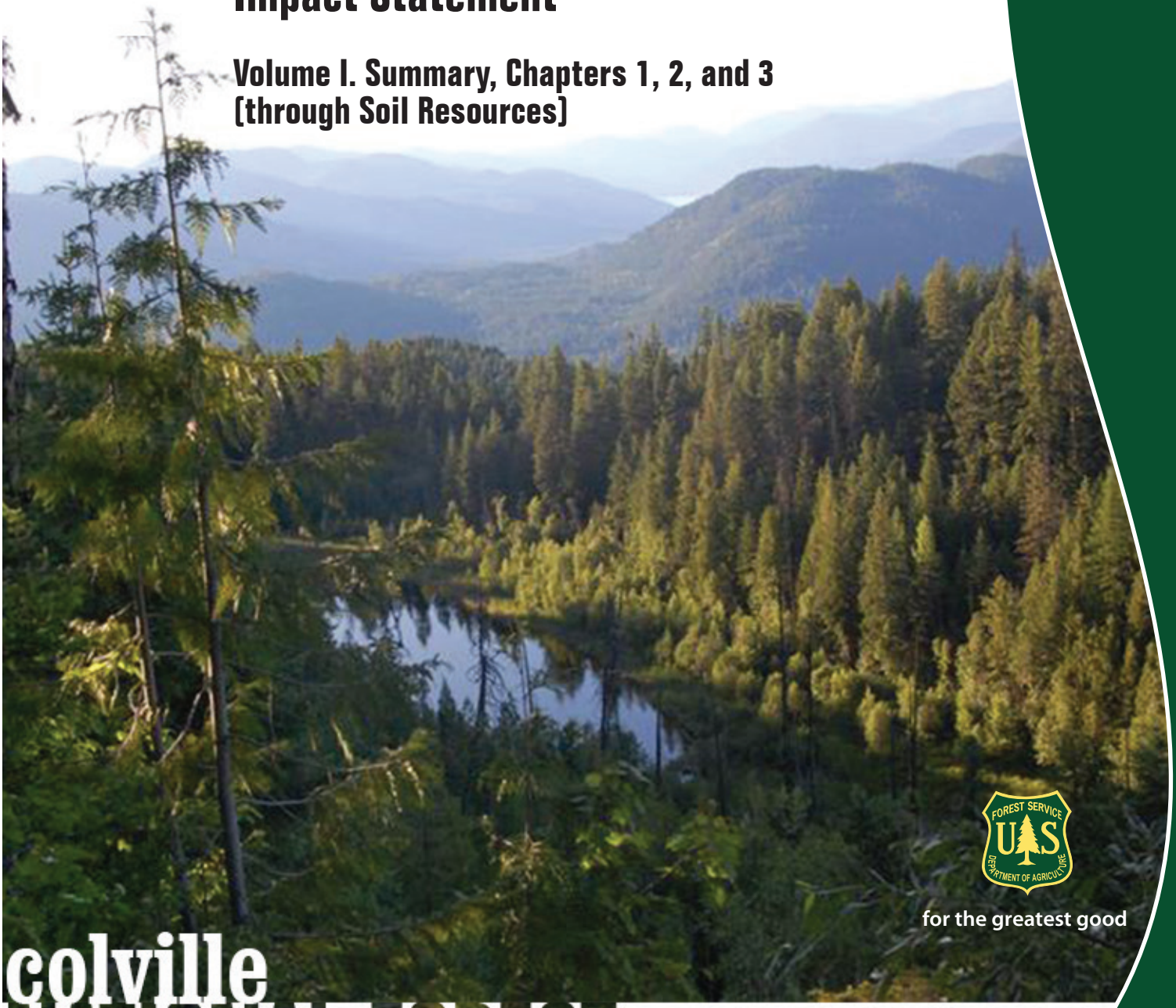
United States Department of Agriculture

# Proposed Revised Land Management Plan for Colville National Forest

## Draft Programmatic Environmental Impact Statement

### Volume I. Summary, Chapters 1, 2, and 3 (through Soil Resources)



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January 2016

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# Proposed Revised Land Management Plan for the Colville National Forest Draft Programmatic Environmental Impact Statement Stevens, Ferry, and Pend Oreille Counties of Washington State

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**Abstract:** This draft environmental impact statement (DEIS) documents the analysis of six alternatives (no action, proposed action, and alternatives P, R, B, and O) developed by the Forest Service for the programmatic management of approximately 1.1 million acres administered by the Colville National Forest. For ease of reference, the accompanying proposed revised land management plan (revised forest plan) reflects the preferred alternative. The alternatives are described in chapter 2. The no-action alternative would keep in place the management direction from the 1988 land and resource management plan (1988 forest plan), as amended. Alternative P is the preferred alternative.

The proposed action and alternatives P, R, B, and O address the following needs for action: (1) maintain or restore ecological conditions that contribute to the recovery and viability of terrestrial plant and wildlife species; (2) manage forest vegetation conditions to be more resilient to disturbances; (3) address climate change implications and vulnerabilities; (4) address changed social and economic conditions and preferences in light of ecosystem capacity; (5) accelerate improvement in watershed condition across the forest; and (6) integrate watershed and aquatic strategies across the forest.

Alternatives P, R, B, and O address new information and concerns that emerged during the implementation of the 1988 forest plan and comply with Federal laws, regulations, and policies. These alternatives also address significant issues (unresolved conflicts with the proposed action) that were identified from comments received during the scoping and public involvement period.

The Forest Service will use the "predecisional administrative review process," also referred to as the "objection process" described in 36 CFR 219 Subpart B of the 2012 Planning Rule. This process gives an individual or entity an opportunity for an independent Forest Service review and resolution of issues before the approval of a plan revision; this subpart identifies who may file objections to a plan revision, the responsibilities of the participants in an objection, and the procedures that apply to the review of the objection. Generally, individuals and entities who have submitted substantive formal comments related to this plan revision during the opportunities for public comment for this decision may file an objection.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the agency's preparation of the final EIS and proposed revised forest plan. Therefore, comments should be provided before the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews. Comments on the DEIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3)

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**Date Comments Must Be Received:** Within 90 days following publication of the notice of availability of the DEIS in the Federal Register. The notice is expected to be published on or around February 5, 2016; however, it is the commenter's responsibility to calculate the end of the 90-day period.

# Summary

## Proposed Action

The Colville National Forest (or the Forest) proposes to revise its 1988 land management plan (forest plan). The area affected by the proposal includes about 1.1 million acres of public land. The revised forest plan would allocate National Forest System (NFS) lands to 13 management areas (MAs) including: Focused Restoration, General Restoration, Backcountry, Backcountry Motorized, Wilderness-Designated, Wilderness-Recommended, Eligible and Suitable Wild and Scenic Rivers, Scenic Byways, Administrative Recreation Sites, and Riparian Management Areas. The proposed MAs represent different management themes with varying emphasis such as vegetation management, watershed restoration, motorized and non-motorized recreation, or special designations designed to sustain the social, economic, and ecological attributes of the Forest.

Allocation to a specific MA is not intended to mandate or direct the Forest Service to propose or implement any action; rather, the MAs provide direction on desired conditions and allowable activities and uses, as described in the revised forest plan, regarding:

- Timber harvest/timber production;
- Commercial and personal use of special forest products and firewood;
- Fire (planned and unplanned ignitions);
- Livestock grazing;
- Motorized use;
- Mechanized use;
- Over-snow motor vehicle use;
- Road construction and reconstruction; and
- Minerals (leasable and saleable mineral materials).

## Purpose and Need

The purpose of the action is to revise the 1988 forest plan for the Colville National Forest. The revised forest plan would guide natural resource management activities on the Forest, and address changed conditions and direction that have occurred since the original forest plan (1988 forest plan), while meeting the objectives of Federal law, regulation, and policy. Specifically, the revised forest plan would provide management direction for forest resources both forestwide and specific to management areas.

Over the 25-year life of the forest plan, economic, social, and ecological conditions have changed. New laws, regulations, and policies are in place. Congressional direction, court decisions, conservation agreements, recovery plans, and scientific findings contribute to changed management conditions and support the need for revision. Endangered Species Act species listings have been updated, and new information based on monitoring and scientific research is available. Specific need for change topics include wildlife habitat, vegetative systems, climate change, social systems, and aquatic and riparian systems.

Due to these changed conditions and the age of the forest plan, the Colville National Forest began the process of revising its plan in 2003. The need for revision is based on legal requirements, changed

conditions, and the Analysis of the Management Situation (2015). Revision is also warranted because the forest plan is beyond the 10- to 15-year duration provided by the National Forest Management Act (NFMA) (16 U.S.C. 1606(e) (5) (A)).

## Public Involvement

The Colville National Forest started forest plan revision in 2003, followed by public participation, which began in 2004 with community workshops about the need to change the existing forest plan. We held workshops in communities throughout northeastern Washington, with additional workshops on specific topics, including wilderness and recreation from 2005 to 2008. Meetings with representatives from local counties began in 2004, and are being held on a continuing basis throughout the forest plan revision process. Government-to-government consultation with tribal nations and staff-to-staff consultation with their resource specialists began early in the process and continues. State agencies are cooperating agencies. Federal agencies the Forest Service works closely with are the Department of Homeland Security and the U.S. Fish and Wildlife Service. A 2007 memorandum of agreement with the Washington State Association of Counties provides a framework for our work with the three local counties. Three federally recognized tribes have engaged at varied levels: the Colville Confederated Tribes (the Forest's largest neighbors), and the smaller Spokane and Kalispel Tribes. We held additional meetings with interest groups, user groups, State and Federal officials, tribal staff, and industry groups.

In June 2011, the Forest Service published a combined notice announcing that the proposed actions for the Colville and Okanogan-Wenatchee National Forests were available for public review and comment. Public meetings and outreach efforts continued through 2013, based on the information related to both forests.

The 90-day comment period per the 2011 notice drew 27,274 comment letters, of which 889 contained unique and substantially different comments. We received letters, emails, form letters, and public comment forms from tribes, individuals, organizations, agencies, businesses, and groups from 15 states in the United States and British Columbia, Canada; however, this does not include state affiliation for all of the form letters. We analyzed 3,250 comments from the 889 comment letters to identify the significant issues driving the alternatives.

After the comment period, the regional forester determined that the most effective process to reflect public input and resource needs was to separate the Colville and Okanogan-Wenatchee National Forests' plan revision effort. Moving forward from today, the DEIS reflects issues and alternatives specific to the Colville National Forest only. The Okanogan-Wenatchee National Forest is in the process of developing a proposed forest plan and completing a separate analysis specific to its resource needs and public input specific to that forest. All input, including public comments received to date, will continue to be part of each forest plan revision, as appropriate.

## Significant Issues

Six significant issues led to the development of multiple programmatic strategies (or alternatives) for revising the plan. A summary of these alternatives as well as analysis of the environmental consequences they pose are the focus of this draft environmental impact statement (DEIS).

- Old forest (late-successional) management, and timber production
- Motorized recreation trails
- Access
- Recommended wilderness areas

- Wildlife
- Riparian and aquatic resource management

# Alternatives

The six issues led the agency to develop six alternatives. Table 1 provides a short description of each alternative.

**Table 1. Short description of alternatives considered in detail**

| Alternative | Short Description |
|---|---|
| 1988 Forest Plan – No-action alternative | The “no-action alternative” reflects current management practices under the existing forest plan, as amended and implemented. It provides the basis for comparing the existing condition to the proposed action and the alternatives.<br>If the decisionmaker were to choose to continue to implement the 1988 forest plan versus choosing a revised alternative, interim direction in the Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH) and the Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens) would be considered final direction for the Colville National Forest (i.e., would no longer be considered interim).<br>Continuing with the current forest plan would provide an annual predicted wood sale quantity (PWSQ) volume of 41 MMBF with an estimated wage contribution of $19,335,000.<br>There is no recommended wilderness in the 1988 forest plan. |
| Proposed Action | The June 2011 proposed action addresses the need for change. It applies landscape ecology concepts to provide for ecological resilience to disturbances, including the effects of climate change and incorporates new science related to the recovery of terrestrial and aquatic threatened and endangered species.<br>The overarching emphasis of this alternative would be to apply active vegetation management in a dynamic landscape approach to increase vegetation resilience and move the landscape toward desired conditions. Silvicultural prescriptions such as variable density thinning and free selection would promote structural and landscape complexity on 71 percent of the forest. Planned and unplanned ignitions would be used as management tools across the Forest, but would be emphasized on 30 percent of the Forest.<br>The proposed action would provide an annual predicted wood sale quantity (PWSQ) volume of 62 MMBF with an estimated wage contribution of $31,224,000.<br>The proposed action would recommend 101,390 acres of additional wilderness and would provide backcountry recreation management emphasis on 14 percent of the Forest.<br>The proposed action adopts the Aquatic and Riparian Conservation Strategy (ARCS), replacing INFISH with a long-term strategy that uses best science and aligns species and water quality recovery plans. |
| Alternative P | The overall vegetation management approach, outputs in alternative P, and backcountry recreation management would be similar to the proposed action.<br>Alternative P would create the Kettle Crest Special Interest Area (approximately 82,800 acres). This management area allocation would recognize and protect outstanding recreation opportunities in a semi-primitive setting while allowing continued motorized and mechanized recreation opportunities.<br>In response to comments on the proposed action, alternative P would recommend 68,300 acres of wilderness.<br>Like the proposed action, alternative P would adopt ARCS. However, it would also expand the key watershed network, and increase riparian protection through additional plan components (ARCS-modified). |

| Alternative | Short Description |
|---|---|
| Alternative R | Alternative R would emphasize a large-scale reserve approach for late-successional forest structure, emphasizing a passive management approach to reach desired conditions. Silvicultural prescriptions such as shelterwood with reserves and variable density thinning would be used on 22 percent of the Forest, in consideration of the 21-inch upper diameter limit on cutting live trees. Planned and unplanned ignitions would be used as management tools across the Forest, but would be emphasized on 75 percent of the Forest.<br>Alternative R would provide an annual predicted wood sale quantity (PWSQ) volume of 14 MMBF with an estimated wage contribution of $6,692,000.<br>Alternative R would recommend 207,800 acres of additional wilderness.<br>Alternative R would take the same aquatic strategy approach as alternative P through ARCS-modified. |
| Alternative B | The intent of alternative B is to addresses the concerns of multiple constituencies in one alternative by balancing land allocations between areas emphasizing active management (timber management zones) (43 percent), emphasizing a mix of active and passive management (Restoration Areas) (31 percent), and emphasizing passive management (recommended and designated wilderness) (23 percent).<br>Alternative B would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure. It would include additional plan components limit mechanical restoration treatments (timber harvest) in late-successional structure to dry plant association groups only.<br>Alternative B would provide an annual predicted wood sale quantity (PWSQ) volume of 37 MMBF with an estimated wage contribution of $17,428,000.<br>This alternative would recommend 220,330 acres of additional wilderness and would emphasize non-motorized recreation opportunities.<br>Alternative B would retain and integrate the INFISH, continuing riparian area management similar to the no-action alternative.<br>Where plan components were not identified by the collaborative group, the 1988 Colville Forest Plan (no-action alternative) would provide plan direction (remain unchanged). |
| Alternative O | Similar to alternative B, the intent of alternative O is to balance land allocations between areas emphasizing active management (Responsible Management Areas) (39 percent), emphasizing a mix of active and passive management (Restoration Areas) (34 percent), and emphasizing passive management (backcountry and recommended/designated wilderness) (25 percent).<br>Alternative O would create the Kettle Crest Special Interest Area. This management area allocation would recognize and protect outstanding recreation opportunities in a semi-primitive setting while allowing continued motorized and mechanized recreation opportunities.<br>Similar to alternative B, alternative O would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure. It would include additional plan components to limit mechanical restoration treatments (timber harvest) to a one-time entry.<br>This alternative would recommend fewer acres of additional wilderness (15,950 acres) than alternative B, and would instead emphasize backcountry recreation opportunities (21 percent).<br>Alternative O would provide an annual predicted wood sale quantity (PWSQ) volume of 38 MMBF with an estimated wage contribution of $17,465,000.<br>Where the collaborative group did not identify plan components, the proposed action would provide plan direction. This includes the proposed action's approach to adopt ARCS. |

All alternatives represent, to varying degrees, the principles of multiple-use, and ecological and economic sustainability. The alternatives provide basic protection of forest resources and comply fully with applicable laws, regulations, and policies. In addition, all the alternatives would:

- Meet the purpose and need for change or address one or more significant issues;
- Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land;
- Provide protections for riparian areas;
- Maintain air quality that meets or exceeds applicable Federal, State, and/or local standards or regulations;
- Include measures for preventing the destruction or adverse modification of critical habitat for threatened and endangered species;
- Protect heritage resources;
- Recognize the unique status of American Indian tribes and their rights retained by trust and executive order with the United States, including consultation requirements;
- Provide sustained multiple uses, products, and services in an environmentally acceptable manner (including leasable and locatable minerals, timber, livestock forage, and recreation opportunities);
- Retain existing designated areas (e.g., wilderness areas, scenic byways, national scenic trails); and
- Retain all existing permitted activities and facilities.[1]

The following would not change among alternatives:

- **Developed Recreation Sites –** Existing developed recreation sites would be retained in all alternatives, and no developed recreation sites would be removed or created. Allocation of administrative recreation sites would remain constant for all action alternatives.
- **Eligible Wild and Scenic Rivers –** The two rivers identified as eligible for inclusion in the Wild and Scenic River System for the 1988 forest plan (8 miles) are carried forward in this revision effort and would not vary by alternative.
- **Designated Wilderness –** The Salmo-Priest Wilderness Designation would remain constant for all alternatives.
- **Research Natural Areas (RNAs) –** Allocations of RNAs would remain constant for all alternatives.

## Comparison of Alternatives

Chapter 3 presents a detailed description of the effects of the alternatives. Table 2 provides a summary of effects by revision topic.

[1] All permits will be reviewed for compliance with the revised forest plan. Any permit found to be out of compliance will be brought into compliance as soon as practicable using a variety of tools, including modifications or amendments to the permit.

**Table 2. Comparison of some plan revision key indicators**

| Resource and Indicator | No-action | Proposed Action | Alt. P | Alt. R | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| **Vegetation** | | | | | | |
| Uses a Fixed Reserves, connectivity corridors and Diameter Limit Management Approach for Managing Late-successional Reserves and Old Forest Habitat Versus Dynamic Landscape Management Approach | Fixed Reserves, connectivity corridors and Diameter Limit | Dynamic Landscape | Dynamic Landscape | Fixed Reserves and Diameter Limit | Fixed Reserves, connectivity corridors and Diameter Limit | Fixed Reserves, connectivity corridors and Diameter Limit |
| **Timber Production[2]** | | | | | | |
| Acres/Percentage Suitable for Timber Production | 535,725<br>48% | 653,242<br>59% | 656,628<br>60% | 129,420<br>12% | 384,485<br>35% | 347,535<br>32% |
| Acres/Percent Harvest Allowed for Other Resource Objectives | 323,025<br>29% | 205,508<br>19% | 202,122<br>18% | 729,330<br>66% | 474,265<br>43% | 511,215<br>46% |
| Predicted Wood Sale Quantity[3] MMBF<br>CCF | 41<br>82,800 | 62<br>125,900 | 62<br>125,400 | 14<br>28,900 | 37<br>77,000 | 38<br>77,000 |
| **Roads** | | | | | | |
| Percent of Forest Suitable for Roads | 83% | 73% | 75% | 75% | 74% | 74% |
| **Recommended Wilderness** | | | | | | |
| Acres/Percent Recommended for Wilderness | 0 | 101,390<br>9% | 68,300<br>6% | 207,800<br>19% | 220,330<br>20% | 15,950<br>1% |
| Designation of Kettle Crest Special Interest Area | No | No | Yes | No | No | Yes |
| **Recreation** | | | | | | |
| Percent Forestwide Where Roads, Trails, and Areas may be Designated for Motor Vehicle Use | 89% | 79% | 80% | 76% | 75% | 78% |
| **Wildlife** | | | | | | |
| Old Forest Management Plan Direction Contribution to Viability | Low | Moderate | High | High | Low | Low |
| **Riparian Habitat** | | | | | | |
| Number of Subwatersheds with Improved Trend | 7 | 12 | 15 | 15 | 15 | 7 |

[2] All outputs present in annual measurements
[3] Predicted wood sale quantity includes both commercial and non-commercial (e.g., firewood) wood products sold, on average, per year.

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# Chapter 1. Purpose of and Need for Action

The Forest Service prepared this programmatic draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal laws and regulations. This DEIS discloses the environmental impacts that would result from the proposed action and alternatives. This document is organized into four chapters:

- ***Chapter 1. Purpose of and Need for Action.*** This chapter includes the history of the proposal, the purpose of and need for action, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- ***Chapter 2. Alternatives, including the Proposed Action.*** This chapter provides a more detailed description of the agency's proposed action and alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- ***Chapter 3. Affected Environment and Environmental Consequences.*** This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area, significant issues, and environmental component.
- ***Chapter 4. Consultation and Coordination***. This chapter provides a list of preparers and agencies consulted during the development of the DEIS.
- ***Appendices.*** The appendices provide more detailed information to support the analyses presented in the DEIS.
- ***Index.*** The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Colville National Forest Supervisor's Office.

## Background

The Colville National Forest is managed by the Forest Service, an agency of the U.S. Department of Agriculture (USDA). As required by the National Forest Management Act (NFMA) of 1976 (16 U.S.C. 1604, et seq.), the Forest Service currently manages Colville National Forest under a land management plan (forest plan) approved in 1988. The 1988 forest plan, including its amendments, is the main document that guides Forest decision-making with respect to managing natural resources (e.g., soil, water, vegetation, and ecosystems) and human uses (e.g., recreation, thinning, livestock grazing, firewood gathering, special use permits, and search for solitude) of the Colville National Forest. The Newport Ranger District is still part of the Kaniksu National Forest, but has been administered by the Colville National Forest since 1974. Throughout this document, the terms "Colville National Forest" and "Forest" refer to both the Colville and that portion of the Kaniksu National Forest that Colville National Forest administers.

The Colville National Forest is proposing to revise its 1988 forest plan. Per direction in the NFMA and its implementing regulations found in 36 CFR 219, every national forest must revise its land management plan:

- Every 10 to 15 years;
- When conditions or demands in the area covered by the plan have changed significantly;
- When changes in agency policies, goals, or objectives would have a significant effect on forest level programs; and
- When monitoring and evaluation indicate revision is necessary.

During the 25-year life of the forest plan, economic, social, and ecological conditions have changed. New laws, regulations, and policies are in place. Congressional direction, court decisions, conservation agreements, recovery plans, and scientific findings contribute to changed management conditions and support the need for revision. Endangered Species Act species listings have been updated, and new information based on monitoring and scientific research is available.

Due to these changed conditions and the age of the plan, the Colville National Forest began the process of revising its plan in 2003. During this process, the Forest developed multiple programmatic strategies (or alternatives) for revising its plan. A summary of these alternatives (chapter 2) as well as analysis of the environmental consequences (chapter 3) they pose are the focus of this draft environmental impact statement (DEIS).

## Development of the Proposed Action

The Colville and Okanogan-Wenatchee National Forests began a joint forest plan revision effort in 2004, with community workshops, county representative meetings, and tribal consultation. In June 2011, the scoping of the proposed action was initiated with the Federal Register Notice of Intent to Prepare an EIS and Revised Forest Plan. That scoping notice indicated the Forests would be revising under the provisions of the National Forest planning regulations in effect prior to November 9, 2000, referred to in this document as the 1982 Planning Rule. (See the following hyperlink for the 1982 procedures: http://www.fs.fed.us/emc/nfma/includes/nfmareg.html.)

On May 9, 2012, the agency established a new planning rule (the 2012 Planning Rule). The 2012 Rule also provides transition language at 36 CFR 219.17(b)(3), allowing the responsible official to elect to use the provisions of the prior planning regulations to prepare plan amendments and revisions. The responsible official has elected to continue to follow the provisions of the planning regulations in effect prior to May 9, 2012, as indicated in the 2011 Notice of Intent. However, in consideration of transition time requirements, the Forest will develop the monitoring plan per 36 CFR 219.12 of the 2012 Rule.

In 2014, after review of public input and the feasibility of the combined process, the regional forester determined that separating the Colville and Okanogan-Wenatchee National Forests' revision efforts was the best way to reflect public input and resource needs. While the analyses for the forests are still considering all public comments received to date, the Colville DEIS and future documents will reflect issues and alternatives specific to the Colville National Forest. The Okanogan-Wenatchee National Forest is completing a separate analysis and draft revised forest plan specific to its resource needs and public input.

The proposed revised forest plan updates the desired conditions, objectives, standards, guidelines, special areas, suitability, and monitoring requirements that will guide management of the Colville National Forest for the next 10 to 15 years. It also changes the description and allocation of the management areas to achieve forestwide desired conditions and to provide opportunities for a

range of activities. The proposed revised forest plan accompanying this DEIS addresses the need for changes as described below.

## Planning Area

The 1.1-million-acre Colville National Forest is located in the northeastern corner of Washington State within Ferry, Stevens, and Pend Oreille Counties. Ranger district offices are located in Republic, Kettle Falls, Metaline Falls, and Newport, and the supervisor's office is located in Colville (see figure 1).

Waters from the Colville National Forest feed Lake Roosevelt on the Columbia River, which is impounded by the Grand Coulee Dam, the largest power-supplying dam in the United States. The Grand Coulee Dam generates 21 billion kilowatt-hours of electricity per year, supplying power to Washington, Oregon, Idaho, Montana, Wyoming, Colorado, California, Nevada, New Mexico, Utah, Arizona, and Canada. Hydropower and flood control on the Columbia River are governed by the Columbia River Treaty between the United States and Canada. In addition, two hydropower projects have acreage on the Colville National Forest on the Pend Oreille River. Boundary Dam generates one-third of Seattle City Light's power, and Box Canyon Dam supplies power for Pend Oreille County.

Plant species data include about 2,400 vascular and nonvascular plant and fungi taxa that occur on the Forest and vicinity. Of those, 38 have been identified as Pacific Northwest Region sensitive species. The moonwort species, *Botrychium lineare*, occurs here at the only site in Washington State, thriving on the Colville National Forest. In addition, two wildflower-viewing sites are documented and described for public recreation opportunities. The wide range of geological and soil types, precipitation, and elevations spanning warm valley bottoms to cold mountain peaks create a diverse assortment of plant communities.

Three hundred twenty-three known species of vertebrate wildlife occur in the Forest, including 73 species of mammals, 234 birds, 9 reptiles, and 7 species of amphibians. Thirty-one species or sub-species of fish inhabit Colville National Forest waters. Unique wildlife species such as red-tailed chipmunk, northern bog lemming, and woodland caribou live on the Forest. The Selkirk Mountains and Kettle River Range are also the only place in America where woodland caribou, moose, elk, mule deer, and white-tailed deer share the same habitat. Northeastern Washington is home to approximately 65 percent of Washington State's white-tailed deer population, a majority of them on the Colville National Forest.

The very eastern portion of the Forest is included in the Selkirk Grizzly Bear Recovery Area. The recovery area is one of two in Washington State and one of six in the Nation. It includes the Selkirk Mountains Ecosystem of northern Idaho, southern British Columbia, and northeastern Washington. The recovery area supports a small population of grizzly bears estimated at 40 to 50 bears.

The Forest also contains recovery area and proposed critical habitat for the last remaining herd of woodland caribou in the continental U.S. The recovery area for the Selkirk Mountain woodland caribou, the most endangered mammal in the continental U.S., includes a portion of the Colville National Forest and public lands in northern Idaho and southern British Columbia. In 2013, only 18 animals were counted in the entire recovery area.

The Forest does not contain designated critical habitat for Canada lynx, but follows current science direction for managing Canada lynx habitat. The Kettle Crest is identified as a core area important for the recovery of Canada lynx in Washington.

