligoni* be subsumed in *C. l. nubilus*.

Later, in *Taxonomy and Management*, Cronin et al. (2015) imply that we should reject the subspecies concept not only for wolves, but for all species. The authors assert that "it is important to acknowledge that subspecies designations, including those of wolves, are generally subjective" (p. 34). It is one thing to assert that *C. l. ligoni* is invalid because one does not subscribe to the subspecies concept, and yet another to demonstrate that this subspecies is invalid based on the consensus from a range of empirical data that transcend morphological and molecular attributes. Our purpose here is not to debate the validity of the subspecies concept, but simply to point out that the conclusions presented in Cronin et al. (2015) are inconsistent with their data. Nevertheless, given their acknowledgment of criteria for subspecies designation and reference to taxonomic treatises that address subspecies taxonomy of wolves, and despite their protests regarding subjectivity, we proceed under the assumption that Cronin et al. (2015) have accepted that the taxonomic unit of interest here is the subspecies.

Although the definition of subspecies has become an increasingly controversial issue, in part due to the use of subspecies as a unit of conservation (Haig et al. 2006), many evolutionary biologists define subspecies as *groups of populations* that are distinguishable and restricted to a geographic region, where characters could overlap to some small degree, and that (as conspecifics) could have the ability to, or may, interbreed with adjoining subspecies (Mayr and Ashlock 1991). By this definition, Cronin et al.'s (2015) finding of population structure among wolves within the Alexander Archipelago does not falsify a subspecies designation; neither does the reported lack of monophyly across SNPs in samples from GMU1 with other southeast Alaska GMUs. In fact, monophyly at nuclear alleles is not always found between species (e.g., vonHoldt et al. 2011), much less subspecies. Limited gene flow (or, alternatively, lack of lineage sorting) between a few northern coastal and continental wolves was surmised in mitochondrial DNA analyses (Weckworth et al. 2010, 2011), although levels of gene flow were hypothesized to be low and insufficient to homogenize nuclear microsatellite alleles in these wolf populations (Weckworth et al. 2005). We submit that few systematists would agree with Cronin et al. (2015) that subspecies should be defined on the basis of complete reproductive isolation (Crandall et al. 2000), and fewer would suggest that subspecies cannot comprise more than one population.

Based on traditional population pairwise F_{ST} values and Bayesian clustering analyses, Cronin et al. (2015) demonstrate that populations within southeast Alaska show high levels of intra-regional differentiation that are similar to levels found between southeast Alaska and other North American wolves, and greater than inter-regional differentiation among interior wolves. Cronin et al. (2015) interpret this to indicate lack of isolation of southeast Alaska, but failed to rigorously test whether the distribution of genetic variation in wolves of the Alexander Archipelago support or reject the subspecies hypotheses called *C. l. ligoni*. Cronin et al. (2015) did not conduct multiple hierarchical-level significance testing, such as hierarchical analysis of molecular variance (Excoffier et al. 1992) that would have identified significant hierarchical partitions in the dataset, or fixed K-clustering analyses that would reveal partitions deeper than the population level. Their analyses that most specifically test for differentiation between regional (subspecies) levels were PCoA (Figure 2, Cronin et al. 2015) and neighbor joining analyses (Figure 4, Cronin et al. 2015), although the latter is of limited value due to failure to report bootstrap values to assess robust nodes. We note, however, PCoA did show two separate regional-level clusters, one comprised solely of wolves of southeast Alaska (with a single exception of a BC wolf, likely from Vancouver Island), and one comprised almost exclusively of wolves from outside southeast Alaska except for a few mainland coastal individuals. This is not surprising as the coastal mainland, especially near major river drainages that bisect the Coast Mountains, is where multiple distinctive mammal lineages (Cook et al. 2006; MacDonald and Cook 2007) and species (Runck et al. 2009) come into contact. Our concerns with Cronin et al. (2015) also are related to sampling strata (e.g., combining the single Vancouver Island (coastal) sample with 34 samples from interior BC) and repeatability of analyses due to lack of geo-references or archived specimens.

Whether recognizing the coastal wolves as a subspecies or simply a set of distinct populations, 2 points are key: 1) A large set of characters (morphological, behavioral, and ecological), including a series of independent genetic analyses, consistently demonstrates that coastal southeast Alaska wolves are distinctive from continental wolves (those populations found interior of Pacific coastal mountain ranges); and 2) these populations harbor a disproportionately large amount of unique genetic variation of this carnivore in North America. Both points represent scientific evidence of discreteness and significance of the coastal Alaskan wolves within the criteria necessary for agency protection under the Endangered Species Act (Federal Register 1996). These biological findings are not surprising as this region has a dynamic geologic history characterized by isolation of organisms from the continent throughout the late Quaternary. Isolation, which continues today due to high coastal mountains and Holocene fragmentation of the Alexander Archipelago, has produced considerable faunal complexity and a disproportionately large number of endemic lineages (e.g., *Mustela erminea*; Cook and MacDonald 2001; Dawson et al. 2014). Endemics for a number of taxonomic groups are only now being discovered and described due to newly available specimens and novel molecular approaches (e.g., Barry and Tallmon 2010; Sikes and Stockbridge 2013).

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1991; Avise 2004), then genetic, behavioral, and ecological data from coastal wolves (Weckworth et al. 2005, 2010, 2011; Muñoz-Fuentes et al. 2009, 2010; Stronen et al. 2014) refute Nowak's (1995, 2002) proposition that *C. l. ligoni* be subsumed in *C. l. nubilus*.

Later, in *Taxonomy and Management*, Cronin et al. (2015) imply that we should reject the subspecies concept not only for wolves, but for all species. The authors assert that "it is important to acknowledge that subspecies designations, including those of wolves, are generally subjective" (p. 34). It is one thing to assert that *C. l. ligoni* is invalid because one does not subscribe to the subspecies concept, and yet another to demonstrate that this subspecies is invalid based on the consensus from a range of empirical data that transcend morphological and molecular attributes. Our purpose here is not to debate the validity of the subspecies concept, but simply to point out that the conclusions presented in Cronin et al. (2015) are inconsistent with their data. Nevertheless, given their acknowledgment of criteria for subspecies designation and reference to taxonomic treatises that address subspecies taxonomy of wolves, and despite their protests regarding subjectivity, we proceed under the assumption that Cronin et al. (2015) have accepted that the taxonomic unit of interest here is the subspecies.

Although the definition of subspecies has become an increasingly controversial issue, in part due to the use of subspecies as a unit of conservation (Haig et al. 2006), many evolutionary biologists define subspecies as *groups of populations* that are distinguishable and restricted to a geographic region, where characters could overlap to some small degree, and that (as conspecifics) could have the ability to, or may, interbreed with adjoining subspecies (Mayr and Ashlock 1991). By this definition, Cronin et al.'s (2015) finding of population structure among wolves within the Alexander Archipelago does not falsify a subspecies designation; neither does the reported lack of monophyly across SNPs in samples from GMU1 with other southeast Alaska GMUs. In fact, monophyly at nuclear alleles is not always found between species (e.g., vonHoldt et al. 2011), much less subspecies. Limited gene flow (or, alternatively, lack of lineage sorting) between a few northern coastal and continental wolves was surmised in mitochondrial DNA analyses (Weckworth et al. 2010, 2011), although levels of gene flow were hypothesized to be low and insufficient to homogenize nuclear microsatellite alleles in these wolf populations (Weckworth et al. 2005). We submit that few systematists would agree with Cronin et al. (2015) that subspecies should be defined on the basis of complete reproductive isolation (Crandall et al. 2000), and fewer would suggest that subspecies cannot comprise more than one population.

Based on traditional population pairwise F_{ST} values and Bayesian clustering analyses, Cronin et al. (2015) demonstrate that populations within southeast Alaska show high levels of intra-regional differentiation that are similar to levels found between southeast Alaska and other North American wolves, and greater than inter-regional differentiation among interior wolves. Cronin et al. (2015) interpret this to indicate lack of isolation of southeast Alaska, but failed to rigorously test whether the distribution of genetic variation in wolves of the Alexander Archipelago support or reject the subspecies hypotheses called *C. l. ligoni*. Cronin et al. (2015) did not conduct multiple hierarchical-level significance testing, such as hierarchical analysis of molecular variance (Excoffier et al. 1992) that would have identified significant hierarchical partitions in the dataset, or fixed K-clustering analyses that would reveal partitions deeper than the population level. Their analyses that most specifically test for differentiation between regional (subspecies) levels were PCoA (Figure 2, Cronin et al. 2015) and neighbor joining analyses (Figure 4, Cronin et al. 2015), although the latter is of limited value due to failure to report bootstrap values to assess robust nodes. We note, however, PCoA did show two separate regional-level clusters, one comprised solely of wolves of southeast Alaska (with a single exception of a BC wolf, likely from Vancouver Island), and one comprised almost exclusively of wolves from outside southeast Alaska except for a few mainland coastal individuals. This is not surprising as the coastal mainland, especially near major river drainages that bisect the Coast Mountains, is where multiple distinctive mammal lineages (Cook et al. 2006; MacDonald and Cook 2007) and species (Runck et al. 2009) come into contact. Our concerns with Cronin et al. (2015) also are related to sampling strata (e.g., combining the single Vancouver Island (coastal) sample with 34 samples from interior BC) and repeatability of analyses due to lack of geo-references or archived specimens.

Whether recognizing the coastal wolves as a subspecies or simply a set of distinct populations, 2 points are key: 1) A large set of characters (morphological, behavioral, and ecological), including a series of independent genetic analyses, consistently demonstrates that coastal southeast Alaska wolves are distinctive from continental wolves (those populations found interior of Pacific coastal mountain ranges); and 2) these populations harbor a disproportionately large amount of unique genetic variation of this carnivore in North America. Both points represent scientific evidence of discreteness and significance of the coastal Alaskan wolves within the criteria necessary for agency protection under the Endangered Species Act (Federal Register 1996). These biological findings are not surprising as this region has a dynamic geologic history characterized by isolation of organisms from the continent throughout the late Quaternary. Isolation, which continues today due to high coastal mountains and Holocene fragmentation of the Alexander Archipelago, has produced considerable faunal complexity and a disproportionately large number of endemic lineages (e.g., *Mustela erminea*; Cook and MacDonald 2001; Dawson et al. 2014). Endemics for a number of taxonomic groups are only now being discovered and described due to newly available specimens and novel molecular approaches (e.g., Barry and Tallmon 2010; Sikes and Stockbridge 2013).

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Abstract

A major flood in February 1996 triggered more than 100 geomorphic features affecting forest roads in a 181 km^2 study area in the western Cascade Range, Oregon. Eight types of features, including mass movements and fluvial features, were mapped, measured and analysed using geographic information systems and sediment budgets for the road network. Although roads functioned as both production and depositional sites for mass movements and fluvial processes, the net effect of roads was an increase in basin-wide sediment production. Debris slides from mobilized road fills were the dominant process of sediment production from roads. Road-related sedimentation features were concentrated in a portion of the study area that experienced a rain-on-snow event during the storm and was characterized by the oldest roads and steep slopes underlain by unstable, highly weathered bedrock. The downslope increase in frequency of features and volumes of sediment produced, combined with the downslope increase in relative frequency of fluvial over mass-wasting processes, suggests that during an extreme storm event, a road network may have major impacts on stream channels far removed from initiation sites. Overall this study indicated that the nature of geomorphic processes influenced by roads is strongly conditioned by road location and construction practices, basin geology and storm characteristics. Published in 2001 by John Wiley & Sons, Ltd.

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Strength of tree roots and landslides on Prince of Wales Island, Alaska

Tien H. Wu, , William P. McKinnell III, and , Douglas N. Swanston

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Canadian Geotechnical Journal, 1979, 16(1): 19-33, https://doi.org/10.1139/t79-003

ABSTRACT

The stability of slopes before and after removal of forest cover was investigated. Porewater pressures and shear strengths were measured and the soil properties were determined by laboratory and *in situ* tests. A model of the soil–root system was developed to evaluate the contribution of tree roots to shear strength. The computed safety factors are in general agreement with observed behaviors of the slopes. Decay of tree roots subsequent to logging was found to cause a reduction in the shear strength of the soil–root system.

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Risk of Landslides in Shallow Soils and Its Relation to Clearcutting in Southeastern Alaska

TIEN H. WU
DOUGLAS N. SWANSTON

ABSTRACT. A significant increase in the frequency of landslides in shallow soils on hillside slopes of southeastern Alaska following timber harvest by clearcutting has been observed. This phenomenon relates to the loss of root strength and evapotranspiration stress that follows the cutting of the trees. A method for evaluating the landslide risk is described in this paper. A hillside with a nearly uniform slope is represented by an infinite slope and the piezometric level required for shear failure is computed. A one-dimensional infiltration-seepage model is used to calculate the response of the piezometric level to rainfall. Weather data are used to calculate the probability of the piezometric level exceeding the value required for slope failure. Uncertainties in soil strength and slope angle may also be accounted for in the calculation of failure probability. Field data obtained from a site near Hollis, Alaska, are used to illustrate the method of risk evaluation and cost analysis. FOREST SCI. 26:495–510.

ADDITIONAL KEY WORDS. Failure probability, piezometric level, slope stability.

TIMBER HARVEST BY CLEARCUTTING is a common practice in the coniferous forests of the Cordilleran area. Among the many ecological problems caused by clearcutting in this area are the effects on the stability of steep hillside slopes. Data have been presented to show that clearcutting increases the creep rate of slopes (Barr and Swanston 1970, Gray 1970). Empirical evidence gathered in southeastern Alaska (Bishop and Stevens 1964, Swanston 1969) indicates that the frequency of landslides classified as debris avalanches increases significantly a few years after clearcutting. The debris avalanches in southeastern Alaska usually occur during periods of heavy autumn rain and begin with a small slide located near the top of the slope. Because of the high water content, the disturbed soil flows rapidly downhill as a viscous fluid and erodes much of the soil along its path. This results in a scar that extends from the initial slip to the bottom of the slope (Fig. 1). The probable occurrence of debris avalanches and its consequences are clearly important factors to be considered in the planning of logging operations.

Because the various factors that contribute to the development of a debris avalanche cannot be predicted with precision, a probabilistic approach to risk evaluation is appropriate. This approach is comparatively simple when applied to slides on approximately uniform or planar slopes with a shallow soil cover underlain by impervious bedrock such as those near Hollis, Alaska. Hence, solutions for these special conditions are readily obtained. The solutions presented

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FIGURE 1. View of south-facing slope of Maybeso Valley, 1975 (light colored stripes are slide scars).

here also serve to illustrate the general approach of probabilistic risk evaluation and its application to forest management practice. This paper first summarizes the mechanism of the debris avalanche and the environmental factors that control slope stability. It then outlines procedures that may be used to evaluate risk of debris avalanches and assess potential damage or loss. Analysis of the slopes near Hollis is used as an example.

MECHANISM OF LANDSLIDES

Figure 2 shows a hillside with a nearly uniform slope. The depth of the soil cover is $(h + h')$[1] and ab indicates the bedrock surface which is parallel to the ground surface. Such a slope may be analyzed as an infinite slope (e.g., Lambe and Whitman 1969). The soil mass is shown as a block abcd. The forces that act on the mass include the weight of the soil W_s, the weight of the trees W_t, the wind force on the trees F_w, and the shear and normal forces on the surface ab, T and N, respectively. The shearing resistance along ab is defined by

$$S = [c' + (\sigma - u)\tan \phi' + s_r]\ell \tag{1}$$

where c' and ϕ' are the cohesion and angle of internal friction in terms of effective stresses, respectively, $\sigma = N/\ell$ is the normal stress, u is the porewater pressure, and s_r is the contribution of the roots to shear strength. Shear failure along ab occurs if the force T required for equilibrium of the block is equal to the shearing resistance S,

$$S = T \tag{2}$$

or

$$\left[c' + \left\{(W_s + W_t)\frac{\cos \alpha}{\ell} - u\right\}\tan \phi + s_r\right]\ell = (W_s + W_t)\sin \alpha + F_w. \tag{3}$$

The forces W_s, W_t, F_w may be estimated without too much difficulty. The

[1] All symbols are collected and defined at the end of the text.

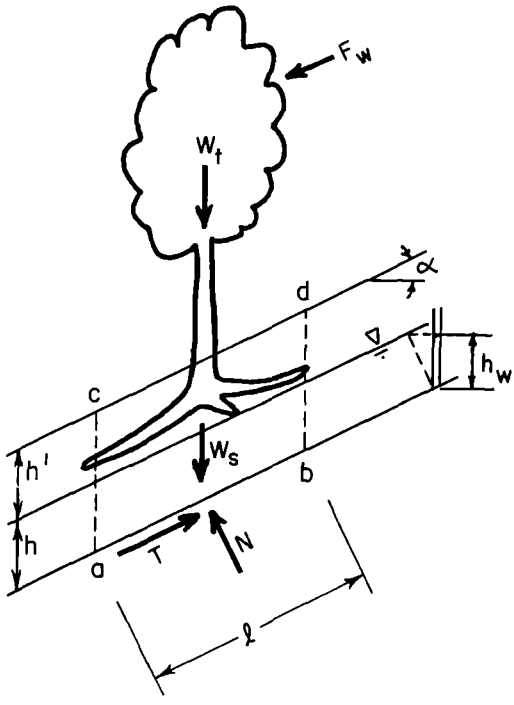

FIGURE 2. Forces on sliding soil mass (symbols are explained in text).

values of c' and ϕ' should be measured by appropriate shear tests and s_r may be determined from root strength and root density. The results of tests on live roots of Sitka spruce (*Picea sitchensis* (Bong.) Carr.), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and Alaska yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach) in southeastern Alaska indicate that (Wu and others 1979)

$$s_r = 1.2t_r \tag{4}$$

and t_r is given by

$$t_r = \Sigma T_{ri} n_i \tag{5}$$

where T_{ri} = failure load of a root with diameter i, n_i = number of roots with diameter i per unit area of soil.

The porewater pressure u is related to the elevation of the groundwater table. For seepage parallel to the ground surface (Fig. 2)

$$u = \gamma_w h_w = \gamma_w h \cos^2\alpha \tag{6}$$

where γ_w is the unit weight of water and h_w, h, and α are as shown in Figure 2.

At a specific location, when all the above quantities are known one may calculate the safety factor of a slope, defined as the ratio

$$F = S/T. \tag{7}$$

A safety factor of one or less indicates that failure should occur and a safety factor larger than one indicates stability. Alternatively, the value of h which would cause failure (denoted by h_f) can be calculated given the forces W_s, W_t, and F_w, soil properties, and slope angle.