Bull trout is federally listed as a threatened species under the Endangered Species Act. Portions of streams on the Forest have been designated as critical habitat for the recovery of this species.

The Forest provides a variety of recreation opportunities. The Salmo-Priest Wilderness (31,400 acres) is an example of the Okanogan Highlands landform and is the only wilderness in the northeastern section of the state. The Forest hosts 80 miles of National Recreation Trails. Two of the longest trails are the Kettle Crest (44 miles) and the Shedroof Divide (21.8 miles). The other two National Recreation Trails are the Lakeshore Trail, also known as Sullivan Lake (4.3 miles), and Pass Creek-Grassy Top (7.8 miles). The International Selkirk Loop is one of 31 routes in the Nation designated as an All American Road. It winds through northeastern Washington, northern Idaho, and southeastern British Columbia. The loop received the national Rural Community Assistance Action Award from the Chief of the U.S. Forest Service for 2000 to 2001.

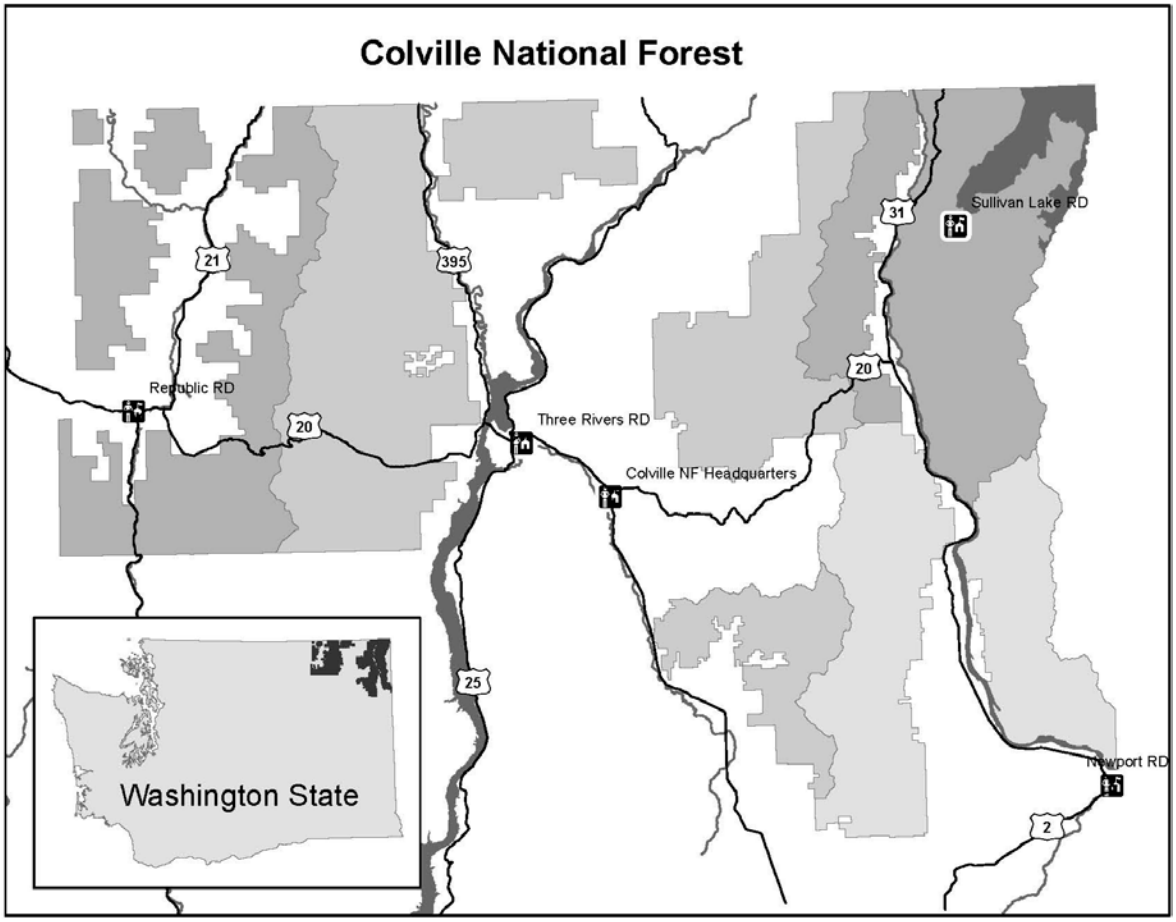


**Figure 1. Colville National Forest vicinity map**

# Need for Change

The forest supervisor initiated forest plan revision based on legal requirements and significant changes that have occurred in conditions and demands since the 1988 forest plan went into effect. The Analysis of the Management Situation (AMS) (2015) documents the need to establish or change forest plan management direction. Revision is also warranted because the forest plan is beyond the 10- to 15-year duration provided by the NFMA.

Using the information from the AMS, as well as information provided through public engagement and outreach with various public groups, organizations, agencies, officials, and individuals, the Colville National Forest identified five recommended needs for change in the 1988 forest plan.

## Wildlife Habitat

There is a need to maintain or restore ecological conditions that contribute to the recovery and viability of terrestrial plant and wildlife species. The 1988 forest plan needs to be updated to reflect new species listings, designated critical habitat, and current science relating to plant and animal species and their habitats. Some wildlife species have been added to the Federal Threatened and Endangered Species List and some have included a new designation of critical habitat (woodland caribou). A considerable body of information is now available concerning the viability of terrestrial wildlife and plant species of management focus. This includes viability assessments for the Interior Columbia Basin and for northeastern Washington. Key factors that influence viability of many of the species assessed include habitat alteration due to timber harvest, wildfire, and other vegetation management activities; restoration of riparian and wetland habitats; and reduction of habitat effectiveness and connectivity due to the potential impacts of roads. Climate change may alter how water systems function and it is projected to exacerbate the loss of old forest habitat due to increased fire rates. This creates a need to restore watershed conditions to be more resilient to disturbances to provide for the recovery and viability of wildlife and plant species.

## Vegetative Systems

There is a need to manage forest vegetation conditions to be more resilient to disturbances. The Douglas-fir dry and Northern Rocky Mountain mixed conifer forest types are susceptible to continued severe insect and disease outbreaks. The existing forest plan does not adequately address the factors that have created these unsustainable conditions, nor does it adequately address the varied nature of the landscape. In addition, climate change is predicted to make these conditions even more challenging to sustain. Thus, there is a need to revise the forest plan to focus restoration actions in Douglas-fir dry and Northern Rocky Mountain mixed conifer landscapes, and create conditions that are more resilient to anticipated disturbances. Lodgepole pine forest types are also in need of updated management direction that addresses the challenges described above. For example, historically, frequent fires maintained low tree abundance on dry landscapes with fire cycles lengthening with Euro-settlement. Over time, stand density has increased due to fire suppression. In the absence of fire and without human intervention, competition for water and nutrients, insect and disease mortality, the number of shade-tolerant species, range of even-age class structure, and amount of dead material have increased (Everett et al. 2007). In the past 10 to 15 years, fire acres in eastern Washington have increased with amplified severity reflective of higher fuels levels and tree mortality influences, along with longer fire seasons. Experimental work has shown that these increasing trends can be reduced through active management when applied at a landscape scale (Schwilk et al. 2009).

## Climate Change

There is a need to address climate change implications and vulnerabilities. The existing forest plan does not address the potential effect of climate change. Recent scientific findings on climate change (Intergovernmental Panel on Climate Change (IPCC) 2014) have dramatically improved our understanding of how ecosystems have changed and are likely to change in the future. Changing climate conditions have affected ecosystem composition, structure, process, and spatial pattern, altering the character and distribution of habitats for surrogate plant and animal species. In addition, climate change has altered, and will continue to alter disturbance regimes, including forest insects and diseases, fire, and hydrologic regimes. Future conditions may be more favorable to some undesired non-native plant, wildlife, and aquatic species (IPCC 2014). The full impact of climate change on ecosystems is uncertain, but an integrated management direction that provides flexibility to respond to a changing environment is needed to maintain or restore the resilience of the national forests in the face of these changes.

## Social Systems

There is a need to address changed social and economic conditions and preferences in light of ecosystem capacity. Colville National Forest provides a variety of opportunities for recreating, working, and practicing cultural and spiritual traditions. In turn, communities provide infrastructure and skills to support forest management. Sustainable social and economic opportunities depend on well-functioning and resilient ecological systems. During the past 20 years, demographic and economic changes have altered how people use and access the Forest. Plan revision needs to address changed social, economic, and ecological conditions. There is a need for the Forest to contribute to predictable and sustained flows of economic and social benefits (e.g., ecosystem services[4]) within the capability of the ecosystem. Social changes include an increasing demand, largely due to population growth, for a variety of recreation opportunities on public lands. An example of changes in recreation use and visitor preferences is a trend toward shorter-duration visits to the Forest compared to those in the past. A more ethnically diverse population is visiting the Forest and visitors are now more likely to stay for a day or weekend, rather than for longer periods. In addition, demand for recreation opportunities in ‘front country’ areas is greater than for backcountry areas. New activities and modes of travel continue to appear, e.g., mountain bicycles with over-snow tires and snowmobiles that resemble motorcycles. Plan revision needs to address such a shift, within the capability of the available infrastructure and the ecosystem. Economic shifts in markets for timber products and declines in timber harvests have caused many eastern Washington wood processors to close. Plan revision needs to address the types and extent of forest management activities that can be accomplished within projected budgets.

## Aquatic and Riparian Systems

There is a need to accelerate improvement in watershed condition across the Forest. The current forest plan and amendments do not adequately provide integrated management direction to maintain and restore properly functioning watersheds that provide a range of benefits on and off the Colville National Forest within a timeframe that is meaningful. This is supported by new

[4] Ecosystem services are commonly defined as the benefits people obtain from ecosystems. Ecosystem services include basic services—provisioning services like the delivery of food, fresh water, wood and fiber, and medicine—and services that are less tangible and harder to measure but equally critical: regulating services like carbon sequestration, erosion control, and pollination; cultural services like recreation, ecotourism, and educational and spiritual values; and supporting services like nutrient cycling, soil formation, and primary productivity. http://www.fs.fed.us/ecosystemservices/About_ES/faq.shtml#ecoservices

science, the listing of bull trout (*Salvelinus confluentus*) under the Endangered Species Act (1988), designation of critical habitat for bull trout (2010), information provided by the bull trout recovery plan (2014), and the results of new assessment tools such as the national Watershed Condition Framework. Properly functioning watersheds provide stable and productive ecological systems and allow for conditions that support aquatic species viability and self-sustaining populations, contribute to the recovery and de-listing of threatened and endangered species, and restore stream systems that do not meet Washington State water quality standards (WADoE 2014).

There is also a need to integrate watershed and aquatic strategies across the Forest. The existing Colville Forest Plan was completed in 1988, and was amended by the Inland Native Fish Strategy (INFISH; USDA 1995) in 1995. Since 1988, the Aquatic Restoration Strategy (ARS; USDA 2005), the Aquatic and Riparian Conservation Strategy (ARCS; USDA 2008) and the Watershed Condition Framework (Potyondy and Geier 2010) have been developed to reflect management direction recommended by current research and supported by regional and national policy. The ARS is a Forest Service Pacific Northwest Regional operational strategy that reinforces the foundation of existing forest plan strategies, including broad-scale passive restoration, and strategically focused active restoration and guides implementation through establishment of specific goals and objectives and a formal process for near-term active restoration. The 2010 National Watershed Condition Framework process evaluated current conditions at the subwatershed scale and identified priority subwatersheds where focused restoration could improve watershed condition on NFS lands. ARCS is a refinement of previous forest plan strategies (including the Northwest Forest Plan, PACFISH, and INFISH) incorporating key concepts from the ARS and watershed condition framework, and is intended to provide the core set of desired conditions, suitability, objectives, standards and guidelines for aquatic and riparian management. ARCS provides additional watershed direction intended to restore and maintain watershed conditions and processes that sustain a full range of ecosystem services and support beneficial uses of water, with a focus on protection and restoration of native anadromous and non-anadromous fisheries. Consistency and integration of new research and regional and national direction on restoration and protection of watershed and aquatic habitat and function will contribute to the restoration and maintenance of riparian and aquatic habitats and beneficial uses of water and increase resilience to disturbance.

# Decision Framework

The entire environmental impact statement process, including the Draft EIS and Final EIS, is meant to inform the responsible official (the regional forester) so that s/he can decide which alternative (the proposed action, no action, or another alternative) to choose.

This is a programmatic DEIS. The decisions that result from this process are broad-scale planning decisions that will guide the selection and design of future projects and activities on the Colville National Forest. Programmatic decisions are made in the forest plan, and they are expressed as goals (identified as desired conditions), objectives, standards, guidelines, management area allocations, special areas, suitability, and monitoring. The forest plan provides a broad framework that guides project-level decisions, but does not authorize, fund, or carry out any site-specific activities. Instead, the forest plan establishes limitations on what actions may be authorized and what conditions must be met during project-level decision making.

A forest plan establishes key decisions for the long-term management of a national forest. The 1982 planning regulations establish the following as decisions required in forest plans:

1. Forestwide multiple-use goals and objectives including projections of goods and services that may be produced (36 CFR 219.11(b), 1982 Rule)
2. Forestwide management requirements (standards) (36 CFR 219.13 – 219.27, 1982 Rule)
3. Management area direction and prescriptions, including management practices (36 CFR 219.11(c), 1982 Rule)
4. Suitability for timber and grazing (36 CFR 219.14, 219.16, and 219.20, 1982 Rule)
5. Monitoring and evaluation requirements (36 CFR 219.11(d), 1982 Rule and 36 CFR 219.12, 2012 Rule)
6. Recommendation to Congress of areas eligible for wilderness designation as required (36CFR 219.17 (a), 1982 Rule) and rivers eligible for inclusion in the National Wild and Scenic Rivers System as required (16 U.S.C. 1271-1287), (36 CFR 297) and (47 FR 39454)

The regulations guiding the forest plan revision process give latitude to the Forest Service to determine the scope of topics included in the revision.

The Pacific Northwest Regional Forester will review the proposed plan, alternatives, and environmental consequences, and then decide which plan alternative best addresses the desired conditions, multiple-use opportunities, diverse needs of people, and sustainable management of the Colville National Forest as well as meeting the requirements of the National Forest Management Act and the Multiple-Use Sustained-Yield Act.

## Relationship to Other Law, Regulation, Policy, and Strategic Guidance

Forest Service direction and guidance for managing National Forest System (NFS) lands comes from several sources and is not altered by forest plan revision. National and regional direction includes laws, executive orders, and regulations. Forest Service policy guides activities on national forests. All forest activities must comply with national direction and reflect national policy.

The hierarchy of management direction ranges from national and regional direction to site-specific, project-level direction when the forest plan is implemented. Figure 2 shows the primary levels of direction.

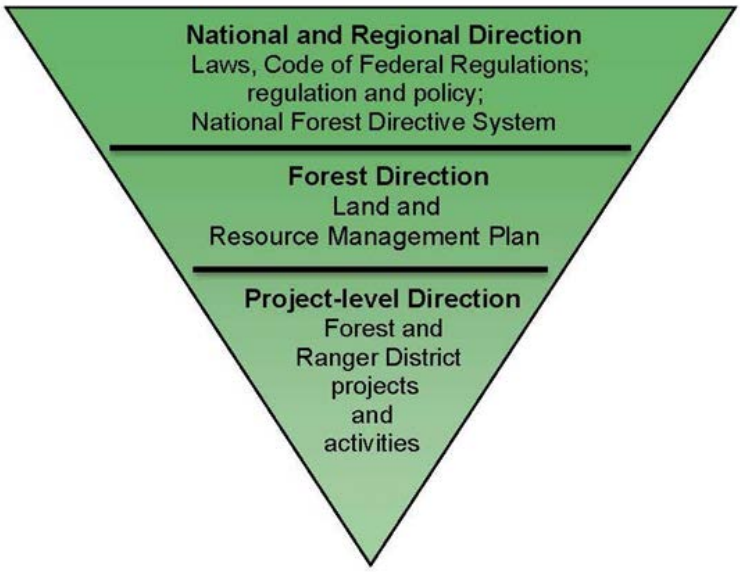


**Figure 2. Hierarchy of management direction for all national forests**

## National and Regional Direction and Guidance

As a Federal land management agency, the Forest Service must follow all applicable laws and regulations. If laws change or are amended, or if new laws are enacted, the Forest Service will comply with the changes or additions. The same situation applies to executive orders and agency policy, as expressed in Forest Service Manual (FSM) and Handbook (FSH) directives. This direction does not need to be restated in the forest plan. Wherever the laws, regulations, or policies have more stringent requirements than forest plan direction, the Forest must and will comply with those requirements.

Examples of Federal laws with which forest plans must be consistent are the Endangered Species Act, the National Historic Preservation Act, Wilderness Act, Clean Water Act, Clean Air Act, Multiple-use Sustained Yield Act, and the National Forest Management Act. Guidance for these laws comes from the Code of Federal Regulations (CFR), and the Forest Service Directive System (the Forest Service Handbooks and Forest Service Manuals). That material is not repeated in the proposed revised forest plan, but a summary of these may be found on the Forest Service national web page at http://www.fs.fed.us/publications/.

National rules applicable to all national forests, such as the Travel Management Rule (36 CFR Parts 212, 251, 261, and 295) and the 2001 Roadless Area Conservation Rule (36 CFR Part 294) continue to apply, are not repeated in the proposed revised forest plan, and may not be altered through the forest plan revision process.

Guidance for forest plans is from the USDA Forest Service Strategic Plan (http://www.fs.fed.us/plan/). This national-level plan is a framework for the National Forest System annual performance plan. It guides units such as individual national forests or ranger districts in proposing project-level work, while considering the opportunities and challenges detailed in their local unit plans. Like individual forest plans, the strategic plan focuses on outcomes or results that are to be achieved over time. Forest plans consider the National Strategic Plan in developing desired conditions and objectives. A goal of the USDA Strategic Plan

FY2014–2018 is to restore, sustain, and enhance the Nation's forests, with a desired outcome for forests and grasslands to be healthy, productive, diverse, and resilient to disturbance.

The Interior Columbia Basin Ecosystem Management Project (1994–2000) was a broad-scale effort to develop scientific knowledge of the ecological and biophysical trends, risks, and opportunities within the interior portion of the Pacific Northwest. One outcome of that project is The *Interior Columbia Basin Strategy* (2003; revised 2014) which includes an interagency memorandum of understanding (2014) that outlines how the strategy will be used to guide the amendment and revision of land and resource management plans for USDA Forest Service and USDI Bureau of Land Management administered lands within the Columbia Basin.

The Colville National Forest contributes to the accomplishment of national strategic guidance in accordance with its own unique combination of social, economic, and ecological conditions. The proposed plan helps define the Forest's role in advancing the agency's national strategy and reflects the national goals, which are based on the Government Performance and Results Act (2010).

### Forest-specific Resource Plans

A forest may have a forestwide resource plan, such as a fire management plan or access and travel management plan, which serves to implement the forest plan. These plans are consistent with, and subordinate to the forest plan.

### Project-level Decisions

A forest plan does not authorize site-specific activities. Project activities such as timber harvest, trail construction, or motor vehicle use designations occur through subsequent project-specific decision-making, consistent with forest plan direction. Once finalized, the Forest will carry out on-the-ground projects and activities designed to accomplish management objectives and move the project area toward desired conditions described in the revised plan. Projects and activities will be subject to the National Environmental Policy Act and other applicable laws and regulations. Project decisions must be consistent with the forest plan.

### Decisions Authorized per the 1988 Forest Plan

Once finalized in a record of decision, the revised forest plan will replace the current forest plan and the management direction within the current forest plan will no longer be applicable. It is not expected that the final revised plan direction would result in immediate re-evaluation or changes to on-going contracts, permits, or project decisions and activities when the Forest transitions to the revised forest plan. After the effective date of the revised plan, all new project decisions, contracts, permits, renewals, and other activities will be consistent with the plan direction.

## Relationship to Other Entities

Forest Service planning regulations require the agency to review the planning and land use policies of other Federal agencies, State and local governments, and Indian tribes. The review includes:

1. Consideration of the objectives of other Federal, State and local governments, and Indians tribes, as expressed in their plans and policies;
2. An assessment of the interrelated impacts of these plans and policies;
3. A determination of how each Forest Service plan should deal with the impacts identified; and,

4. Where conflicts with Forest Service planning are identified, consideration of alternatives for their resolution.

Agencies and governing entities contacted between 2003 and 2015 include U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Kalispel Tribe, Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians, Ferry County Board of Commissioners, Pend Oreille County Board of Commissioners, and Stevens County Board of Commissioners.

### County Governments

Local government officials from the counties within and adjacent to the Colville National Forest have been invited to participate in forest plan development since the beginning of the planning effort (2003). Forest representatives have met with individual county board of commissioners as well as met with combined boards and with county departments. Between 2005 and 2015, the Forest Service met specifically with county commissioners more than 65 times. In addition, county commissioners participated in plan revision collaboration and workgroup meetings, and Forest Service representatives met with various county committees and departments such as Stevens County Public Lands Advisory Committee.

Each county's comprehensive plan has been assessed and considered during the revised plan development (Ferry County (2013), Pend Oreille County (2013), Stevens County (2008), and Okanogan County (2014)). The county land use plans describe local government goals and objectives for land management and provide opportunities for coordination between the Forest Service and the county. The following information is a summary of the full review that is located in the project record.

The over-arching theme of the Ferry County comprehensive plan's vision statement is that "Ferry County would like to preserve its character and identity." Ferry County offers a rural character of natural beauty and abundance. This includes values such as independence, privacy, and personal freedom that attract many people seeking both permanent residence and seasonal refuge. The primary goals that tie to national forest management include:

1. Maintain a rural land use style,
2. Preserve agricultural lands of long-term commercial significance.
3. Preserve natural resources throughout the County and offer special protection to areas designated as critical areas, or environmentally sensitive areas.
4. Provide safe and convenient areas for use of motorized and non-motorized vehicles and equipment;
5. Increase job opportunities and broaden the economic base in Ferry County through encouragement of industry that is compatible with other land uses; and
6. Support multiple use on public lands.
7. Encourage and accommodate as many diverse recreational activities and areas as possible that are compatible with other land uses.

The Pend Oreille County comprehensive plan's vision is based on a Statement of Values: Why We Live Here, where natural resources are conserved and land is used efficiently, ensuring that new development is compatible with the surrounding uses, sensitive to the surrounding natural areas, and retains the rural character of the community. Specific goals that connect with national forest management include:

1. Maintaining the rural character of Pend Oreille County,
2. Protecting the traditional rural ways of making a living;
3. Encouraging employment opportunities;
4. Maintaining an efficient, safe, and environmentally responsible road system;
5. Supporting new development that is consistent with a realistic assessment of the availability of water; and protecting groundwater recharge areas and preventing the contamination of vulnerable groundwater resources;
6. Protecting environmentally sensitive areas;
7. Providing necessary public facilities and services, in places and at levels proportionate to planned development intensity and environmental protection. (USFS Landing Strip [Sullivan Lake], Sullivan Lake Ranger Station and Newport Ranger Station have been designated by Pend Oreille County as Essential Public Facilities); and
8. Coordinating and collaborating with the U.S. Forest Service and other public resource agencies and managers to inventory recreational opportunities and promote the shared use and full enjoyment of publicly owned land in the County.

The comprehensive county plan's (2008) vision for Stevens County emphasizes healthy landscapes where natural resources are conserved and land is used efficiently. Natural resources are well managed, healthy, productive and provide a steady, sustainable stream of products for economic viability while maintaining and enhancing opportunities for recreation. Specific goals related to national forest management:

1. Include economic development as one of the considerations in the process of land use planning, transportation planning, infrastructure planning, and the determination of urban growth areas.
2. Sustainable management decisions for public lands shall consider the diversity of customary practices, traditions, culture and ways of life found throughout the County
3. Maintain and enhance natural resource-based industries in the County, protect critical areas including surface and groundwater resources, and provide for the stewardship and productive use of forest, mineral, and agricultural lands.
4. Protect and enhance the character and quality of rural areas in ways that promote traditional rural lifestyles and industries,
5. Provide an efficient, functional, and environmentally responsible transportation network throughout Stevens County by utilizing and maintaining existing infrastructure, integrating transportation planning with other elements of the comprehensive plan, and coordinating with other Federal, State, tribal and local agencies.
6. Support the retention, enhancement, and development of recreation areas and activities, and parks and open space within Stevens County.

The west side of the Colville National Forest borders Okanogan County. The comprehensive county plan's (2014) vision for Okanogan County emphasizes independence, privacy, and personal freedom for its citizens, works to strengthen the local economy, while also putting forth efforts to maintain a clean and healthy environment. The plan advocates for resource-based industries and activities such as agriculture, forestry, fishing, mining, and recreation while

providing forest-related jobs for the local economy. The following uses are priority uses in support of the County's forestry economy:

1. Harvest and processing of forest products.
2. Equipment yards, repair and maintenance operations.
3. Manufacturing that requires proximity to forest products.
4. Home occupations and home-based industries.
5. Residential uses including vacation rental, single family, extended family, and farm worker housing, with covenants to assure compatibility with resource activities.

Although the interdisciplinary team did not find any direct conflicts or inconsistencies between the proposed plan’s management direction and the counties’ natural resource management objectives (where found), the county representatives perceive potential issues regarding economic effects related to recommended wilderness, expected timber outputs, and motorized access.

All elements of the above plans were considered while developing alternatives for the Colville National Forest plan revision. The social and economic impacts to the counties are discussed in more detail in chapter 3.

### State

Several Washington State agencies either are affected by, or affect, Forest management. These include Washington Department of Fish and Wildlife, Washington Department of Natural Resources, and Washington State Department of Ecology. The Forest coordinated information with these State agencies during all phases of the plan revision process. Those offices provided formal comments during the scoping and other public involvement stages. Statewide assessments were considered in the development of the revised forest plan (June 2010).

### Tribes

American Indian tribes are sovereign nations. They are government entities with which the Forest Service has established and continues to maintain government-to-government relationships. In government-to-government consultation, the Forest Service acknowledges the sovereignty of federally recognized American Indian tribes and the special government-to-government relationship between the tribes and the United States through Executive Order (E.O.) 13175 (November 6, 2000).

Tribes have reserved rights and privileges for their tribal members on any off-site reservation lands ceded through treaties or executive orders to the U.S. Government. The Forest Service manages some of those off-reservation lands ceded through treaties or executive orders. Therefore, the agency has certain legal responsibilities to American Indian tribes. The Forest Service is required to manage the lands under their stewardship with full consideration of the Federal trust responsibility and tribal rights and interests, particularly reserved rights where they exist. In meeting these responsibilities, the agency consults with the tribes whenever proposed policies or management actions may affect their interests.

Members of the planning interdisciplinary team consulted tribal representatives during development of the revised forest plan. The forest supervisor met with the Kalispel Tribe of Indians, Spokane Tribe of Indians, and the Confederated Tribes of the Colville Reservation; as a result, specific tribal comments were incorporated in this DEIS and revised forest plan.

### Federal

Management of Federal lands adjacent to the Colville National Forest was considered in the formulation of alternatives and their cumulative effects. This included the USDI Fish and Wildlife Service, USDI Bureau of Land Management, National Oceanic and Atmospheric Administration, U.S. Customs and Border Protection, U.S. Air Force, and the Regional Interagency Executive Committee.

Consideration of national scenic trails, utility corridors, recommended wilderness, and other management concerns across boundaries were discussed with the Okanagan and Idaho Panhandle National Forests. The forests met to ensure management problems were not created because of Colville National Forest proposed forest plan direction.

## Public Involvement

The Colville National Forest started forest plan revision in 2003, followed by public participation, which began in 2004 with community workshops about the need to change the existing forest plan. Workshops were held in communities throughout northeastern Washington, and additional workshops on specific topics, including wilderness and recreation were held from 2005 to 2008. Meetings with representatives from local counties began in 2004, and are being held on a continuing basis throughout the forest plan revision process. Government-to-government consultation with tribal nations and staff-to-staff consultation with their resource specialists began early in the process and continues. State agencies are cooperating agencies; Federal agencies the Forest Service works closely with are the Department of Homeland Security and the U.S. Fish and Wildlife Service. A 2007 memorandum of agreement with the Washington State Association of Counties provides a framework for our work with the three local counties. Three federally recognized tribes have engaged at varied levels: the Colville Confederated Tribes (the Forest's largest neighbors), and the smaller Spokane and Kalispel Tribes. Additional meetings with interest groups, user groups, State and Federal officials, tribal staff, and industry groups were held.

In June 2011, the Forest Service published a combined notice announcing the proposed actions for the Colville and Okanogan-Wenatchee National Forests were available for public review and comment. Public meetings and outreach efforts continued through 2013, based on the information related to both forests.

The 90-day comment period per the 2011 notice drew 27,274 comment letters, of which 889 contained unique and substantially different comments. We received letters, emails, form letters, and public comment forms from tribes, individuals, organizations, agencies, businesses, and groups from 15 states in the United States and British Columbia, Canada; however, this does not include state affiliation for all of the form letters. We analyzed 3,250 comments from the 889 comment letters to identify the significant issues driving the alternatives.

As stated previously, the regional forester determined that the most effective process to reflect public input and resource needs was to separate the Colville and Okanogan-Wenatchee National Forests' plan revision effort. Moving forward from today, this DEIS reflects issues and alternatives specific to the Colville National Forest only. The Okanogan-Wenatchee National Forest is developing a proposed forest plan and completing a separate analysis specific to its resource needs and public input specific to that forest. All input, including public comments received to date, will continue to be part of each forest plan revision, as appropriate.

## Significant Issues

Public, tribal, State, and local agency comments play an important role in the forest plan revision process. We reviewed all comments submitted on the proposed action to determine how they would be considered in the analysis. The Council on Environmental Quality regulations at 1501.7 (a) (2) state that the agency will, "Determine the scope (§1508.25) and the significant issues to be analyzed in depth in the environmental impact statement." We identified comments on old forest management, motorized recreation trails, road access, recommended wilderness, wildlife habitat, and riparian and aquatic resource management as significant issues used to formulate alternatives. Other comments were used to refine the proposed action while still meeting the purpose of and need for plan revision; and others are considered in the environmental analyses. A report on the public comments is provided on the forest plan revision website: ***http://www.fs.usda.gov/main/colville/landmanagement/planning***

Following are the significant issues that led to the development of the alternatives described in chapter 2.

### Old Forest (Late-successional) Management, and Timber Production

Some members of the public are concerned that the proposed action does not protect old forests and wildlife habitat as well as the current forest plan. Other members of the public are concerned that the proposed action does not allow enough timber production, which hurts the economy. Some are also concerned that the proposed action limits the Forest Service's ability to defend forests from insects, disease, and fire.

In their comments, some members of the public asked for increased timber production. They are concerned that the proposed action does not allow enough timber production, which hurts the economy. One representative comment stated:

> "…the Colville would expect to continue to produce between 25 to 35 MMBF per year. The 1988 plan estimated the forest can and does produce 123.4 MMBF per year annually for the first decade… Eastside screens adopted in 1994 restricted timber sales in the San Poil Watershed for 15 years causing Colville Tribes milling operations to close. Because of the lack of active management of timber harvest, our forest has insect infestations, disease and stand replacing wildfires…."

Others expressed a different view that they *"…are opposed to weakening protection for trees greater than 21 inches diameter at breast height (dbh). Furthermore, since the process for an exception to cutting greater than 21-inches dbh trees is provided in the screens, we see no need to change guidance that has a default position of retention of these trees*."

Other members of the public are concerned that the proposed action does not safeguard old forests and wildlife.

> "The final forest plan must at a minimum meet the standards and guidelines of the existing strategies, and should aim to improve them. Provide specific benchmarks that ensure viability of focal species. The FPR-PA[5] recognizes the need of the forest plan to ensure viability of wildlife guided by new and emerging science. Please insure good monitoring and research to validate efficacy and resilience to changing climate."

> "For our forests to remain diverse and thriving, the forest plans must provide specific guidelines - both forestwide and within specific land allocations - to maintain and

[5] FPR-PA = Forest Plan Revision – Proposed Action

> connect habitat that supports viable wildlife populations for all native species. Many species rely on mature or old-growth forests to survive, so these types of forests must be protected and actively managed."

> "Is this the structural stage distribution of the original primary forest when it was affected by the historic fire regime before logging and fire suppression? If not, what is the current structural stage distribution at a watershed level? What factors make this particular structural stage distribution the "desired" one? Why is a greater percentage in the old forest stages not desired?"

Some are also concerned that the proposed action limits the Forest Service's ability to defend forests from insects, disease, and fire.

> "During the course of the analysis it is important that the total areas that have restrictions for commodity production be quantified and analyzed relative to the potential effect of insect and disease moving between the management areas and the ability to suppress wildfires as they might affect private land, communities, and those areas that are designated for commercial timber production. This is an important concept that should be considered in determining how the desired conditions and objectives can be met relative to forest health and fire suppression."

> "AFRC is generally opposed to a diameter limit because it restricts silvicultural options… overstocking will lead to increasing forest health problems and should be considered."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- The effects on local economy (through commercial timber outputs) of alternative approaches in providing late structure forests.
- The risk of wildfire, especially adjacent to communities.
- Contribution to the recovery and viability of late structure/ old forest-dependent species.

Key indicators:

- Predicted output, uses and activity levels
  - Timber (cubic feet)
  - Estimated percentage of forest structural stages (after 20, 50, and 100 years)
  - Estimated acres by wildfire risk level (fire regime condition class)
- Economic and social sustainability
  - Estimated economic differences between alternatives
- Location and acres of allocations, specifically related to roaded access within wildland-urban interface (WUI)
- Comparison to the proposed action of the contribution to viability of late structure/old forest dependent species

## Motorized Recreation Trails

Public comments reflected opposing desires regarding motorized recreation opportunities, particularly the distribution and quantity of motorized trails. Some members of the public

expressed concerns that the distribution and quantity of motorized trails negatively affects tourism and the local economy, while other stakeholders[6] said that they want fewer miles of motorized trails and that they don't like the resource damage, noise, and conflict associated with them.

This comment expresses concern about expanding motorized recreation opportunities:

> "It is inappropriate to reward user groups that break the law (i.e., trespass into Wilderness), cause the greatest resource damage to trails and vegetation, and probably cause the greatest impact to wildlife with new expanded opportunities to do more of the same."

Another comment expressed an opposing view:

> "There are currently more wilderness trails available in Washington State alone than any one person could hike in a lifetime. By making trails non-motorized we only eliminate access to more tax paying citizens… Motorized trail users, for the most part, are organized and concerned citizens that are out to enjoy the wonders of our natural world just like the non-motorized users."

The public also raised concerns about the distribution and number of motorized and non-motorized trails. Some stakeholders said that the distribution and number affect tourism and the local economy in the plan area.

> "We strongly support the stated goal of having 5% of the trail system adjacent to communities… Creating additional trails for mountain bicycling and other non-motorized recreation, readily accessible from the edges of the rural communities, will provide significant recreation, health, and economic benefits for their residents."

> "Both Motorized and Non-Motorized recreation are important parts of how many users, like me, experience the Forest, from hunters and anglers to backcountry horsemen and ORV users…Making this change would make it impossible for people with limited mobility to visit these areas. It would also hamper backcountry emergency rescues, making them more difficult and expensive."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- The distribution of motorized and non-motorized recreation areas to assess contribution to motorized / non-motorized recreation opportunities.
- The contribution of motorized recreation on the national forest to the local county economy.
- Contribution to the recovery and viability of wildlife and aquatic species that are sensitive to human disturbances that result from motorized recreational activities.

Key indicators:

- Predicted output, uses and activity levels for motorized/non-motorized use
    - Wildlife - location and acres of allocations for motorized use

[6] Stakeholders = members of the public that have an interest in use and management of the Colville National Forest.

- Recreation - location, miles, and acres of allocation for motorized and non-motorized use

- Economic and social sustainability
  - Employment, income, and tax contributions related to recreation
  - Evaluation of access to motorized and non-motorized trails

## Access

Some stakeholders expressed concern that the proposed action does not provide enough roads for recreation, grazing, fire suppression, timber harvest, and firewood collection. They commented that lack of access would have a negative impact on economic well-being. Other stakeholders expressed concern that the Forest Service does not have the capacity to maintain the current road network and that unmaintained roads damage wildlife, water, and fish.

The following comments express views that the proposed action does not provide enough roads for cost-effective resource production, fire suppression, and recreation:

> "The road density constraints of 2-3 miles per square mile are inadequate to service commodity production, fire suppression or motorized recreation, and will make prescribed burning and pre- commercial thinning more expensive."

> "Many of these designations are done over existing grazing allotments that will result in loss of cattle and vegetation management as cattlemen are no longer able to maintain economic viability. Cattle activity has been stated as able to continue with management changes, but these changes are not economically viable, and the local economies must not be devastated by this proposed action."

The following comments express concerns that the proposed action does not provide enough roads for recreation and firewood collection, among other things:

> "It is vital to our citizens to keep the forest open for public access, for firewood cutting, food gathering activities, recreation and hunting, just to name a few."

> "[C]losing roads makes it harder if not impossible for volunteers to access the area to help maintain the trails and other resources."

> "The ability for local, regional, and national citizens to gain value from and develop a sense of connection to these national forests depends on their ability to get to the land and experience it first-hand. As such, we recommend that all alternatives of the Forest Plan incorporate increased access aimed at enhancing the quality of experiences available to a broad spectrum of recreational users."

Other stakeholders said they are concerned that the Forest Service does not have the capacity to maintain its current roads, and that unmaintained roads negatively affect wildlife viability, water quality, and fish populations.

> "The Forest has a vastly oversized and unmanageable road system. This road system presents a substantial risk to soil, water, and aquatic resources…In the context of ever-declining road maintenance budgets, the only appropriate management response is to reduce the number of roads."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- Evaluate the effects of road density limits on roaded access for recreation use, wildfire suppression, and vegetation management activities, specifically commercial timber harvest.
- Evaluate whether the management direction concerning road density, road location and objectives for treatment of high-risk roads is effective in restoration or preservation of watershed and hydrologic function and in contributing to the viability of aquatic, terrestrial plant, and wildlife species whose population and habitat are known to be sensitive to the impacts of roads.

Key indicators:

- Predicted output, uses, and activity levels
  - Location and amount of allocations suitable for roads
  - Changes in road density desired conditions by allocation
  - Relative contribution to the recovery and viability of surrogate species
  - Objectives for reduction in miles of high-risk roads
- Economic and social sustainability
  - Social impact related to recreation opportunities
  - Economic contribution related to timber production

## Recommended Wilderness Areas

While forest plans may make a preliminary recommendation for additional wilderness, only Congress can designate wilderness. Some stakeholders are concerned that the proposed action recommends too much additional wilderness. They commented that more wilderness areas hurt the economy by limiting timber harvest, grazing, mountain biking, and motorized recreation. Members of the public also raised concerns about the increased cost of managing additional wilderness.

Other stakeholders said that the proposed action does not include enough additional wilderness areas; they want more. They said that they want to make sure that wilderness provides habitat connections for wildlife. Additionally, some members of the public are concerned about protecting the uniqueness of these areas, and they said that additional wilderness improves the local economy.

These comments express the concern that too much wilderness hurts the local economy by limiting recreation, timber harvest, and grazing:

> "[M]y perception so far is that wilderness eliminates mountain bikes, mechanical trail maint., forest management, fire response ability, any form of motorized shared use, and doesn't seem to play well with the cattle grazers or other land users"

> "Tourism by mountain bikers can help revitalize rural communities…we bring dollars to each community we visit; our recent stay in the Kettle Crest area saw us spending money on camping (North Lake RV Park & Campground), fuel, food (grocery stores and restaurants), liquor, maps and other bicycle-related items."

Other members of the public said that wilderness provides economic benefits to local communities:

> "all of these lands provide significant wilderness character and a wild, scenic backdrop for the area's many scenic driving routes and communities that promote the region's rustic, remote, backcountry as part of their growing recreational and tourism economy" and "non-motorized trails are very important for the attractiveness to the affluent (money-spending) hiking crowds of Spokane."

Concerns were also raised about possible increases in overall wilderness management costs for the Forest:

> "Trail work costs [substantially more] per mile than non-wilderness trail work. The USFS is funding trail work at a very reduced level, depending on volunteers. Wilderness trail maintenance is most always done with taxpayer monies, not volunteers. Wilderness trail work is the most time and labor intensive (thus most expensive) trail maintenance. (money that the USFS does not have.)" "The Forest Service can not adequately manage the wilderness currently in the inventory. Money for trail and bridge construction/maintenance is in short supply and from all indications will be in shorter supply in the near and mid term future."

There were concerns that the recommendations did not include areas that may have outstanding wilderness character, and did not include areas that may contribute to habitat connectivity.

> "We are concerned that several parts of the Kettle Crest were left outside the recommended wilderness boundary including Snow Peak, Jungle Hill and the Mt. Leona area. We recommend all of the Kettle Crest, north and south of Sherman Pass in the Profanity and Bald Snow areas, be included inside the recommended wilderness boundary…Hall Mountain and Grassy Top should be recommended for wilderness as they provide rugged terrain and are designated habitat for grizzly bears and woodland caribou. Quartzite with its old growth cedar grove would be the closest wilderness area to Spokane."

> "…when reviewing the documents describing the proposed additions I was quite surprised by how little of the lands that currently have wilderness characteristics are being recommended for the designation."

Other stakeholders are concerned that some proposed wilderness areas do not meet the appropriate criteria for that designation:

> "The recommended areas do not satisfy wilderness criteria. Wilderness areas should be areas that are untouched by human activity."

> "Within the boundaries of AbercrombieHooknose PWA in Steven's County, stumps, dozer thinning, clear-cut logging activity and roads are clearly visible within the proposed wilderness area. This leads us to believe that the Forest Service has not ground-truthed for wilderness characteristics within the boundaries of the Potential Wilderness Areas (PWA)."

> "This review must look at boundary locations and ease of locating on the ground, eliminating cherry stems (like Profanity as an example), and exclude recognizable areas of logging and roading before you develop any alternatives for the final draft EIS."

Commenters expressed concern that proposed direction may not maintain wilderness character prior to wilderness designation by Congress, which can be a lengthy process.

> "The plan should also make clear the forest service's intent … by including language in the plan that will protect the wilderness characteristics of all of the CNF Potential Wilderness Areas (PWAs), and not just the roadless areas covered under the Roadless Area Conservation Rule."

> "The PA fails to protect the wilderness character of recommend wilderness areas by allowing snowmobile use to continue in those recommended wilderness areas."

The public also raised concerns about recreation in wilderness:

> "…'the following selected activities could continue to be authorized in Preliminary Administratively Recommend Wilderness Areas: Summer off-highway vehicle use …; Winter motorized use …; and Vegetation management activities would not be authorized in Preliminary Administratively Recommend Wilderness Areas.' The above statement makes the motorized community VERY nervous. First off, the draft Plan even highlights 'could continue to be authorized.' It doesn't GUARANTEE continued use. Why not? Second, we have witnessed these areas managed as de-facto Wilderness on Montana Forests and see no reason why that wouldn't happen here."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- Whether recommended wilderness areas contribute to the need for wilderness.
- The availability tradeoffs, especially summer and winter motorized uses.
- The market and non-market costs and benefits associated with wilderness.

Key indicators:

- Predicted output, uses, and activity levels
  - Location and amount of recommended wilderness
  - Miles of trail available for mechanized or motorized use
  - Acres suitable for timber harvest and grazing

## Wildlife

The public is concerned that the proposed action does not adequately protect wildlife. They said that they want more protection for federally listed species such as grizzly bear, lynx, caribou, and other wildlife species of concern such as wolverine and northern goshawk. To protect these species, stakeholders said they want connected habitats, habitats that are not disturbed by roads and trails, as well as more large trees and snags.

Other stakeholders are concerned that increasing wildlife protection decreases opportunities for recreation, timber production, and livelihoods.

These comments express concern that the proposed action does not protect wildlife adequately:

> "[recommended wilderness] areas are also part of designated habitat for grizzly bears and caribou and provide connectivity for those and other species; wilderness protection would provide added habitat security."

> "The potential to contribute to the sustainability of focal species that require low levels of human activity is another key ecological benefit of wilderness... These are grizzly bear,

> Canada lynx, wolverine, American marten, and woodland caribou (on Colville National Forest)."

> "For wildlife species such as the grizzly bear, motorized trails and high-use trails are other important considerations in evaluating habitat suitability and may influence how you view the desired road density of a particular area. We urge you to articulate in the Forest Plan a clear vision for road management."

> "The plan must do more than define, describe, and highlight the importance of these ecological dynamics and components; the plan must explain how the CNF proposes to maintain and promote these dynamics and components across the landscape as well as the extent to which the CNF will permit natural disturbance to do this work…We agree with these statements regarding HRV of late-successional forest, the need to restore the large-tree component of our forests, and the lack of snags >21″ dbh."

> "When large and very large 'hazard' trees must be felled they should be left in place. Even prone, they can fill an important ecological function. Somehow, redirect woodcutters away from large/very large high value snags and toward the many, smaller diameter Douglas-firs that should be removed from the forest."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- Contribution to habitat connectivity for surrogate wildlife species.
- Contribution to the recovery and viability of snag-dependent wildlife species.
- Contribution to the recovery and viability of surrogate and listed wildlife species.

Key indicators:

- A comparison of the relative contribution to provide habitat connectivity for surrogate wildlife species.
- A comparison of the relative contribution to the viability of snag-dependent wildlife species.
- A comparison of the relative contribution to the recovery and viability of surrogate wildlife species.
- A comparison of the relative contribution to the recovery and viability of listed wildlife species.

## Riparian and Aquatic Resource Management

Some members of the public expressed concern that the proposed action does not adequately protect riparian areas such as those adjacent to streams, lakes, wetlands, and rivers. They said that they want the Forest Service to limit the negative effects of roads, grazing, and off-highway vehicles in these areas. Other members of the public are concerned that the protection of these aquatic resources limits timber production, grazing, and recreation.

Public comments raised concerns that the proposed action does not provide watershed and aquatic resource protections that are as effective as current forest plan direction. Concerns centered on managing possible detrimental impacts of uses such as roads, livestock grazing, and motorized trails in riparian areas.

> "The Forest has a vastly oversized and unmanageable road system. This road system presents a substantial risk to soil, water, and aquatic resources."

> "The Proposed Action should include and address the need for restoration of stream connectivity with floodplains, including restoration of off-channel habitats, particularly where roads are located within floodplains."

> "Many of these [grazing] allotments are co-located in sensitive areas with ESA [Endangered Species Act] listed fish and are degrading both aquatic and riparian habitat. The effects from livestock grazing are well documented both by the Forest Service and in scientific literature. It is clear that stricter standards and guidelines need to be implemented to minimize the effects of grazing on listed fish and their habitat. Specifically, grazing in key watersheds should, at a minimum, lead to the improvement or restoration of riparian conditions."

> "Summer off-highway vehicle use and winter motorized use can be very detrimental to stream channels and stream habitat (especially ATVs, motorcycles, etc.). It is very difficult to enforce appropriate use when these vehicles are allowed in riparian areas. Safeguards are needed for effective protection of riparian habitats."

Other stakeholders commented that there is a need to balance uses.

> "I'm concerned this tact will be used as a way to eliminate road miles/access for no valid reason. We support changes to roads and trails to meet these goals but don't believe elimination is ever the only viable solution."

> "Livestock grazing should be considered as a tool for vegetation management and rangeland health."

> "Enclosing pictures of a 'restoration project' in Ferry County, before and after. This project was supposedly to open up 2.5 miles of upland habitat to develop 'connectivity'… As you can see from the before and after pictures this area was made a wasteland. Water is not flowing freely. There is no habitat connectivity. It did not improve water quality or aquatic/riparian habitat. It destroyed aquatic/riparian habitat. ICBEMP science put to use. Before ICBEMP and Eastside Screens, we had clean water, riparian habitat and fish in these streams. Now we do not."

Another concern raised was potential impact of increased aquatic protection on ability to effectively manage grazing allotments.

> "Watersheds are an important part of our Forest Service Grazing Allotments. The desired condition should provide for improved forage for livestock. All planning activities that have any effect on management or the number of AUM's of the grazing allotments need to be coordinated with local cattlemen associations, local governments and grazing permit holders."

### *Evaluation Criteria*

The following indicators were used to evaluate this issue and to develop the variations between the alternatives:

- The viability of threatened, endangered, and sensitive plants within riparian corridors
- The effectiveness of riparian management area widths and other plan components related to aquatic conservation in riparian and upland areas to contribute to and enhance the recovery of threatened, endangered and sensitive fish species, and maintain or restore watershed function, water quality, and natural flow regime.

- Contribution to the recovery and viability of riparian-dependent wildlife species.

Key indicators:

- Acres designated for riparian habitat management
- Plan components for protection and restoration of water resources and riparian systems
- Acres within key and INFISH priority watersheds
- Relative contribution to recovery and viability of riparian-dependent surrogate wildlife and fish species.
- Predicted trends for sensitive plant species

## Other Issues

The Colville National Forest received comments that were considered and may have related plan components, but did not drive development of alternatives. The National Environmental Policy Act regulations, in Sec. 1501.7 (3) direct agencies to "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior review (§1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere." Specifically, these comments are:

- Outside the scope of the proposed action
- Already decided by law, regulation, or other higher level decision
- Irrelevant to the decision to be made
- Conjectural and not supported by scientific or factual evidence: or
- Those that contributed to other sections, such as the purpose of and need for action, or the scope of the analysis

Some of the comments are of widespread public interest. Below is a summary of those areas of interest with an explanation of how they are considered in the forest plan revision process. It should be understood these comments were not arbitrarily dismissed as they continue to provide useful information.

## Other Topics Related to the Decision to be Made

The following list is not all-inclusive, but it does highlight key topics of interest to the public that will not be addressed in the DEIS.

### Boundaries Designated By Congress

It is outside the authority of the Forest to move any boundary established by Congress. Congressionally designated areas on the Colville National Forest include the Salmo-Priest Wilderness and the Pacific Northwest National Scenic Trail. Changes to these congressionally designated areas are not included in the forest plan revision effort.

### Eligible Wild and Scenic Rivers

Commenters expressed the desire to see more rivers eligible for inclusion in the Wild and Scenic Rivers System. The determination of eligibility for designation under the Wild and Scenic Rivers Act is made through a process outlined in the Forest Service Handbook, 1909.12 Chapter 80.

Rivers found to be eligible remain eligible until a suitability assessment is completed, or another eligibility process is conducted.

The responsible official has the discretion to determine whether and to what extent an issue is appropriate for consideration in plan revision. As there has not been a change in circumstances since the inventory completed for the 1988 forest plan, evaluation of eligibility for additional rivers was not a revision topic and is not addressed in the DEIS. The proposed revised plan carries forward the rivers identified as eligible for inclusion in the Wild and Scenic River System for the 1988 forest plan and includes plan components to maintain the free-flowing characteristic and outstandingly remarkable values of eligible rivers. Rivers eligible for inclusion in the Wild and Scenic River System do not vary by alternative.

### 2001 Roadless Area Conservation Rule (36 CFR Part 294)

The proposed action includes management direction for inventoried roadless areas identified in the 2001 Roadless Area Conservation Rule. On October 21, 2011, the 10th Circuit Court of Appeals reversed the Wyoming District Court and upheld the USDA's 2001 Roadless Rule in *Wyoming* v. *United States Department of Agriculture*. The decision by the 10th Circuit resolves 10 years of litigation. The ruling confirms that the agency has the authority to manage and protect roadless lands within the National Forest System and that the department complied with all applicable laws in adopting the 2001 Roadless Rule. Under the 2001 Roadless Rule, new road construction and reconstruction are generally prohibited in inventoried roadless areas, and timber harvest is only permitted under a few limited exceptions. It is outside the authority of the proposed revised forest plan to make any changes to boundaries of inventoried roadless areas.

### Allotment Management

Many people expressed concerns regarding domestic cattle grazing. Some people want to end grazing on national forests altogether. Eliminating grazing is inconsistent with Forest Service policy. Opening and closing allotments or changing allotment boundaries are site-specific decisions not made in this forest plan revision process. The proposed revised forest plan and alternatives identify suitability for grazing and the DEIS discloses the effects of grazing on other resources. Alternatives are not designed to change boundaries, end grazing, or make site-specific changes to allotments. The proposed revised forest plan describes management direction, such as desired conditions for the variety of vegetation types within grazing allotments, that may result in future changes to allotment management plans.

### Travel Management

Due to high interest in the national forest travel management process, it is important to explain that decisions about specific routes and areas for motor vehicle use are not proposed in this plan revision. Instead, the proposed forest plan identifies where particular activities may or may not be suitable to occur. The identification of an area as suitable or not suitable for a use is not a commitment or final decision; rather it provides guidance for project- and activity-level decision-making. For example, the identification of lands suitable for motorized recreation is not an authorization for motor vehicle use on a specific trail or within a specific area. The *final* decision to designate a trail for motor vehicle use would be made following a project-level NEPA analysis, consistent with the final revised forest plan suitability direction.

The Colville National Forest completed non-winter motor vehicle use designations as required by Subpart B of the Travel Management Rule (36 CFR 212) in 2008. Additional site-specific NEPA analysis would be required for any future motor vehicle use map (MVUM) designation changes.

The proposed action and alternatives identify areas suitable for over-snow vehicle motor vehicle use, but forestwide site-specific designations per Subpart C of the Travel Management Rule will be made during subsequent site-specific NEPA analysis. In the interim, over-snow motor vehicle use will continue to be governed by existing forest orders and route designations.

Many people asked that the Travel Management Rule (36 CFR 212) be set aside, or that previous decisions to designate roads, trails, or areas for motor vehicle use be modified in the revised forest plan. It is not in the authority of the responsible official to set aside law, regulation, or policy. Nor does the draft proposed plan make site-specific decisions that designate or prohibit motor vehicle use as stated in the previous paragraphs.

## Climate Change

Climate change concerns appeared in several comments. Some people do not consider climate change a proven phenomenon, while others feel it should be the central impetus for change. Forest Service policy is to consider the effects of climate change in forest plan revisions. Climate change is likely to affect all vegetation types and biophysical resources, result in consequences for many resources, affect the resilience of road and trail networks and other forest infrastructure, and is part of the dynamic baseline condition. All alternatives focus on designing desired conditions to provide healthy, resilient forests and more resilient infrastructure (e.g., trails, campgrounds, roads) in the face of climate change and other disturbance factors. Climate change is identified in the purpose of and need for action section of this DEIS as a reason for updating the current forest plan.

## Access for People with Disabilities

People commented that denial of motor vehicle access to people with disabilities violates the Americans with Disabilities Act. The Americans with Disabilities Act defers to Section 504 of the Rehabilitation Act of 1973, which says that no person with a disability can be denied participation in a Federal program available to all other people solely because of his or her disability. In conformance with section 504, wheelchairs or mobility devices are welcome on all NFS lands that are open to foot travel, and they are specifically exempted from definition as a motor vehicle in section 212.1 of the Travel Management Rule (36 CFR 212.1). There is no legal requirement to allow people with disabilities to use off-highway vehicles (OHVs) or other motor vehicles on roads, trails, and areas closed to motor vehicle use. Reasonable restrictions on motor vehicle use, applied consistently to everyone, are not discriminatory. This concern has been decided by law.