In the planning of timber harvest the question would be: what is the steepest

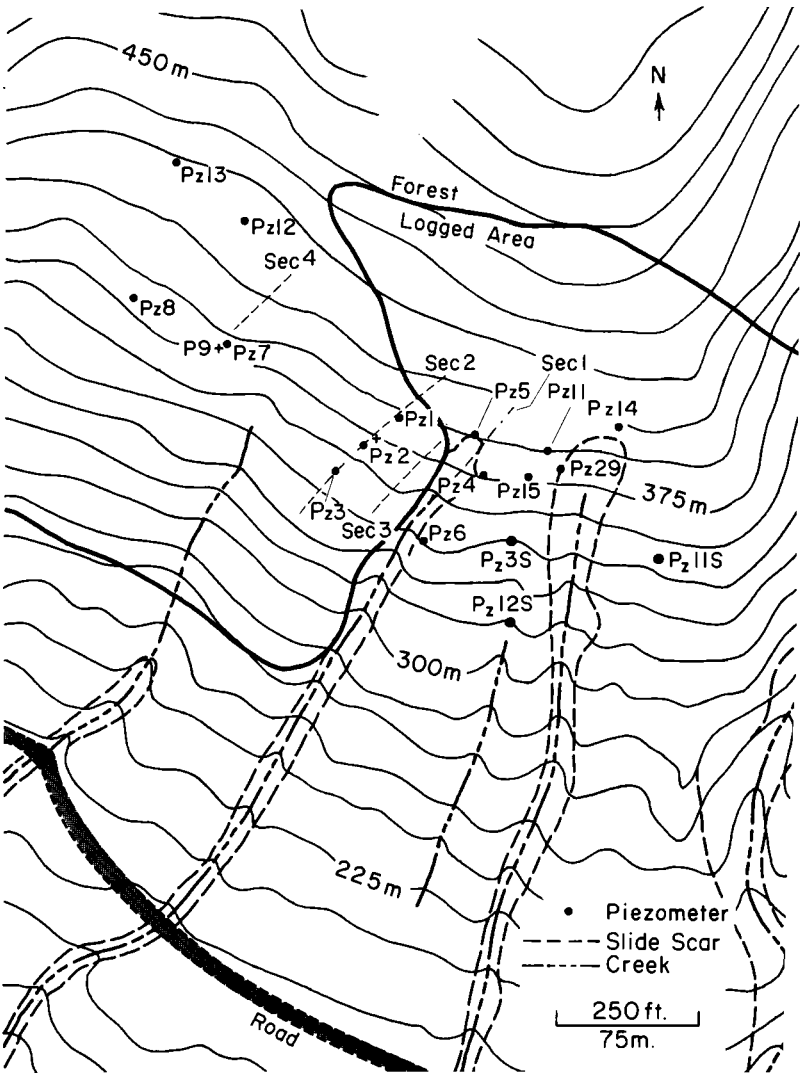

FIGURE 3. Locations of piezometers, Maybeso Valley.

slope (maximum α) that could be logged without causing failure? The value of α required for failure could be calculated from Equation (3) if the forces, soil properties, and piezometric head are known. However, all of these quantities can only be estimated and uncertainties are involved. The piezometric head h_w may be expected to fluctuate with rainfall and other seasonal effects and is difficult to predict. In the probabilistic approach, we estimate the probability that the piezometric head h_w will be equal to or exceed a given value during a specified time interval. For given slope angle α, soil properties, W_s, W_t, and F_w, the probability that h will be equal to or greater than the calculated h_f is also the probability of failure. In addition, if the area is large, the soil properties c' and ϕ' may vary over a considerable range as natural soils are nonhomogeneous. The slope angle α may also be expected to vary over a large area due to local topographic features such as drainage depressions. Estimates of their mean values and their dispersions

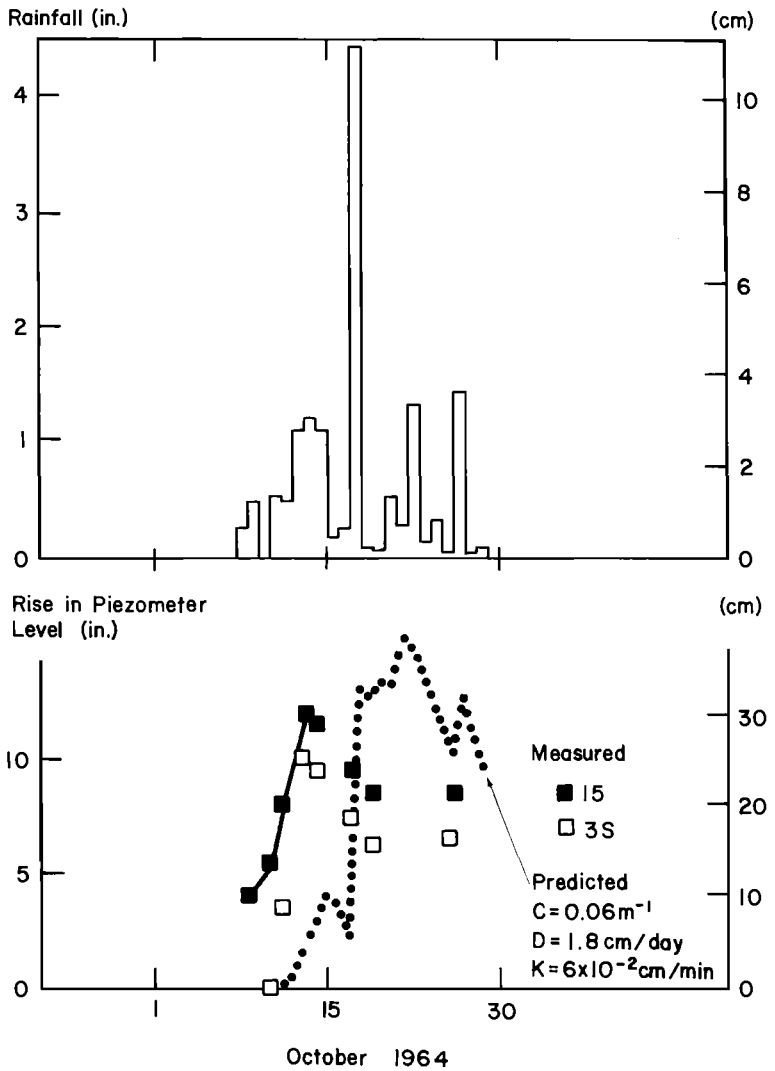

FIGURE 4a. Piezometric levels, 1964, Maybeso Valley.

from the means can be made and the uncertainties can also be accounted for in the probability analysis. The decision problem then becomes one of choosing the acceptable failure probability.

PIEZOMETRIC HEAD

On hillside slopes with shallow soil cover underlain by impervious bedrock such as that shown in Figure 2, the piezometric head usually rises rapidly during rainstorms, followed by a rapid drop. The characteristics of the rise and fall in relation to the rainfall depends on the slope angle, depth of the soil cover, soil permeability K, the slope of the soil moisture-suction curve C, and evapotranspiration loss. Clearcutting may alter these factors by various degrees and in turn may affect the response of the piezometric head to rainfall. This is illustrated by the results of porewater pressure measurements in the Maybeso Valley near Hollis (Swanston 1967, Wu and others 1979).

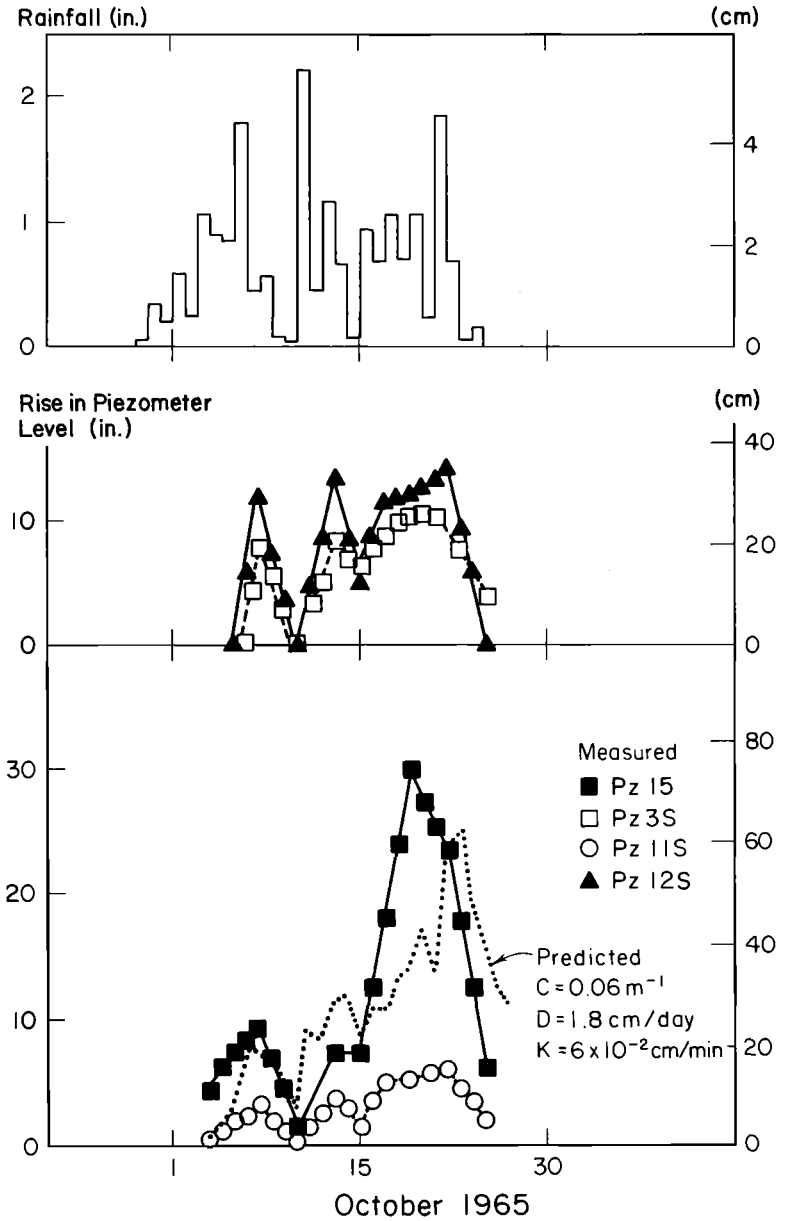

FIGURE 4b. Piezometric levels, 1965, Maybeso Valley.

Figure 3 shows the instrumentation on the slope. The measured porewater pressures in late September and October of 1964 and 1965, about 4 years after a part of the area was logged by clearcutting, are shown in Figures 4a and b. Figure 4c shows the measured porewater pressures in late September and October 1974 after a regrowth of Sitka spruce has been established on the logged slopes. During the relatively dry summer months the piezometric level is very small or zero. Substantial rises in the piezometric level occur only after the autumn rains begin as shown in Figure 4. To compare the piezometric levels under different conditions, consider first the piezometric levels in 1974. The piezometric levels in the

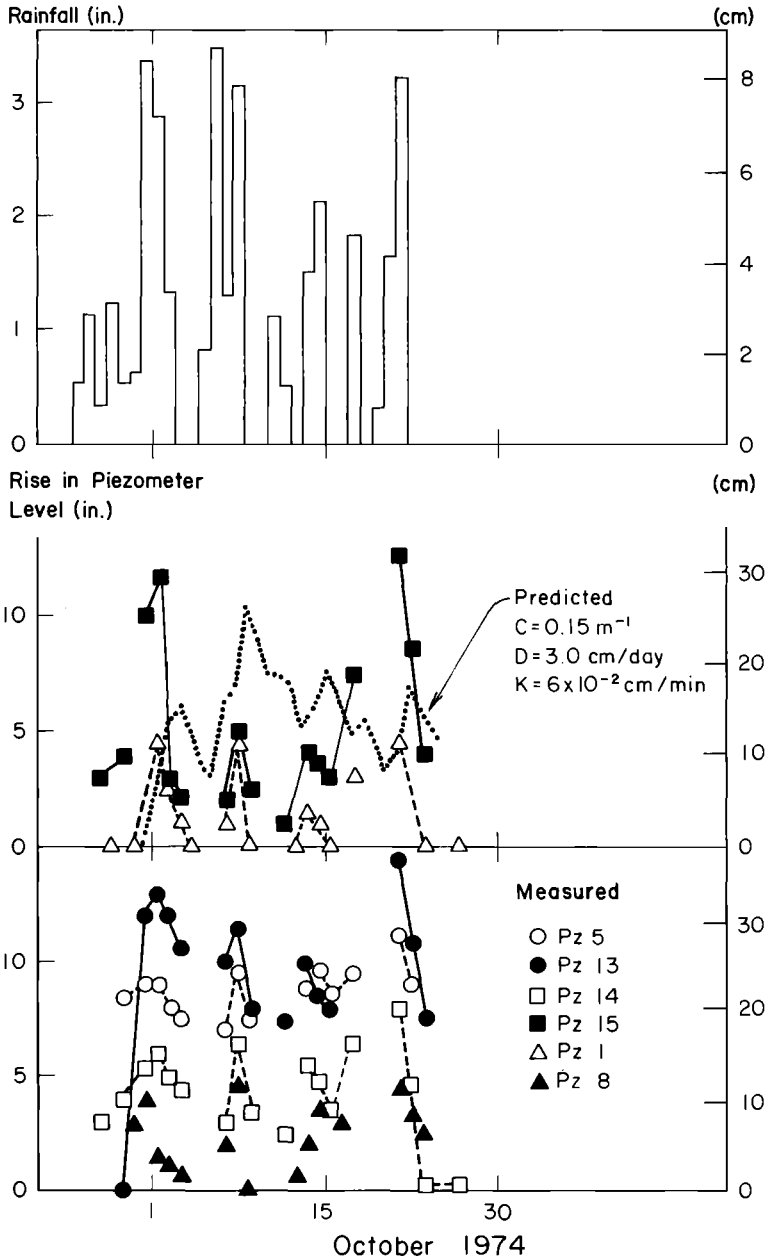

FIGURE 4c. Piezometric levels, 1974, Maybeso Valley.

regrowth area (Pz 14, Pz 15) are about the same as those in the uncut forest (Pz 13). However, comparison of the piezometric levels of 1974 with those of 1965 shows significant differences. In piezometer Pz 15, which was replaced in 1974, the measured level in 1965 is much higher than that in 1974, although the rainfall intensity for 1965 is considerably lower. Comparison between 1965 and 1974 porewater pressures in other piezometers is more difficult because the piezometers are not placed in precisely the same locations and the porewater pressures

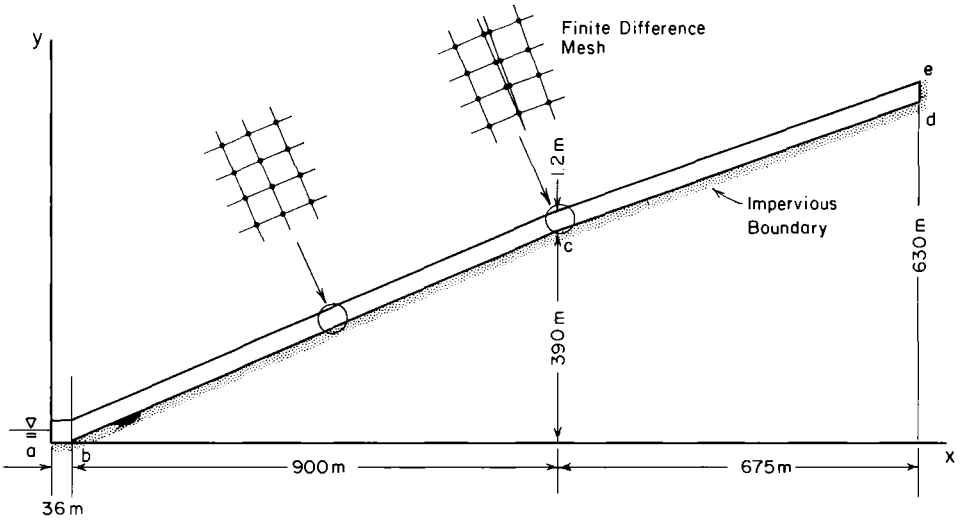

FIGURE 5. Simplified cross section of slope and finite difference mesh used for seepage computation.

appear to vary considerably within short distances. Nevertheless, it can be seen that the porewater pressures in 1965 are at least as large as those in 1974, although the rainfall in 1965 is considerably lower. The record for 1964 is not as reliable because piezometer readings were not made every day as they were in 1965 and 1974. However, the measured piezometer rises and rainfall in 1964 are both close to those of 1965.

The fluctuation in the piezometric levels is the net result of rainfall entering the ground, the evapotranspiration loss, and the drainage loss due to seepage and interception. The rainfall may be obtained from the precipitation record. The drainage loss due to seepage was analyzed by considering the slope as two-dimensional and solving the differential equation for two-dimensional flow (Bear 1972)

$$\frac{\partial}{\partial x}\left[K(\underline{h})\frac{\partial \underline{h}}{\partial x}\right] + \frac{\partial}{\partial z}\left[K(\underline{h})\frac{\partial \underline{h}}{\partial z}\right] = (1 - n)G_s C(h_w)\frac{\partial \underline{h}}{\partial t} + q \qquad (8)$$

where $\underline{h}$ = the head, $\frac{\partial \underline{h}}{\partial x}$ and $\frac{\partial \underline{h}}{\partial z}$ = gradients in the x and z directions, t = time, K = the permeability, $C(h_w)$ = slope of soil moisture-suction curve, q = source term, n = porosity, and G_s = specific gravity. Equation (8) may be solved numerically by the method of finite differences (Carnahan and others 1969). The Maybeso valley slope is simplified as shown in Figure 5 together with the finite difference grid. With no rainfall, the computed drop in water table due to seepage is about 0.6 cm/day.

The potential evapotranspiration has been estimated by Thornthwaite's method to be of the order of 90 cm/year (Gass and others).[2] While the distribution of evapotranspiration throughout the year is not known for this location, results of measurements by Fritschen and others (1977) indicate that evapotranspiration of a Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) in Washington continued

[2] Gass, C. R., R. F. Billings, and M. E. Stephens. Soil Management Report for the Hollis Area, South Tongass National Forest, Ketchikan, AK.

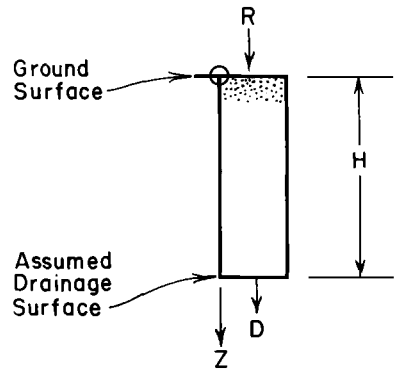

FIGURE 6. One-dimensional flow (symbols are explained in text).

at a nearly uniform rate well into November. Since the climate at Hollis is similar one may infer that evapotranspiration continues during the autumn rain season. Assuming that all the potential evapotranspiration occurs during the 4 months from July through October gives an evapotranspiration rate of 0.75 cm/day as an upper limit. It is known that evapotranspiration can vary over a wide range depending on solar radiation, air temperature and humidity, wind speed, and soil moisture (Molchanov 1960, Penman 1967, Sellers 1969). While available data are inadequate for accurate representation of the evapotranspiration, the rough estimate indicates that it is of the same order of magnitude as the seepage loss and hence both would strongly influence the piezometric level during and after rainstorms.

In order to analyze the fluctuations in the piezometric level and determine the effect of evapotranspiration and other factors we simplify the problem and consider only one-dimensional infiltration (Fig. 6). Here H represents the thickness of the previous soil lying on top of an impervious base. Equation (8) then reduces to

$$K\frac{\partial^2 \underline{h}}{\partial z^2} = (1 - n)G_s C(h_w)\frac{\partial \underline{h}}{\partial t} + q. \tag{9}$$

The boundary conditions are

$$z = 0, \quad K\frac{\partial \underline{h}}{\partial z} \begin{array}{ll} = R & \text{if } \underline{S} < 1 \\ = 0 & \text{if } \underline{S} = 1 \end{array} \tag{10}$$

where R is the rainfall and $\underline{S}$ is the degree of saturation. The evapotranspiration and seepage parallel to the slope are combined into a discharge rate D. It is assumed that this occurs at the bottom of the previous soil layer whose thickness is H, or

$$z = H, \quad K\frac{\partial \underline{h}}{\partial z} = D. \tag{11}$$

The soil properties are K, n, G_s, and C, and the input parameters are R and D.