## Budget

Many people commented that the revised forest plan should not be constrained by a budget. However, it is not realistic or reasonable to ignore expected funding levels during forest plan revision. Increases in budgets beyond expected levels could result in a faster rate of achievement of the desired conditions than those projected by alternative. Recent budget trends are essentially level or slightly declining and those trends are expected to continue in the near future. This is not a significant issue to be analyzed in the DEIS because the forest plan does not influence or control the budget for the Forest.

Many people commented that budget considerations should be included in the development of forest plan objectives, commenting that budgets affect delivery of goods and services people value about a national forest, such as trails and campgrounds, well-maintained roads to drive, and the availability of people to monitor activities and enforce rules to prevent resource damage. The proposed objectives do consider budget trends.

### Fees

Some commenters raised the topic of fees for a variety of forest products and uses. Fees are an administrative decision and are outside the scope of the forest plan revision process.

### Solar and Wind-generated Power

National- and regional-level assessments of potential for solar and wind power indicate the Colville National Forest does not offer a high potential for either energy source; therefore, there is no need to develop specific guidance in the proposed forest plan.

### Recreation Residences

Recreation residence permits are issued or renewed as a site-specific decision. Such decisions are not included in the plan revision process or decision.

### Record of Decision, Nationwide Application of Fire Retardant on National Forest System Land, December 13, 2011

This record of decision established new national direction for the use of fire retardant applied from aircraft to manage fires, and will be carried forward unchanged. The new direction includes procedures for monitoring and reinitiating consultation with U.S. Fish and Wildlife Service if aerially applied fire retardant affects certain species or habitat. The direction also provides greater protection for cultural resources

### Application of Laws and Regulations

Many commenters asked that existing laws and regulations be specifically mentioned and interpreted as to applicability in the proposed forest plan, such as enlarging on the list of multiple uses a national forest should have in relation to the Multiple-Use Sustained-Yield Act. It is not the role or purpose of a forest plan to interpret laws and regulations. Forest Service direction for managing NFS lands comes from several levels. National and regional direction includes laws, executive orders, and regulations. Forest Service policy guides activities on the Forest. All Forest activities must comply with national direction and reflect national policy. Applicable laws and regulations apply to the Colville National Forest and cannot be overridden by a forest plan, making this issue outside the scope of the forest plan revision process.

### Administrative or Site-specific Actions

Many commenters requested the inclusion of administrative actions, such as adding lookouts to the recreation rental program. Administrative actions are made outside the authorities of the proposed forest plan. Commenters also asked that the revised forest plan make site-specific actions such as installing an outhouse at a specified trailhead. The proposed forest plan provides broad guidance and information for project and activity decision-making on the Colville National Forest for approximately the next 15 years. Forest plans are strategic in nature. They do not include project and activity decisions. Those decisions are made later or outside the forest plan when proposals for a specific action in a specific area are made and analyzed, and there is the opportunity for public involvement.

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# Chapter 2. Alternatives, Including the Proposed Action

## Introduction

This chapter describes and compares the alternatives considered for revising the 1988 Colville Forest Plan. This section also presents the alternatives in comparative form, describing the differences between each alternative and providing a clear basis for choice among options by the decisionmaker and the public. The revision includes changing all, or a portion of, the programmatic decisions that make up the 1988 forest plan. Some of the information used to compare alternatives is based on the design of the alternative (i.e., the arrangement of management areas) and some of the information is based on the social, environmental, and economic effects of implementing that alternative (i.e., expected outcomes for social, economic, or ecological conditions). This chapter provides the following four discussions:

- Development of alternatives;
- Description of each alternative considered in detail, including the preferred alternative and elements common to all alternatives;
- Alternatives considered but eliminated from detailed study; and
- Comparison of alternatives.

## Development of Alternatives

As discussed in chapter 1, this revision of the forest plan is based on the "need for change." Key issues were identified in public comment on the proposed action. These issues drove alternative development. Additional issues common to all alternatives were also identified and considered in the effects analysis. Some additional items are addressed in the revision because they are required by planning regulations (i.e., 36 CFR 219.14 through 219.26 (1982 Planning Rule)).

The no-action alternative reflects current management practices under the 1988 forest plan, as amended and implemented, and provides the basis for comparing alternatives to current management and levels of output. While all alternatives provide a wide range of multiple uses, goods, and services, some give slightly greater emphasis to selected resources based on the alternative response to various revision topics.

The proposed action is based on the need for change identified in the Analysis of the Management Situation (AMS), implementation and monitoring of the current forest plan, and early public working group meetings (2004). The alternatives to the proposed action were developed through the public meetings that continued through 2008 and public comments on the 2011 proposed action scoping. The alternatives represent a range of possible management options from which to choose.

Forest plans do not make budget decisions. However, alternatives emphasize different programs to different degrees, with an expectation of appropriate funding. Should Congress emphasize specific programs by appropriation, a redistribution of priorities would follow, regardless of the alternative implemented.

All alternatives to the proposed action considered in detail respond to the need for change or address one or more significant issue. However, not all possible alternatives were carried into detailed study, as the list of options would have been prohibitively large. Instead, the responsible official identified those alternatives that both met the criteria and created a reasonable range of outputs, direction, costs, management requirements, and effects from which to choose. All alternatives would meet law, regulation, and policy.

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# Alternatives Considered in Detail

In addition to the no-action alternative and the proposed action, the Forest Service developed four action alternatives, which respond to the needs for change and issues identified by the public. Table 3 provides a short description of each alternative. Additional detail is provided in the following sections.

**Table 3. Short description of alternatives considered in detail**

| Alternative | Short Description |
|---|---|
| 1988 Forest Plan – No-action alternative | The no-action alternative reflects current management practices under the existing Forest Plan, as amended and implemented. It provides the basis for comparing the existing condition to the proposed action and the alternatives.<br>If the decisionmaker were to choose to continue to implement the 1988 forest plan versus choosing a revised alternative, interim direction in the Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH) and the Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens) would be considered final direction for the Colville National Forest (i.e., would no longer be considered interim).<br>Continuing with the current plan would provide an annual predicted wood sale quantity (PWSQ) volume of 41 MMBF with an estimated wage contribution of $19,335,000.<br>There is no recommended wilderness in the 1988 forest plan. |
| Proposed Action | The June 2011 proposed action addresses the need for change. It applies landscape ecology concepts to provide for ecological resilience to disturbances, including the effects of climate change and incorporates new science related to the recovery of terrestrial and aquatic threatened and endangered species.<br>The overarching emphasis of this alternative would be to apply active vegetation management in a dynamic landscape approach to increase vegetation resilience and move the landscape toward desired conditions. Silvicultural prescriptions would promote structural and landscape complexity on 71 percent of the forest. Planned and unplanned ignitions would be used as management tools across the forest, but would be emphasized on 30 percent of the forest.<br>The proposed action would provide an annual predicted wood sale quantity (PWSQ) volume of 62 MMBF with an estimated wage contribution of $31,224,000.<br>The proposed action would recommend 101,390 acres of additional wilderness and would provide backcountry recreation management emphasis on 14 percent of the forest.<br>The proposed action adopts the Aquatic and Riparian Conservation Strategy (ARCS), replacing INFISH with a long-term strategy that uses best science and aligns species and water quality recovery plans. |
| Alternative P | The overall vegetation management approach, outputs in alternative P, and backcountry recreation management would be similar to the proposed action.<br>Alternative P would create the Kettle Crest Special Interest Area (approximately 82,800 acres). This management area allocation would recognize and protect outstanding recreation opportunities in a semi-primitive setting while allowing continued motorized and mechanized recreation opportunities.<br>In response to comments on the proposed action, alternative P would recommend 68,300 acres of wilderness.<br>Like the proposed action, alternative P would adopt ARCS. However, it also would expand the key watershed network, and increase riparian protection through additional plan components (ARCS-modified). |

| Alternative | Short Description |
|---|---|
| Alternative R | Alternative R would emphasize a large-scale reserve approach for late-successional forest structure, emphasizing a passive management approach to reach desired conditions. Silvicultural prescriptions would be used on 22 percent of the forest, in consideration of 21-inch upper diameter limit on cutting live trees. Planned and unplanned ignitions would be used as management tools across the forest, but would be emphasized on 75 percent of the forest.<br>Alternative R would provide an annual predicted wood sale quantity (PWSQ) volume of 14 MMBF with an estimated wage contribution of $6,692,000.<br>Alternative R would recommend 207,800 acres of additional wilderness.<br>Alternative R would take the same aquatic strategy approach as alternative P through ARCS-modified. |
| Alternative B | The intent of alternative B is to address the concerns of multiple constituencies in one alternative by balancing land allocations between areas emphasizing active management (timber management zones) (43 percent), emphasizing a mix of active and passive management (Restoration Areas) (31 percent), and emphasizing passive management (recommended and designated wilderness) (23 percent).<br>Alternative B would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure. It would include additional plan components limit mechanical restoration treatments (timber harvest) in late-successional structure to dry plant association groups only.<br>Alternative B would provide an annual predicted wood sale quantity (PWSQ) volume of 37 MMBF with an estimated wage contribution of $17,428,000.<br>This alternative would recommend 220,330 acres of additional wilderness and would emphasize non-motorized recreation opportunities.<br>Alternative B would retain and integrate the INFISH, continuing riparian area management similar to the no-action alternative.<br>Where plan components were not identified by the collaborative group, the 1988 Colville Forest Plan (no-action alternative) would provide plan direction (remain unchanged). |
| Alternative O | Similar to alternative B, the intent of alternative O is to balance land allocations between areas emphasizing active management (Responsible Management Areas) (39 percent), emphasizing a mix of active and passive management (Restoration Areas) (34 percent), and emphasizing passive management (backcountry and recommended/designated wilderness)(25 percent).<br>Similar to alternative P, alternative O would create the Kettle Crest Special Interest Area (approximately 99,000 acres). This management area allocation would recognize and protect outstanding recreation opportunities in a semi-primitive setting while allowing continued motorized and mechanized recreation opportunities.<br>Similar to alternative B, alternative O would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure. It would include additional plan components to limit mechanical restoration treatments (timber harvest) to a one-time entry.<br>This alternative would recommend fewer acres of additional wilderness (15,950 acres) than alternative B, and would instead emphasize backcountry recreation opportunities (21 percent).<br>Alternative O would provide an annual predicted wood sale quantity (PWSQ) volume of 38 MMBF with an estimated wage contribution of $17,465,000.<br>Where the collaborative group did not identify plan components, the proposed action would provide plan direction. This includes the proposed action's approach to adopt ARCS. |

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## The Preferred Alternative

The responsible official, the regional forester for the Pacific Northwest Region, has identified alternative P as the preferred alternative for this DEIS, which is presented as the proposed plan. **This does not represent a decision, but rather an indication of the agency's preference at this stage of analysis**. Public comments on the effects analysis and additional analysis of effects may result in refinement of this alternative in the final EIS, or selection of a different alternative in the record of decision.

## Elements Common to All Action Alternatives

All alternatives represent, to varying degrees, the principles of multiple-use and ecological and economic sustainability. The alternatives provide basic protection of forest resources and comply fully with applicable laws, regulations, and policies. In addition, all the alternatives would:

- Meet the purpose and need for change or address one or more significant issues;
- Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land;
- Provide protections for riparian areas;
- Contribute to the recovery and viability of terrestrial and aquatic wildlife and plant species;
- Maintain air quality that meets or exceeds applicable Federal, State, and/or local standards or regulations;
- Include measures for preventing the destruction or adverse modification of critical habitat for threatened and endangered species;
- Protect heritage resources;
- Recognize the unique status of American Indian tribes and their rights retained by trust and executive order with the United States, including consultation requirements;
- Provide sustained multiple uses, products, and services in an environmentally acceptable manner (including leasable and locatable minerals, timber, livestock forage, and recreation opportunities);
- Retain existing designated areas (e.g., wilderness areas, scenic byways, national scenic trails); and
- Retain all existing permitted activities and facilities.[7]

In addition, the following plan components are common to all alternatives. (The components are described in detail in the proposed revised plan, which accompanies this document.)

### Desired Conditions

Desired conditions include descriptions of desired outcomes because of Forest Service management. The desired conditions are described in detail in the proposed revised plan, which accompanies this document.

### Objectives

Objectives are time-specific, measurable statements of a desired rate of progress toward a desired condition or conditions. They should be based on reasonably foreseeable budgets.

[7] All permits will be reviewed for compliance with the revised forest plan. Any permit found to be out of compliance will be brought into compliance as soon as practicable using a variety of tools, including modifications or amendments to the permit.

## Forestwide Standards and Guidelines

Standards and guidelines include design considerations, mitigations, and constraints for project-level decisions. Although the action alternatives share some common forestwide standards and guidelines, many vegetation and road-related components vary by alternative. Riparian area plan components also vary by alternative.

## Suitability of Uses

The criteria for the suitability of various uses (e.g., livestock grazing, timber harvest, recreation opportunity) are the same in all alternatives. However, when the criteria are applied to the different alternatives, there may be variations in the amount of land suitable for certain uses (i.e., if an alternative has more recommended wilderness, there would be less land suitable for timber harvest).

## Monitoring Strategy

Monitoring and evaluation provide the strategy for determining the degree to which on-the-ground management is maintaining or making progress toward desired conditions. All action alternatives share a common monitoring framework, whereas the monitoring strategy for the no-action alternative is unique.

## Plan Components Common to All Action Alternatives

Management direction for the following resource topic areas remains unchanged between action alternatives.

### *Vegetation*

All action alternatives include the same long-term vegetation desired condition, which is defined by the historic range of variability (HRV). The historical range of variability refers to the dynamic behavior and function of ecosystems before dramatic changes occurred with European settlement, generally considered to be the mid-1800s for this area (Aplet and Keeton 1999). The historical range of variability provides a framework to determine changes to ecosystem attributes that have occurred between historical and current conditions and recognizes that ecosystems experience a range of conditions across which processes are resilient and self-sustaining.

We used an assessment of forest dynamics and the historical range of forest structure to develop a range of desired representation across structural stages within five vegetation types (Douglas-fir dry; Northern Rocky Mountain conifer; Spruce/Subalpine fir; Subalpine fir/Lodgepole pine; and Western redcedar/Western hemlock). These vegetation types reflect the plant association groups found on the Colville National Forest.

Having a range of forest structural stages provides resilience and is compatible with maintaining characteristic disturbance processes such as wildland fire, insects and diseases, as well as habitat conditions for associated wildlife species. A range of structure contributes to aesthetic settings, particularly along scenic byways and highways.

Table 4 describes forestwide desired conditions for each vegetation type. Although all action alternatives include similar desired conditions for vegetation structure, the management approaches used to achieve desired condition vary by alternative. Each alternative description provides more detail.

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**Table 4. Desired condition for forest structure[8] (percent)**

| Vegetation Type | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|
| Douglas-fir dry | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| Northern Rocky Mountain mixed conifer | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| Western hemlock / Western redcedar | 4-24 | 0 | 7-27 | 0 | 55-83 |
| Subalpine fir / Lodgepole pine | 45-65 | 0 | 33-53 | 0 | 3 |
| Spruce / Subalpine fir | 14-46 | 0 | 13-41 | 0 | 29-57 |

All action alternatives provide the same desired conditions (goals), standards and guidelines for non-forested vegetation types. Non-forested vegetation types such as subalpine and montane meadows, shrub-lands and wetlands are managed as unique habitats for plants and wildlife.

### *Invasive Species*

A 2005 decision that updated methods of treatment and increased the emphasis on prevention of invasive plant species in the Pacific Northwest Region amended the current forest plan. Management direction provided in this decision, the *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision* (USDA Forest Service 2005), is common to all alternatives.

### *Wildland Fire Management*

Use of natural ignitions for resource benefits would be expanded to the whole Forest, with the exception of administrative and recreation sites. Analysis of weather conditions, ignition location, and resource concerns would be used to make decisions related to the use of natural ignitions to achieve resource benefits. Planned ignition would be allowed to achieve resource objectives forestwide in all action alternatives. Desired conditions, guidelines, and standards for wildland fire management would remain the same across all alternatives. The *Record of Decision, Nationwide Application of Fire Retardant on National Forest System Land, December 13, 2011,* (USDA Forest Service 2011*)* established new national direction for the use of fire retardant applied from aircraft to manage wildfires and would be applicable across all alternatives.

### *Air Quality*

The State of Washington regulates air quality. Existing laws and regulations define requirements. Desired conditions, guidelines, and standards would remain the same as shown in the draft plan across all alternatives.

### *Soils*

Management direction for soils would be common across all action alternatives.

### *Grizzly Bear*

Management of grizzly bear habitat does not vary between action alternatives. Grizzly bear management is defined by the 1986 Interagency Grizzly Bear Guidelines, Colville National Forest Guidelines for

[8] Structure Definition

| | |
|---|---|
| Early | Trees less than 10 inches diameter at breast height (d.b.h.) or canopy cover less than 10 percent |
| Mid Open | Trees 10 to 20 inches d.b.h., canopy cover 10 percent and greater, but less than 40 percent |
| Mid Closed | Trees 10 to 20 inches d.b.h., canopy cover 40 percent or greater |
| Late Open | Trees 20 inches d.b.h. or greater, canopy cover 10 percent and greater, but less than 40 percent |
| Late Closed | Trees 20 inches d.b.h. or greater, canopy cover 40 percent or greater |

Management in Occupied Grizzly Bear Habitat (USDA 1988), Grizzly Bear Recovery Plan (USFWS 1993), and Amended Biological Opinion for the Continued Implementation of the Colville National Forest (and the Idaho Panhandle National Forest) Forest Plans (USDI 2001). The Forest would incorporate management guidance from these documents in all action alternatives considered in this DEIS. The forest has occupied grizzly bear habitat.

### *Woodland Caribou and Canada Lynx*

Management for woodland caribou and Canada lynx would not vary between action alternatives. Woodland caribou habitat management currently follows direction identified in the 2001 USFWS biological opinion for seasonal habitat needs and the Colville National Forest winter recreation strategy[9] (USFS 2003). Current management direction for Canada lynx is provided through the Canada Lynx Interagency Agreement that relies on the science summarized in the Canada Lynx Conservation Assessment and Strategy (ILBT 2013). The Forest would incorporate the management guidance from these documents in all action alternatives considered in this DEIS.

### *Heritage*

Laws and regulations provide guidance for protecting and managing heritage resources. The heritage resource is also coordinated with the State Historic Preservation Office and Indian tribes. This emphasis and protection would be the same in all alternatives.

### *Livestock Grazing*

The revised plan proposes no changes in the status, location, or boundaries of permitted range allotments or type of livestock**.** However, plan components that affect management of livestock grazing would vary by alternative.

### *Minerals, Locatable*

Federal lands open to locatable mineral entry under the Mining Act of 1872 would not change by alternative. Desired conditions, guidelines, and standards concerning locatable minerals would be common to all alternatives.

### *Minerals, Saleable*

Federal lands available for mineral material permits do not change by alternative. Desired conditions concerning saleable minerals would be common to all action alternatives.

### *Motorized Recreation Suitability*

Motorized recreation would not be suitable in research natural areas, designated wilderness areas, and recommended wilderness in all alternatives. (Although in some alternatives, use of existing motorized trails within recommended wilderness management areas would be allowed to continue.) Suitability for motorized use varies within other management areas.

Current seasonal restrictions for deer and elk winter range would be maintained in all alternatives.

### *Wild and Scenic Eligible Rivers*

As there has not been a change in circumstances since the inventory was completed for the 1988 forest plan, evaluation of eligibility for additional rivers was not a revision topic and is not addressed in the DEIS. The two rivers identified as eligible for inclusion in the Wild and Scenic River System for the 1988

[9] The Colville National Forest winter recreation strategy was completed to balance the needs of secure winter habitat for caribou with access for winter recreation activities.

forest plan (8 miles) are carried forward in this revision effort and would not vary by alternative. All action alternatives would include plan components to maintain the free-flowing characteristic and protect the outstandingly remarkable values of eligible rivers.

**Table 5. Colville National Forest eligible wild and scenic rivers by segment and classification**

| River name | Recommended classification | Miles |
|---|---|---|
| South Fork Salmo River | Wild | 5 |
| Kettle River | Recreational | 3 |

### *Scenery Management System*

Scenery would be managed through the Scenery Management System in all action alternatives. The valued landscape character descriptions would not replace other desired conditions, such as vegetation. Rather, the vegetation desired conditions are a key component of the valued landscape character. Scenic integrity objective zones would overlay the management areas. The direction for scenery management applies regardless of the management area boundary. Applicability of plan direction is guided by the principle that where there is an overlap of scenery management direction with other plan components, the most restrictive plan direction applies, depending on site-specific conditions and the activity or use.

### *Lands and Special Uses*

The Forest Service “Lands” program includes activities such as landownership adjustment, boundary and title management (including land exchanges and acquisitions, granting or accepting of easements), and other activities that are primarily real estate-type actions. The goals of this program include: (1) consolidating landownership patterns to meet the objectives of forest land and resource management plans and to improve land management efficiencies; (2) securing and protecting the rights, title, land, and resources of public land from unauthorized use and occupancy; and (3) providing legally defensible boundaries and accurate, complete landownership records of NFS lands. These program activities will continue and management direction would not change across the action alternatives.

The Forest administers a variety of lands and recreation uses under special use permits, leases, or easements. The types of recreation and special use opportunities would remain the same across alternatives, although the areas and acres of the forest where they might occur vary. Forest plan management direction applicable to areas defined by special use permit, lease, or easement would not change across the action alternatives.

## Management Areas

Although all alternatives include management area allocations with applicable desired conditions, standards, and guidelines, the land management emphasis, acres, names, and associated plan components of the management areas vary by alternative. The no-action alternative (the 1988 plan) identifies 13 management areas based on vegetation and land use. The action alternatives offer a varying array of management area prescriptions designed to achieve the need for change or address significant issues. Management area direction ranges from areas emphasizing passive management in wilderness (natural processes dominate vegetation change) to areas emphasizing active management in focused restoration or responsible management areas (vegetation management through timber harvest and planned fire use).

Table 6 provides an overview of all proposed management areas and their application across alternatives. A ‘-’ indicates the management area is not included in the indicated alternative. Maps of the alternatives are provided in the supplement folder and on the website. Two management areas overlay other management areas as shown with an asterisk in the table. These are the riparian habitat

conservation/riparian management areas in all alternatives and the Kettle Crest recreation special interest area in alternatives P and O.

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**Table 6. Proposed management area (MA) descriptions and percentages of total forest by alternative**

| Management Areas | Description | No Action | Proposed Action | R | P | B | O |
|---|---|---|---|---|---|---|---|
| Wood/Forage | The management goal is to achieve optimum production of timber products while protecting basic resources. | 39 | - | - | - | - | - |
| Scenic/ Timber | The management goal is to provide a natural appearing foreground, middle, and background along major scenic travel routes while providing wood products. | 20 | - | - | - | - | - |
| Old Growth Dependent Species Habitat/ Late Forest Structure | The management goal is to provide essential habitat for wildlife species that require late and old forest habitat components (e.g., structure such as large and old trees, large snags, and downed wood) and contribute to the maintenance of diversity of wildlife habitats and plant communities. | 3 | - | 51 | - | - | - |
| Caribou Habitat[10] | The management goal is to provide seasonal habitats for woodland caribou to contribute the Colville National Forest portion of a fully recovered population as specified in the Caribou Recovery Plan. | 3 | - | - | - | - | - |
| Winter Range | The management goal is to meet the habitat needs of deer and elk to sustain carrying capacity at 120 percent of the 1980 level, while managing other resources (e.g., timber harvest, recreation) consistent with fish and wildlife management objectives. | 11 | - | - | - | - | - |
| Scenic/Winter Range | The management goal is to provide a natural appearing foreground, middle, and background along major scenic travel routes while providing for winter range management. | 7 | - | - | - | - | - |
| Focused Restoration[11] | Management area emphasis would focus on the restoration of ecological integrity and ecosystem function at the landscape scale using both active management (mechanical treatment and prescribed fire) and passive management (natural processes, including disturbances and succession) to restore natural processes and improve resiliency, while emphasizing important fish and wildlife habitats. Spatially, these areas include the key watersheds, and grizzly bear and caribou recovery areas not included in Backcountry and Backcountry Motorized management areas. The active management focus in key watersheds would promote riparian goals. | - | 23 | - | 28 | - | - |

[10] The woodland caribou recovery area is integrated with the Focused Restoration management area under the proposed action and alternative P, and integrated with the Late Forest Structure management area in alternative R.
[11] In the proposed action provided to the public in June 2011, Focused Restoration was labeled as Active Restoration 2.

| Management Areas | Description | No Action | Proposed Action | R | P | B | O |
|---|---|---|---|---|---|---|---|
| General Restoration[12] | Management area emphasis would focus on enhancing ecological integrity and ecosystem function at the landscape scale using active management (mechanical treatment and prescribed fire) to restore natural processes and improve resiliency. | - | 48 | 22 | 45 | - | - |
| Active Management/ Responsible Management Areas | Management area emphasis would be to use active forest management (timber harvest and prescribed fire) to provide forest products to the local economy and move the forest toward desired conditions for resilience to insects, disease, and uncharacteristic wildfire. While the management emphasis would be the same for both these MAs, the "Responsible Management Area" was named through a collaborative process and is retained to honor the collaborative process. | - | - | - | - | 43 | 39 |
| Restoration | Like the Focused and General Restoration MAs, management area emphasis would focus on the restoration of ecological integrity and ecosystem function at the landscape scale using both active management (mechanical treatment and prescribed fire) and passive management (natural processes, including disturbances and succession) to restore natural processes and improve resiliency, with limited mechanical treatment in late forest structure habitat. The landscape would be natural appearing in the majority of this management area, but in comparison to the Backcountry and Backcountry Motorized management areas, these areas have National Forest System roads and areas of intensive, concentrated management activity or facilities. | - | - | - | - | 31 | 34 |
| Backcountry | Management area emphasis would be to provide non-motorized backcountry recreation opportunities in a natural-appearing landscape. Mechanized uses may be allowed. The MA would contribute habitat conditions for species that benefit from an unroaded and summer non-motorized landscape. | 8 | 8 | 2 | 8 | less than 1 | 16 |
| Backcountry Motorized | Management area emphasis would be to provide motorized backcountry recreation opportunities in a natural-appearing landscape. Summer motorized use would be suitable and allowed where identified on the Forest's Motor Vehicle Use Map. Both cross-country and trail-based winter over-snow vehicle use would be suitable. Mechanized would also be suitable. These MAs would contribute habitat conditions for species that benefit from an unroaded landscape. | 1 | 6 | less than 1 | 5 | less than 1 | 5 |

[12] In the proposed action provided to the public in June 2011, General Restoration was labeled as Active Restoration 3.

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| Management Areas | Description | No Action | Proposed Action | R | P | B | O |
|---|---|---|---|---|---|---|---|
| Recreation | The management area goal is to provide roaded and unroaded recreation opportunities in a natural appearing setting, to provide semi-primitive motorized and non-motorized recreation while meeting objectives of wildlife management, and to provide for quality winter recreation opportunities including downhill skiing, Nordic skiing, and other compatible uses. (This MA includes general recreation, recreation/wildlife, and skiing areas in the 1988 Forest Plan.) | 5 | - | - | - | - | - |
| Wilderness – Designated | Congress has designated the Salmo-Priest Wilderness on the Colville National Forest (31,445 acres). Management area emphasis is, and would continue to be under all action alternatives, to preserve the five qualities of wilderness character - untrammeled, natural, undeveloped, opportunities for solitude or primitive and unconfined recreation, and other features of values. In addition, the management areas direction in all alternatives proposes specific objectives, standards, and guidelines for the use of prescribed fire in wilderness. | 3 | 3 | 3 | 3 | 3 | 3 |
| Wilderness – Recommended | Management area emphasis would be to protect and maintain the social and ecological characteristics that provide the basis for the wilderness recommendation. Depending on the alternative (see detailed alternative descriptions), non-conforming wilderness uses including motorized trail maintenance and reconstruction, and mechanized uses (e.g., mountain biking) may be allowed to continue until Congress takes action to designate the areas as wilderness. | - | 9 | 19 | 10 | 20 | 1 |
| Research Natural Areas | Research natural areas (RNA) are established to provide study and protection of a full range of habitat types and remain in a relatively unaltered condition for non-manipulative research, observation, and study. Plan direction would continue to emphasize maintaining the research values of the areas. Management activities in a research natural area must be consistent with the purposes for which the RNA was established (or proposed) or specifically maintain the values of the RNA. | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 |
| Eligible and Suitable Wild and Scenic Rivers | Portions of two rivers on the Colville National Forest, the Kettle River (classified as recreational) and the South Fork Salmo River (classified as wild), have been identified as being eligible for inclusion in the National Wild and Scenic River Inventory. Plan direction would continue to emphasize maintaining the free-flowing characteristic and outstandingly remarkable values for which the river is determined eligible. | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 |

| Management Areas | Description | No Action | Proposed Action | R | P | B | O |
|---|---|---|---|---|---|---|---|
| Scenic Byways | Management area emphasis would be to maintain or enhance the qualities of the byway. The Colville National Forest includes all or part of the Sherman Pass Scenic Byway (designated as both a Washington State Scenic Byway and a National Forest Scenic Byway), the North Pend Oreille Scenic Byway (designated as a Washington State Scenic Byway), and the International Selkirk Loop (designated as an All-American Road).<br>A ½-mile strip on either side of the byway centerline defines the scenic byway management area. Management direction would only apply to portions of the byway within National Forest System lands. | less than 1 | 2 | 2 | 2 | 2 | 2 |
| Nationally Designated Trails | Management direction is for all nationally designated trails located within the administrative boundaries of National Forest System lands. The corridor where management direction applies consists of the visible foreground, which is generally one-half mile in width either side of the centerline of the trail, including viewpoints, water sources, campsites, and spur trails to these features. | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 |
| Kettle Crest Special Int. Area* | Special interest areas (SIAs) are a category of administratively designated special areas with outstanding special characteristics or unique values. These unique values consist of scenic, geological, botanical, zoological, paleontological, historical, or recreational values. SIA management areas overlay other management areas. For example, a special interest area could also be managed for Focused or General Restoration. If there are management area guidance conflicts, the most protective guidance will apply. Management area emphasis would be to ensure protection of the values for which the area is designated. | - | - | - | 8* | - | 9* |
| Administrative and Recreation Sites (Includes permitted and developed recreation sites) | The sites are established as separate management areas rather than overlays or inclusions in other management areas. The management direction remains unchanged from current plans. | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 | less than 1 |

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| Management Areas | Description | No Action | Proposed Action | R | P | B | O |
|---|---|---|---|---|---|---|---|
| RHCA/RMAs* | Depending on alternative, riparian habitat would be allocated to riparian management areas (RMA) under the Aquatic Restoration Conservation Strategy (ARCS) or riparian habitat conservation areas (RHCA) under Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH)) This MA would overlay other MAs. They are mapped at the forest-scale, therefore locations may change based on project-level reconnaissance. RMAs and RHCAs occur on the margins of standing and flowing water and widths vary depending on feature type. The RMA/RHCA MA emphasis is to maintain and restore the riparian structure and function of perennial and intermittent streams, ponds, reservoirs, lakes, seeps, spring, and wetlands. This MA also provides connectivity for riparian-dependent plants and animals. | 13 | 16 | 16 | 16 | 13 | 16 |
| TOTAL[13] | | 100 | 100 | 100 | 100 | 100 | 100 |

*Overlaps with other management areas

[13] Numbers in this table are rounded, and several management areas overlap other management areas; therefore, not all columns add up to exactly 100 percent.

## Alternatives Description

The proposed action is based on the need for a change. We developed additional action alternatives in response to significant issues the public raised during the comment period. Each sub-heading in this section (e.g., Timber Production, Access, Recommended Wilderness) represents an issue as described in chapter 1. A comparison of alternatives is included at the end of this section.

### No Action

The no-action alternative is the current land management plan as amended. Major amendments to the current land management plan include the Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH) (1995), Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens) (1995), and the Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants (2005).

#### *No-Action Alternative Relationship to the Significant Issues and the Need for Change*

**Late-successional and Old Forest Management**

The 1988 forest plan management direction emphasizes a fixed reserves approach for old growth habitat (MA 1) on about 3 percent of the forest (approximately 30,740 acres). Maintaining a fixed reserve system does not guarantee all the allocated acres are in a condition that currently contain old forests. Due to ongoing natural disturbance processes (fire or insect and disease), some stands may currently be in an early or midseral forest structural stage. Fixed reserves are at least 300 acres in size, no scheduled timber harvest is permitted, and appropriate suppression occurs on all wildfires.

Vegetation management on all other suitable lands follows the Eastside Screen amendment, designed to maintain habitat components for species associated with eastside late-successional forests including retention of live trees over 21 inches d.b.h. (diameter at breast height). The intent of the screens was to retain key habitat features, promote vigor and health of the forests, and preserve management options until replaced by a landscape-scale analysis process.

**Timber Production**

The 1988 Colville National Forest Plan describes the long-term sustained yield (LTSY) for the forest at 170.7 million board feet (MMBF) per year with an annual allowable sale quantity (ASQ) of 123 MMBF.

However, amendments such as INFISH and the Eastside Screens have changed the implementation of forest plan, reducing both the LTSY and the ASQ. The effects of these subsequent amendments are included in chapter 3.

Scheduled timber production is suitable on 49 percent of the forest. Timber harvest for other resource objectives is allowed on 29 percent of the forest. The annual predicted wood sale quantity under the no-action alternative (1988 forest plan, as amended) is 41 MMBF.

**Motorized Recreation Trails**

The current forest plan provides direction for motorized uses associated with both seasons. It identifies where motorized recreation use may not be authorized or may be limited for the protection of aquatic, plant and wildlife habitats. In addition, summer motorized recreation use is

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also restricted to those routes (roads and trails) identified on the Forest's current-year motor vehicle use map (MVUM), which was developed in response to Subpart B of the 2005 Travel Management Rule (Forest Plan Amendment #31 – Clarification of Forest Plan Direction Regarding Motor Vehicle Use (2008)). Summer motorized trails make up 36 percent of the total summer trail miles designated for motor vehicle use on the Forest.

About 1.2 percent of total forest acreage is in a backcountry motorized recreation management area, providing limited motorized recreation opportunities in an unroaded setting.

**Access**

Currently, the Colville National Forest manages approximately 4,000 miles of National Forest System roads. The 1988 forest plan identifies 83 percent of the forest as suitable for road construction, but plan direction requires newly constructed project roads to be closed after use unless otherwise justified in a site-specific analysis. Road density desired conditions vary from 0.4 mile per square mile to 1.5 miles per square mile of open road depending on the management area emphasis to protect species such as elk and deer. Additional direction from the Interagency Grizzly Bear Committee (IGBC) describes open road density (1 mile per square mile) and total road density (2 miles per square mile) within bear management units in the Selkirk Ecosystem of the Grizzly Bear Recovery Zone. Other access management and road construction suitability guidance comes from the 2013 Lynx Conservation Assessment and Strategy, the Caribou Winter Recreation Strategy, and the 2001 Roadless Area Conservation Rule.

However, there is concern that the current road system is not aligned with current and future management objectives or budgets. In addition, the current forest plan does not address how roads and road management may affect hydrologic function and processes, and water quality, or the best science related to road-related disturbance effects to a broader list of species.

**Recommended Wilderness**

The Salmo-Priest Wilderness (congressionally designated) covers about 3 percent of the Colville National Forest. The 1988 forest plan does not include any recommendations for additional wilderness.

**Wildlife**

The 1988 forest plan emphasizes habitat for deer and elk through guidelines for human access (see previous Access section), retention or creation of thermal cover, and retention or creation of forage. Other species were addressed through management area designation or specific standards and guidelines. In 1995, the forest plan was amended with the Eastside Screens to provide additional management guidance for wildlife species associated with late successional and old forest habitat. However, this was intended to be interim direction, and implementation over the last 20 years has revealed shortcomings in this one-suite of species management approach. In addition to the issues related to addressing vegetative system resiliency for late-successional and old forests discussed previously, the diameter size emphasis of the Eastside Screens lacks direction for other important habitat structure elements such as snags and downed logs.

In addition, the no-action alternative does not address the need to incorporate the conservation strategy, critical habitat, and recovery plan direction for federally listed species and best science for providing viability for other at-risk species.

## Riparian and Aquatic Resources

The Colville Forest plan was amended by the Inland Native Fish Strategy (INFISH) (USDA Forest Service 1995a) which provides additional watershed direction intended to restore and maintain the ecological health of watersheds and aquatic ecosystems on National Forest lands for native resident fisheries. INFISH established riparian habitat conservation areas (RHCA) and a priority watershed network. INFISH also incorporated riparian management objectives (RMOs), and additional goals, standards and guidelines (with no distinction between standards and guidelines) to restore and maintain riparian and aquatic resources into the Colville Forest plan.

The 1995 INFISH was intended to be an interim strategy and does not provide a comprehensive watershed, aquatic, and riparian conservation and restoration strategy. Although there are indications aquatic habitat conditions may be slowly improving under current management, continuing with the interim strategy would not address the need to integrate restoration of terrestrial and aquatic ecosystems or facilitate integrated management of aquatic resources with upslope terrestrial vegetation and recreation management.

### Riparian Widths

RHCAs defined in INFISH are areas where riparian-dependent ecosystems receive primary emphasis, and management activities are subject to specific standards and guidelines (USDA Forest Service 1995a). RHCA widths are shown in table 7. RHCA widths may be increased or decreased when necessary to attain RMOs when site-specific data supports the change.

**Table 7. Riparian habitat conservation area (RHCA) width**

| Stream and water body classification | RHCA width |
|---|---|
| Fish-bearing streams | 300 feet slope distance on each side (600 feet total) |
| Permanently flowing non-fish-bearing streams | 150 feet slope distance on each side (300 feet total) |
| Ponds, lakes, reservoirs and wetlands greater than 1 acre | 150 feet slope distance around feature |
| Seasonally flowing or intermittent streams, wetlands less than 1 acre | 100 feet slope distance in priority watersheds,<br>50 feet slope distance in non-priority watersheds. |

### Priority Watershed Network

INFISH priority watersheds on the Colville National Forest were originally designated in 1998 and updated in 2001. INFISH designated as “priority” watersheds those areas “having excellent habitat or strong assemblages of inland native fish, particularly bull trout, or watersheds that provide for population distribution goals, or watersheds having a high restoration potential” (USDA Forest Service 1995a). The INFISH priority network on the Colville National Forest is shown in figure 3. RHCA widths in priority watersheds under INFISH are wider than RHCA widths in non-priority watersheds for non-fish-bearing intermittent streams and wetlands less than 1 acre (table 7). In INFISH priority watersheds, watershed analysis is required before certain road activities and construction of new recreation facilities are permitted in RHCAs, and there are specific protections against increased sedimentation through prioritization of road treatments in priority watersheds.

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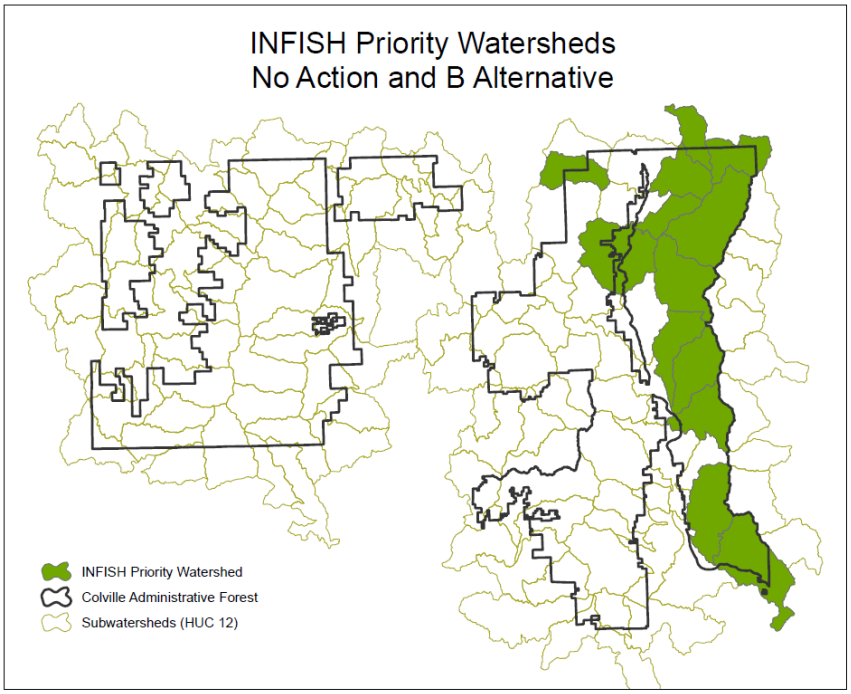


**Figure 3. INFISH Priority Watersheds for no action and alternative B**

## Proposed Action

We developed the proposed action to address the need for change related to managing vegetation to be more resilient to disturbances, to maintain or restore ecological conditions that contribute to species diversity and the recovery and viability of at-risk species, and to provide integrated management direction to maintain and restore properly functioning watersheds. It also addresses the need to provide a sustainable flow of timber and both motorized and non-motorized recreation opportunities to provide economic and social contributions to the community and nation.

In particular, the proposed action: (1) applies landscape ecology concepts to provide for ecological resilience to disturbances, including wildfire and the effects of climate change, (2) incorporates science related to the recovery of terrestrial and aquatic threatened and endangered species, (3) integrates plan components for water resources and riparian areas, and (4) recommends 101,390 acres as additions to the Wilderness Preservation System.

Both active management, which includes timber harvest, non-commercial thinning, planned ignitions, and passive management, which includes using unplanned ignitions and natural processes, would be used to move vegetation toward desired conditions.

### *Proposed Action Alternative Relationship to the Significant Issues*

#### Late-Successional and Old Forest Management

Unlike the 1988 forest plan (no-action alternative), the proposed action would use a dynamic landscape approach[14] for providing late forest structure, allowing late structure forests to shift location in response to ecological processes (e.g., wildfires). Forestwide desired conditions for forest structure would be based on historic range of variability (see table 4). Late-successional

[14] See chapter 3 for a detailed description of the dynamic landscape approach.

forests would be managed in different ways depending on the management area-specific desired conditions. For example, in management areas where roads are present, planned ignition and timber harvest may both be utilized whereas in areas with less access or with other management emphasis, unplanned ignitions may be the optimal tool.

**Timber Production**

Scheduled timber production would be suitable on 59 percent of the forest. Timber harvest for other resource objectives would be allowed on 19 percent of the forest. The annual predicted wood sale quantity would be 62 MMBF.

**Motorized Recreation Trails**

The proposed action would increase the opportunity for backcountry motorized and non-motorized recreation to address the increase in visitor use due to population growth and changing demographics described in the need for change related to social systems. It would offer a range of recreation settings in both the front (roaded setting) and backcountry (unroaded setting) to accommodate how people use and access the forest.

Approximately six percent of the forest would be allocated to the Backcountry Motorized MA, which would be suitable for summer and winter motorized recreation. Approximately eight percent of the forest would be allocated to the Backcountry MA, which would emphasize non-motorized recreation opportunities and would not suitable for motorized recreation. (Both would be suitable for mechanized use.) The other roaded management areas would provide an additional 71 percent of the forest as suitable for summer and winter motorized recreation.

**Access**

The proposed action would reduce suitability for roads to 73 percent of the forest (compared to 83 percent in the no-action alternative). It would also include desired conditions for total road densities to address terrestrial wildlife (e.g., grizzly bear), hydrologic function, and aquatic species (e.g., bull trout) habitat needs while continuing to maintain an access system of authorized roads that are safe, affordable, and environmentally sound. The road density desired conditions would vary from 2.0 miles per square mile in the Focused Restoration MA to 3.0 miles per square mile in the General Restoration MA (both averaged at the 5th field watershed).

**Recommended Wilderness**

By law, all NFS lands must be evaluated for possible wilderness recommendation during the plan revision process. This evaluation showed a need for additional wilderness opportunities on the forest.

The proposed action would recommend 9 percent of the forest for wilderness. These areas would include Abercrombie-Hooknose (35,080 acres), Bald Snow (15,200 acres), Hoodoo (11,010 acres), Profanity (26,550 acres), and Salmo-Priest Adjacent (13,550 acres) inventoried roadless areas. Forest plan components would direct that the wilderness character and potential for each area recommended is to remain intact until congressional action is taken or the area is released from consideration through a future plan amendment or revision. Existing mechanized uses would be allowed to continue, but no new motorized or mechanized recreation opportunities would be allowed.

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### Wildlife

In addition to the ecosystem plan components for managing vegetation through a dynamic landscape approach and addressing habitat connectivity through road density desired conditions (described above), the proposed action would include species-specific management direction for surrogate wildlife species associated with late-successional habitat structures through proposed plan components for late successional habitat, retention of snag habitat, and down woody debris.

### Riparian and Aquatic Resources

The proposed action would address the need for updated, integrated direction for watershed, aquatic and riparian management and would increase the pace and scale of aquatic restoration. Riparian and aquatic resource direction that would be included in the proposed action is based on the Region 6 Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008), which is a refinement of earlier strategies and plans including the Aquatic Restoration Strategy (ARS) (USDA 2005), the Northwest Forest Plan (USDA Forest Service and USDI BLM, 1994), PACFISH (USDA and USDI 1995), and INFISH (USDA Forest Service 1994c and 1995). ARCS includes designation of riparian management areas, designation of a key watershed network, and a core set of desired conditions, objectives, standards and guidelines, designed to provide ecological conditions conducive to maintaining, restoring, and enhancing habitat necessary to sustain aquatic and riparian-dependent species on NFS lands.

#### Riparian Widths

Riparian management areas (RMAs) are areas where riparian-dependent resources receive primary emphasis and are designated for all streams and aquatic features. RMAs would not prohibit management activities, but management in RMAs should contribute to maintaining or moving RMAs toward desired conditions. Compared to the no-action alternative, the RMAs in the proposed action would be more protective due to the increased RMA-width buffer on intermittent streams and natural lakes and ponds.

**Table 8. Riparian management area width**

| Stream and water body classification | Riparian Management Area width |
|---|---|
| Fish-bearing streams | 300 feet slope distance on each side (600 feet total) |
| Permanently flowing non-fish-bearing streams | 150 feet slope distance on each side (300 feet total) |
| Lakes and natural ponds | 300 feet slope distance around feature |
| Constructed ponds, and reservoirs and wetlands greater than 1 acre | 150 feet slope distance around feature |
| Seasonally flowing or intermittent streams; wetlands, seeps, and springs less than 1 acre, and unstable or potentially unstable areas | 100 feet slope distance from stream (200 feet total), 100 feet slope distance around wetland, seep, spring, or unstable or potentially unstable area |

#### Key Watersheds

Key watersheds are a network of watersheds that serve as strongholds for important aquatic resources or have the potential to do so through focused restoration (USDA Forest Service 2008). Key watersheds are designated at the subwatershed scale and were selected based on population condition of focal aquatic species (interior redband trout, westslope cutthroat trout, and bull trout), and aquatic habitat condition and function. Management in key watersheds minimizes risk and maximizes restoration and preservation of ecological health. The key watershed network in the proposed action was identified in 2011, and would expand the INFISH priority network in the no-action alternative with the addition of 13 additional subwatersheds. Four subwatersheds in the

INFISH priority network were not included in the key watershed network for the proposed action because they did not have the aquatic habitat conditions or focal species population necessary for designation as a key watershed.

The proposed action also includes measureable restoration objectives for key watersheds. The establishment of a key watershed network and measurable restoration objectives for key watersheds is a significant difference between the proposed action and the no-action alternative.

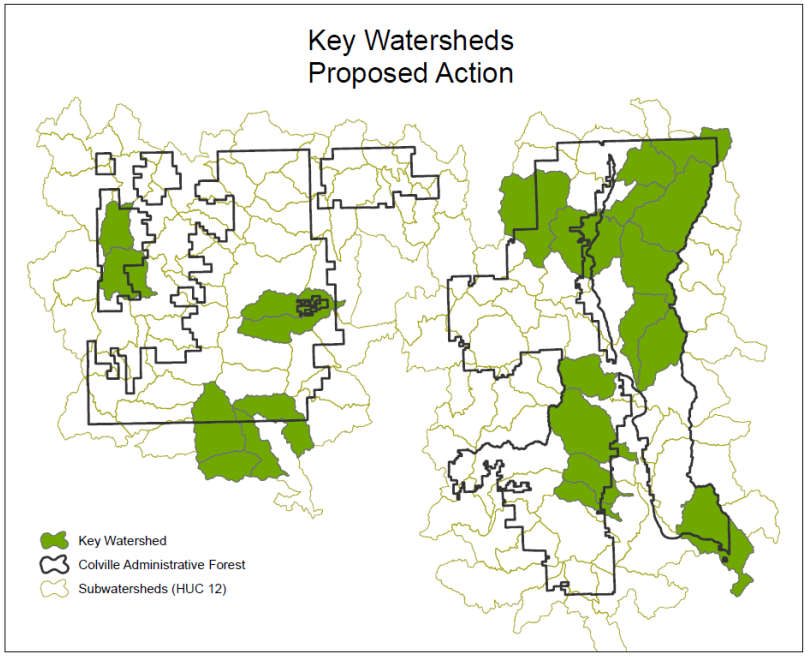


**Figure 4. Key watershed network under the proposed action**[15]

## Alternative P (Modified Proposed Action)

Alternative P responds to public concern that management direction as shown in other alternatives could result in lower revenue to local economies, reduced ability to address fuel levels and wildfire risk to adjacent communities, protection of water quality, and ability to provide a mix of recreation opportunities, while also addressing multiple-use management and development of resilient landscapes. This alternative would propose the same management areas as the proposed action, but would vary the location of those allocations on the landscape with the intent to provide a sustained flow of economic contributions to the local communities, and adds the Kettle Crest Special Interest Area (approximately 82,800 acres).

In particular, alternative P would: (1) apply landscape ecology concepts to provide for ecological resilience to disturbances, including wildfire and the effects of climate change, (2) incorporate science related to the recovery of terrestrial and aquatic threatened and endangered species, (3) integrate plan components for water resources and riparian areas using ARCS-modified, and (4) recommend 68,300 acres as additions to the Wilderness Preservation System.

[15] Management direction and desired conditions apply only to NFS lands. Portions of key watersheds outside the Colville National Forest boundary are shown for informational purposes only.

Both active management (timber harvest, non-commercial thinning, and planned ignitions), and passive management (unplanned ignitions and natural processes), would be utilized to move vegetation toward desired conditions.

### *Alternative P Relationship to the Significant Issues and the Need for Change*

#### Late-Successional and Old Forest Management

Unlike the no-action alternative, alternative P would use the dynamic landscape approach described in the proposed action to manage vegetation toward desired conditions (figure 4).

#### Timber Production

Scheduled timber production would be suitable on 60 percent of the forest. Timber harvest for other resource objectives would be allowed on 18 percent of the forest. The annual predicted wood sale quantity would be 62 MMBF.

#### Motorized Recreation Trails

Alternative P is similar to the proposed action, increasing the opportunity for backcountry (unroaded setting) motorized and non-motorized recreation opportunities. Approximately five percent of the forest would be allocated to the Backcountry Motorized MA, which would be suitable for summer and winter motorized recreation. Approximately eight percent of the forest would be allocated to the Backcountry MA, which would emphasize non-motorized recreation opportunities and would not suitable for motorized recreation. (Both would be suitable for mechanized use.) The other roaded management areas would provide an additional 73 percent of the forest as suitable for summer and winter motorized recreation.

#### Access

Alternative P would reduce suitability for roads to 75 percent of the forest (compared to 83 percent in the no-action alternative). Similar to the proposed action, it would also include desired conditions for total road densities to address terrestrial wildlife (e.g., grizzly bear), hydrologic function, and aquatic species (e.g., bull trout) habitat needs while continuing to maintain an access system of authorized roads that are safe, affordable, and environmentally sound. However, in alternative P, the road density desired conditions would vary from no greater than 1.0 mile per square mile in the Focused Restoration MA to no greater than 2.0 miles per square mile in the General Restoration MA (both averaged at the 5th field watershed).

#### Recommended Wilderness

Alternative P would recommend 6 percent of the forest for wilderness. These areas would include Abercrombie-Hooknose (37,660 acres), Bald Snow (14,693 acres), and Salmo-Priest Adjacent (16,710 acres) inventoried roadless areas. Forest plan components would direct that the wilderness character and potential for each area recommended is to remain intact until congressional action is or the area is released from consideration through a future plan amendment or revision. Existing mechanized uses would be allowed to continue, but no new motorized or mechanized recreation opportunities would be allowed.

#### Wildlife

Like the proposed action, alternative P would provide ecosystem plan components for managing vegetation through a dynamic landscape approach, and would address habitat connectivity through road density desired conditions and motorized recreation suitability (described above).

And, like the proposed action, it would include species-specific management direction for surrogate wildlife species that are associated with these late-successional habitat structures through proposed plan components for large trees, retention of snag habitat, and down woody debris.

**Riparian and Aquatic Resources**

Riparian and aquatic resource direction in alternative P would be based on ARCS (described in the proposed action), but would incorporate additional management direction to address issues specific to the Colville National Forest. The incorporation of additional desired conditions, objectives, and standards and guidelines is referred to as "ARCS-modified."

Examples of the additional plan direction in ARCS-modified include:

1. Additional desired conditions for general water resources and roads in RMAs.
2. Clarity to riparian management area objectives that address improvement of riparian function at dispersed and developed recreation sites, restoration of riparian processes altered by roads, and restoration of upland vegetation in riparian management areas toward historic range of variation.
3. Additional objectives for key watersheds tied to the National Watershed Condition Framework and threatened, endangered and sensitive species recovery plans.
4. Plan components to prevent and control aquatic invasive species, improve watershed and aquatic habitat function, improve aquatic organism passage, and address livestock grazing effects to greenline areas.

#### Riparian Widths

RMA widths would be the same as the proposed action (table 8).

#### Key Watersheds

At the time the proposed action alternative was released to the public, the key watershed network was delineated at the subwatershed scale. Boundaries, names, and numbers of subwatersheds have changed since that release, and additional fish distribution and aquatic habitat data were gathered. The key watershed network in alternatives R, P, and O was updated using the most current (2014) subwatershed delineations, fish distribution data, and aquatic habitat condition data (figure 5). The key watershed network would be larger in alternative P than in the proposed action.

Compared to the proposed action, five subwatersheds were added to the key watershed network and three subwatersheds were removed because they had less than 25 percent Colville National Forest ownership.