If all these are known, Equations (9), (10), and (11) may be used to compute the values of $\underline{h}$ at different depths and times. The groundwater surface at any time is the point at which $h_w = 0$. This allows us to obtain the fluctuations of h with time. However, in the present case we wish to evaluate the effect of D on measured piezometric level. This was accomplished empirically by calibrating it against observed fluctuations of the groundwater level. Calculations were made with different values of D to obtain the best fits to the data. These are shown as

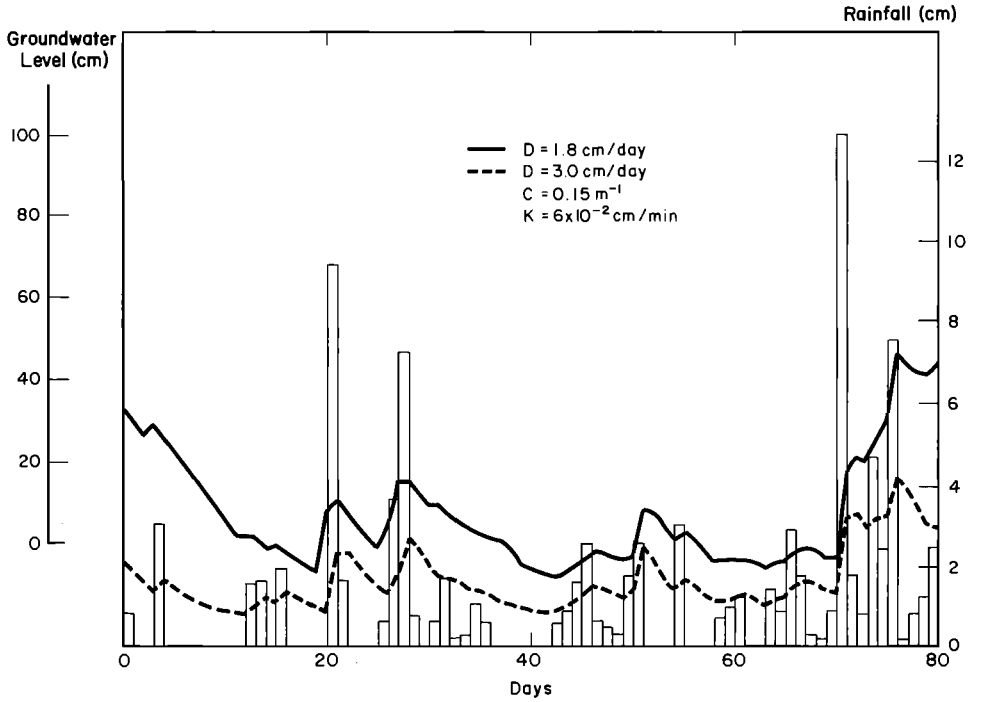

FIGURE 7. Simulated piezometric levels.

dotted lines in Figures 4a, 4b, and 4c and the values of D and C are also indicated. We note that the piezometric levels measured in the different piezometers do not always show the same pattern of fluctuation. The computed curves are taken as representative of the average conditions in the upper part of the slope (Pz 15 in Figs. 4a and b; and Pz 5, Pz 13, Pz 14, Pz 15 in Fig. 4c). Comparing the values of D and C used in the analytical models in Figures 4a, 4b, and 4c, we see that the difference in porewater pressure response between 1965 and 1974 represents a change of D from 1.8 cm/day in 1965 to 3.0 cm/day in 1974 and of C from 0.06 to 0.15 m^{-1}. These values of D are of the same order of magnitude as the sum of the estimated seepage loss and evapotranspiration loss. The increased value of D for 1974 may be attributed to increased evapotranspiration loss because of the regrowth. It can also include the effect of a lower antecedent soil moisture because of the regrowth. This may also be the reason for the larger value of C in 1974 since C is known to increase with decreasing soil moisture.

While the one-dimensional model is approximate and does not account for all of the factors that contribute to fluctuations of the piezometric level, the preceding example shows that if adequate data are available for a site, an analytical model may be calibrated with the data and used to simulate the average groundwater level. The actual groundwater level at a particular point may be expected to differ from the predicted average as shown in Figure 4. This difference is the error introduced by uncertainties in the model and the parameters.

RISK EVALUATION

The results cited in the preceding sections indicate that the various parameters that affect slope stability cannot be determined with precision even with extensive field instrumentation. A rational method that takes into account the uncertainties

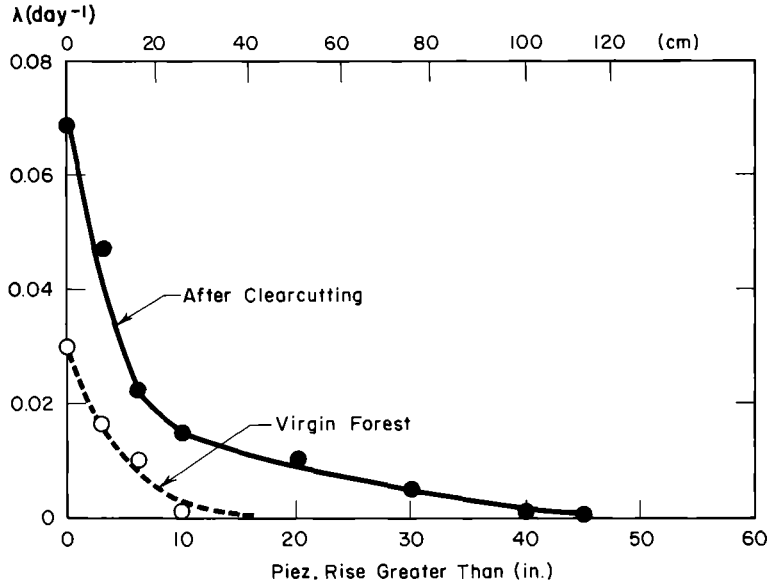

FIGURE 8. Distribution of piezometric levels.

is the use of probability theory to assess risk. As an illustration, this approach is used to assess the risk of debris avalanches in the Maybeso Valley. We first simplify the problem by assuming that all the parameters except the porewater pressure are precisely known. Then the problem consists of estimating the probability that u will reach a level that will satisfy Equation (3).

In order to compute porewater pressure, it is necessary first to obtain weather data for the period under consideration. We assume that the nature of precipitation in the future will remain the same as in the past. Then the rainfall record may be generated by Monte Carlo simulation. We first simulate the daily occurrence of rainfall and no rainfall as a Markov chain (Haan and others 1976) in which the states 1 and 2 represent rain and no rain, respectively. The transition matrix is

$$P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} \tag{12}$$

in which P_{ij} represents the transition from state i to state j. Because heavy rainstorms in the Hollis area occur mostly during the months of September, October, and November, the recorded rainfall at Ketchikan for these months from 1972 through 1974 (Environmental Science Services Administration 1972–74) were used to obtain

$$P = \begin{bmatrix} 0.78 & 0.22 \\ 0.34 & 0.66 \end{bmatrix}. \tag{13}$$

The weather for the first day was generated using the fractions of days with and without rain. The presence or absence of rainfall on the subsequent days was generated with the transition matrix, Equation (13).

For a rainy day, the amount of rainfall was generated from the distribution of rainfall for the months of September, October, and November 1972–74. The one-dimensional model, Equation (9), was used to compute the groundwater level. An example of simulated rainfall and groundwater level is shown in Figure 7. To

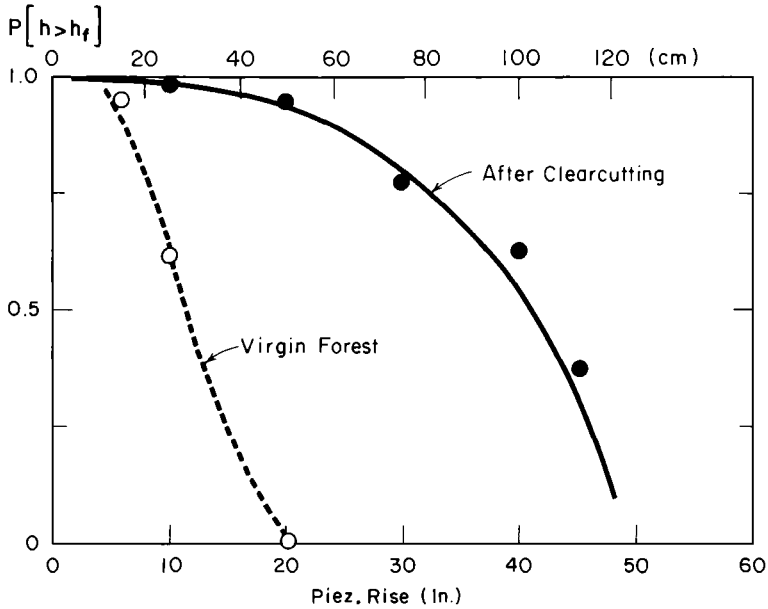

FIGURE 9. Probability of piezometric height (h) exceeding the height required for failure (h_f).

determine the probability of the groundwater level h exceeding a given value at least once during the annual rain season of approximately 3 months, we should carry out the simulation for a large number of 3-month periods. Then the probability is the number of rain seasons in which the level is exceeded divided by the total number of rain seasons simulated.

Alternatively a simplified approach may be taken. We determine λ, the number of times a given height h is exceeded per unit time interval from a simulated record such as Figure 7. Figure 8 shows the relation between λ and h. If we assume that the occurrences of peak groundwater level are independent of each other, then the probability that a given groundwater level h will occur at least once during a time interval t is given by the Poisson distribution

$$P(h \geqslant h_1) = 1 - e^{-\lambda t} \tag{14}$$

where h_1 = given value of h. For failure to occur, we should have $h = h_f$. Hence, the probability of failure is

$$P_f = P\,(h \geqslant h_f) = 1 - e^{-\lambda t}. \tag{15}$$

To calculate the failure probability, we consider t to be the period from 4 to 8 years after clearcutting, because, for the species in the Hollis area, the roots die after the tree is cut. Decay of roots progresses so that $S_R \rightarrow 0$ after about 4 years (Wu and others 1979). Significant regrowth is established about 8 years after logging. The rain season of September through November for 4 years constitutes about 300 days. The values calculated by Equation (15) are shown in Figure 9. Computation of h_f was made with Equations (3) and (5); the average soil properties $c' = 5.3$ kPa, $\phi' = 34.7°$; $s_r = 0$, $\alpha = 39°$, $h + h' = 1.22$ m, $W_t = 0$, $F_w = 0$, which represent the slope after clearcutting. We obtained $h_f = 0.84$ m. Hence, the probability of failure is

$$P_f = P(h \geqslant 0.84 \text{ m}). \tag{16}$$

From Figure 9, we see that the probability of this occurrence is about 0.75.

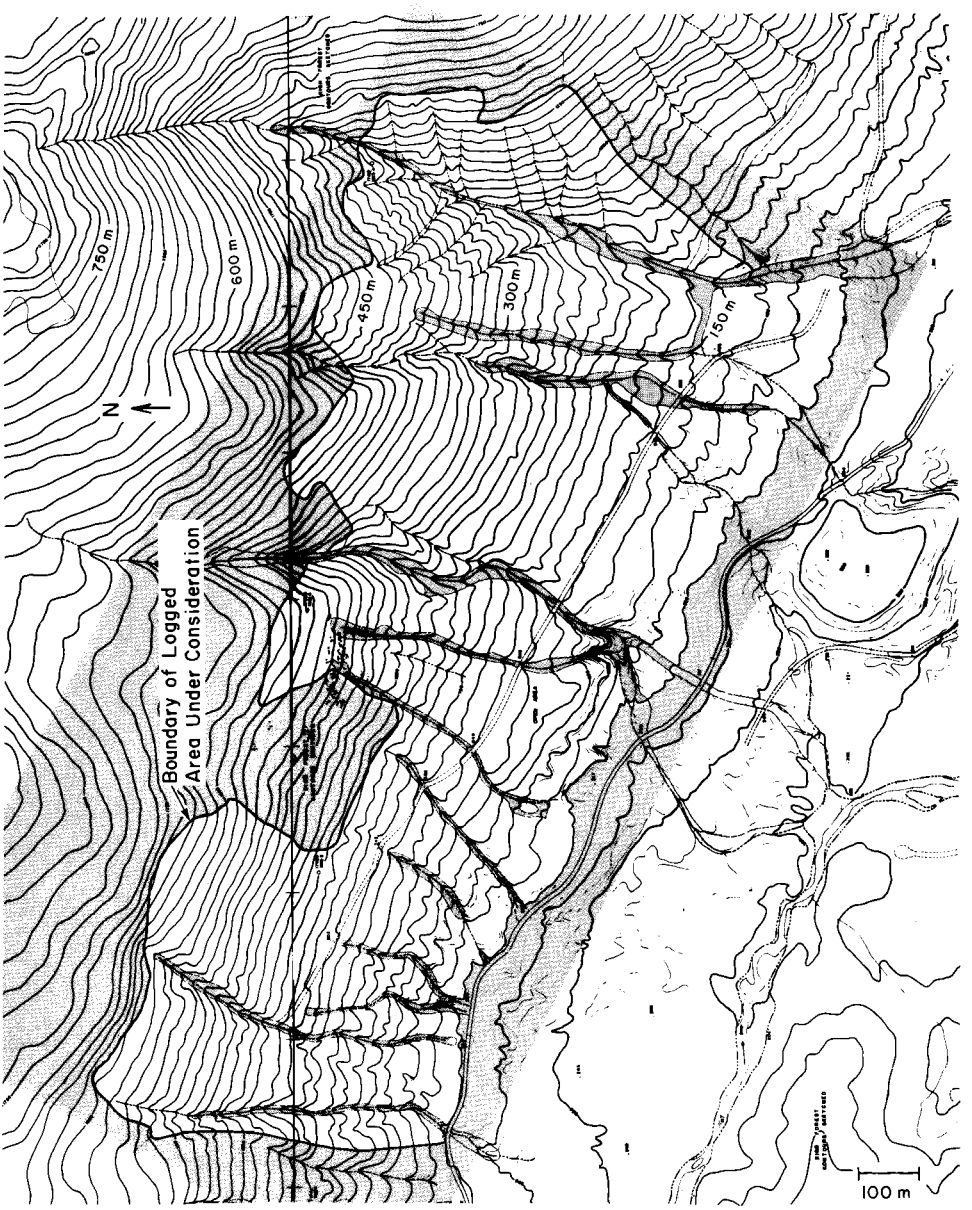

FIGURE 10. Map of a part of logged area, Maybeso Valley, showing landslide scars.

If one chooses an acceptable failure probability of, say, 0.30, then the slope angle α which will have $P_f \leq 0.30$ can be calculated. This would indicate the steepest slope that could be subjected to clearcutting without incurring a risk greater than 0.30. From Figure 9, we see that the probability of having a rise in groundwater level of 1.14 m is about 0.30. The slope that would be on the verge of failure when $h = 1.14$ m would have $\alpha = 34°$. Hence, slopes steeper than this should not be logged if the failure probability is to be kept below 0.30. If a failure probability of 0.10 is required, similar calculations give $\alpha = 32°$ as the steepest slope that can be logged.

The failure probability calculated above does not account for uncertainties about the soil strength and slope geometry and the model uncertainty. These uncertainties and their effects can be evaluated as shown in the following example. If the shear strength s, slope angle α, and the model uncertainty on h, N_h, are considered as random variables, then failure represents the joint occurrence of s, α, N_h, and $(h \geq h_f)$, or

$$P_f = P[(h \geq h_f) \cap (s, \alpha, N_h)]. \tag{17}$$

We assume that s, α, and N_h are independent but h_f is a function of s and α. Hence,

$$P_f = \sum_{s,\alpha,N_h} P[s]P[\alpha]P[N_h]P[(h \geq h_f)|(\alpha, s, N_h)] \tag{18}$$

where $P[(h \geq h_r)|(\alpha, s, N_h)]$ is given in Equation (14) and Figure 9. As an example we use the data from the Hollis site which show that the minimum and maximum shear strengths are respectively $c' = 2.1$ kPa, $\phi' = 37°$, and $c' = 6.0$ kPa, $\phi' = 44°$ (Wu and others 1979). We assume that the distribution of shear strength is uniform within these limits and there is no uncertainty about α and the model and obtain $P_f = 0.70$.

Expected Cost

The preceding examples serve only to illustrate the method of computation and do not constitute recommendations on acceptable risk. The choice of the acceptable risk or failure probability is properly a management decision. Logically, such decisions would be based on estimated socioeconomic values. Statistical decision theory may be used to estimate the cost due to probable failures. The measure used is the expected cost, defined as (Benjamin and Cornell 1970)

$$E = P_f C_f \tag{19}$$

where P_f is as defined by Equation (18) and C_f is the cost of a failure. This allows one to compare the costs with monetary benefits derived from logging. The cost of landslides is one of the items that should be included in the cost estimates.

If the volume of soil eroded is considered to be the cost, we may use the experience in the Maybeso Valley to illustrate the loss caused by debris avalanches. The map in Figure 10 shows a portion of the north slope of the Maybeso Valley. The heavy line in the figure indicates the logged area under consideration. The shaded areas indicate slide scars with no vegetation. These have a total area of approximately 0.17×10^6 m^2. The area affected by slides is about 9 percent of the area logged. An estimate of the volume of soil removed may be made with the approximation that the depth of the failure surface is 1 m below the original ground surface. The calculated volume of soil removed is then 0.17×10^6 m^3, or about 0.1 m^3/m^2 of logged area. A large area as the one under consideration may be considered to be composed of many small potential slides, each one of which represents an independent occurrence. Then the soil loss of 0.1 m^3/m^2 is equal to the expected cost E. For $P_f = 0.70$, $E = 0.1$ m^3/m^2; Equation (19) gives $C_f = 0.14$ m^3/m^2. If clearcutting were restricted to slopes with α less than 39°, P_f would be less than 0.70. The new expected cost can be computed with Equation (19) using the new P_f and $C_f = 0.14$ m^3/m^2.

Concluding Remarks

The procedure outlined in this paper may be used to assess the risk and cost of landslides due to clearcutting. It is based on the principles of soil mechanics and

seepage. Soil properties needed for the analysis may be determined from standard tests. Uncertainties caused by natural variations in soil properties, slope angles, and precipitation, and inaccuracies in the analytical models may be accounted for.

The prediction of the porewater pressure changes by the theory of infiltration and seepage requires information on evapotranspiration which is often not available. Hence, calibration of the theoretical model with measured porewater pressure is needed to overcome this problem and evaluate the model uncertainty. It will be necessary to do this for various climates, vegetation covers, and subsurface conditions.

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Symbols Used in Text

C = slope of soil moisture-suction curve
C_f = cost of a failure
c' = cohesion
D = water discharge rate
E = expected cost
F = safety factor
F_w = wind force
H = thickness of soil layer above groundwater level
h' = soil depth
h = soil depth below groundwater level
h_w = piezometric head
$\underline{h}$ = total head
h_f = piezometric head required to cause failure
K = soil permeability
ℓ = length of slip surface
N = normal force
N_h = model uncertainty factor
n = soil porosity

n_i = number of roots with diameter i per unit area of soil
P = probability
P_f = probability of failure
Pz = piezometer
q = source term
R = rainfall
S = shear resistance (force)
$\underset{\sim}{S}$ = degree of saturation
s_r = contribution of roots to shear strength
s = shear strength (stress)
T = shear force
T_{ri} = failure load of a root with diameter i
t = time
u = pore water pressure
W_s = weight of soil
W_t = weight of trees
α = slope angle
γ_w = unit weight of water
λ = the number of times a given h is exceeded per unit time interval
σ = normal stress
ϕ' = angle of internal friction

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On the variable effects of climate change on Pacific salmon

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ABSTRACT

Water temperature has manifold effects on the biology of Pacific salmon. Thermal optima enable Pacific salmon to maximize growth while temperatures above thermal optima can induce stress and lead to mortality. This study investigated the impacts of climatic changes and water management practices on Chinook and Steelhead smolts in the Columbia River Basin using an integrated earth system model and a multiple regression model that incorporated nonlinear survival responses to water temperature. Results revealed that the effects would vary significantly with the species, location, and climate change scenario. Mean survival rates may increase by more than 10% in Upper Columbia River, while reduce by 1~13% and 2~35% for Chinook and Steelhead smolts respectively, in the Lower Columbia River by 2080s. This study highlights the importance of integrating the nonlinear response of survival rate to river temperature and water management effects in climate change vulnerability analysis for salmonid stocks.

1. Introduction

Pacific salmon are among the most iconic wild animals on the planet, known for their remarkable anadromous lifestyle that takes them from spawning grounds to the high seas and back again to complete their life cycle (Groot and Margolis, 1991). In the past several decades, many salmon species and populations have experienced dramatic declines and localized extirpations across their ranges as a result of natural and anthropogenic changes (Mote et al., 2003) causing scholars to ponder their future in the Anthropocene (Mote et al., 2003; Morrongiello et al., 2012; Ward et al., 2015). The fact that Pacific salmon span so many environments (from inland rivers, to estuaries, to coastal habitats, to the high seas) during their life cycle exposes them to diverse stressors and challenges that are amplified by human activities. The mortality of salmon (and other fish) depends on both intrinsic and extrinsic factors (Morrongiello et al., 2012), with the latter most directly related to environmental conditions. Water temperature is regarded as the "master factor" (Brett, 1971) - water temperature affects growth, feeding rates, metabolism, risk of diseases, availability of food, travel time, stress and other aspects of salmonids' lifecycle and biology (EPA, 2001; Carter, 2005).

Between 1895 and 2011, the annual air temperature in the Pacific Northwest has warmed by about 0.7 °C (Crozier, 2014). Warmer air temperatures affect stream temperature, induce earlier snowmelt, and reduce flow during summer (Walters et al., 2013), resulting in a series of changes and uncertainties to the living conditions of Pacific salmon. Climate change is expected to further increase water temperature and alter flow regime throughout Columbia River Basin (CRB) (Mantua et al., 2010). Meanwhile, water demands are projected to rise with population growth and socio-economic development (Hejazi et al., 2015), which may require stronger water regulation and increased hydropower generation (Sternberg, 2010). These changes have the potential to generate considerable challenges for the salmon stocks in CRB and contribute further uncertainty regarding their future.

CRB is characterized by heavy regulation and management due to dam construction, hydropower generation and irrigation water withdrawal (Rechisky et al., 2013). Although previous studies have investigated the relationship between hydrosystem function, reservoirs and salmon (Keefer et al., 2004; Welch et al., 2008; Schaller and Petrosky, 2007), coupling such vulnerability analysis with consideration of climate change has been rare. Several studies of climate change impacts on survival of salmon in CRB suggest different outcomes although most project declining trends in survival rate (Mantua et al., 2010; Benjamin et al., 2013; van Vliet et al., 2013; Wade et al., 2013; Walters et al., 2013; Ward et al., 2015; DeBano et al., 2016). However, it remains unclear how climate change will affect salmon survival in the

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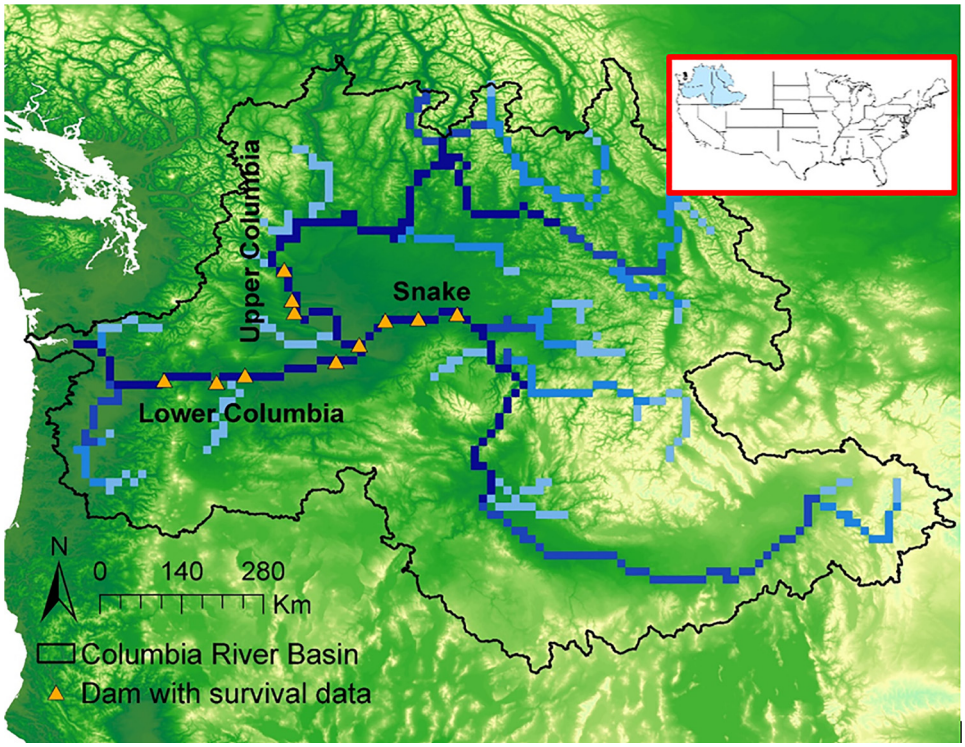

Fig. 1. Orange triangles represent data locations with survival data, background color shows vegetation coverage in terms of leaf area index extracted from Llaverie et al. (2014) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

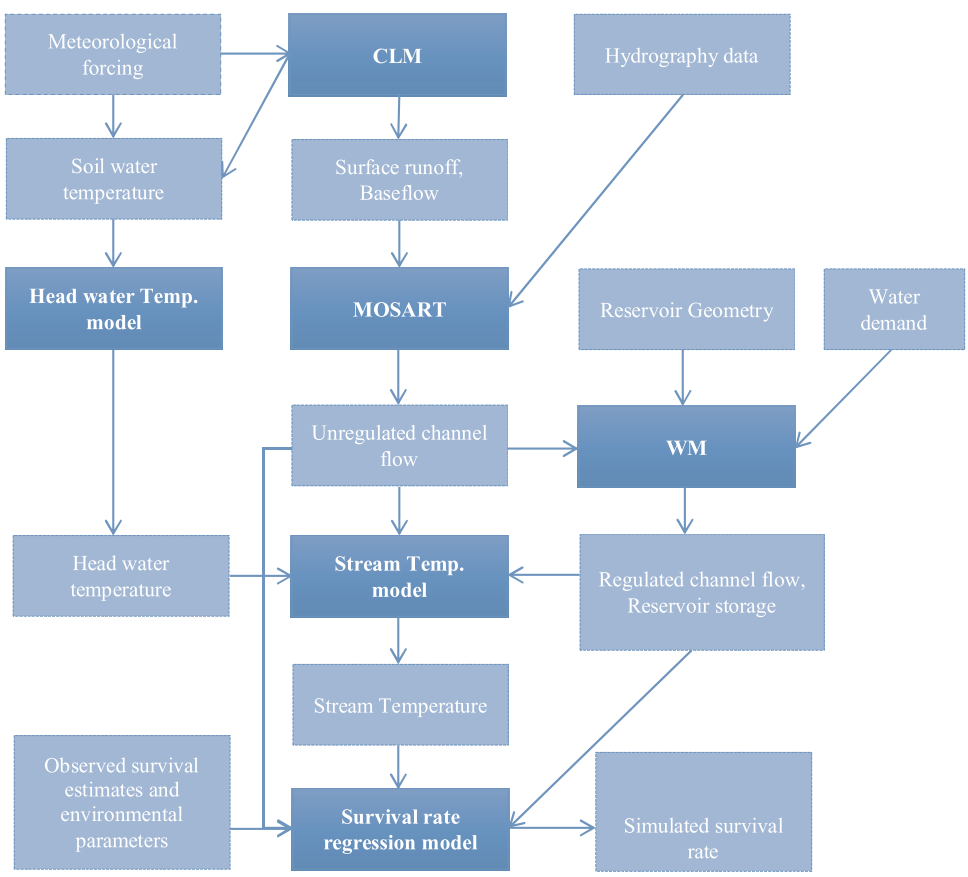

Fig. 2. Conceptual framework of MOSART and regression model (blocks with solid outline represent models, and blocks with dash outline represent data).

Table 1
A list of the CMIP5 models used in this study (Gao et al., 2014).

Model	Institution	Resolution (Lon × Lat)
1. ACCESS1.0	Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia and Bureau of Meteorology (BOM),	1.875 × 1.25
2. ACCESS1.3	Australia	1.875 × 1.25
3. BCC_CSM1.1	Beijing Climate Center, China Meteorological Administration	2.81 × 2.81
4. CanESM2	Canadian Centre for Climate Modelling and Analysis, Canada	2.81 × 2.81
5. CCSM4	National Center for Atmospheric Research, USA	1.25 × 0.9375
6. CESM1-BGC	University Corporation for Atmospheric Research	1.25 × 0.9375
7. CESM1-CAM5		1.25 × 0.9375
8. CMCC-CM	Euro-Mediterraneo sui Cambiamenti Climatici, Italy	0.75 × 0.75
9. CMCC-CMS		1.875 × 1.875
10. CNRM-CM5	Centre National de Recherches Meteorologiques, Meteo-France, France	1.41 × 1.40
11. CSIRO Mk3.6.0	Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia	1.875 × 1.875
12. EC_EARTH	Royal Netherlands Meteorological Institute	1.125 × 1.125
13. GFDL-ESM2M	NOAA/Geophysical Fluid Dynamics Laboratory, USA	2.5 × 2.0
14. GFDL-ESM2G		2.5 × 2.0
15. HadGEM2-CC	Met Office Hadley Centre, UK	1.875 × 1.25
16. HadGEM2-ES		1.875 × 1.24
17. INM-CM4.0	Institute of Numerical Mathematics, Russia	2.0 × 1.5
18. IPSL-CM5A-LR	L'Institut Pierre-Simon Laplace, France	3.75 × 1.875
19. IPSL-CM5A-MR		2.5 × 1.25
20. IPSL-CM5B-LR		3.75 × 1.875
21. MIROC-ESM	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies and Japan	2.81 × 2.81
22. MIROC-ESM-CHEM	Agency for Marine-Earth Science and Technology	2.81 × 2.81
23. MIROC5		1.41 × 1.41
24. MPI-ESM-LR	Max Planck Institute for Meteorology, Germany	1.875 × 1.875
25. MPI-ESM-MR		1.875 × 1.875
26. MRI-CGCM3	Meteorological Research Institute, Japan	1.125 × 1.125
27. NorESM1-M	Norwegian Climate Centre	2.5 × 1.875

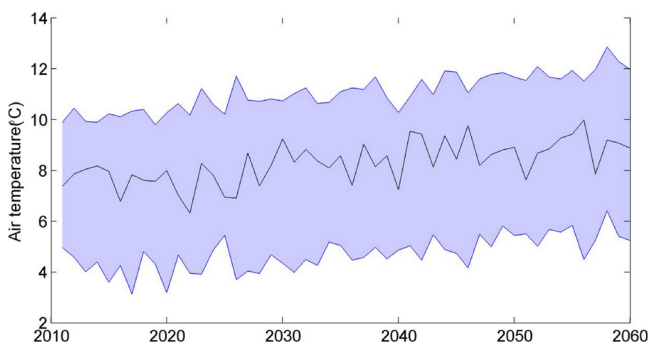

Fig. 3. Annual average air temperature of Columbia River Basin from the regional climate simulation used in this study (black line) compared to the range projected by 27 GCMs (Table 1) in CMIP5 (shaded area).

presence of complex water management.

It is also worth noting that many studies use the maximum temperature tolerance or upper thermal tolerance thresholds of salmon to quantify climate change influences (Mantua et al., 2010; van Vliet et al., 2013; Wade et al., 2013). In these studies, if water temperature exceeds the predefined threshold in one location, the local salmon population is assumed to be under threat. This approach ignores the fact that salmon respond nonlinearly to stream temperature with an optimum temperature range for growth (EPA, 2001; Carter, 2005; Elliott and Elliott, 2010). An optimum temperature range enhances growth and performance of salmon stocks, and survival chances are higher because of sufficient food availability, lower vulnerability to diseases, more optimal physiological performance and so forth. Temperature rises below their population-specific optimum temperature are generally beneficial for salmonid stocks, while further increase beyond the range results in stress for salmonid stocks and affects their behavior (Carter, 2005; Elliott and Elliott, 2010), cardiorespiratory and swimming performance (Farrell et al., 2008; Eliason et al., 2011) and even survival (Farrell, 2009). Estimating climate change impacts based on upper tolerable temperature alone tends to overestimate the negative influences from temperature warming, as it neglects the benefit of temperature rises from below to within the optimum range to growth, particularly during periods such as early life stages where rapid growth is critical. Such discussions are particularly salient if there is hope that current actions to stem carbon emissions (see IPCC, 2007; Buob and Stephan, 2011) could be successful such that water temperatures will not increase perpetually.

This study incorporates the nonlinear response of salmon to ambient water temperature and quantifies the changes in survival under climate change with effects of water management explicitly considered. Here we focus on juvenile Chinook salmon (*Oncorhynchus tschawytscha*) and Steelhead (*Oncorhynchus mykiss*) in the mainstream of Columbia and Snake River due to data availability (Fig. 1). These species start their life cycle start in freshwater, migrate to the ocean as juveniles and return home as adults to spawn. Details of the data and methodology are explained in Section 2. Section 3 illustrates climate change and water management induced changes on stream temperature and discharge, and presents potential impacts on survival rates of smolt Chinook and Steelhead. A summary of key findings and discussion of limitations and future work are provided in Section 4

2. Materials and methods

2.1. Earth system model

This study adopts a physically-based stream temperature model, Model for Scale Adaptive River Transport (MOSART) (Li et al., 2013, 2015) that is coupled with the Community Land Model (CLM, version 4.0). MOSART also includes a water management module (Voisin et al., 2013; Li et al., 2015) (Fig. 2). CLM (Lawrence et al., 2011) is the land component of the Community Earth System Model (CESM). Surface runoff and subsurface runoff simulated by CLM are routed separately into streams and through river networks using MOSART. Then the riverine heat balance is coupled to the river water dynamics, including the advective heat fluxes (from hillslopes laterally into rivers and from upstream to downstream rivers) and energy exchanges between water and air. Simulated stream temperatures have been validated against

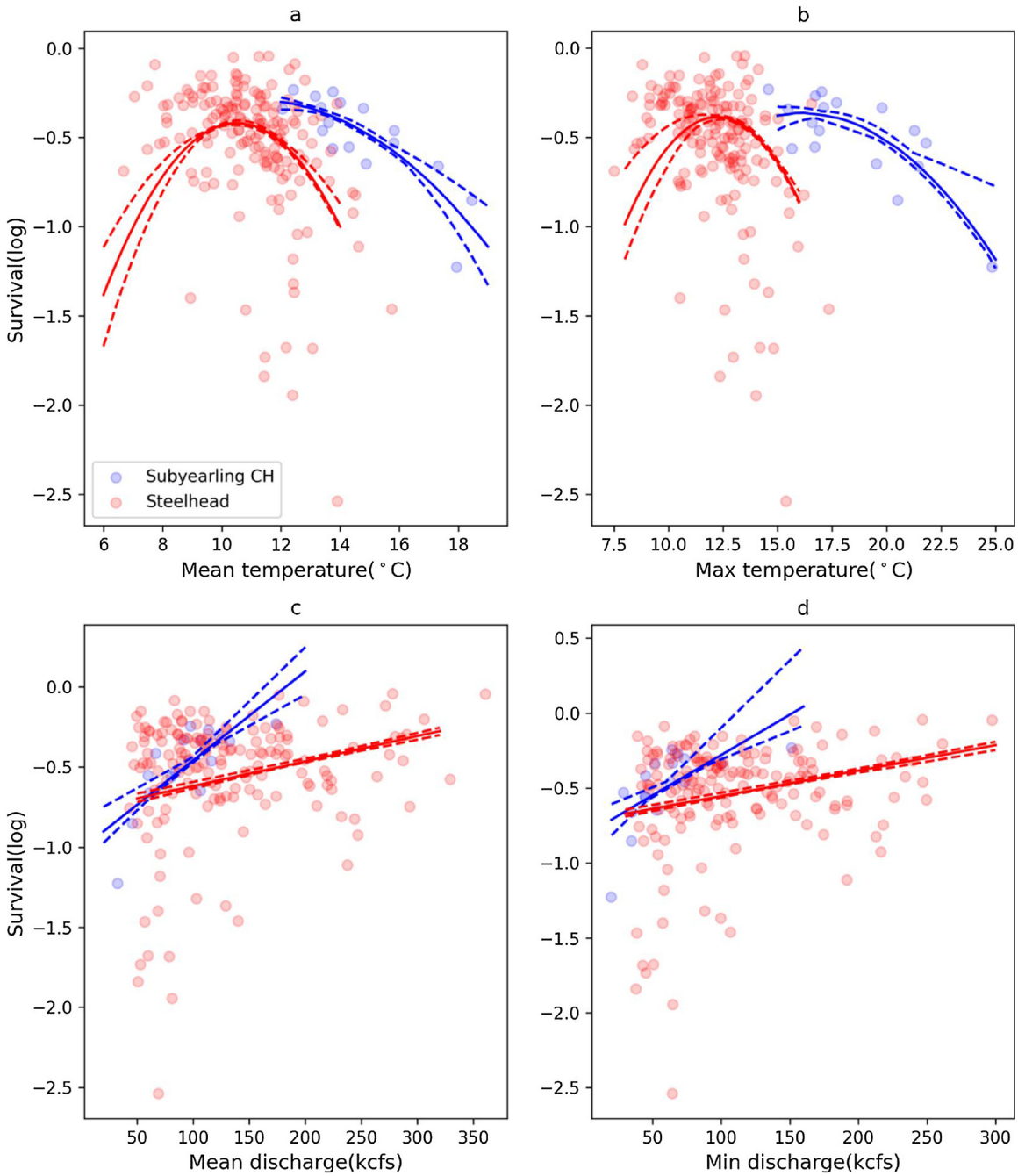

Fig. 4. Regression between logarithm of observed annual average juvenile survival rate and individual environmental parameter (mean temperature (a), max temperature (b), mean discharge (c) and min discharge over migration season (d)) for subyearling Chinook (blue, Snake River Species) and Steelhead (red) using quadratic functions for stream temperature and linear for discharge, dashed lines show 95% bootstrap confidence interval and solid lines represent median fitted values (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

Table 2
Fitted coefficients in the nonlinear regression model of log(survival rate) with water temperature and discharge.