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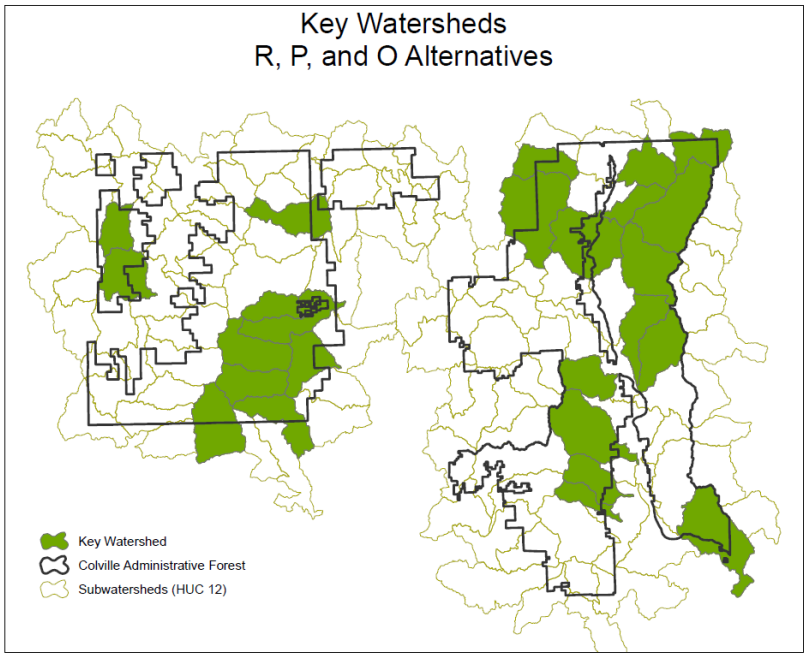


**Figure 5. Key watershed network under alternatives P, R, and O**

## Alternative R

Alternative R responds to the public comments that support static late forest structure reserve land allocations, emphasis on maintaining habitat components for species associated with eastside late successional forests, and a 21-inch upper diameter limit on cutting live trees, similar to the no-action alternative. Public issues concerning potential impacts that road access and summer motorized trail use may have on aquatic, riparian, and wildlife habitats, including grizzly core areas and habitat connectivity are addressed through lower road density desired conditions, few acres allocated for backcountry motorized recreation, and a high proportion of recommended wilderness areas. Likewise, alternative R responds to public concerns that ARCS would not provide watershed, aquatic, and riparian resource protection as effective as the INFISH.

In particular, alternative R would: (1) substantially increase late-successional reserves in both the number of acres and the size and connectivity of the areas, (2) integrate plan components for water resources and riparian areas using ARCS-modified, and (3) recommend 207,800 acres as additions to the Wilderness Preservation System.

Although active management (timber harvest, non-commercial thinning, and planned ignitions) would be used as management tools where suitable, alternative R would have more emphasis on passive management (unplanned ignitions and natural processes) to move vegetation toward desired conditions as a result of management area allocations.

### *Alternative R Relationship to the Significant Issues and the Need for Change*

#### Late-successional and Old Forest Management

Like the no-action alternative, this alternative would use a fixed reserve management approach to maintain late forest structure in fixed geographic locations. Fixed reserves would be allocated across 51 percent of the forest in a Late Structure MA. Although not suitable for timber production, timber harvest would be used as a management tool to maintain and improve

resiliency of the late and old forest habitat components (e.g., structure such as large and old trees, large snags, and downed wood). In addition, alternative R would retain emphasis on maintaining habitat components for species associated with eastside late successional forests and the 21-inch upper diameter limit on cutting live trees.

**Timber Production**

Scheduled timber production would be suitable on 12 percent of the Forest. Timber harvest for other resource objectives would be allowed on 66 percent of the Forest. The annual predicted wood sale quantity would be 14 MMBF.

**Motorized Recreation Trails**

The amount of area allocated to backcountry recreation opportunities (unroaded setting) is similar to the no-action alternative. Less than one percent of the forest would be allocated to the Backcountry Motorized MA (suitable for summer and winter motorized recreation) and approximately two percent of the Forest would be allocated to a Backcountry MA (not suitable for motorized recreation). (Both would be suitable for mechanized recreation use.) Although the other roaded MAs would provide an additional 73 percent of the Forest as suitable for summer and winter motorized recreation, the increase in recommended wilderness (see description below) would reduce both motorized and mechanized recreation opportunities compared to the no-action alternative.

**Access**

Alternative R would reduce suitability for roads to 75 percent of the Forest (compared to 83 percent in the no-action alternative). It would also include desired conditions for total road densities to address terrestrial wildlife (e.g., grizzly bear), hydrologic function, and aquatic species (e.g., bull trout) habitat needs while continuing to maintain an access system of authorized roads that are safe, affordable, and environmentally sound. The road density desired conditions would vary from no greater than 1.0 mile per square mile in the Late Forest Structure MA to no greater than 2.0 miles per square mile in the General Restoration MA (both averaged at the 5$^{th}$ field watershed).

**Recommended Wilderness**

This alternative would recommend 19 percent of the Forest as wilderness. The areas that would be recommended are described in table 9. Forest plan components would direct that the wilderness character and potential for each area recommended is to remain intact until congressional action is taken or the area is released from consideration through a future plan amendment or revision. Mechanized and motorized use would not be suitable and a site-specific prohibition (per 36 CFR 261) would accompany the record of decision for the forest plan.

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**Table 9. Alternative R recommended wilderness**

| Inventoried Roadless Area | Acres |
|---|---|
| Abercrombie-Hooknose | 37,650 |
| Bald Snow | 18,810 |
| Cougar Mountain | 6,210 |
| Deer Creek | 5,820 |
| Grassy Top | 2,200 |
| Hall Mountain | 7,890 |
| Harvey Creek | 5,720 |
| Hoodoo | 11,060 |
| Jackknife | 8,940 |
| Owl Mountain | 11,060 |
| Profanity | 37,770 |
| Quartzite | 5,340 |
| Salmo-Priest Adjacent | 15,980 |
| South Huckleberry | 9,680 |
| Thirteenmile | 10,890 |
| Twin Sisters | 14,610 |

### Wildlife

Although alternative R would maintain the fixed reserves management approach for late-successional and old forest habitat, it also would include species-specific management direction for surrogate wildlife species that are associated with these late-successional habitat structures through proposed plan components for large trees, retention of snag habitat, and down woody debris. Also, compared to the no-action alternative, habitat connectivity would be addressed through reduced road density desired conditions and reduced acres suitable for motorized recreation. (See previous motorized trail recreation, access, and recommended wilderness descriptions).

### Riparian and Aquatic Resources

Riparian management area widths, the key watershed network and designation process, and riparian and aquatic resource goals, objectives, standards, and guidelines (ARCS-modified) are the same as alternative P. Unlike the no-action alternative, this addresses the need for updated, integrated direction for watershed, aquatic, and riparian management.

## Alternative B

Alternative B combines feedback from timber and environmental interest groups and incorporates management strategies supported by the Northeast Washington Forestry Coalition. Alternative B would address the concerns of multiple constituencies in one alternative by balancing land allocations between areas emphasizing active management (timber management zones), emphasizing a mix of active and passive management (restoration areas), and emphasizing passive management (designated and recommended wilderness).

Like the no-action alternative, alternative B would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure. However, it would include additional plan components to limit mechanical

restoration treatments (timber harvest) in late-successional structure to dry plant association groups only.

Where plan components were not identified by the collaborative group, the 1988 Colville Forest Plan (no-action alternative) would provide plan direction (remain unchanged).

Active management (timber harvest and non-commercial thinning) would be emphasized in the Active Management MA, although the retention of the Eastside Screens would limit their continued application over time. Passive management (unplanned ignitions and natural processes) would be emphasized in the other management areas across the Forest.

### *Alternative B Relationship to the Significant Issues and the Need for Change*

#### Late-Successional and Old Forest Management

Like the no-action alternative, this alternative would use a fixed reserve management approach to maintain late forest structure in fixed geographic locations on 31 percent of the Forest. However, alternative B would include plan components to exclude timber harvest as a management tool in late-successional mixed conifer stands. Restoration of ecological integrity and ecosystem function would be achieved primarily through natural process with limited active management activity in late forest structure habitat. In addition, alternative B would retain the 21-inch upper diameter limit on cutting live trees.

#### Timber Production

Scheduled timber production would be suitable on 35 percent of the Forest. Timber harvest for other resource objectives would be allowed on 43 percent of the Forest. The annual predicted wood sale quantity would be 37 MMBF.

#### Motorized Recreation Trails

Alternative B would provide less backcountry motorized recreation opportunities (unroaded setting) than the no-action alternative as less than one percent would be allocated to the Backcountry Motorized MA. Although an additional 74 percent of the Forest would be suitable for summer and winter motorized recreation in the other roaded management areas, the increase in recommended wilderness (see description below), would reduce both motorized and mechanized recreation opportunities compared to the no-action alternative.

#### Access

Alternative B would reduce suitability for roads to 74 percent of the Forest (compared to 83 percent in the no-action alternative). Additionally, this alternative would cap total miles of NFS roads at the current level, about 4,000 miles, and would include a standard stating that for any miles added to the NFS road system, an equal amount of existing road miles would be required to be decommissioned. This standard was developed to address public concerns about potential resource damage caused by the road system and would be intended to mitigate road-related resource impacts in contrast with the road density desired condition approach of the proposed action.

#### Recommended Wilderness

Alternative B would recommend 20 percent of the Forest for wilderness. The areas that would be recommended are described in table 10. Forest plan components would direct that the wilderness character and potential for each area recommended is to remain intact until congressional action

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is taken or the area is released from consideration through a future plan amendment or revision. Mechanized and motorized use would not be suitable and a site-specific prohibition (per 36 CFR 261) would accompany the record of decision for the forest plan.

**Table 10. Alternative B recommended wilderness**

| Inventoried Roadless Area | Acres |
|---|---|
| Abercrombie-Hooknose | 37,600 |
| Bald Snow | 19,880 |
| Bodie Mountain | 4,510 |
| Clackamas Mountain | 430 |
| Cougar Mountain | 6,140 |
| Deer Creek | 5,820 |
| Grassy Top | 2,200 |
| Hall Mountain | 7,890 |
| Harvey Creek | 5,690 |
| Hoodoo | 11,690 |
| Jackknife | 8,940 |
| Jackson Creek | 3,000 |
| Owl Mountain | 11,060 |
| Profanity | 37,650 |
| Quartzite | 5,360 |
| Salmo-Priest Adjacent | 15,960 |
| South Fork Mountain | 1,190 |
| South Huckleberry | 9,920 |
| Thirteenmile | 10,870 |
| Twin Sisters | 14,530 |

### Wildlife

Like the no-action alternative, alternative B would maintain the fixed reserves management approach for late-successional and old forest habitat, but it also would include species-specific management direction for surrogate wildlife species that are associated with these late-successional habitat structures through proposed plan components for retention of snag habitat and down woody debris. Also, compared to the no-action alternative, habitat connectivity would be addressed through reduced acres suitable for roads and motorized recreation. (See previous motorized trail recreation, access, and recommended wilderness descriptions.)

### Riparian and Aquatic Resources

Like the no-action alternative, alternative B would continue riparian and aquatic management under INFISH. Riparian habitat conservation area widths, the priority watershed network, and riparian and aquatic resource goals objectives, standards, and guidelines would all remain the same as the current forest plan.

## Alternative O

Alternative O was designed to reflect areas of agreement expressed by participants at a series of public meetings that focused on motorized recreation, wilderness recommendations, and vegetation management.

Similar to alternative B, the intent of alternative O would be to balance land allocations between areas emphasizing active management (Responsible MA), emphasizing a mix of active and passive management (Restoration MA), and emphasizing passive management (backcountry MAs and recommended/designated wilderness). Like the no-action alternative, this alternative would retain the Eastside Screens, 21-inch upper diameter limit for cutting live trees, and the large-scale reserve approach for late-successional forest structure.

Where the collaborative group did not identify plan components, the proposed action would provide plan direction. This would include management direction to (1) incorporate science related to the recovery of terrestrial and aquatic threatened and endangered species and (2) integrate plan components for water resources and riparian areas (ARCS).

Alternative O would designate 99,000 acres as the Kettle Crest Recreation SIA.

### *Alternative O Relationship to the Significant Issues and the Need for Change*

#### Late-Successional and Old Forest Management

Like the no-action alternative and alternative B, this alternative would use a fixed reserve management approach to maintain late forest structure in fixed geographic locations on 34 percent of the Forest. It would include plan components to exclude timber harvest as a management tool in late-successional mixed conifer stands. Restoration of ecological integrity and ecosystem function would be achieved primarily through natural process with limited active management activity in late forest structure habitat. In addition, alternative O would retain the 21-inch upper diameter limit on cutting live trees.

#### Timber Production

Scheduled timber production would be suitable on 32 percent of the Forest. Timber harvest for other resource objectives would be allowed on 46 percent of the Forest. The annual predicted wood sale quantity would be 38 MMBF.

#### Motorized Recreation Trails

Alternative O would increase the opportunity for backcountry (unroaded setting) motorized and non-motorized recreation opportunities. Approximately 5 percent of the Forest would be allocated to the Backcountry Motorized MA (suitable for summer and winter motorized recreation) and approximately 16 percent would be allocated to the Backcountry MA (not suitable for motorized recreation). (Both would be suitable for mechanized use.) An additional 73 percent of the Forest would be suitable for summer and winter motorized recreation in the other roaded MAs.

Unique to this alternative and in acknowledgement of ongoing public disagreement around wilderness recommendations, a 99,000-acre recreation special interest area along the Kettle Crest would be created including areas both north and south of Sherman Pass. Management emphasis of the Kettle Crest Special Interest Area would emphasize outstanding recreational values in a semi-primitive setting and would allow uses (roads, motorized and non-motorized recreation, and

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vegetation management for example) to the extent that the uses were in harmony with the special recreation values of the area.

**Access**

Alternative O would reduce suitability for roads to 74 percent of the Forest (compared to 83 percent in the no-action alternative). Additionally, this alternative would cap total miles of NFS roads at the current level, about 4,000 miles, and would include a standard stating that for any miles added to the NFS road system, an equal amount of existing road miles would be required to be decommissioned. This standard was developed to address public concerns about potential resource damage caused by the road system and would be intended to mitigate road-related resource impacts, in contrast with the road density desired condition approach of the proposed action.

**Recommended Wilderness**

Alternative O would recommend 1 percent of the Forest for wilderness, the Salmo-Priest Adjacent area (15,950 acres). Forest plan components would direct that the wilderness character and potential for each area recommended is to remain intact until congressional action is taken or the area is released from consideration through a future plan amendment or revision. Existing mechanized uses would be allowed to continue, but no new motorized or mechanized recreation opportunities would be allowed.

**Wildlife**

Like the no-action alternative, alternative B would maintain the fixed reserves management approach for late-successional and old forest habitat, but it also would include species-specific management direction for surrogate wildlife species that are associated with these late-successional habitat structures through proposed plan components for retention of snag habitat and down woody debris. Also, compared to the no-action alternative, habitat connectivity would be addressed through reduced acres suitable for roads and motorized recreation. (See motorized trail recreation, access, and recommended wilderness descriptions above.)

*Riparian and Aquatic Resource Management*

Like the proposed action, riparian and aquatic resource direction would be integrated through the implementation of ARCS. However, riparian area widths and the key watershed network and designation process would be the same as alternatives R and P.

# 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 proposed action provided suggestions for alternative methods to address the need for change. Some of these alternatives may have been outside the scope of the need to revise the forest plan, 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.

## Biological Capability Only

It was suggested that biological capability should be the only consideration in developing alternatives, rather than considering budget or perceived political or social constraints.

First generation forest plans were developed and approved under national direction unconstrained by budget assumptions. Without considering reasonably foreseeable budgets, the 1980s-era forest plan established unrealistic expectations of activity and output. It would be disingenuous to continue to portray unrealistic objectives based on unconstrained or much higher budget levels. The Forest Service has learned it is important to analyze the effects of plan alternatives within the fiscal capability of the unit, because financial constraints are often the primary limiting factor in achieving desired conditions.

## Alternatives that give priority to a single resource

The public suggested alternatives that would emphasize protection and restoration of watershed conditions or the unconstrained use of mineral-rich areas over all other resources. Alternatives that would not meet the intent of the NFMA's regulations for revising forest plans were also suggested.

Use of biological considerations only, or managing the Forest as if it were all critical habitat for threatened or endangered species, in developing alternatives would not meet the intent of NFMA regulations for revising forest plans. The regulations speak to considering ranges of resource outputs, being responsive to public issues and management concerns, and delivering plans that provide for multiple uses. Access to and use of minerals is already covered by existing law, regulation, and policy.

## Snowpack alternative

This alternative would emphasize retaining snowpack and returning stream flows to historic levels, implying that current stream flows are less than past conditions. The suggested approach to accomplish this would be by limiting tree cutting. However, increasing the density of the forest canopy would not feasibly increase stream flows (water yield). Rather research has shown that water yields increase and run-off time is altered when a substantial amount of the tree canopy area of a forested watershed is removed (Bosch and Hewlett 1981).

## Inventoried Roadless Areas alternatives

Some members of the public suggested an alternative that promoted removing any constraints to road building and commercial timber harvest within inventoried roadless areas.

However, management of inventoried roadless areas (outside of Idaho and Colorado), must follow the 2001 Roadless Area Conservation Rule (36 CFR 294 Subpart B). The rule generally prohibits new road construction and reconstruction in inventoried roadless areas, and timber harvest is only permitted under a few limited exceptions. While NEPA allows consideration of alternatives that are contrary to rules, this issue has been litigated and affirmed by the courts.

## Forest Rangeland and Renewable Resources Planning Act

The planning regulations at 36 CFR 219.12(f)(6) (1982) require that at least one alternative be developed "which responds to and incorporates the RPA [Resources Planning Act] Program tentative resource objectives for each forest displayed in the regional guide."

The last RPA Program was developed in 1995. The requirement for a "RPA Program" was replaced in the Government Performance and Results Act of 1993 with a requirement for the Agency to develop a Strategic Plan. Currently, the Forest Service Strategic Plan (FY2014 to 2018) provides broad overarching national guidance for forest planning and national objectives

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for the Agency. All of the alternatives considered in detail in this EIS integrate these broad strategic objectives.

## Minimum Level of Management

Under this alternative, only the minimum level of management needed to maintain and protect the Forest as a part of the National Forest System would be accomplished. No acres would be classified as suitable for timber production or grazing, no trees would be harvested, and no timber would be produced. Management would be solely focused on preventing resource damage or addressing the safety of forest visitors and would be limited to management of the recreation facilities, roads and trails. Treatments in wildland urban interface areas would continue to meet liability concerns.

It was determined that this alternative should not be considered in any further detail because it would not meet the need for change identified for revising the current forest plan or address the significant issues raised by the public. It would also not meet the legal requirements of the Multiple Use Sustained Yield Act and National Forest Management Act to provide for multiple uses and benefits of the national forests.

# Comparison of Alternatives

Chapter 3 presents a detailed description of the effects of the varying management allocations and plan components across alternatives. The following table provides a summary of effects by revision topic.

**Table 11. Comparison of some plan revision key indicators**

| Resource and Indicator | No Action Alt | Proposed Action | Alt P | Alt R | Alt B | Alt O |
|---|---|---|---|---|---|---|
| **Vegetation** | | | | | | |
| Uses a Fixed Reserves and Diameter Limit Management Approach for Managing Late-successional Reserves and Old Forest Habitat Versus Dynamic Landscape Management Approach | Fixed Reserves and Diameter Limit | Dynamic Landscape | Dynamic Landscape | Fixed Reserves and Diameter Limit | Fixed Reserves and Diameter Limit | Fixed Reserves and Diameter Limit |
| **Timber Production**[16] | | | | | | |
| Acres/Percentage Suitable for Timber Production | 535,725<br>48% | 653,242<br>59% | 656,628<br>60% | 129,420<br>12% | 384,485<br>35% | 347,535<br>32% |
| Acres/Percent Harvest Allowed for Other Resource Objectives | 323,025<br>29% | 205,508<br>19% | 202,122<br>18% | 729,330<br>66% | 474,265<br>43% | 511,215<br>46% |
| Predicted Wood Sale Quantity (PWSQ)<br>MMBF<br>CCF | 41<br>82,800 | 62<br>125,900 | 62<br>125,400 | 14<br>28,900 | 37<br>77,000 | 38<br>77,000 |
| **Roads** | | | | | | |
| Percent of Forest Suitable for Roads | 83% | 73% | 75% | 75% | 74% | 74% |

[16] All outputs present in annual measurements

| Resource and Indicator | No Action Alt | Proposed Action | Alt P | Alt R | Alt B | Alt O |
|---|---|---|---|---|---|---|
| Total Road Density Desired Conditions versus Capping Road Miles at Existing | Road densities between 0.4-2 mi/mi$^2$ | Road densities between 2-3 mi/mi$^2$ and no net increase in key watersheds | Road densities between 1-2 mi/mi$^2$ and no net increase in key watersheds and riparian MAs | Road densities between 1-2 mi/mi$^2$ and no net increase in key watersheds and riparian MAs | Cap on existing mile and no net increase in key watersheds | Cap on existing miles |
| **Recommended Wilderness** | | | | | | |
| Acres/Percent Recommended for Wilderness | 0 | 101,390<br>9% | 68,300<br>6% | 207,800<br>19% | 220,330<br>20% | 15,950<br>1% |
| Existing Mechanized and Motorized a Suitable Use | Does Not Apply | Yes | Yes | No | No | Yes |
| Change to Miles of Trail Currently Designated for Motor Vehicle Use (MVUM) | 0 | 0 | 0 | -39 | -39 | 0 |
| Change to Miles of Trail Suitable for Mechanized Use (Mountain Bikes) | 0 | -155 | -177[17] | -220 | -228 | -31[18] |
| Designation of Kettle Crest Special Interest Area | No | No | Yes<br>(82,800 acres) | No | No | Yes<br>(99,000 acres) |
| **Recreation** | | | | | | |
| Percent Forestwide Where Roads, Trails, and Areas may be Designated for Motor Vehicle Use (Suitable for Motorized Recreation) | 89% | 79% | 80% | 76% | 75% | 78% |
| Percent Forestwide with Non-motorized Recreation plan direction—Includes non-motorized Backcountry MA, RNAs, Recommended Wilderness, and Wilderness | 11% | 21% | 20% | 24% | 25% | 22% |

[17] Change in miles is based on effects if recommended wilderness became wilderness through congressional designation.
[18] Change in miles is based on effects if recommended wilderness became wilderness through congressional designation.

| Resource and Indicator | No Action Alt | Proposed Action | Alt P | Alt R | Alt B | Alt O |
|---|---|---|---|---|---|---|
| **Socio-Economic** | | | | | | |
| Estimated Employment Contribution (no. of jobs all resource areas) | 937 | 1,146 | 1,144 | 721 | 904 | 910 |
| Estimated Wage Income Contribution by Timber Harvest ($1,000s) | $19,335 | $31,224 | $31,089 | $6,692 | $17,428 | $17,465 |
| **Wildlife** | | | | | | |
| Old Forest Management Plan Direction Contribution to Viability | Low | Moderate | High | High | Low | Low |
| Snag Habitat Plan Direction Contribution to Viability | Low | Moderate | High | High | Low | Low |
| Habitat Connectivity Plan Direction Contribution to Viability | Low | Moderate | High | Moderate | Low | Low |
| Plan Direction Contribution to Recovery (Caribou/Lynx) | Low/Low | High/Moderate | High/High | High/Moderate | Low/Low | Low/Low |
| **Riparian Habitat** | | | | | | |
| Acres/Percent within Key or INFISH Priority Watersheds | 214,283 acres/19% — INFISH Priority Watersheds | 371,943 acres/34% — Key Watersheds | 451,525 acres/41% — Key watersheds | 451,525 acres/41% — Key Watersheds | 214,283 acres/19% — INFISH Priority Watersheds | 451,525 acres/41% — Key Watersheds |
| Riparian-dependent Wildlife and Fish Species – Riparian Management Direction Relative Contribution to Recovery and Viability | Least of all alternatives | Higher than no action, but less than Alts P and R | Second highest of all alternatives | Highest of all alternatives | Least of all action alternatives, but better than the no action | Better than no action and Alt B, but less than Alts P and R |
| Number of Subwatersheds with Improved Trend | 7 | 12 | 15 | 15 | 15 | 7 |

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# Chapter 3. Affected Environment and Environmental Consequences

## Introduction

This chapter summarizes the physical, biological, social, and economic environments of the planning area and the predicted effects of implementing each alternative on those environments. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2. More detailed information, including methodology and assumptions, can be found in the resource specialist reports located in the "Plan Set of Documents" on the website and available upon request.

For estimating the effects at the programmatic-Forest Plan level, the assumption has been made that the kinds of resource-management activities allowed under the plan component direction are reasonably foreseeable future actions to achieve the desired conditions. However, the specific location, design, and extent of such activities are generally not known at this time. The decisions are made on a site-specific (project-by-project) basis. Therefore, the discussions here refer to the potential for the effect to occur and are in many cases only estimates. The effects analyses are useful when comparing and evaluating alternatives on a forestwide basis, but are not intended to be applied directly to specific locations on the Forest.

### Related Information

The following is explanatory information related to effects analysis discussed in this chapter.

### Programmatic Framework of the Land Management Plan

The proposed plan and its alternatives do not authorize implementation of management activities described in the effects analyses. The proposed plan and its alternatives provide a programmatic framework that guide site-specific actions, but they do not authorize, fund, or carry out any project or activity.

Because the proposed plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications or long term environmental consequences of managing the forests under this programmatic framework. The proposed plan sets the stage for what future management actions are needed to achieve desired outcomes (desired conditions, objectives, special areas) and provides the sideboards (suitability, standards, guidelines) under which future activities may occur in order to manage risks to ecological, social, and economic environments. To actually implement site-specific projects, project and activity-level planning, environmental analysis and decisions must occur. For example, the proposed plan may contain direction to close or rehabilitate roads in order to benefit riparian areas; however, a subsequent site-specific analysis and decision must be made for proposals that involve road closures or decommissioning.

### Environmental Analysis and Overall Assumptions

In development of the environmental analyses that follow, the best available science was considered and is documented in the "Plan Set of Documents." The environmental analyses focus on the need for change and issues identified through the scoping process. Overall assumptions were made in the analyses of alternatives and include the following.

## Fiscal capability assumption

In order to evaluate the effects of the plan alternatives assumptions are needed about the level of management activities over the life of the forest plan which is 10 to 15 years. The level of management activities for the Colville National Forest is based on a reasonable idea of the fiscal capability of the Forest. Fiscal capability is subject to variation during the Federal budget process over the course of the next 15 years, but for the purposes of land management planning the fiscal capability is based on the current situation and recent trends in Forest budget. As fiscal capability changes in the future, management activities on the ground may increase or decrease. The following is a brief summary of the fiscal capability.

## Budget Trends

For the past 5 years, the total budget has averaged 17 million dollars per year. The 5-year funding levels have remained at a relatively constant level (they varied up to 10 percent) and are expected to remain around this level for the near future.

Based on the above budget trend, this analysis assumes the following:

- The expected amount of acres treated (prescribed fire, mechanical fuels, stand improvement activities, or timber harvest) will remain constant over the life of the forest plan, approximately 6,000 to 12,000 acres per year on average.
- Roadwork on the forest will average 20 miles per year of reconstruction, construction or decommissioning over the life of the plan.

## Agreements and Partnerships

The Forest has received funding outside the allocated budget for special projects from special budget allocations, such as those for collaborative forest restoration. Several partnerships with organizations provide grant monies for projects and provide substantial volunteer time. They are not included in the fiscal capability because these opportunities are unusual, tied to specific management activities, and/or time-limited.

## Climate Change Assumption

This analysis draws on existing synthesis and assessments prepared by the Intergovernmental Panel on Climate Change (IPCC) and U.S. Climate Change Science Program Science Assessment Products (CCSP SAP) as well as information from Forest Service Research to provide an overview of consistent scientific information on climate change projections for the planning area. Specifically assumptions about climate change for the planning area is based on information developed by the U.S. Forest Service Pacific Northwest Research Station, University of Washington Climate Change Group, and the U.S. Forest Service Climate Change Resource Center. The key area of risk identified and related to this analysis is the expected forest mortality and long-term transformation of forest landscapes, caused by the combined effects of increasing wildfire risk, changing precipitation patterns, insect outbreaks, and increased spread of tree diseases.

## Travel Management Assumption

The Forest has a motor vehicle use map in place that designates the roads and trails that are open to motorized use. The Forest does not have any open motorized play areas. For purposes of this analysis, the assumption is that there will be no changes to travel management designation on National Forest System lands.

## 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). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare; create and maintain conditions under which man and nature can exist in productive harmony; and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). Short-term uses are those that generally occur for a finite period. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource.

The change in the programmatic management of the Colville National Forest under any of the action alternatives would not provide for any short-term uses that would jeopardize the long-term productivity of the lands and resources of the forests because productivity is addressed at the project level. Descriptions of short-term and long-term environmental consequences can be found in the "Environmental Consequences of Each Alternative by Resource" section of this chapter.

## Unavoidable Adverse Environmental Consequences

The proposed plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Therefore, decisions made in the proposed plan do not cause unavoidable adverse environmental consequences. The application of standards and guidelines during future project and activity decision-making would provide resource protection measures and would limit the extent and duration of any adverse environmental impacts. For a detailed discussion of types of environmental consequences expected from future activities, see specific resource topic areas in this chapter.

## 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 lost for a period but could be regained, such as the temporary loss of timber productivity in forested areas kept clear for use as a power line right-of-way or road.

Because the proposed plan does not directly authorize or mandate any site-specific project or activity (including ground-disturbing actions), none of the alternatives causes an irreversible or irretrievable commitment of resources. Future project-level decisions under any of the alternatives may result in potential irreversible or irretrievable commitments of resources, which would be disclosed accordingly.

## American Indian Religious Freedom Act

Agencies must make a good faith effort to understand how Indian religious practices may come into conflict with other forest uses and consider any adverse impacts on these practices in their decision-making practices. Within the boundaries of the Colville National Forest, there are three potentially affected tribes: the Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians and Kalispel Tribe. Federal guidance for tribal consultation directs the Forest to increase and improve the involvement of tribes in the decision-making process in the areas where our decisions affect tribes and their tribal rights and interests. There is a trust responsibility with regard to managing the resources on which the reserved rights are based.

The Forest is also required to consult with all Federally recognized tribes that had/have traditional uses within the Forest boundary. This consultation extends to the Kalispel Tribe of Indians, the Spokane Tribe of Indians, and the Confederated Tribes of the Colville Reservation. No effects on American Indian social,

economic, or subsistence rights are anticipated as a result of this Forest Plan revision effort. No matter which alternative is chosen for implementation, the Forest will be required to consult with tribes when management activities may impact tribal rights and/or cultural sites and cultural use, according to the Consultation Protocol. Formal consultation with the Confederated Tribes of the Colville Reservation was initiated in 2003. Formal consultation with the Spokane and Kalispel Tribes was initiated in 2015.

Desired conditions for American Indian Rights and Interests, for all action alternatives, would be for the Colville National Forest to:

- recognize and maintain culturally significant species and the habitat necessary to support healthy, sustainable, and harvestable plant and animal populations to ensure that rights reserved by tribes are not significantly impacted or diminished;
- recognize, ensure, and accommodate tribal member access to the Forest for the exercise of tribal rights and cultural uses consistent with law, policy, and regulation; and
- recognize and protect traditional cultural areas as associated with the traditional beliefs of a Tribe about its cultural history.

## Prime Farmland, Rangeland, and Forestland

No prime farmland, rangeland, or forestland as defined by the National Resource Conservation Service has been identified in the planning area. Forest Plan revision or the Forest Plan would not directly affect such lands, although implementation of the Plan could have indirect effects. Regardless of the alternative selected for implementation, National Forest System lands would be managed with sensitivity to the values of all private and public lands.

## Threatened, Endangered and Sensitive Species

Potential effects to species listed under the Endangered Species Act (ESA) can be found in chapter 3, as well as in the Wildlife, Aquatics, Fisheries, and Botany specialist reports (project file). The Biological Assessment and Biological Evaluation will be finalized for the revised Forest Plan and final EIS. Management direction to protect the threatened, endangered, candidate, and sensitive species, or to provide for their habitats, can be found in the revised draft Forest Plan (forestwide and management area desired conditions, standards, and guidelines).

## Wetlands and Floodplains

The Forest Plan revision and Forest Plans do not directly implement any management activities that would result in loss of wetland or floodplains. Revised forestwide management direction identifies the need to restore currently degraded wetlands and floodplains, and provides a broad spectrum of standards and guidelines designed to protect soil, water, riparian, and aquatic resources. The goals and intent of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) would be met through compliance with this direction. Documentation for this conclusion can be found in this EIS, chapter 3 and in the revised Forest Plan (desired condition, standards, and guidelines).

## Conflicts with Other Agency or Government Goals or Objectives

Contact, review, and public involvement with other Federal and State agencies indicate no major conflicts between the revised Forest Plan and the goals and objectives of other governmental entities.

# Regulatory Framework

## Relevant Laws, Regulations, and Policy that Apply

As a Federal land management agency, the Forest Service must follow all applicable laws and regulations. If laws change or are amended, or if new laws are enacted, the Forest administration will comply with the changes or additions. The same situation applies to executive orders and agency policy, as expressed in forest service manual (FSM) and handbook (FSH) directives. These laws are considered in the course of the analysis of effects. A more comprehensive list of laws, regulations and policy is located in Appendix D.

Guidance for these laws comes from the Code of Federal Regulations (CFR), and the Forest Service Directive System (the Forest Service Handbooks and Forest Service Manuals).

National rules applicable to all national forests, such as the Travel Management Rule (36 CFR Parts 212, 251, 261, and 295) and the 2001 Roadless Area Conservation Rule (36 CFR Part 294) apply.

Federal laws of which forest plans and revised forest plans must be consistent are:

**Clean Air Act of 1970** (42 U.S.C. §7401 et seq.) – This act is the comprehensive Federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes the Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants.

**Clean Water Act of 1977 (**33 U.S.C. §1251 et seq.) – Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulates quality standards for surface waters.

**Endangered Species Act of 1973** [ESA] (16 U.S.C 1531-1536, 1538-1540) **–** Provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

**Federal Land Policy Management Act of 1976** – Requires public lands to be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition and that will provide for outdoor recreation and human occupancy and use.

**Forest and Rangeland Renewable Resources Planning Act of 1974** [RPA] [As Amended Through Public Law 106-580, Dec. 31, 2000] (16 U.S.C. 1601) – Establishes standards for how the Forest Service manages the national forests, requires the development of land management plans for national forests and grasslands, and directs the Forest Service to develop regular reports on the status and trends of the nation's renewable resources on all forest and rangelands.

**Granger-Thye Act of 1950 -** Allows concessionaire fees for recreation facilities to be reduced for work performed to maintain and enhance those facilities.

**Healthy Forests Restoration Act of 2003** (16 U.S.C. 6501 et seq.) – Expedites the preparation and implementation of hazardous fuels reduction projects on Federal land and assisting rural communities, states and landowners in restoring healthy forest and watershed conditions on State, private and tribal lands.

**Multiple-Use Sustained Yield Act of 1960** – States that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and authorizes and directs the Secretary of Agriculture to develop and administer the renewable surface resources of the national forests for the multiple use and sustained yield of products and services.

**National Environmental Policy Act of 1969 [NEPA]** (42 U.S.C. 4321 et seq.) – Directs all Federal agencies to consider and report the potential environmental impacts of proposed Federal actions, and established the Council on Environmental Quality.

**National Forest Management Act of 1976 [NFMA]** (Act of October 22, 1976; 16 U.S.C. 1600) – Requires the provision for multiple use and sustained yield of products and services in accordance with the Multiple-Use, Sustained-Yield Act of 1960, and the coordination of outdoor recreation, range, timber, watershed, wildlife, fish, and wilderness.

**National Historic Preservation Act** (Public Law 89-655; 16 U.S.C. 470 et seq.) **–** Provides for the preservation of historical and archaeological sites in the U.S. The act created the National Register of Historic Places, the list of National Historic Landmarks, and the State Historic Preservation Offices.

**Wilderness Act of 1964** (16 U.S.C. 1121, 1131-1136) **–** Created the National Wilderness Preservation System, which protects nearly 110 million acres of wilderness areas in states throughout the nation.

## Affected Environment and Environmental Consequences by Resource

This section includes analysis of each of the resources affected by our alternatives and is arranged alphabetically under two headings: “Terrestrial and Aquatic Conditions and Resiliency,” and “Social and Economic Conditions.”

| Terrestrial and Aquatic Conditions | Social and Economic Conditions |
|---|---|
| Forest Vegetation | Economic |
| Botany | Heritage |
| Climate Change | Livestock Grazing |
| Fire | Minerals and Geology |
| Invasive Plants | Recreation |
| Fisheries | Scenery |
| Hydrology | Special Uses |
| Soil | Social |
| Wildlife | Tribal |

# Terrestrial and Aquatic Conditions and Resiliency

## Forest Vegetation

This section analyzes the issues of old forest management and timber production as it relates to six different alternatives for the revised forest plan on the Colville National Forest. The classification of vegetation on the forest is described, and the historical range of variation is compared to the current condition. Recent timber harvest levels, as well as projected future levels are described for each alternative. The projected vegetation condition after 100 years is modeled and compared to the historical range of variation for each alternative.

### Affected Environment

#### Background

The Colville National Forest is considered to be part of the Northern Rocky Mountains, with the Kettle River Range on the west half of the forest, and the Selkirk Mountains defining the eastern half. The Cascade mountain range lies to the west of the area and has a significant influence on precipitation patterns and rain shadow effects that influence vegetation.

Vegetation on the Colville National Forest is highly complex and varied as a result of a wide diversity of soil parent materials, highly diverse topography, interaction of continental and maritime climatic patterns, significant and persistent disturbance processes that include fire, insects, and disease, and strong influences by larger scale climatic events including the El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) (Heyerdahl et al. 2008).

Climate patterns for the Colville are influenced by a transition between an intense rain shadow effect in the west formed by the Cascades, and the inland expression of maritime climate in the east caused by the convergence and uplifting of moist air masses over the Rockies. The result is a considerable west-east variation in precipitation across the forest. This variation can be seen expressed in vegetation from open, dry Douglas-fir types along the Okanogan-Ferry County line on the western boundary of the Forest, to more moist redcedar-hemlock vegetation types near the Idaho border on the eastern boundary of the Forest (Williams et al. 1995).

Soil parent material is highly varied and originates from sedimentary, igneous, and metamorphic processes. The entire area has been influenced by glaciation and has been covered by major continental ice sheet advances in the past, as evidenced by rounded off hills and glacial deposits of varying depths. Volcanic influences are also frequently evident with columnar basalt layers and volcanic ash, including deposits from the large Mt. Mazama eruption, as well as more recent deposits from the Mt. St. Helens eruption in 1980 (Quigley et al. 1996).

#### Methods

##### *Vegetation Composition*

Vegetation composition for the planning area was classified based on plant association groups (PAGs), which are groups of plant associations with similar moisture and temperature regimes. The PAG data was produced in 2012 and covers the entire Colville National Forest. Forested PAGs were then assigned to a Landfire biophysical setting (BpS), and a subsequent common name vegetation type. Landfire biophysical settings represent vegetation that may have been dominant on the land before European settlement and are based on an approximation of the historical disturbance regime (LANDFIRE 2007). These biophysical

settings provide a good description of general vegetation characteristics, along with historical disturbance regimes, successional pathways, and basic spatial information. They also provide a link between the vegetation analysis presented here and the fire/fuels analysis.

### *Forest Structure*

Current forest structure information comes from the Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) Gradient Nearest Neighbor (GNN) data. The GNN data is a consistently interpreted vegetation data set based on an imputation processes utilizing a 2012 Landsat image (GNN 2012). Forest Inventory and Monitoring (FIA) plots, Continuous Vegetation Survey (CVS) plots, ecology plots, and other established vegetation plots were utilized as source data in the imputation process. Table 12 shows how structure types were defined.

Forest tree structure has a great influence on how stands develop, which species are able to grow and reproduce, and has been identified as an important factor in assessing fire behavior as well as providing various wildlife habitats. Forest structural stages are a product of successional processes and include both natural and human influenced disturbance. There are several major disturbance processes that influence forest structural stage development including fire, insects and diseases, windthrow, climate variations such as droughts, landslides and avalanches, and human induced influences such as livestock grazing and timber harvest.

**Table 12. Structure class definitions based on canopy cover and diameter**

| Structure | Definition |
|---|---|
| Early | Trees less than 10 inches d.b.h. or canopy cover less than 10 percent |
| Mid Open | Trees 10 to 20 inches d.b.h., canopy cover 10 percent or greater and less than 40 percent |
| Mid Closed | Trees 10 to 20 inches d.b.h., canopy cover 40 percent or greater |
| Late Open | Trees 20 inches or greater d.b.h., canopy cover 10 percent or greater and less than 40 percent |
| Late Closed | Trees 20 inches or greater d.b.h., canopy cover 40 percent or greater |

Tree structure is classified into five general groups based on diameter and canopy cover as shown in table 12. Haugo et al. (2015) used a similar approach to defining structure classes, and the GNN data (2012) lends itself well to easily analyzing forest structure at multiple scales using these definitions. The diameter is based on the quadratic mean diameter in inches of trees whose heights are in the top 25 percent of all tree heights in the stand. This generally means that the diameters of the larger co-dominant trees in a stand are used to define the structure class.

### Historic Range of Variability

Historic range of variability (HRV) analysis was used to evaluate forest structure. The historical range of variability refers to the dynamic behavior and functioning of ecosystems before dramatic changes occurred with European settlement, generally considered to be the mid-1800s for this area (Aplet and Keeton 1999). The historical range of variability provides a framework to determine changes to ecosystem attributes that have occurred between historical and current conditions and recognizes that ecosystems experience a range of conditions across which processes are resilient and self-sustaining. When allowed to move beyond the limits of the range of variability, ecosystems move into a state of disequilibrium or disorganization (Kaufmann et al. 1994, Holling and Meffe 1996, Egan and Howell 2001).

### Vegetation modeling

A state and transition model, ST-Sim (2014), was used to simulate forest dynamics and development of forest structure through time. This model provided forest structure for each vegetation type, as well as potential timber production outputs. The model was run for 300 years for each vegetation type and average values from years 101 to 300 were used to develop HRV ranges. The model showed how different potential management areas (MAs) and actions affect forest structure and forest products through time. Table 13 shows the three actions that were modeled to occur annually, along with estimated acres for each action by vegetation type and alternative. These acres are based on budget assumptions and the requirement to have non-declining timber output over time. Additional details of how these actions were modeled can be found in the project record.

**Table 13. Average annual treatment acres modeled by vegetation type and alternative**

| Vegetation Type | Treatment Type | No Action | Alt. P Proposed Action | Alt. R | Alts. B and O |
|---|---|---|---|---|---|
| Douglas-fir dry | Mechanical Fuels Treatment | 615 | 3,074 | 615 | 1,229 |
| | Prescribed Fire | 2,153 | 2,153 | 2,153 | 2,153 |
| | Timber Harvest | 500 | 2,500 | 500 | 1,000 |
| Northern Rocky Mountain Mixed Conifer | Mechanical Fuels Treatment | 481 | 1,925 | 0 | 963 |
| | Prescribed Fire | 1,686 | 1,686 | 1,686 | 1,686 |
| | Timber Harvest | 388 | 1,550 | 0 | 775 |
| Western redcedar/western hemlock | Mechanical Fuels Treatment | 0 | 0 | 0 | 309 |
| | Prescribed Fire | 0 | 0 | 0 | 0 |
| | Timber Harvest | 0 | 0 | 0 | 0 |
| Subalpine Fir/Lodgepole pine | Mechanical Fuels Treatment | 0 | 0 | 0 | 0 |
| | Prescribed Fire | 1,040 | 1,040 | 1,040 | 1,040 |
| | Timber Harvest | 1,900 | 950 | 475 | 475 |

Three management categories were created to model vegetation across the forest through time, with each plan management area assigned to a category. These management categories are wilderness/other, harvest, and production. The wilderness/other category consists of congressionally designated areas or areas proposed for wilderness designation where active vegetation management is limited to the use of fire. The harvest category includes those areas where scheduled timber harvest is not planned, and where there would only be incidental timber harvest for specific resource benefit to meet management objectives. The production category includes areas where scheduled timber harvest would be planned, and where a full suite of active management could occur, including harvest, prescribed fire, and mechanical fuels treatment. See the project record for a full listing of management areas and categories.

State and transition models are only an approximation of complex forest dynamics (Peterson et al. 2011). However, they can provide useful information on how forest structure changes through time, and what types of outputs can be expected. The individual state and transition models for each vegetation type used for this effort were originally developed under the Integrated Landscape Assessment Project (ILAP 2013) and then modified based on local knowledge and experience (see appendix B of the specialist report for details).

## Current Conditions

### *Vegetation Composition*

The Colville is composed primarily of vegetation in the dry Douglas-fir type, characterized by ponderosa pine and Douglas-fir plant associations across the lower elevations of the forest. On the eastern, wetter half of the forest, mixed conifer stands dominate at higher elevations and more northerly aspects, with western hemlock plant associations and a variety of tree species such as western redcedar, western larch, and western white pine. On the western, drier side of the forest, similar elevations and aspects produce stands of lodgepole pine and subalpine fir, frequently found with western larch and Douglas-fir. The wettest portions of the forest support stands of western redcedar and western hemlock. Table 14 shows how plant association groups were categorized into Landfire biophysical settings and vegetation types. Figure 6 clearly shows the majority of acres occurring in the Douglas-fir dry vegetation type, followed by the Northern Rocky Mountain mixed conifer type.

**Table 14. Vegetation types, Landfire biophysical settings, plant association groups, and approximate total acres**

| Vegetation Type | Landfire Biophysical Setting Number and Name | Plant Association Groups* | Acres |
|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | PP/AGSP-PUTR dry shrub-grass<br>DF-PP/AGSP-PUTR-FEID-ARUV<br>DF/CARU-SPBE-PAMY-ARUV-SYOR<br>DF/SYAL-PHMA<br>DF/VACA-VAME-VAMY | 486,045 |
| Northern Rocky Mountain mixed conifer | 1010471 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | WH/GASH-XETE-VAME-HODI-ARNE<br>WH/GASH-BENE-RHMA-PAMY-CLUN<br>WH/ACCI-GASH-BENE-ACTR-POMU | 308,365 |
| Western redcedar / western hemlock | 1010471 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%)<br>1010472 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest - Cedar Groves (5%) | WH/POMU-TIUN-OXOR-ARNU3<br>WH/OPHO-ATFI-LYAM<br>WH/MEFE-XETE-RUPE | 95,820 |
| Subalpine fir / lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | PIAL/VASC-LUHI-CARU<br>SAF/CARU-PAMY<br>SAF/VASC-VACA-VAME-LIBOL<br>SAF/RHAL-XETE-ARLA-POPU | 173,699 |
| Spruce / subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%)<br>1011610 - Northern Rocky Mountain Conifer Swamp (10%) | SAF/TRCA3-ATFI-GYDR-STAM-riparian | 20,240 |

*See appendix A of the specialist report for plant acronym definitions.

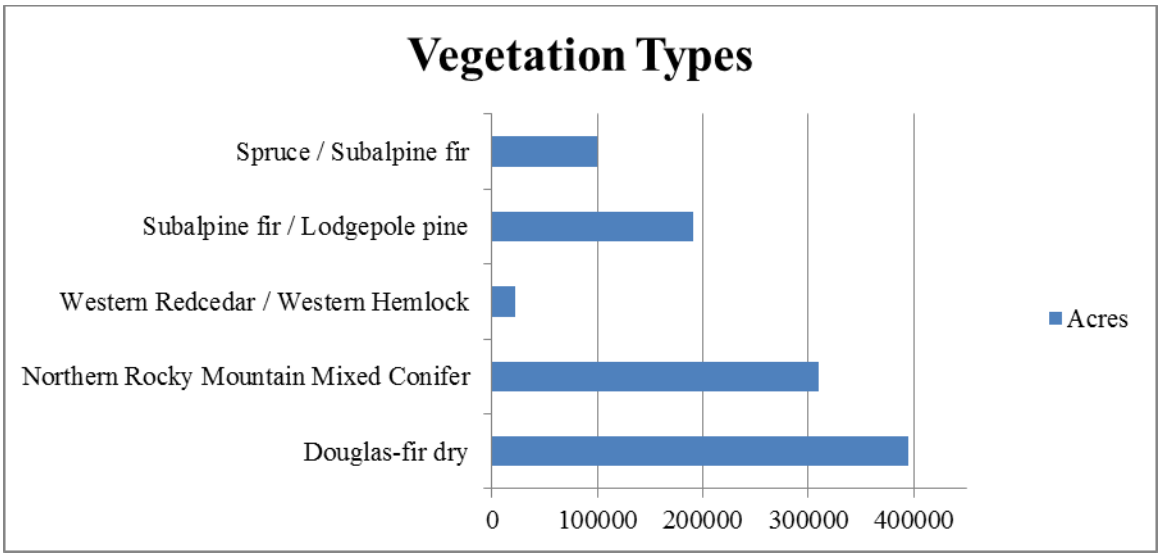


**Figure 6. Approximate current total acres for each vegetation type**

### *Forest Structure*

Table 15 shows total current acres in each structure class and vegetation type, along with total percentages. The majority of the forest is in the mid closed structure class (57 percent), with lesser amounts in the early (19 percent) and late closed (15 percent) classes.

**Table 15. Approximate total current acres in each structure class and vegetation type**

| | Early | Mid Open | Mid Closed | Late Open | Late Closed | Total (Acres) | Total (%) |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 58,325 | 34,023 | 277,046 | 24,302 | 92,349 | 486,045 | 44% |
| Northern Rocky Mountains mixed conifer | 58,589 | 12,335 | 200,437 | 3,084 | 33,920 | 308,365 | 28% |
| Spruce / subalpine fir | 4,250 | 0 | 12,144 | 0 | 3,846 | 20,240 | 2% |
| Subalpine fir / lodgepole pine | 57,321 | 6,948 | 85,113 | 3,474 | 22,581 | 191,052 | 17% |
| Western hemlock / western redcedar | 33,537 | 0 | 49,826 | 0 | 12,457 | 95,820 | 9% |
| Total (Acres) | 212,023 | 53,306 | 624,566 | 30,860 | 151,116 | 1,101,522 | |
| Total (%) | 19% | 5% | 57% | 3% | 15% | | |

Table 16 shows the percentage of each structure class within each vegetation type. Subsequent analyses of structure classes by vegetation type will only use percentages.

**Table 16. Current structure class percentage by vegetation type**

| | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|
| Douglas-fir dry | 12 | 7 | 57 | 5 | 19 |
| Northern Rocky Mountains mixed conifer | 19 | 4 | 65 | 1 | 11 |
| Spruce / subalpine fir | 21 | 0 | 60 | 0 | 19 |
| Subalpine fir / lodgepole pine | 33 | 4 | 49 | 2 | 13 |
| Western hemlock / western redcedar | 35 | 0 | 52 | 0 | 13 |

The historic range of variability (HRV) was developed for forest structures across the different vegetation types. Table 17 compares current structure conditions for each vegetation type to HRV.

**Table 17. Historical range of variability percentages by vegetation type for each structure class compared to current conditions**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Current | 12 | 7 | 57 | 5 | 19 |
| | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| Northern Rocky Mountain mixed conifer | Current | 19 | 4 | 65 | 1 | 11 |
| | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| Spruce / Subalpine fir | Current | 21 | 0 | 60 | 0 | 19 |
| | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| Subalpine fir / Lodgepole pine | Current | 33 | 4 | 49 | 2 | 13 |
| | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| Western hemlock / Western redcedar | Current | 35 | 0 | 52 | 0 | 13 |
| | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |

Black shading indicates values below HRV, while gray shading indicates values above HRV.

For all vegetation types except subalpine fir/lodgepole pine, there is an abundance of mid structural stage and a lack of late stages. This reflects the effects of fire exclusion, as well as the widespread stand-replacing fires of the early 1900s and past timber management. The majority of forest stands are in a mid-closed structure condition, showing smaller tree sizes than would be expected historically, and for the dry type, more canopy cover.

The subalpine fir / lodgepole pine type shows an abundance of late closed stage and a lack of early stage, which is consistent with fire exclusion and the ecology of lodgepole pine dominated stands. Given the effects of mountain pine beetle and a stand-replacing fire regime, there historically would be little late structure in this type, and the majority would be in early and mid-structure classes. Current conditions show that more of this type has transitioned into the late closed stage, likely due to the lack of disturbance required to move these stands back to an early stage. Current conditions in both the mid open and late open shows a small percentage, whereas historically these would not have existed. This again is likely due to fire exclusion and active pine beetle activity causing mortality and reducing canopy cover. This could also reflect recent management in lodgepole pine stands, where canopy cover has been temporarily reduced.

### *Insects and Disease*

Levels of insect and disease related mortality across eastern Washington have been widely publicized over the past several years. In most cases the scale of recent insect outbreaks are unprecedented (WA DNR 2014-2). Fire suppression, grazing, and harvesting have been identified as the principal factors resulting in increased stocking levels, increased levels of mid and late seral species, and homogenization of spatial patterns. Widespread fires in the 1920s and 1930s also created large areas of even-aged forests. All of these factors contribute to uncharacteristic conditions that support larger scale and more persistent insect outbreaks (Hessburg et al. 1994). Insect and disease affected acres have consistently exceeded fire affected acres for the Colville National Forest. Figure 7 shows total insect and disease activity since 1980, while figure 8 shows fire acres since 1970.

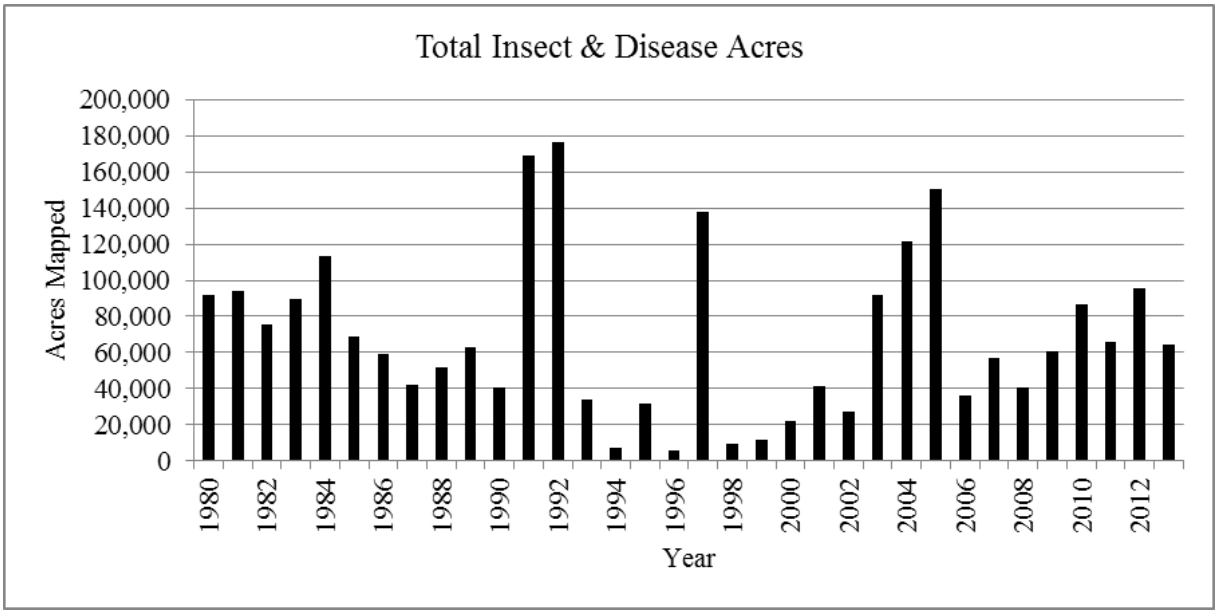


**Figure 7. Total insect and disease activity 1980 to 2013 (acres)**

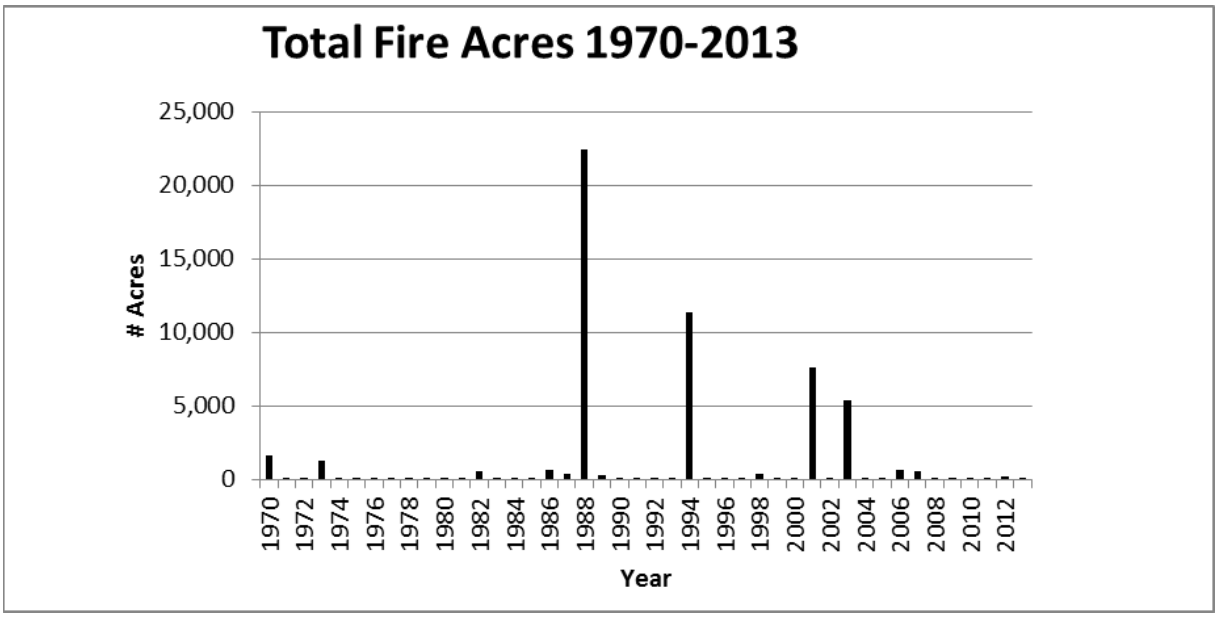


**Figure 8. Total fire acres on the Colville National Forest 1970 to 2013**

A recent report from the Washington Department of Natural Resources (WA DNR 2014-2) notes that the acres of trees killed or damaged by insects and diseases is 150 percent greater than in the 1990s, 200 percent greater than in the 1980s, and 175 percent greater than in the 1970s.