	R^2	*p*-value	Fitted coefficient					
			β_1	β_2	β_3	β4	β5	β6
Chinook	0.877	< 0.01	0.0816	−0.0048	0.4440	−0.0117	0.0019	0.0011
Steelhead	0.514	< 0.01	0.8259	−0.0369	0.5122	−0.0225	0.0025	−0.0004

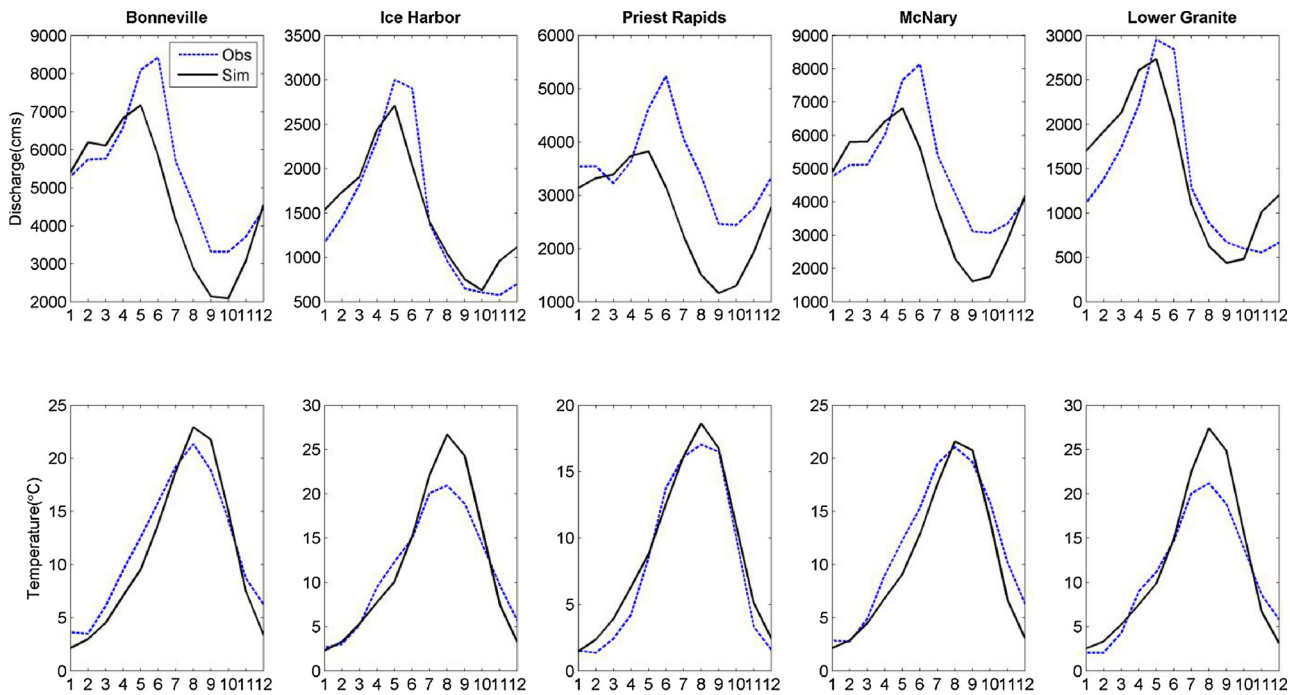

Fig. 5. Comparison of simulated mean monthly discharge and temperature from MOSART-WM with observed values from Columbia Basin Research at five dam locations in main stream of Columbia and Snake River.

observations from over 320 USGS gauge stations in the US (Li et al., 2015).

A water management module (WM) is integrated within MOSART to represent the impacts of anthropogenic activities including local water extraction and reservoir operation (Voisin et al., 2013; Li et al., 2015). Local extraction is performed for each grid cell and water is extracted first from the grid's surface and subsurface runoff and then from the river channel storage to satisfy the local water demand. The reservoir module regulates the reservoir storage based on generic operating rules for three categories: flood control, irrigation water supply and a combination of both (Voisin et al., 2013) to provide supply to grid cells where water demand is unmet by local extraction. A total of 1839 reservoirs are retrieved from the GRanD database in the conterminous US (Lehner et al., 2011). MOSART seamlessly integrates river routing, stream temperature, and water management in an earth system modeling framework, enabling it to represent the advective heat flux along the river network in a physically consistent manner. More details of MOSART stream temperature model are provided in Li et al. (2015).

The atmospheric forcing used to drive CLM-MOSART is derived from a Regional Earth System Model (RESM) (Gao et al., 2014) following the Representative Concentration Pathways (RCP) 4.5 and 8.5 scenarios (Riahi et al., 2011; Van Vuuren et al., 2011). The water demand data used by the WM module are derived from the Global Change Assessment Model (GCAM) (Edmonds and Reilly, 1983), which tracks water withdrawals and consumption for six water-demand sectors: irrigation, livestock, municipal, electricity generation, primary energy, and manufacturing water demands (Hejazi et al., 2015). In this study, the historical and projected water demand time series are provided at a monthly scale, and applied uniformly within each month since MOSART runs at an hourly time step. The impacts of two RCP emissions and land use and land cover scenarios are compared: RCP8.5 is a business-as-usual scenario that stabilizes the global radiative forcing at 8.5 W/m^2 by 2100 and RCP4.5 is a mitigation scenario capping the global radiative forcing at 4.5 W/m^2 by end of 21st century. The mean temperature of CRB projected by the Regional Earth System Model driven by the Community CESM4 falls well within the range and close to the average of 27 Global Climate Models (Table 1) in the Coupled Model Intercomparison Project Phase 5 (CMIP5) (Fig. 3). The regional climate simulations used in model evaluation were bias-corrected to reproduce the mean and variance of the observed surface temperature and precipitation.

2.2. Regression model

Four parameters with data availability were used to represent the hydrological and environmental conditions for juvenile Chinook and Steelhead: mean daily stream temperature, maximum daily stream temperature in migration season, mean daily discharge and minimum daily discharge. Survival rate estimates during 1998–2014 were obtained based on observations from Fish Passage Center (Fish Passage Center (FPC), 2017) for three reaches: Snake River (Lower Granite Dam to McNary Dam), Lower Columbia (McNary Dam to Bonneville Dam) and Upper Columbia (Rock Island Dam to McNary Dam). After data screening (statistical model performance and bootstrap robustness), subyearling Chinook at Snake River is used in this study. Fig. 1 shows the main reaches and the locations of the observation sites within CRB. The observation period for smolt survival estimates is May 20-June 30 for subyearling Chinook and April 17-May 28 for Steelhead.

Observed data of environmental parameters during the same period were obtained from Columbia Basin Research (Columbia Research Center (COLUMBIA RIVER BASIN), 2017) for 11 dam locations within the three reaches (Lower Granite Dam, Little Goose Dam, Lower Monumental Dam, Ice Harbor Dam, McNary Dam, John Day Dam, the Dalles Dam, Bonneville Dam, Rock Island Dam, Priest Rapids Dam, Wanapum Dam), and then averaged by the river reach. The weekly/biweekly survival rate data and daily environmental parameters were aggregated over the observed period to represent inter-year variations.

A log-linear multiple regression analysis is performed to relate the observed annual smolt survival rate to water temperature and discharge as predictor variables. A log-transformation of the estimates of survival probabilities is used to stabilize the variance and model a multiplicative effect. The relationship between survival rate and stream temperature has a clear nonlinear pattern, in agreement with Carter (2005). Temperature related parameters are fit as a quadratic function. An optimal

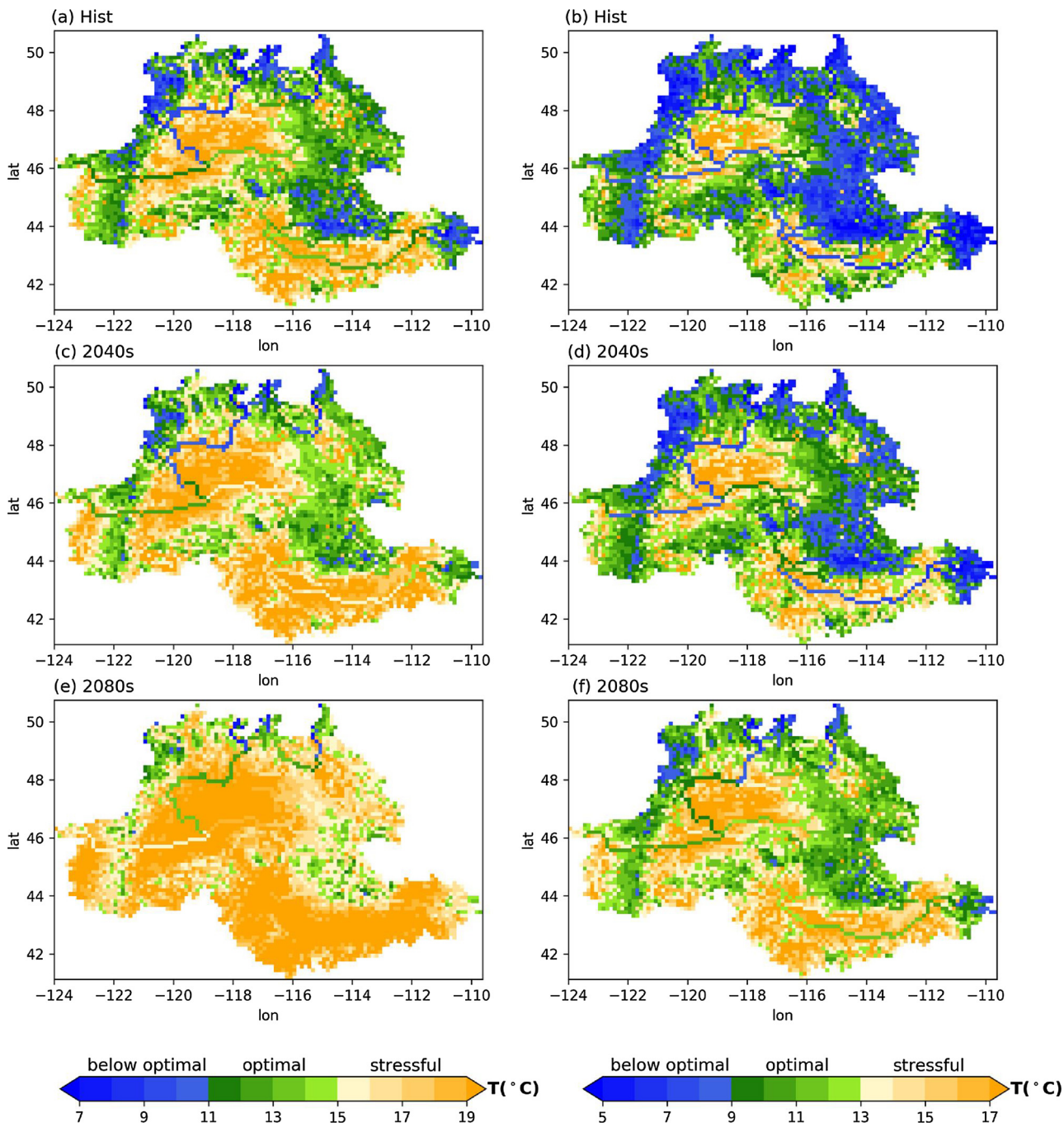

Fig. 6. Mean stream temperature of historical (a, b) and projected 2040s, RCP4.5 (c, d) as well as 2080s, RCP8.5 (e, f) in Columbia River Basin during migration season of juvenile Chinook (5/20˜6/30: left column) and juvenile Steelhead (4/17˜5/28: right column) with color representing temperature classification (blue colors: below optimal, green cFolors: optimum range, yellow colors: stressful for smolt) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

range around 11–15 °C for Chinook and 9–13 °C for Steelhead is found, with survival rate increasing and decreasing with water temperature below and above the optimal range (Fig. 4). The optimal temperature ranges are determined based on three criteria: 1) observed survival estimates are relatively high in this range, with obvious increase with temperature before this range and decline after this range; 2) regression from bootstrap resampling shows relative consistency which implies this range is stable and not significantly affected by sample size; 3) a comparison across literature (EPA, 2001; Carter, 2005; Wade et al., 2013; Mantua, 2015) confirms the selected ranges are reasonable representation for smolt survival in CRB. Generally, Steelhead is more sensitive to stream temperature rise compared to Chinook. The Steelhead survival rate decreases rapidly above 13 °C and is less than 0.4 above 15 °C. Smolt survival rate generally increases with discharge.

Quadratic function is chosen to represent the nonlinearity inherent in the relationship between estimated survival rate ($\hat{S}$) and mean stream temperature t_{ave} as well as maximum stream temperature t_{max} without increasing the regression complexity significantly. Linear function is used for streamflow-related parameters mean discharge (q_{ave}) and min discharge ($qmin$) in this case. This combination of functions has been used in Comprehensive Passage Model (COMPASS) and shown reasonable explanatory power (Zabel et al., 2008).

The model equation used in the regression analysis was

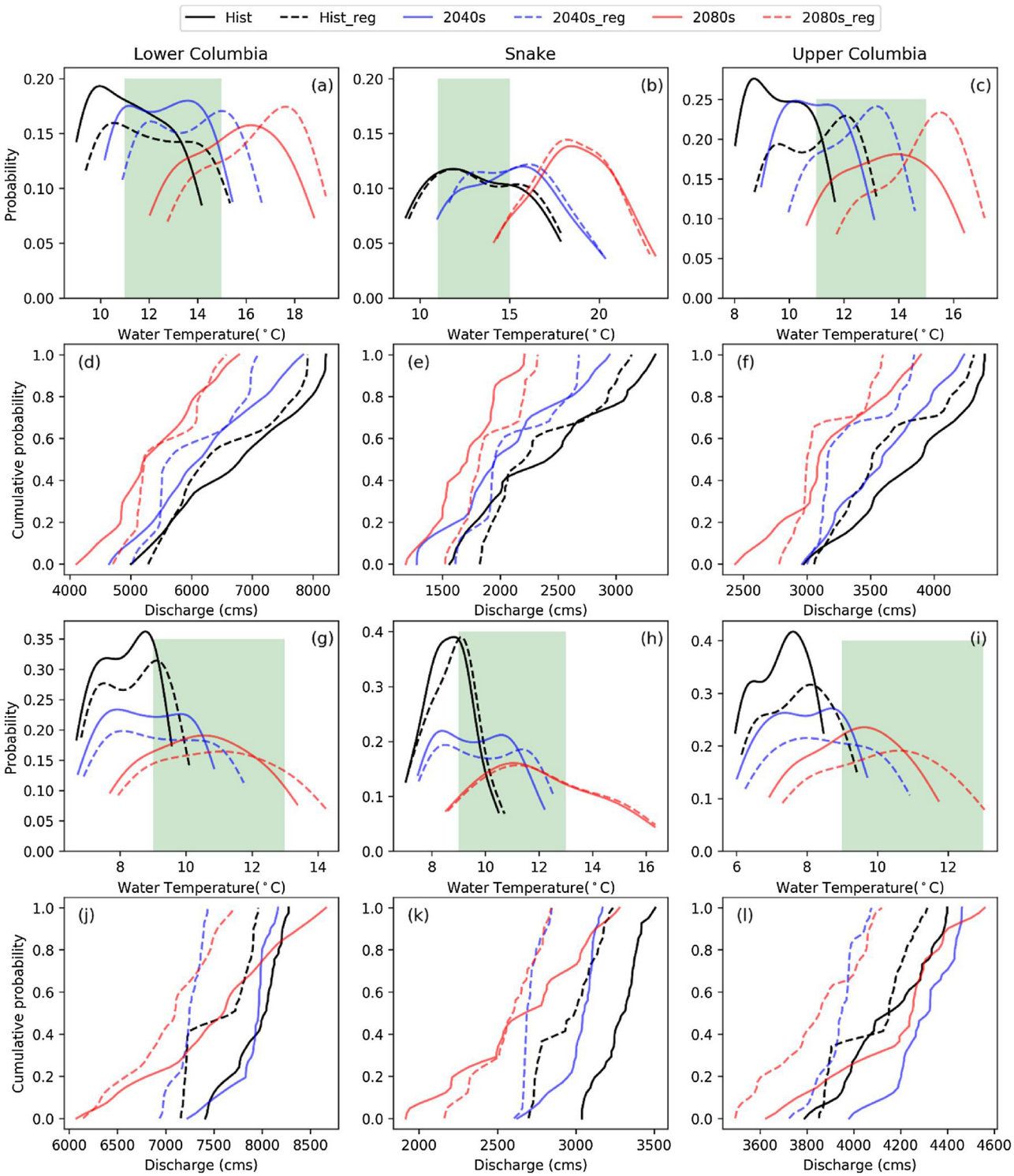

Fig. 7. Probability distribution of daily water temperature (a, b, c, g, h, i) (green shade represents the optimum temperature range) and cumulative distribution of daily discharge (d, e, f, j, k, l) during the migration season of juvenile Chinook (top two rows) and Steelhead (bottom two rows) in historical (black lines) and future periods (2040s: blue lines, 2080s: red lines) with free flowing flow (solid lines) and regulated flow (dashed lines) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

$$Log(\hat{S}) = \alpha + \beta_1 \bullet t_{ave} + \beta_2 \bullet t_{ave}{}^2 + \beta_3 \bullet t_{max} + \beta_4 \bullet t_{max}{}^2 + \beta_5 \bullet q_{ave} + \beta_6 \bullet q_{min} \quad (1)$$

with intercept (α) and partial regression coefficients (β_i; $i = 1, \cdots, 4$). Parameters were estimated using ordinary least squares. The R-square of regression of Chinook survival rate with the four parameters is 0.87. The corresponding R-square for Steelhead is 0.51. The p-value for the regression model is less than 0.001 (Table 2).

The uncertainty in the regression model due to the limited historical sample is estimated by bootstrap resampling of the historical data (100 bootstrap samples). Dashed lines in Fig. 4 show 95% confidence intervals from bootstrap resampling. The fitted patterns and trends remain consistent, which suggests the statistical relationships between survival rate and the four environmental parameters for subyearling

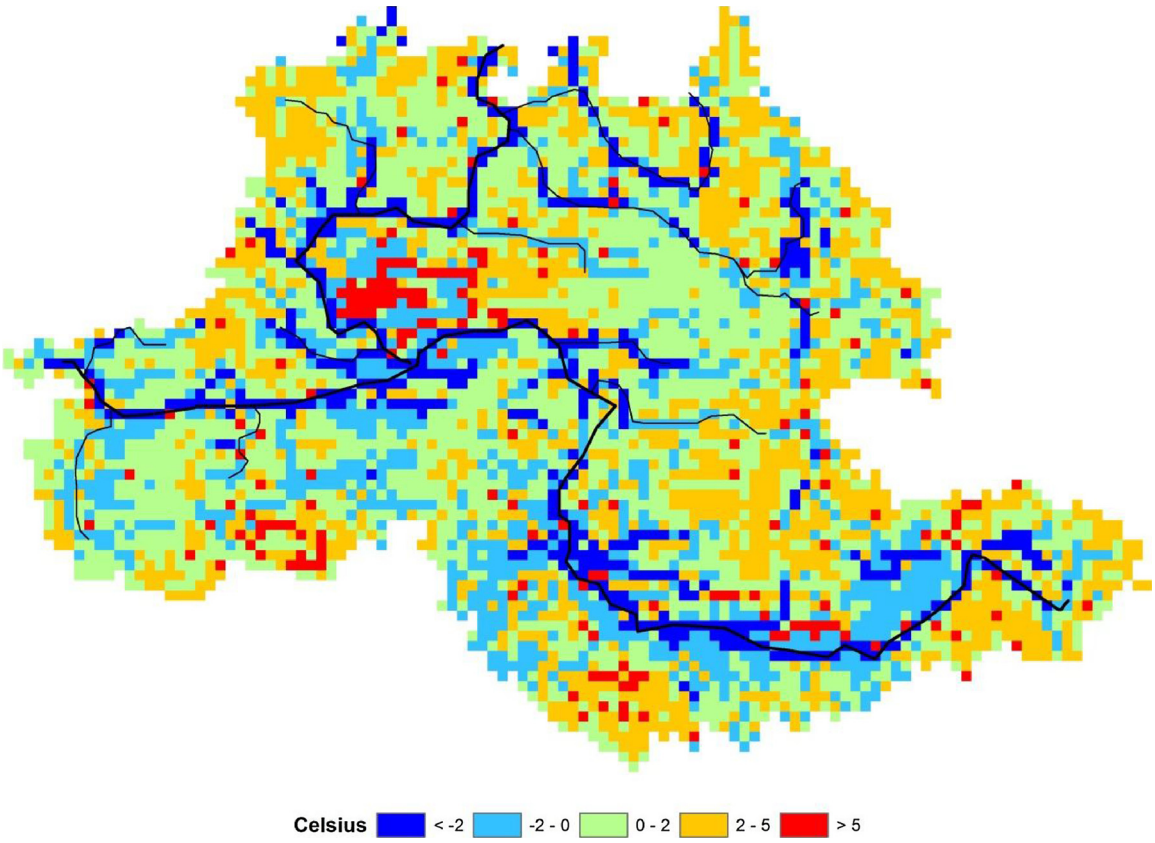

Fig. 8. Difference between average stream temperature and air temperature during April-June under RCP4.5 in the 2040s (blue color represents stream is cooler than air, other colors represent stream is warmer than air) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

Chinook and smolt Steelhead hold solid.

Model evaluation is performed by feeding the regression models with simulated reanalysis historical streamflow and stream temperature of 1998–2012 that has been bias corrected to reproduce the mean and variance of the observed surface temperature and precipitation (*Experiment sim*). Another experiment is designed by feeding observed climate data to the regression model (*Experiment reg*) to delineate bias from the regression model and earth system model. Mean bias between survival rate from experiment *sim* and observed values is about 19% for smolt Chinook and 22% for juvenile Steelhead, and that between experiment *reg* and observation is 0.3% for Chinook and 12% for Steelhead. Results suggest the regression models produce satisfactory smolt survival rate with accurate environmental parameters. Although the earth system framework (MOSART) has been validated across the contiguous US and widely used in many studies, it focuses on large scale studies and needs to be further calibrated for regional studies. A comparison of the simulated streamflow and temperature (Fig. 5) at five dam locations in CRB shows that MOSART tends to underestimate water temperature in the main channel during migration season of juvenile Steelhead (April-May), which would lead to an underestimate of survival rate for Steelhead in historical period.

3. Results

3.1. Climate warming induced temperature change

Stream temperature is projected to warm throughout CRB in the 2040s and 2080s under both climate scenarios (RCP4.5 and 8.5). Fig. 6 illustrates the spatial distribution of water temperature in CRB for Chinook (left column) and Steelhead (right column) of historical and future periods with climate change effects alone. Colors represent the temperature zone for the two species respectively: water temperature of lower than 11 °C is below optimal for Chinook (blue colors), 11–15 °C is the optimum zone (green colors) and higher than 15 °C (yellow colors) is stressful for Chinook; temperature lower than 9 °C is sub-optimal for Steelhead, the optimum range is 9–13 °C and temperature rising above 13 °C is stressful for Steelhead. The optimum temperatures for juvenile Chinook and Steelhead are derived based on the correlation between observed survival estimates and migration season mean stream temperature on mainstreams of Columbia and Snake River (Fig. 4). The difference between the optimum temperature of Chinook and Steelhead results not only from the different sensitivity of each species to water temperature, but also variations in the migration season: juvenile Chinook migrate around May 20˜June 30 while juvenile Steelhead migrate around April 17˜May 28 based on the data from the Fish Passage Center (Fish Passage Center (FPC), 2017).

Results show that water temperature in the main stream of Lower Columbia River, which is downstream of CRB, is within the optimum range for juvenile Chinook in the historical period but is shifted to be stressful by the 2080s. Stream temperature in Lower Columbia is currently below optimum for Steelhead but rises to the optimal range for juvenile Steelhead due to climate warming by the 2080s. Stream temperature of Upper Columbia River is below the optimum range in the historical period for smolt Chinook and Steelhead, but it will shift to the optimal zone for both species by the 2080s. Current temperature in Snake River is within the optimum range for juvenile Chinook; it shifts to stressful in the 2040s even with a mitigation climate scenario (RCP4.5) and is likely to be lethal for smolt Chinook by the 2080s. In contrast, Steelhead may benefit from temperature increase in Snake River with temperature shifting from below optimum to optimum by the 2080s.

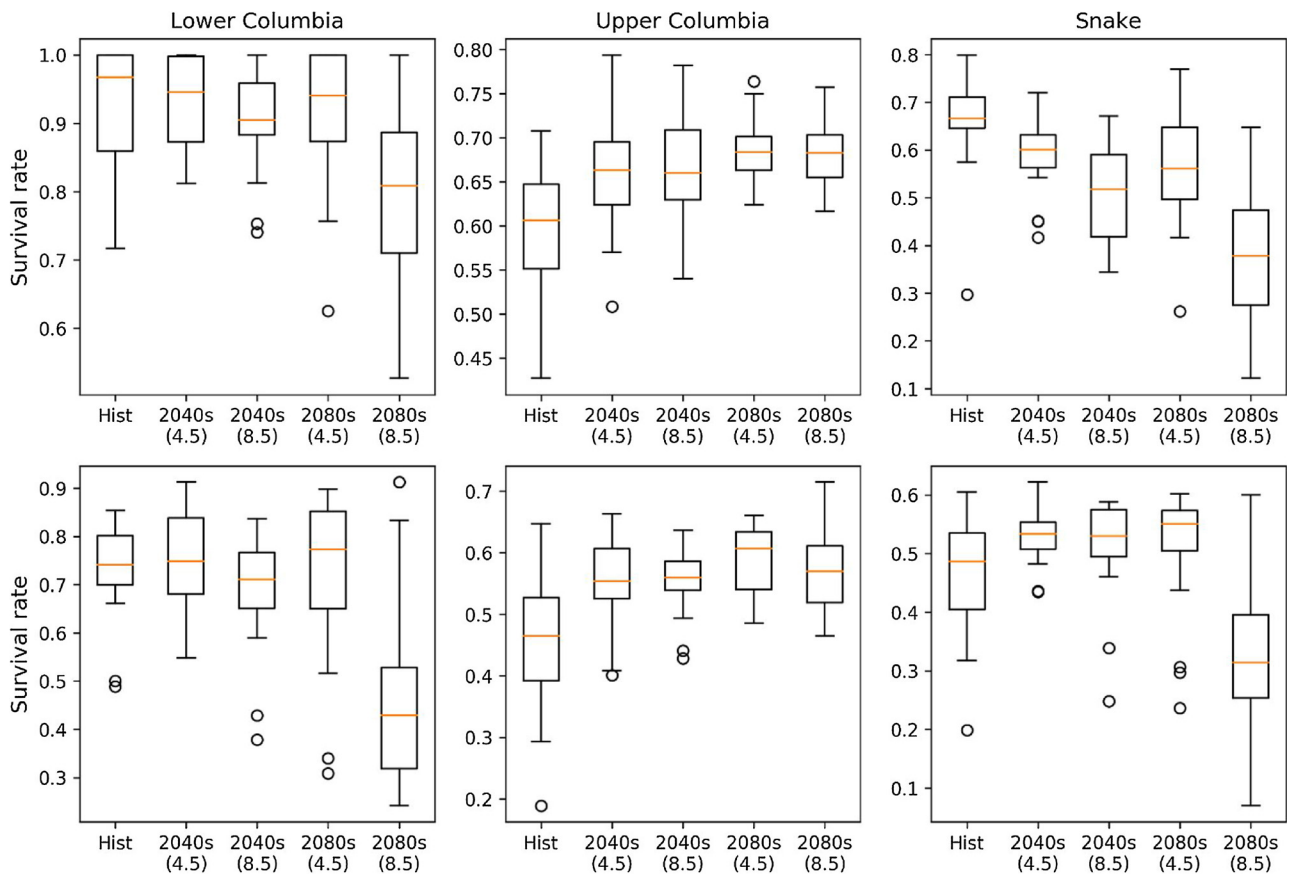

Fig. 9. Survival rate of juvenile Chinook (top row) and Steelhead (bottom row) during historical (1985–2004) and projected periods (2040s and 2080s) under two climate scenarios (RCP4.5 and RCP8.5) in Lower, Upper Columbia and Snake River.

3.2. Water management impacts

River regulation has significant influences on stream flow (Arheimer et al., 2017). Here we compare water management (including regulation and water withdrawal) effects on daily discharge during the migration period of smolt Chinook and Steelhead. Fig. 7 illustrates the historical and future cumulative distribution of discharge in Upper Columbia, Lower Columbia and Snake River. Climate change (solid lines) results in consistent flow decline in Columbia and Snake River during the migration season of Chinook smolts (5/20 ˜ 6/30) (Fig. 7, d–f). In contrast, it leads to more flow in Upper Columbia during the migration season of Steelhead smolts (Fig. 7, l). The effects of water management on streamflow depend on whether upstream reservoirs release or store water and how much water is withdrawn from the channels. Water management (dashed lines) in general reduces flow in Upper Columbia (Fig. 7, f and l) and has a mixed effect on streamflow in Snake River (Fig. 7, e and k). If water releases in June can offset water withdrawals, channel flow in the Snake River is predicted to increase. Lower Columbia is downstream of Upper Columbia and Snake, so its flow is affected by the accumulated effects from upstream regulation as well as regulation and withdrawal within its own segment.

Fig. 7 also presents the probability distribution of stream temperature during the migration season, and how it relates to the optimum temperature. Climate change (solid lines) leads to uniform shifts of temperature to higher values. Interestingly, water management (dashed lines) also results in a noticeable shift to the right for Upper and Lower Columbia River. As flow is reduced by regulation, the heat exchange between the warmer air and the reduced volume of water likely increases and elevates water temperature since stream temperature in the main channels is generally cooler than the overlying air during April-June (Fig. 8). Water management has minor effects on stream temperature in Snake River, which can be attributed to the negligible changes in streamflow.

3.3. Changes of juvenile survival

The stream temperature and discharge at the main stems of Columbia and Snake River simulated by the integrated human-nature system model (Li et al., 2015) are used as inputs to the regression model to quantify smolt survival at three main reaches (Upper Columbia, Lower Columbia and Snake) in CRB. Results show that juvenile Chinook and Steelhead inhabiting the Upper Columbia may benefit with warmer climate (Fig. 9). Projected mean survival rates are likely to increase by more than 10% for both species largely because the water temperature shifts to the optimum range with climate change (Fig. 7). In contrast, survival rates of juvenile Chinook and Steelhead in Lower Columbia may decline by the 2080s and even by the 2040s under the more aggressive climate scenario RCP8.5. This results from the combined effects of temperature stress and decreased streamflow. Smolt Chinook in Snake River tends to decline by 12 ˜23% till the 2040s and 15˜ 43% by the end of this century, caused by stressful temperature warming and less flow in the river channels. Juvenile Steelhead, on the contrary, may expect more than 10% increase in survival rate by the 2040s due to the preferable water temperature.

There is no significant change in inter-year variability of survival rates for most scenarios except in the 2080s under RCP8.5. This abrupt increase is mainly attributed to the larger variability in maximum temperature (Fig. 10). Extreme hot temperatures projected in this business-as-usual scenario are lethal for salmonid stocks and result in low survival rate.

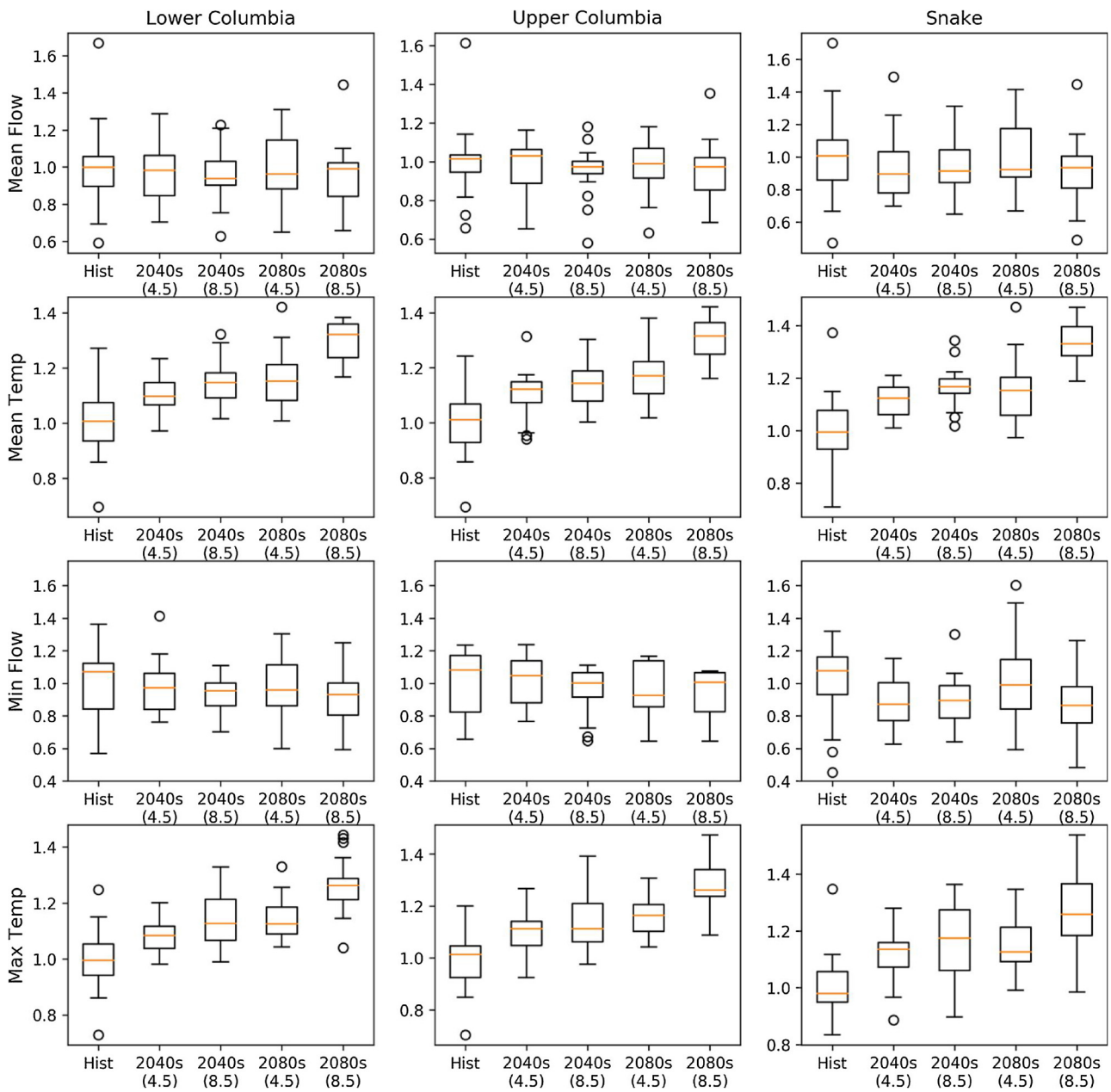

Fig. 10. Normalized mean flow, mean temperature, min flow and max temperature of April-June by historical 20-year average of each at Upper Columbia, Lower Columbia and Snake River for historical (1985–2004) and future scenarios (2031–2050 and 2071–2090), each data point is seasonal statistics of one year.

4. Discussion and conclusions

Instead of using a tipping point to classify water temperature into suitable and lethal, this study acknowledges the fact that the biological response of salmon to water temperature is continuous and nonlinear, and incorporates the nonlinear response into climate change impact analysis. Our results suggest that whether climate warming brings detrimental or beneficial effects on juvenile salmon depends on its relation with the optimum temperature range. If warming results in temperature closer to or within the optimum range, then it enhances smolt growth. If temperature rises beyond the preferred temperature range, then it becomes stressful for salmonids and may reduce survival rate. We recognize that there can be population-specific thermal optima, at scales more refined than what we used in this paper. As such, further efforts to characterize population-specific thermal performance (e.g., like Eliason et al., 2011) would be particularly important for future model refinement.

Another key finding of this study was that water mangement, including reserovir regulation and water withdrawl, is seamlessly coupled within the earth system model to provide a realistic representation of streamflow, water temperature and juvenile survival. Water management reduces flow in the channel and causes temperature rise in Columbia River during smolt migration season. This study provides survival projections of juvenile Chinook and Steelhead with spatial details as well as insight on how interactions between climate change and water management may affect smolts in CRB. Similar modeling exercises extending through to the adult spawning migration would be particularly informative in the future.

Previous literature found that climate change has negative impacts on juvenile survival rate (Mantua et al., 2010; Benjamin et al., 2013; van Vliet et al., 2013; Wade et al., 2013; Walters et al., 2013; Ward et al., 2015; DeBano et al., 2016). This study shows that the effects of climate change vary by location, climate change scenario and specie. There are two possible reasons for the differences. First, many studies

Table 3
Comparison of this study with similar studies.

	Van Vliet et al. (2013)	Wade et al. (2013)	Walters et al. (2013)	DeBano et al. (2016)	This study
Modeling framework	Temperature tolerance and flow change analysis	Compare climate exposure and sensitivity	Linear regression model	Stressor analysis	Linear regression model
Parameters	Water temperature and streamflow	Stream temperature and discharge	Air temperature and discharge	Riparian function, woody debris, embeddedness and find sediment, low flow, summer stream temperature	Mean stream temp. Max stream temp. Mean discharge Min discharge
Model resolution	Daily at 0.5 degree	Weekly at 1/16 degree	Daily at one USGS gauge	Daily at 1/8th degree	Daily at 1/8th degree
Study region	Global	Pacific Northwest (PNW)	Lemhi River Basin (tributary to Salmon River, Idaho)	Umatilla Subbasin (Oregon)	Columbia River Basin
Species	None	Steelhead	Chinook	None	Chinook (wide and hatchery), Steelhead
Projected period	2031-2060 and 2071-2100	2030-2059	2040 and 2080	2040 and 2080	2005-2090
GCMs	ECHAM5/MPIOM, CNCRM-CM3, IPSL-CM4	Ensemble of 20 GCMs	ECHO-G and CGCM3.1 T47	Ensemble of 10 GCMs	1 GCM: RE5M
Emission scenarios	A2 and B1	A1B	A1B	A1B	RCP4.5 and RCP8.5
Human activities	None	None	Water diversion	Agricultural intensification	Local water extraction and reservoir regulation
Main results	Increase in frequency and magnitude of exceeded temperature tolerance	Exposure to temperature increase in the southern PNW and flow changes in northern and interior	Diverted flow causes 42-58% decrease in juvenile survival rate than undiverted; climate change results in additional 11-29% decrease	Agricultural intensification has negative impacts on water quality	Smolt survival is projected to increase in Upper Columbia and decrease in Lower Columbia for both Chinook and Steelhead
Major scientific merit	First global assessment	Vulnerability analysis; Spatial results	Water diversion	Agricultural intensification	Reservoir operation and water extraction; integration of nonlinear effects from water temperature

examined the frequency or time of reaching lethal threshold based on one or multiple metrics (Mantua et al., 2010; van Vliet et al., 2013; Ward et al., 2015; DeBano et al., 2016) or utilized linear relationship between survival and temperature (Walters et al., 2013), which do not capture the inherent nonlinearity of survival rate response to physical parameters. In particular, the effects of optimal stream temperature range are not considered. Second, effects of regulation on streamflow and stream temperature are not considered in these studies. A detailed comparison of this study and previous literature is described in Table 3. It is worth noting that changing river conditions could alter the predator community (e.g., more invasive species such as smallmouth bass) and the relative performance of the predators (e.g., increased food consumption, improved feeding efficiency) and this should be considered in future studies.

Estimates in this study focus on main stream of Columbia and Snake Rivers because of data availability and need of consistence in pursuit of accuracy. Extrapolation of the regression relationship to other areas in the basin or other basins should be adjusted based on local conditions. Survival results presented in this study do not consider factors such as climate variability including Pacific Decadal Oscillation and El Niños-Southern Oscillation, intra-annual hydrological variability, change in reservoir operation, harvesting, land use changes and restoration (Battin et al., 2007; Hilborn, 2013; Kilduff et al., 2015; Mantua, 2015), which affect growth and survival of salmonid stocks and should be investigated in future research. This study uses an integrated modeling framework consisting of a single model for each earth system and human component to predict changes in stream temperature and juvenile salmon survival. Although the models have been verified in previous studies particularly over the US to provide reasonable representation (Li et al., 2013, 2015; Hejazi et al., 2015; Voisin et al., 2013;Liu et al., 2017 Wan et al., 2017), a comparison across climate and earth system models is useful to quantify the uncertainty in simulation but beyond the scope of this study. Moreover, effects of reservoir stratification on stream temperature are not considered in the stream temperature model and need to be incorporated in future research. Hence our results should be interpreted with caution because of the large spatial variance in the survival rate change and uncertainty in migration path. On the other hand, Pacific salmon have evolved for thousands of years so neglecting the adaptation capacity (both in terms of plasticity and genetic changes) of salmon may result in an overestimate of the negative impacts from environmental change. Nevertheless, climatic extremes may reduce the adaptive potential (Kovach et al., 2015) and cause unprecendented losses in salmon populations. Many actions can be taken to tackle the hotspots with high risk such as restoring the connectivity of floodplains (*18*) or riparian restoration (Justice et al., 2017). Diverse and connected habitats through all life stages are particularly useful to buffer against changes such as warming (Crozier et al., 2008). Finer scale analysis with more details on all life-stages of salmon is necessary before it will be possible to determine which conservation actions are optimal for different species, populations, and locations within the habitats transited during their entire lives.

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STATUS OF AMERICAN MARTENS IN COASTAL FORESTS OF THE PACIFIC STATES

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American martens (*Martes americana*) are associated strongly with mature conifer forests and once occurred throughout the mountains of the coastal Pacific states. We sought to document the distribution of martens in this region using historical records and to understand recent change in their distribution. We described the distribution of martens from 1900 to 1949 using museum and trapping records and compared it to recent (1989-1998) detections at camera and track-plate stations. Martens were detected at only 12 of the 237 (5.1%) survey sample units in coastal California, Oregon, and Washington. Martens are absent from most of the historical range of the Humboldt marten (*M. a. humboldtensis*) in California and also may have declined on the Olympic Peninsula of Washington. Few data exist from northwestern Oregon and southwestern Washington, but the limited amount of protected public land and absence of reported road kills are reasons for concern for populations in this region. Martens still occur in the central and southern coastal mountains of Oregon. Our results suggest that conservation of martens in coastal forests will require new initiatives to protect existing populations and new efforts to document all populations of martens in this region. Conservation measures should include a reevaluation of timber harvest plans that affect habitat in coastal forests, interagency cooperation on a coastal marten conservation assessment, and the collection of new survey information, especially on private lands in southwestern Washington and northwestern Oregon.

Key words: conservation, distribution, marten, *Martes americana*, Pacific states

American martens (*Martes americana*) once occurred throughout the coastal forests of northern California, Oregon, Washington, British Columbia, and Alaska (Hall 1981). The species is typically associated with late-seral coniferous forests characterized by closed canopies, large trees, and abundant standing and down woody material (Buskirk and Powell 1994; Thompson and Harestad 1994). Coastal Pacific forests are extremely productive and include some of the most valuable trees in the world. The relatively easy access by ocean to this resource resulted in heavy exploitation of the region early in the period of European settlement (United States Department of Agriculture 1992). Because much of the coastal forest region is in private ownership, the focus on timber production continues. Although the status of American martens was

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considered during the planning process for restoring late-successional habitat within the range of the northern spotted owl (*Strix occidentalis caurina*) on federal lands (Northwest Forest Plan-United States Department of Agriculture 1993), this was largely a summary of professional opinion and did not include significant review of existing data or collection of new data. However, the marten was judged the 2nd-least likely mammal species to remain well distributed within the range of the northern spotted owl in Washington, Oregon, and California under the preferred alternative (United States Department of Agriculture 1993).

Three subspecies of *M. americana* occur in the coastal or near-coastal regions of the Pacific Northwest. In California, the range of *M. a. humboldtensis* includes the northwestern coast from the Oregon-California boundary south to Sonoma County (Grinnell and Dixon 1926; Grinnell et al. 1937; Fig. 1A). The Humboldt subspecies is replaced at the northern boundary of the range of coast redwoods (*Sequoia sempervirens)* by *M. a. caurina,* which continues along the coast north to British Columbia (Merriam 1890; Miller 1912; Wright 1953; Fig. 1A). *M. a. sierrae* (Grinnell et al. 1937) occurs nearest the coast in the Trinity Mountains in northwestern California and then east to the Cascades and south throughout the Sierra Nevada.

Of the coastal subspecies, *M. a. humboldtensis* has attracted the greatest conservation concern (Kucera et al. 1995; Zielinski and Golightly 1996). Originally, the Humboldt marten occurred from sea level to about 3,000 feet in the "narrow northwest humid coast strip, chiefly within the redwood belt" (Grinnell et al. 1937:209). Grinnell et al. (1937) related accounts of individual trappers taking 35 and 50 martens in 1 winter within a few miles of the coast. Declining harvests led to the closure of the season in extreme northwestern California in 1946. Zielinski and Golightly (1996) could not document a single verified location within the historical range of *M. a. humboldtensis* in the 50 years prior to 1995. The subspecies was assumed to be either very rare or extinct.

Martes a. sierrae, which occurs in the Sierra Nevada of California, and *M. a. caurina,* which occurs in coastal Oregon, Washington, and British Columbia and the Cascades, have apparently never become as uncommon as the Humboldt marten. Although trapping of the Sierran subspecies was prohibited in 1954, it has remained well distributed over most of its historical range (Grinnell et al. 1937; Kucera et al. 1995; Schmepf and White 1977). At the time of European settlement, *M. a. caurina* occurred throughout coastal forests of Oregon and Washington, including locations at sea level (Bailey 1936; Hagmeier 1956). However, previous reviews indicate that martens appear to be absent from the coastal forests of northern Oregon and southern Washington and rare on the Olympic Peninsula (Dalquest 1948; Gibilisco 1994; R. E. Johnson and K. M. Cassidy, in litt.; D. B. Marshall, in litt.; Sheets 1993; Verts and Carraway 1998). Martens are still legally trapped in coastal Oregon and Washington, although the season has been closed intermittently for various periods since the 1930s (L. Cooper, pers. comm.; Martinsen 1971; Rhymon 1969).

Comparing the historical distribution of a species to its current distribution is the 1st step toward determining its status. We conducted an assessment of martens in the coastal mountains of the Pacific states. We summarized the current status of the coastal subspecies and report new survey results. We build on reviews of other western subspecies of martens (Kucera et al. 1995; D. B. Marshall, in litt.; Sheets 1993; Verts and Carraway 1998; Zielinski and Golightly 1996) and consider together the status of *M. a. humboldtensis* and *M. a. caurina* across their ranges in California, Oregon, and Washington.

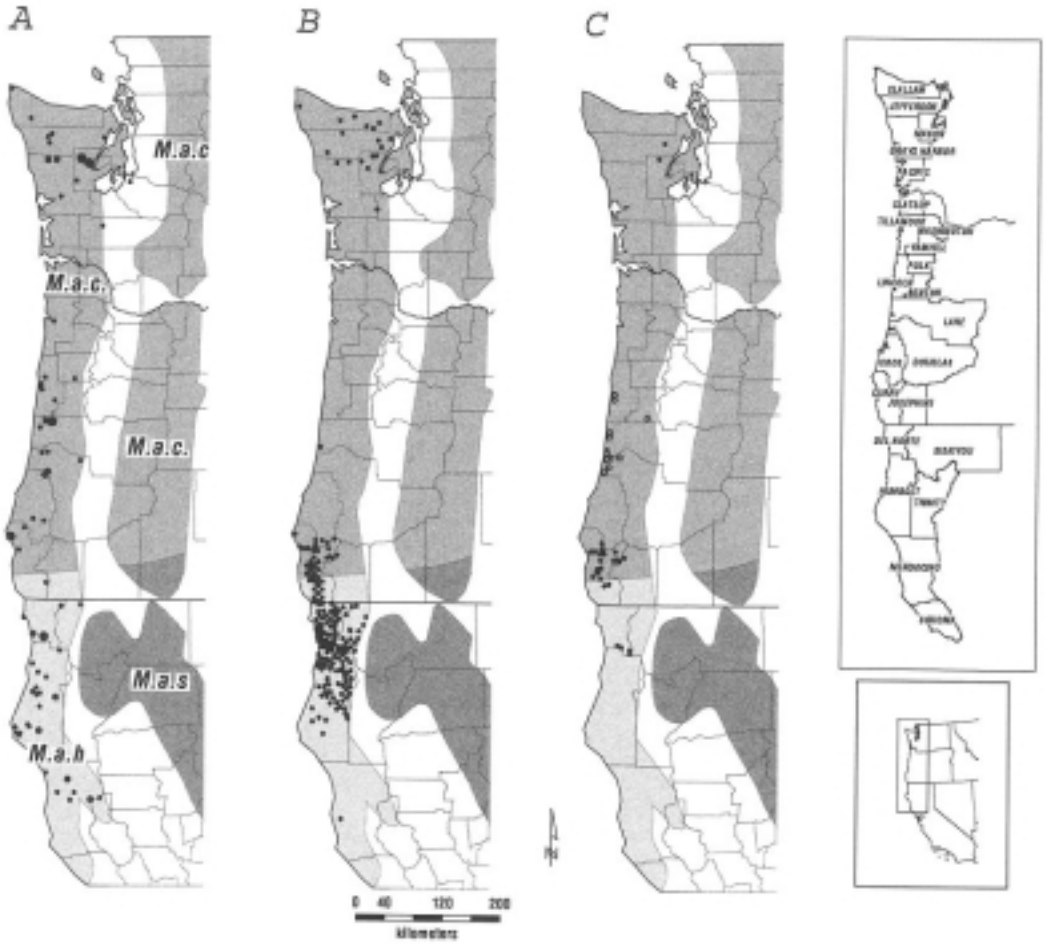

FIG. 1.--A) Historical distribution of *Martes americana humboldtensis* and *M. a. caurina* in California, Oregon, and Washington based on records collected during the early and mid-20th century. Size of circles is proportional to the number of records from the location; smallest = 1 and largest = 5-10. B) Centers of track-plate and camera sample units (see text for definition) from 1989 to 1998. C) Contemporary distribution of martens from track-plate, camera, and snow-tracking surveys (solid circles) and road kills or trapped animals (open circles) from 1989 to 1998. Subspecific boundaries are adapted from the integration of ranges presented in Dalquest (1948), Hagmeier (1956), and Hall (1981).

METHODS

Historical Information

We reviewed all available published and unpublished information on *M. a. humboldtensis* and *M. a. caurina*, which included previous reviews (Bailey 1936; Dalquest 1948; Gibilisco 1994; Grinnell et al. 1937; Kucera et al. 1995; D. B. Marshall, in litt.; Maser et al. 1981; Olterman and Verts 1972; Schempf and White 1977; Sheets 1993; Verts and Carraway 1998; Yocum 1974; Zielinski and Golightly 1996), selected files of sightings records from state and federal resource management agencies, and unpublished field notes of agency biologists and fur trappers. We also interviewed individuals who could provide special perspective on the history and current status of martens, including biologists employed by agencies or timber companies, representatives of Native American

tribes, outdoorsmen, and trappers. Information that could not be verified was not included in our database of geographic locations but provided important background information. Most of the historical data used for this analysis came from requests sent to 23 museums in North America for information about *M. a. humboldtensis or M. a.* caurina in their collections.

Contemporary Information

Field surveys.-We summarized 4 types of surveys, conducted from 1989 to 1998, using sooted track plates and remotely operated cameras, which are effective in detecting many forest carnivores, including American martens (Raphael 1994; Zielinski and Kucera 1995). We did not use reported sightings because we doubted the ability of many observers to distinguish martens from other species. Administrative surveys are often recommended as part of biologic evaluations preceding land management activities (e.g., timber harvest). Surveys conducted by research organizations were of 2 types: road based and systematic. In the former, track plates or cameras were placed at regular intervals along roads (K. M. Beyer and R. T Golightly, in litt.; L. L. C. Jones and M. G. Raphael, in litt.; Sheets 1993). In the latter, track plates or cameras were placed at regular intervals throughout the forest in the Klamath region of California and Oregon (Carroll et al. 1999). Follow-up surveys were established at the locations of highly reliable sightings or at locations where a single track or photograph detection had occurred. All surveys used either chicken, fish, deer, or elk as bait. The only stations that used commercial trapping lure (Mountain Marten® and Skunk-it®, M&M Fur Company, Bridgewater, South Dakota, or Gusto, Minnesota Trapline Products, Pennock) as an attractant were systematic research surveys in the Klamath region (only at stations that did not receive either a marten or fisher detection by the 4th visit) and the few follow-up surveys near the Klamath sample units in California.

We summarized the data represented by the 4 types of surveys by adopting the use of a standard sample unit. A sample unit is a collection of ≥4 track-plate stations or line-triggered camera stations or ≥2 35-mm camera stations deployed simultaneously. Those methods were viewed as equivalent because the track-plate and line-triggered stations tend to be run for one-half the duration of the 35-mm cameras. Sample units had multiple stations, and the number of stations differed among sample units. However, each sample unit was recorded as detecting presence when a marten was detected at any 1 of the stations. A minimum of 6.4 km was required between the closest stations of each unit. Similarly, if > 1 survey occurred in the same general location, they were considered independent only if the intersurvey interval exceeded 1 year.

Administrative surveys used either track plates, line-triggered cameras, or 35-mm camera (usually Trailmaster Model 1500 or 500; Goodson and Assoc., Inc., Lenexa, Kansas) stations (4-50 stations/sample unit) that were distributed at about 0.8-km intervals along forest roads in a project area (Zielinski 1992; Zielinski and Kucera 1995). Those surveys were conducted for a minimum of 8 days, except for the 35-mm cameras, which were run for ≥30 days. All administrative surveys were conducted in California and Oregon in 1989-1995.

The road-based research surveys included surveys exclusively within the redwood region in California (K. M. Beyer and R. T Golightly, in litt.) and the predominately line-triggered camera surveys in Washington conducted by L. L. C. Jones and M. G. Raphael (in litt.) and Sheets (1993). Surveys in the redwood region were conducted in 1994 and included 48 sample units, each composed of 6 track-plate stations set at 1-km intervals along roads. Each station was checked every other day for 22 days. The road-based research surveys in Washington included 18 sample units and were conducted in 1990-1992; each sample unit was composed of multiple line-triggered camera stations (and a few track plates in 1990) placed about 1.0 km apart along roadsides and checked every other day for ≥8 days (L. L. C. Jones and M. G. Raphael, in litt.).

The systematic research surveys in the Klamath region were conducted during the summers of 1996 and 1997 and included 78 sample units. A sample unit was a circle of 5 track-plate stations, each 0.5 km from a 6th station in the center, which was 7-10 km from the center of adjacent sample units (n = 468 stations). Nineteen of the units (114 stations) were in Oregon and 59 units (354 stations) in California. Track plates were checked every 2 days for 16 days. Follow-up surveys used 35-mm cameras (n = 13 sample units; 26 stations) or track plates (n = 5 sample units; 38 stations) and were near the locations in

California where the Klamath research surveys detected martens. Those surveys used 10.4-km^2 blocks with either 2 35-mm camera stations or 6 track-plate stations checked for a minimum of 28 and 16 days, respectively.

A few snow-tracking surveys were conducted on the Siskiyou National Forest in Oregon. Where these detected *Martes* tracks outside the known geographic range of fishers, they were included as part of the contemporary record. We were unable to obtain information about the effort or locations of snow surveys in which no tracks were discovered.

Habitat information at detection locations.--We collected vegetation information at all the sample units in the Klamath research surveys and for the follow-up surveys in California at those locations where martens were detected. We used the California Wildlife Habitat Relations (CWHR) system (Mayer and Laudenslayer 1988) to describe the cover type near each location as 1 of 5 tree size classes (class 2 = 2.5-15.2 cm dbh [diameter breast height], 3 = 15.3-27.9 cm dbh, 4 = 28.0-61.0 cm dbh, 5 = >61.1 cm dbh, 6 = class 5 + multiple layers) and 1 of 3 canopy closure classes (sparse-open = 10-39%, moderate = 40-59%, dense = 60-100%). Each track plate also was the center of a variable-radius plot where we used prism sampling (Wenger 1984) to estimate basal area of all trees and snags. We recorded the species, dbh (1.4 m), height, and condition class of each tree in the sample and estimated the number of logs and the canopy closure using 2 perpendicular, 25-m tran-centered on the track plate. Logs that intersected the transect were tallied into 4 maximum-diameter categories (15-30, 31-60, 61-90, and >90 cm). At the track plate and at the 4 cardinal directions at the 4 transect termini, we measured total canopy closure using a densitom-We estimated the percentage cover of the dominant tree and shrub species by eye calibration.

RESULTS

Historical Information

Twenty-three museums (100%) responded, and 4 reported a total of 22 specimens of *M. a. humboldtensis*, all dated before 1928. Five reported a total of 90 specimens 1A) included records from primary museum specimens (62%) and secondary records (38%). The latter include locations published in early accounts (Bailey 1936; Grinnell et al. 1937; Olterman and Verts 1972) and derived from trapper interviews (e.g., Grinnell et al. 1937; Hemphill 1952; Twining and Hensley 1947). All historical records from Washington were primary records, and two-thirds of the records from Oregon and about one-third of the historical locations for California were primary records.

California.-Few records of Humboldt martens are reported from California in the last 60 years. In 1942, 8 trappers in coastal Humboldt and Del Norte counties caught an average of 2 martens, and Twining and Hensley (1947) concluded that the range in northwestern California had contracted. In the late 1940s, Hemphill (1952) estimated > 100 martens on the Mendocino National Forest, although no data were provided. Yocum (1974) reported 7 incidental observations by biologists from 1961 to 1972. Wildlife files of government agencies included 9 observations of Humboldt martens from 1960 to 1975 (Schempf and White 1977). Raphael and Barrett (1981) collected tracks at 135 sooted track-plate stations on the eastern margin of the range of the Humboldt marten, but martens could not be confirmed among them (Raphael 1988). Three tanned skins trapped in the 1940s near Smith River, California (J. Hight, pers. comm.), represented the most recent historical record of martens within the range of *M. a. humboldtensis.* Interviews of biologists, foresters, and trappers in northwestern California did not result in any evidence of verifiable sightings or road kills.

Oregon.--The number of martens harvested in coastal Oregon counties has declined since the 1940s (Fig. 2), most notably in Coos and Curry counties. Caution must be exercised in interpreting trapping data because of annual variation in trapper effort and pelt prices; however, a large increase in the price paid for pelts occurred

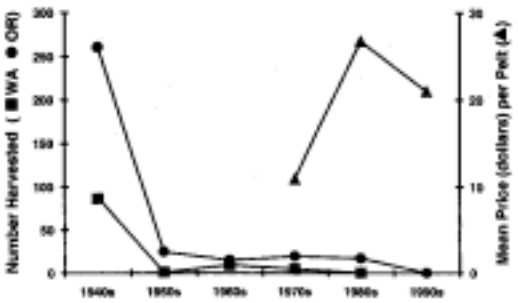

FIG. 2.-Number of martens trapped, by decade, in the predominantly coastal counties of Washington (Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific) and Oregon (Benton, Clatsop, Columbia, Coos, Curry, Josephine, Lincoln, Polk, Tillamook, Washington, Yamhill) and the mean price paid for each pelt.

in the late 1980s with no corresponding increase in harvest for any of the coastal counties (Fig. 2; Verts and Carraway 1998). Sherrell (1970) interviewed trappers in Curry County in the early 1900s and reported several localities where martens were once common but were now rare. By the 1970s martens were considered very rare along the Oregon coast (Mace 1970; Maser et al. 1981). Although historical records are sparse in the northern coastal Oregon counties (Fig. 1A), early trapping records, reported only at the county level, verify occurrence of martens in the northern Oregon counties of Clatsop, Tillamook, Washington, and Yamhill (Anonymous 1914; C. Bruce, pers. comm.; L. Cooper, pers. comm.; D. B. Marshall, in litt.; Verts and Carraway 1998).

Washington.--The historical range of martens in Washington includes all coastal counties (D. B. Marshall, in litt.; Sheets 1993). The harvest of martens in coastal Washington has never been consistent (Fig. 2). Notable was the largest harvest for any decade from the Olympic Mountains in the 1940s, 83 animals from Clallam, Jefferson, and Mason counties. Martens once occurred along the Washington coast to sea level, and Dalquest (1948) suspected that the species still might have occurred in the Willapa Hills in the 1940s. Only a few records exist of martens harvested from the southwestern counties (including martens trapped in the early 1900s in Pacific County; B. Adamire, pers. comm.), and martens are presumed to have been extirpated from this area of Washington (Gibilisco 1994; D. B. Marshall, in litt.; Sheets 1993). In addition to trapping, martens in the Olympic Mountains also were killed by poisons intended for large carnivores (B. Adamire, pers. comm.).

Contemporary Surveys

Survey effort.--Since 1989, a total of 237 sample units, using about 2,360 track-plate or camera stations comprising about 34,800 survey days, were sampled in the coastal mountains of California, Oregon, and Washington (Table 1; Fig. 1B). The density and distribution of surveys were much greater in California than in the other states, but surveys in California favored the northern portion of the historical range of the Humboldt marten over the southern portion (Mendocino and Sonoma counties). Surveys in California included a much larger sample of private land than in Oregon and Washington, where surveys occurred almost exclusively on federal land (Fig. 3). All 35 surveys in Oregon were conducted in either the Siskiyou (34) or Siuslaw (1) National Forests. Surveys in Oregon and Washington were road-based research surveys or administrative surveys (except for a minority of the sample units in Oregon from the Klamath research survey), whereas all 4 types of surveys were conducted in California. We are unaware of any survey that met our minimum requirements for inclusion that was conducted in northwestern Oregon or the southwestern Washington coastal mountains.

Detections.--Martens were detected at 12 of the 237 (5.1%) sample units across all 3 states. Martens were detected at 4 of 184 (2.2%) sample units in California. All 16 detections at these 4 units were clustered in an area <200 km^2 in southern Del Norte

TABLE 1.-Number and type of sample units and stations to survey martens (see Methods) by state, 1985-1998.

	Administrative	Research, road based	Research, systematic	Follow-up	Total
California					
Sample units	69	48	59	8	184
Stations	768	500	354	65	1,687
Oregon					
Sample units	13		19	3	35
Stations	98		114	18	230
Washington					
Sample units		18			18
Stations		443			443
Total					
Sample units	82	66	78	11	237
Stations	866	1,443	468	83	2,360
Survey days	17,196	8,544	7,488	1,560	34,792

FIG. 3.-Contemporary (1989-1998) detections of martens on federal and state public land (shaded) and private land. Detailed views depict actual locations where martens were detected rather than centers of sample units.

County on the Six Rivers National Forest near the southern end of the Siskiyou Wilderness (Fig. 1C). The 1st (1996) and 2nd (1997) detections occurred during the Klamath systematic research surveys. The remainder were from follow-up surveys in 1998 and 1999 conducted within a 15-km radius of the initial detections. No road kills have been reported in coastal California. The 16 detections near the Siskiyou Wilderness, which probably reflected fewer individuals, represented the only known population of martens in the Coast Range of California.

Surveys in Oregon detected martens at 6 of 35 (17.1%) sample units (Fig. 1C) that excluded detections by snow-track survey. Much of the contemporary location information in central Oregon (1980-1998) was derived from road kills, 9 on the Highway 101 corridor in the Siuslaw National Forest and Oregon Dune National Recreation Area and 1 on a national forest road. Most detections of martens in Oregon were on public lands in the central and southern portions of the Oregon Coast Range (Fig. 1C).

In Washington, martens were detected in only 2 of 18 sample units (11.1%) and only at a single station within each unit. All but 1 sample unit were in the Olympic National

TABLE 2.-Distribution detection locations of martens among the California Wildlife Habitat Relationships (CWHR) system cover types, tree size classes, and canopy closure classes (percentages of detections in parentheses); all assessments are visual estimates.

Cover type		Tree size class[a]		Canopy closure class[b]	
Class	No. marten detections	Class	No. marten detections	Class	No. marten detections
Douglas fir	9 (33.3)	Class 2	4 (14.8)	Sparse-open	2 (7.4)
Mixed hardwood and conifer	7 (25.9)	Class 3	7 (25.9)	Moderate	4 (14.8)
Lodgepole pine	4 (14.8)	Class 4	7 (25.9)	Dense	21 (77.8)
Montane chaparral	1 (3.7)	Class 5	8 (29.6)		
Jeffrey pine	1 (3.7)	Class 6	1 (3.7)		
Montane hardwood	1 (3.7)				
Klamath mixed conifer	1 (3.7)				
Unknown	3 (11.1)				

[a] Class 2 = 2.5-15.2 cm dbh (diameter breast height); class 3 = 15.3-27.9 cm dbh; class 4 = 28.0-61.0 cm dbh; class 5 = >61.1 cm dbh; class 6 = class 5 + multiple layers.
[b] Sparse-open = 0-39%; moderate = 40-59%; dense = 60-100%.

Park or Olympic National Forest. No surveys occurred in the central or southern portions of the coastal mountains. No road kills have been reported for coastal areas in Washington. The few summary data from Washington suggest that martens still occur on the eastern Olympic Peninsula.

The contrast between historical and contemporary distributions of martens is especially clear in California, where surveys have been numerous but detections few. Data are too few elsewhere to make similar statements, but absence of detections of martens in the western Olympic Peninsula suggests that their range in northwestern Washington also may have contracted. Martens currently occupy west-central and extreme southwestern Oregon. Unfortunately, the northern Oregon and southern Washington coastal mountains were not well represented in either historical records or the recent survey effort, making it difficult to assess the status of martens there.

Habitat at detection locations.-The stations in California and southern Oregon where martens were detected (n = 27) were represented by 7 different CWHR cover types (Table 2). Douglas fir (*Pseudotsuga menziesii*) was the most common type, but detections also occurred in a montane hardwood and a montane chaparral type. The detection locations were distributed evenly across 3 of 5 tree size classes but were most often in the dense (60-100%) overhead canopy closure class (Table 3). One of the most distinguishing characteristics of the detection locations was the density of shrubs, such as salal (*Gaultheria shallon*), Pacific rhododendron (*Rhododendron macrophyllum)*, and huckleberry oak *(Quercus vaccinifolia)*. Mean shrub cover was 70.5% ± 16.5 SD, with a paucity of logs > 15 cm diameter ($\overline{X}$ = 1.7/site) and large logs >90 cm (0.03/site) and a wide range (0-97.8%; $\overline{X}$ = 69.6%) of average canopy closure readings (Table 3). Nine of 29 detections occurred on serpentine soils on ridges where the basal area of trees was very low (minimum = 9.24 m^2/ha) but where shrub density was high. The southernmost locations, on the Six Rivers National Forest, tended to have the higher values for total basal area and overstory canopy closure.

DISCUSSION

Martens are considered the most abundant of the 4 forest carnivores, which include the fisher (*Martes pennanti*), wolverine (*Gulo gulo*), and lynx (*Lynx canaden*-Although their continental range may have declined (Gibilisco 1994), populations of martens have not suffered the magnitude

TABLE 3.-Vegetation and topographic characteristics at locations in California and Oregon where martens were detected (n = 29 except for shrub and herb cover, for which n = 12).

Character	Range	$\overline{X}$	SD	95% CI
Basal area (BA)	9.24-78.54	40.94	19.47	33.54-48.35
BA, conifer	0-69.30	30.75	19.84	23.20-38.29
BA, hardwood	0-69.30	10.20	17.13	3.68-16.71
Mean diameter breast height (dbh)	7.80-119.50	39.82	26.28	29.82-49.81
Quadratic mean dbh	8.30-122.00	43.38	27.64	32.87-53.90
Mean height	4.00-44.90	19.79	11.76	15.32.-24.26
Mean dbh, conifer	0-119.50	42.39	30.18	30.91-53.87
Mean dbh, hardwood	0-48.00	13.21	15.93	7.15-19.26
Mean, canopy closure (%)	0-97.80	69.64	29.72	58.34-80.94
Percent shrub cover (%)	28.60-90.60	70.52	16.53	60.02-81.03
Mean herb cover (%)	0-51.00	13.83	20.56	0.77-26.90
Number of logs	0-10.00	1.69	2.24	0.84-2.54
Number of large logs	0-1.00	0.03	0.19	0-0.11
Slope (%)	0-65.00	30.38	18.34	23.40-37.35

of decrease in the 20th century that has characterized the other species (Ruggiero et al. 1994). Martens are still legally trapped for their fur in most of the western states. Although individuals are affected by habitat loss, habitat fragmentation, and direct mortality via trapping (Bissonette et al. 1997; Hargis et al. 1999), most of the 14 subspecies appear to be well distributed within their geographic ranges. Exceptions include *M. a. atrata* on Newfoundland (Burnett et al. 1989), *M. a. americana* in portions of eastern Canada (Thompson 1991), and, based on our data, *M. a. humboldtensis.* Our survey results should be cause for concern about the persistence of *M. a. humboldtensis*. Data do not support a similar level of concern for *M. a. caurina* on the Olympic Peninsula, but our results support the conclusions of others (D. B. Marshall, in litt.; Sheets 1993) that martens have declined there. Our documentation of the loss of martens from significant portions of their historical range in the coastal forests contrasts with their status in the interior forests of the Cascades, Sierra Nevada, and Rocky Mountains (Gibilisco 1994; Kucera et al. 1995).

We did not uncover sufficient historical or contemporary data to allow us to evaluate the status of martens in the coastal mountain ranges of central and northern Oregon and southern Washington. The routes taken by early (1800s) museum expeditions bypassed most of this region (Verts and Carraway 1998), and we found few museum records from this era. However, martens are included in the earliest records of commercial fur harvest in the central and northern coastal counties of Oregon (Anonymous 1914; C. Bruce, pers. comm.; L. Cooper, pers. comm.). Because much of the unsurveyed area between central Oregon and southern Washington is privately owned commercial forest or managed state forest (Fig. 3) on which very little mature or old-growth forest remains, we are not optimistic about the abundance of martens there. Martens are sensitive to forest fragmentation in both the Rocky Mountains (Bissonette et al. 1997; Hargis et al. 1999) and the northeastern United States (Bissonette et al. 1997; Chapin et al. 1998) and may respond similarly to fragmentation of mature forest habitat in coastal Oregon and Washington.

The absence of reported road kills along coastal Highway 101 in northern Oregon and southern Washington, in contrast to the dozen or so on the same highway in central

Oregon, also suggests low numbers of martens. Because this highway runs the entire length of the range of coastal martens in the Pacific states, densities of road kills should reflect the abundance of martens. Although not all evidence is as convincing as the results of detection surveys, the data suggest that of the 3 states, martens are most common in coastal Oregon.

In early 1996, the prognosis for the discovery and recovery of populations of martens in coastal California was bleak. The existence of martens within the historical range of the Humboldt subspecies was in doubt (Zielinski and Golightly 1996). Then, in 1996 and 1997, the detection of martens at 2 locations within the historical range of the Humboldt subspecies represented the 1st verified presence of martens in this region in 50 years. However, their location alone is insufficient evidence to conclude that they are members of *M. a. humboldtensis.* None of the animals we detected have been captured and examined, nor have we collected hair or other tissue for analysis. Furthermore, all detections occurred <100 km from the western boundary of *M. a. sierrae* (Grinnell et al. 1937). Also, none of the recent detections in California occurred in redwoods, the forest type with which the Humboldt marten was originally associated (Grinnell and Dixon 1926; Grinnell et al. 1937).

The ambiguity of the original subspecific boundaries and absence of genetic data make it difficult to assign the martens we detected in California to subspecies. Yet, from a conservation perspective, the subspecific affinity of the individual animals is academic; our results document the 1st martens detected within the California Coast Range since the trapping season was closed in 1946. It appears that a population of martens exists within the California coastal mountains, and with sufficient potential for growth to warrant conservation measures. Martens appear to occupy a region of about 150-200 km^2.

The demise of the Humboldt marten was first attributed to overtrapping (Twining and Hensley 1947). However, it has been >50 years since martens have been protected from trapping in northwestern California. We believe that the effect of timber harvest in the redwood region is the most plausible reason for the continued absence of martens from most of the coastal range. The north coast was 1 of the 1st regions subjected to commercial harvest in California. Less than 5% of the original forest cover in the redwood region remains unharvested (Fox 1996). Because martens typically are associated with old forests with a diversity of large structural features (Buskirk and Powell 1994), it is likely that the intensity of timber harvest, especially on private land, has reduced the habitat value over much of the region and may affect immigration of martens to California from populations on public forest land in southwestern Oregon.

Tree basal area and canopy closure at detection locations varied considerably, but martens were almost always detected in dense shrub layer. In this respect, the habitat at marten detection locations resembles that described for the sable (*M. zibellina*) in China (Buskirk et al. 1996). Martens were detected at some locations with very few mature trees, where our previous understanding of the ecology of martens would have suggested that we would be unlikely to detect them. Many of those locations were on ridgetops where serpentine parent material limited density of trees but not shrubs. Detections were distributed quite evenly among size classes of CWHR trees, indicating that size class alone is not sufficient to predict presence of martens. In fact, the average basal area reported here (40.9 m^2/ha) is lower than that reported at track-plate detection locations in the northern (Spencer 1981) and southern (W J. Zielinski, in litt.) Sierra Nevada in California. However, most detection locations were in the CWHR dense class, consistent with the general description of the habitat of martens (Buskirk and Powell 1994). Canopy closure readings measured directly with a densi-

tometer also support the CWHR visual density estimates.

Our study draws attention to potential problems associated with managing a species associated with mature forest conditions in the coastal regions of the Pacific states. All martens detected were on or near public lands (Fig. 3). Detections are clumped in 4 locations, separated by significant distances. Although surveys on private lands in Oregon and Washington have not been conducted, based on the negative results of surveys on private lands in California, we suspect that martens are faring worse on private than public lands. Federal lands in the coastal mountains of the Pacific states are few and fragmented compared with the nearly continuous distribution of national forest and national park land in the Cascades and the Sierra Nevada (Fig. 3).

Our summary of historical information and results of recent detection surveys have emphasized *M. a. humboldtensis*, largely because of the concern about its continued existence (Zielinski and Golightly 1996). More historical and contemporary data exist on the distribution of *M. a. humboldtensis* in California than *M. a. caurina* in Oregon and Washington. However, conservation efforts should focus on all martens in coastal forests throughout the Pacific Northwest. Coastal forest habitats are poorly connected compared with inland habitats (e.g., Cascades, Sierra Nevada) that constitute most of the range of the species in the Pacific states. Our surveys have demonstrated a serious conservation problem that appears to affect populations and subspecies and that requires prompt attention if martens are to persist in forest communities of the Pacific coast.

Acknowledgments

Many people helped collect the field data we synthesized, especially the employees of the United States Forest Service in Oregon and California. In particular we acknowledge the field assistance of T Kirk, J. Lowe, D. Barrett, R. Brening, J. Shamansky, S. Paghlulgi, and A. Hill. C. Ogan, B. Devlin, T Hacking, D. Austin, K. Schmidt, and S. Sniado, all of the Forest Service, provided essential administrative support and coordination for surveys. We thank D. Macfarlane of the Pacific Southwest Region of the United States Forest Service and A. Brickey of the United States Fish and Wildlife Service for providing funding. The Pacific Southwest Research Station of the Forest Service also provided financial support. We are indebted to L. Cooper and C. Bruce of the Oregon Department of Fish and Wildlife and J. Lewis of the Washington Department of Fish and Wildlife for providing information regarding the history of marten distribution. R. Truex assisted with analyses and review, and A. Wright created the maps. K. Aubry provided information about martens in Oregon and Washington and reviewed the manuscript. M. Raphael and S. Buskirk also provided helpful editorial comments, and A. Albert provided editorial assistance.

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Associate Editor was Ronald E. Barry.

Date submitted (Alaskan Standard Time): 11/9/2019 3:00:00 PM
First name: Laura
Last name: Glover
Organization:
Title:
Comments:
My name is Laura Glover and I live in Wilmington, North Carolina.

The Cape Fear river has become another Love Canal.

I am writing to express strong opposition to efforts to roll back the Roadless Area Conservation Rule (Roadless Rule) in Alaska or elsewhere. The Roadless Rule was implemented with unprecedented public support to protect some of our nations most pristine public lands, including large parts of the Tongass National Forest. You must choose the No Action alternative. Any other choice would ignore overwhelming public support and harm Alaskans, including Alaska Natives, and taxpayers across the nation.

In Southeast Alaska, tourism accounts for 28% of employment and generate an annual $1 billion in economic benefit, making it far more of an economic driver than the timber industry, which is less than 1% of the regional economy.

Any choice but the No Action alternative would also put wildlife and critical habitat at risk, threaten access to clean water, and be a step in the wrong direction on climate change jeopardizing Alaskans at a time when the state already faces severe challenges related to rising temperatures. I urge you not to abandon the Roadless Rule in Alaska and instead to put the public interest above corporate profits by choosing to keep the rule in place unchanged.

Thank you for considering my comments.
Regards, Laura Glover

Date submitted (Alaskan Standard Time): 12/16/2019 3:00:00 PM
First name: Lisa
Last name: Glover
Organization:
Title:
Comments:
I am writing to support the No-Action Alternative for the Draft Environmental Impact Statement on the proposed Alaska Roadless Rule, Alternative #1. I support keeping the current Roadless Rule protections in place and intact for the Tongass National Forest. Trumps plan is yet another attack from the Trump administration on Indigenous rights. Alaskan Native communities -- including the Tlingit, Haida, and Tsimshian peoples -- have depended on the Tongass Rainforest for millennia. It is the backbone to their culture, traditions, and communities -- we simply cannot let it disappear.

The Tongass contains some of the largest intact old-growth temperate rainforest in the world, and its value in providing clean water for fish and wildlife habitat is essential to the economic and ecological health of Southeast Alaska. I urge you to keep the federal Roadless Rule intact and current protections in place for national forests in Alaska.

In addition, I strongly object to your plans to reduce and remove protections from our national forests roadless areas. The Roadless Rule is one of the smartest and most popular land management policies the Federal Government has ever adopted. Not only does it preserve some of Americas best fish and wildlife habitat, but it also saves untold millions of taxpayer dollars that might otherwise be spent to subsidize money-losing timber sales. The value of the Roadless Rule in preventing environmentally damaging and economically wasteful road-building and logging is particularly relevant in the Tongass, where logging costs vastly exceed timber revenues and require unconscionable taxpayer subsidies.
Regards, Lisa Glover

Date submitted (Alaskan Standard Time): 12/16/2019 3:00:00 PM
First name: Richard
Last name: Glover
Organization:
Title:
Comments:
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Regards, Richard Glover

Date submitted (Alaskan Standard Time): 11/10/2019 3:00:00 PM
First name: Robert
Last name: Glover
Organization:
Title:
Comments:
My name is Robert Glover and I live in Fresno, California.

I am writing to express strong opposition to efforts to roll back the Roadless Area Conservation Rule (Roadless Rule) in Alaska or elsewhere. The Roadless Rule was implemented with unprecedented public support to protect some of our nations most pristine public lands, including large parts of the Tongass National Forest. You must choose the No Action alternative. Any other choice would ignore overwhelming public support and harm Alaskans, including Alaska Natives, and taxpayers across the nation.

In Southeast Alaska, tourism accounts for 28% of employment and generate an annual $1 billion in economic benefit, making it far more of an economic driver than the timber industry, which is less than 1% of the regional economy.

Any choice but the No Action alternative would also put wildlife and critical habitat at risk, threaten access to clean water, and be a step in the wrong direction on climate change jeopardizing Alaskans at a time when the state already faces severe challenges related to rising temperatures. I urge you not to abandon the Roadless Rule in Alaska and instead to put the public interest above corporate profits by choosing to keep the rule in place unchanged.

Thank you for considering my comments.
Regards, Robert Glover

Date submitted (Alaskan Standard Time): 11/8/2019 3:00:00 PM
First name: Tim
Last name: Glover
Organization:
Title:
Comments:
My name is Tim Glover and I live in Micco, Florida.

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