The National Insect and Disease Risk Map (NIDRM) predicts continued high levels of insect and disease related mortality over the 15-year period between 2013 and 2027, with particularly high levels occurring in northeastern Washington and on the Colville National Forest. Over 42 percent (449,430 acres) of the Colville National Forest are identified as experiencing greater than 25 percent basal area loss between 2013 and 2027 due to insects and diseases based on the NIDRM. The majority of this risk comes from mountain pine beetle, western pine beetle, Douglas-fir beetle, and root diseases. Basal area is the cross sectional area of a tree stem including the bark measured at 4.5 feet off the ground and is used as a measure of tree density.

In 2012, a forest health hazard warning was issued by the State of Washington for portions of eastern Washington, including the western portion of the Colville National Forest within Ferry County. This represented the first time this state authority was ever used since its inception. This designation was focused on western spruce budworm and pine beetles, and was based on recent insect damage, projected future damage, and potential for on-the-ground action to address the damage (WA DNR 2014-1).

Recent insect and disease flights have noted increases in Douglas-fir beetle, fir engraver, pine bark beetles, and western spruce budworm. All of these increases can be attributed to the increasing amounts of Douglas-fir and older lodgepole pine across the landscape, as evidenced by most of these vegetation types being in a mid-closed or late-closed structure type. Higher tree densities, as well as an increase in mid-to-late successional species such as Douglas-fir and western redcedar, have contributed to conditions that are favorable to insect outbreaks (Ferrell 1986, Gibson 2009, Schmitz 1996). Multi layered tree canopies dominated by Douglas-fir and grand fir facilitate western spruce budworm outbreaks (Blackford 2004). The non-native disease white pine blister rust is also contributing to tree stress, resulting in increased vulnerability to mountain pine beetle mortality in western white pine and whitebark pine (Bockino and Tinker 2012).

After four years of defoliation by spruce budworm, bark beetle activity has been increasing – primarily Douglas-fir bark beetle and fir engraver. Defoliators (e.g., western spruce budworm) do not kill trees directly, however continued defoliation over a number of years impacts tree defense capabilities and results in vulnerability to mortality from bark beetles. As trees are defoliated and die, ground fuel beds increase leading to a potential for higher fire severity. Mountain pine beetle attacks can have the potential of changing crown fire rates within lodgepole tree canopies (Page et al. 2012).

Infestation of mountain pine beetle in lodgepole pine has been somewhat persistent since 1980 but shows an increase in acres after 2000. Some of the increase may be due to climate change impacts where mountain pine beetles at higher elevations are completing life cycles in one year instead of two years and more larvae are surviving warmer winters. (Williams and Liebhold 2002, Mitton and Ferrenberg 2012, Rosenberger et al. 2012)

The interaction of increased tree densities, increased insect levels of both defoliators and bark beetles, increased fuel levels, and climate change impacts, such as water stress, are all influencing the levels of current late forest structures and will continue to influence future late forest structure development.

## Need for Change

The forest has identified six different needs that require action, three of which are directly addressed in this section. The first is the need to manage forest vegetation conditions to be more resilient to

disturbances. As noted previously, HRV is a means to assess changes that have occurred and provide a reference condition within which ecosystems are resilient and responsive to disturbances. By developing HRV ranges within each vegetation type, and then assessing how well each alternative moves vegetation toward these ranges, it is possible to determine how forest management affects resiliency.

The second need related to forest vegetation is to address climate change implications and adaptations. This is highly related to the first need, and forests that are resilient to disturbances should implicitly be well adapted to possible effects from climate change. Moving forest vegetation toward HRV will result in more resilient vegetation conditions, and therefore, will result in forests better adapted to climate change. Additionally, some alternatives (proposed action and P) provide additional flexibility in responding to climate change impacts by having broad management areas that allow a variety of management options to address unforeseen impacts.

The third need related to forest vegetation is social and economic conditions. This section specifically addresses timber production levels between the alternatives and provides estimates of outputs needed to move forest vegetation toward desired conditions.

### Old Forest Management and Timber Production

In the revision of the Forest Plan, three broad-scale concerns drove the need to consider how we address late forest structure management and timber production. These are:

- The recent history of high levels of disturbance resulting from insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Social and economic concerns surrounding timber production levels and promotion of late forest structure.

The recent and projected insect and disease-related mortality show a need to move the forest structure across the landscape toward HRV.

Haugo et al. (2015) analyzed restoration needs across Oregon and Washington and found that one of the areas with the highest level of need for restoration was northeastern Washington, including the Colville National Forest. A need for both disturbance and succession related change was shown. Several other recent studies have shown the need for active restoration across western forests (Brown et al. 2004, Hessburg et al. 2005, Franklin et al. 2008). Methods for restoration are project specific, but generally include modification of forest structure and species composition to move individual stands and larger landscapes toward HRV (Jain and Graham 2005).

## Environmental Consequences

### Methodology

The current conditions, trends toward desired conditions, and legal and planning rule requirements are the three areas that are analyzed in this section.

The 1982 Planning Rule has certain requirements for calculation of timber outputs. ST-Sim was used to help calculate the allowable sale quantity (ASQ) and long-term sustained yield (LTSY). The measure will be board foot volume.

## Assumptions

- State and transition models are useful, but far from an exact representation of ecological processes. ST-Sim models were calibrated using local knowledge and by using the Forest Vegetation Simulator (FVS) (Keyser 2008, Moeur and Vandendriesche 2009, Robinson and Beukema 2012).
- GNN is a consistently interpreted data set that covers the entire forest. Accuracy of the classification is reasonable for forest wide analysis down to the scale of a 12th field Hydrologic Unit Code (HUC).
- Late forest structure management under the no-action alternative (maintaining the current Old Growth Management Areas) and R alternative would primarily be passive, where structural changes would be the result of successional process, insect and disease interactions, and fire that escapes initial attack. Some treatments may occur to reduce fire risk by fuels reduction or manipulation of structure and species composition to increase tree vigor to maintain old structure for a longer period of time. Also, fuels reduction would take place in areas that fall within Wildland Urban Interface (WUI) areas.
- Alternatives that propose continuation of Eastside Screens should result in similar, but more spatially static, late closed forest structure levels when compared to the landscape approach. However, late open structure is difficult to create and maintain under Eastside Screens due to the limit of cutting trees over 21 inches d.b.h.. Eastside Screens requires evaluation of the current condition and a comparison against the historical range of variability. If the landscape is below HRV, then there are limitations on cutting trees greater than 21 inches d.b.h.. If the landscape is above HRV, then large trees could be cut to achieve specific objectives. The Eastside Screens emphasize maintaining connectivity between late forest structure areas but does not give specific guidance on planning for late forest structure replacement.
- Late forest structure management under the B and O alternatives that have Restoration Zones would have active management with the emphasis of retaining levels of late forest structure which are at or approach the maximum HRV values.
- Late forest structure management under the R alternative, a large-scale reserve approach, would have minimal active management with the emphasis of retaining levels of late forest structure which are at or approach the maximum HRV values.
- General Forest land in the no-action alternative and non-reserve areas within B, O, and R alternatives would be managed for timber production using the shelterwood with reserves regeneration method. Retaining Eastside Screens would make two-aged management difficult because of the 21-inch diameter cap, and in reality would result in uneven-aged stands within the non-reserve land, with further promotion of closed canopy, mid and late seral stands.
- The proposed action and P alternative would promote structural and landscape complexity. The overarching emphasis would be moving the landscape toward HRV by modifying structure to increase resilience and adaptability. Forest lands in the general and focused restoration areas would be managed using variable density thinning, free selection, and other silvicultural treatments tailored to meet both landscape and site-specific objectives (Franklin et al. 2007, Graham et al. 2007, Aukema and Carey 2008, Puettmann et al. 2009, Franklin and Johnson 2012, DeRose and Long 2014).

## Incomplete and Unavailable Information

### *Climate Change*

While it is possible to reflect potential climate change influences with state and transition models, the results here would not show any potential climate change influences due to the unknown factors of how much change, where the change would influence system dynamics, and how fast the change could occur. Climate science currently does not have forest-scale predictions and probabilities needed for state and transition modeling. Furthermore, there is no agreement between climate models on how vegetation would respond, with widely divergent predictions for dry forest types, which are the majority of forest types that are found on the Colville National Forest (Peterson et al. 2014).

Even given the uncertainty of how vegetation would respond to climate change, there is broad consensus that moving forests toward more resilient conditions should be a general goal of forest management (Millar et al. 2007, DeRose and Long 2014). Resilience has been defined as “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al. 2004). Moving forest structure across the landscape toward HRV is one way to increase resilience, and may be the best option currently available for managing lands where future climate is uncertain (Keane et al. 2009).

## Spatial and Temporal Context for Effects Analysis

The context for the effects analysis is through the modeled management areas and at a forest wide scale. ST-Sim was loaded with current conditions for each management area and then used to model each vegetation type by alternative. Outputs at 20, 50, and 100 years are used to evaluate effects. Emphasis and analysis is on modeled forest structure values at 100 years as compared to HRV values.

## Summary of Effects

Under the current fire suppression model that does not utilize or limits use of natural ignitions to achieve desired conditions, late forest structure would accumulate within wilderness and other areas, where vegetation management is limited to the use of fire, until stand density-related mortality occurs or fires escape initial control efforts. Early successional habitats would likely be lacking under this scenario until a disturbance occurs resulting in an excess of early structure type. For late forest structure, the result could tend to be more of a boom and bust cycle with long periods of time required for early structure to grow into late forest structure.

In the proposed action and alternatives P, R, O, and B there are various amounts of acres recommended for wilderness. All of these areas fit into the wilderness/other category described in the modeling where the use of fire is the only tool to achieve desired conditions. It is uncertain how the fire tool would be used to achieve desired conditions. Currently, natural ignitions are usually suppressed, including in designated wilderness areas, although this plan allows more flexibility in using natural fire as a tool.

Both the proposed action and alternative P were modeled using variable density thinning (VDT) as the primary tool for actively managing forests and moving them toward HRV. Alternatives R, B, and O were modeled using shelterwood with reserves as the primary tool. Appendix B of the specialist report contains details of what types of harvest activities occur under each alternative, and how they were modeled.

### *Late forest structure levels*

Table 18, table 19, and table 20 show modeled forest structure conditions for all alternatives and vegetation types compared to HRV for 20, 50, and 100 years out, respectively. Results indicate that late open forest structure in the Douglas-fir dry type would be within HRV in 100 years for all scenarios,

while late closed forest structure would be well within HRV for the proposed action and alternative P, and just barely within or above HRV for all other alternatives. Results past 100 years indicate that all alternatives maintain the late open structure in Douglas-fir dry within HRV, although the proposed action and alternative P create and maintain more than the other alternatives. For late closed structure in Douglas-fir dry, the proposed action and alternative P maintain the structure type at the midpoint of HRV, while the other alternatives are either at or over the upper limit of HRV. For the late closed structure in the Northern Rocky Mountain mixed conifer type, no alternatives maintain this structure within HRV past 100 years. There is a small window of time when late closed is within HRV, however it quickly exceeds the upper limit. The growth within this vegetation type exceeds the effects from the assumed treatments; hence, most of this vegetation type eventually ends up in the late closed structure type.

Alternative O has the most structure classes (12) within HRV at 100 years, while the B alternative has eleven. The proposed action, P, and R alternatives have eight structure classes within HRV, and the no-action alternative has the least with four structure types within HRV. It is important to note that the amounts of each structure type vary with time, and choosing a different point in time would result in alternatives having a different number of structure types within HRV. For instance, the O alternative is within HRV at 100 years for late closed in Douglas-fir dry, but at 110 years it is above HRV. Also, table 18, table 19, and table 20 do not attempt to indicate how far above or below HRV a structure type may be. For instance, in the Northern Rocky Mountain mixed conifer type, late open structure is within HRV for the O alternative (5 percent) but not in the P alternative (7 percent), even though the P alternative is just 1 percent higher than the HRV range (4 to 6 percent).

The following symbols represent HRV levels in tables 18 through 20.

Above (+) HRV

Below (-) HRV

Within (@) HRV

**Table 18. Modeled forest structure levels at 20 years compared to HRV for all vegetation types and alternatives**

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| **Early Structure** | | | | | | |
| Douglas-fir dry | - | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | @ | - | - | - | @ | @ |
| Western hemlock / western redcedar | @ | - | - | - | @ | @ |
| Subalpine fir / lodgepole pine | - | - | - | - | - | - |
| Spruce / subalpine fir | @ | @ | @ | @ | @ | @ |
| **Mid Open** | | | | | | |
| Douglas-fir dry | @ | + | @ | + | + | + |
| Northern Rocky Mountain mixed conifer | - | + | @ | + | + | + |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| **Mid Closed** | | | | | | |
| Douglas-fir dry | + | + | + | + | + | + |
| Northern Rocky Mountain mixed conifer | + | + | + | + | + | + |
| Western hemlock / western redcedar | + | + | + | + | + | + |
| Subalpine fir / lodgepole pine | @ | @ | @ | @ | @ | @ |

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| Spruce / subalpine fir | + | + | + | + | + | + |
| **Late Open** | | | | | | |
| Douglas-fir dry | - | - | - | - | - | - |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| **Late Closed** | | | | | | |
| Douglas-fir dry | @ | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Western hemlock / western redcedar | - | - | - | - | - | - |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| Spruce / subalpine fir | - | - | - | - | - | - |
| **Total Structure Classes Within HRV** | **6** | **4** | **6** | **4** | **6** | **6** |

**Table 19. Modeled forest structure levels at 50 years compared to HRV for all vegetation types and alternatives**

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| **Early Structure** | | | | | | |
| Douglas-fir dry | - | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Western hemlock / western redcedar | - | - | - | - | @ | @ |
| Subalpine fir / lodgepole pine | - | @ | @ | @ | + | @ |
| Spruce / subalpine fir | - | - | - | - | - | - |
| **Mid Open** | | | | | | |
| Douglas-fir dry | @ | + | @ | + | @ | + |
| Northern Rocky Mountain mixed conifer | - | + | @ | + | + | + |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| **Mid Closed** | | | | | | |
| Douglas-fir dry | + | + | + | + | + | + |
| Northern Rocky Mountain mixed conifer | + | + | + | + | + | + |
| Western hemlock / western redcedar | + | + | + | + | + | + |
| Subalpine fir / lodgepole pine | - | - | - | - | - | - |
| Spruce / subalpine fir | + | + | + | + | + | + |
| **Late Open** | | | | | | |
| Douglas-fir dry | - | - | - | - | - | - |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Subalpine fir / lodgepole pine | + | + | + | + | @ | @ |
| **Late Closed** | | | | | | |
| Douglas-fir dry | @ | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Western hemlock / western redcedar | @ | @ | @ | @ | @ | @ |

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| Spruce / subalpine fir | - | - | - | - | - | - |
| **Total Structure Classes Within HRV** | **3** | **4** | **6** | **4** | **6** | **6** |

**Table 20. Modeled forest structure levels at 100 years compared to HRV for all vegetation types and alternatives**

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| **Early Structure** | | | | | | |
| Douglas-fir dry | - | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Western hemlock / western redcedar | - | - | - | - | - | - |
| Subalpine fir / lodgepole pine | - | @ | @ | @ | @ | @ |
| Spruce / subalpine fir | - | - | - | - | - | - |
| **Mid Open** | | | | | | |
| Douglas-fir dry | @ | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | @ | @ | @ | @ | @ |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| **Mid Closed** | | | | | | |
| Douglas-fir dry | @ | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | - | - | - | - | - |
| Western hemlock / western redcedar | - | - | - | - | @ | @ |
| Subalpine fir / lodgepole pine | - | - | - | - | - | @ |
| Spruce / subalpine fir | @ | @ | @ | @ | @ | @ |
| **Late Open** | | | | | | |
| Douglas-fir dry | @ | @ | @ | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | - | + | @ | + | @ | @ |
| Subalpine fir / lodgepole pine | + | + | + | + | @ | @ |
| **Late Closed** | | | | | | |
| Douglas-fir dry | + | @ | + | @ | @ | @ |
| Northern Rocky Mountain mixed conifer | + | + | + | + | + | + |
| Western hemlock / western redcedar | + | + | + | + | + | + |
| Subalpine fir / lodgepole pine | + | + | + | + | + | + |
| Spruce / subalpine fir | + | + | + | + | + | + |
| **Total Structure Classes Within HRV** | **4** | **8** | **8** | **8** | **11** | **12** |

### *Timber Production*

Several factors influence timber production levels. The first are legal requirements as specified in the National Forest Management Act of 1976 (NFMA), the Multiple Use Sustained Yield Act of 1960 (MUSYA), and the 1982 Planning Rule under which this forest plan is being revised. The second is budget and workforce.

The MUSYA defines "sustained yield of the several products and services" as "the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

NFMA stipulates criteria for determining suitability of forest lands for timber production. It also specifies that timber harvest acres be split into two categories: lands suitable for timber production and other lands for harvest. Requirements to comply with MUSYA are also included as part of timber suitability determinations.

The 1982 Planning Rule summarizes NFMA requirements for determining lands suitable for timber production into four criteria: (1) Has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service, (2) Is forest land, (3) can be successfully regenerated in five years, and (4) harvest would not result in irreversible resource damage. Table 21 shows total suitable forest land by alternative as determined by this method. Appendix C in the specialist report contains full details of how these numbers were developed.

**Table 21. Total acres of suitable forest land by alternative**

| Structure Level | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| Total Suitable Forest Land | 535,725 | 653,242 | 129,420 | 656,628 | 384,485 | 347,535 |

The 1982 Planning Rule also requires the calculation of long-term sustained yield capacity (LTSY) based on productivity and the calculation of allowable sale quantity (ASQ) that is tied to lands that are suitable for timber production.

For the time horizon of this particular planning cycle, the next 20 years, no significant decline in timber productivity is assumed.

Current and anticipated budgets control workforce levels, sets priorities, and thereby constrains the number of acres that can be analyzed for conditions and management needs, areas that can be put into timber sales and administered, and other management needs.

The modeling output from ST-Sim was used to develop the timber production limits by alternative. Each alternative was run for a 300-year period.

The long-term sustained yield is the highest uniform wood yield that may be sustained given multiple-use objectives on lands managed for timber production. LTSY assumes that all suitable land for timber production is in the desired condition. LTSY was calculated assuming that the HRV midpoint for each structure class was the desired condition.

The allowable sale quantity reflects the quantity of timber that may be sold from lands suitable for timber production, within tree utilization standards, for the first decade of the plan given an unlimited budget. It is expressed as an annual average throughout the plan. It takes into account harvest from lands that are not in the desired condition, and therefore is slightly lower than the LTSY. Like the LTSY calculation, the desired condition was assumed to be the midpoint of HRV for each structure class. Since the desired

condition requires more forest stands within a late structure condition, time is required for the trees to grow larger, and therefore ASQ is lower than LTSY.

The projected wood sale quantity (PWSQ) is the estimated quantity of timber and all other wood products that is expected to be sold from the plan area for the plan period. The PWSQ consists of the projected timber sale quantity as well as other woody material such as fuelwood, firewood, or biomass that is also expected to be available for sale. The PWSQ includes volume from timber harvest for any purpose based on expected harvests that would be consistent with the plan components. The PWSQ is also based on the planning unit's fiscal capability and organizational capacity. PWSQ is neither a target nor a limitation on harvest, and is not an objective unless the responsible official chooses to make it an objective in the plan.

The 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 projected wood sale quantity (PWSQ), the projected timber sale quantity 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 neither a target nor a limitation on harvest, and is not an objective unless the responsible official chooses to make it an objective in the plan.

Table 22 shows the long-term sustained yield (LTSY), allowable sale quantity (ASQ), projected wood sale quantity (PWSQ), and projected timber sale quantity (PTSQ) for each alternative for the first decade. See appendix C of the specialist report for details of how each number was calculated, as well as PWSQ and PTSQ numbers for the second decade.

**Table 22. Average annual volumes (million board feet (mmbf)) by alternative for the first decade**

| | No action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| LTSY | 18.3 | 97.5 | 7.5 | 97.4 | 13.9 | 12.2 |
| ASQ | 18.3 | 67.6 | 7.5 | 67.0 | 13.9 | 12.2 |
| PWSQ | 40.6 | 62.1 | 14.3 | 61.8 | 37.4 | 37.5 |
| PTSQ | 26.9 | 48.4 | 9.3 | 48.1 | 23.7 | 23.8 |

The ASQ and LTSY values calculated for the no-action, R, B, and O alternatives are significantly lower than those for the proposed action and alternative P because of the requirement of the 1982 Planning Rule to provide a non-declining flow of timber. The different lines represent different management intensities, with the 1x management intensity being the current assumed intensity of 5,000 acres per year each of timber harvest, mechanical fuels treatments, and prescribed burning. As can be seen, management intensities greater than 1/2x result in wildly fluctuating outputs which violate the non-declining flow requirement. The 1/2x management intensity results in an even and non-declining flow of timber, and thus, this becomes the basis for the ASQ and LTSY. No action and alternatives R and B all have similar non-declining flow graphs.

Underlying the lower ASQ and LTSY values is the fact that the no-action, R, B, and O alternatives continue the direction of Eastside Screens. The diameter limits imposed by Eastside Screens essentially means that once a stand reaches late structure, there is very limited opportunity to do any harvest within that stand. Since the no-action, R, B, and O all continue the Eastside Screens, within a fairly short amount of time (approximately 50 years); more than half of the forest is within a late structure type.

## No-action Alternative

The no-action alternative follows the current Colville Forest Plan as amended. The current management direction of having individual, defined old forest management areas within a matrix of general forest with emphasis on timber production using two-aged regeneration methods would continue. This alternative continues the use of Eastside Screens, which includes conducting a HRV analysis, and generally not cutting trees greater than 21 inches in diameter.

### Old Forest Management and Timber Production

The no-action alternative retains the Eastside Screens that were intended to be interim direction until the forest plan was revised. Eastside Screens restricts cutting of 21-inch diameter and larger trees in many situations requiring justification for cutting, even when site-specific objectives may warrant removal. Retaining all trees greater than 21 inch diameter can result in situations where tree vigor is reduced to a point where density related mortality factors could cause significant mortality resulting in loss of late forest structure.

The Eastside Screens process requires assessment of current conditions and comparison to pre-settlement HRV. When conditions are below HRV, the Eastside Screens prohibit the removal of greater than 21" diameter trees. When conditions are above HRV, there are more opportunities to remove large trees based on specific criteria and for specific objectives. Desired future conditions reflect HRV, thus following the Eastside Screen process should move the forest toward late structure levels as listed in the HRV tables. The main difference between no action and the proposed action is the fixed locations of late forest structure reserves in the no-action alternative, with no opportunity to maintain or enhance it if there is little or no actual late forest structure within the reserve, whereas the proposed action's landscape approach supports planning for replacement in a dynamic landscape. Additionally, the diameter limit imposed by Eastside Screens creates a situation where certain structure types are generally difficult to create and maintain, such as early or late open. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is restricted to essentially fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types.

Managing late closed forest structure at or near the maximum end of the HRV range has a number of risks. Higher stocking results in stand density levels that are within the zone of competition induced mortality, where trees are experiencing increased levels of mortality from high levels of competition for resources such as light and water. The risk of mortality from bark beetles and other insects is greatly increased, and stand structure can change from a late closed structure back to early structure. Within the old forest management areas, some natural processes, such as succession, are allowed to function, but others, such as wildfire, are not.

An emphasis on late forest structure can result in reduced amounts of other forest structural states such as early successional stages. Inadequate representation of early successional structure is a frequent issue across the forested landscape (Swanson et al. 2010).

#### *Modeling Results*

Modeling results (table 23) indicate that in the Douglas-fir dry vegetation type, the current excess of mid closed structure class moves into the late open and late closed structure classes. At 100 years, the majority of this vegetation type is in the late open structure type (49 percent) and late closed structure type (37 percent), with the remainder in mid closed (7 percent) and early (5 percent). Mid open, mid closed, and late open are all within HRV.

In the northern Rocky Mountains mixed conifer type, the majority of structure is within the late closed class (83 percent), followed by mid closed (14 percent) and only 4 percent in the early class. Late closed

is the only structure class within HRV at 100 years, although this is a temporary situation and shortly after 100 years there is an excess of late closed.

Nearly all of the western hemlock / western redcedar type is in the late closed structure class (96 percent). Only 3 percent is in mid closed and 1 percent in early. No structure class is within HRV in this vegetation type.

For subalpine fir / lodgepole pine, the majority is in the early structure class (52 percent), with the remainder in mid closed (45 percent) and only 3 percent in late closed. All structure classes are within HRV in this vegetation type.

In the spruce / subalpine fir type, results show that there would be a lack of early structure type (only 3 percent), although there would be an abundance of late closed type (62 percent). The remainder is in the mid closed type (35 percent). Only the mid closed structure class is within HRV for this vegetation type.

**Table 23. No-action alternative modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 5 | 8 | 53 | 15 | 19 |
| | 50 Years | 5 | 8 | 36 | 28 | 23 |
| | 100 Years | 5 | 2 | 7 | 49 | 37 |
| Northern Rocky Mountain mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 7 | 0 | 70 | 0 | 22 |
| | 50 Years | 3 | 0 | 60 | 0 | 38 |
| | 100 Years | 4 | 0 | 14 | 0 | 83 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 1 | 0 | 65 | 0 | 34 |
| | 50 Years | 0 | 0 | 35 | 0 | 65 |
| | 100 Years | 0 | 0 | 0 | 0 | 100 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 27 | 18 | 41 | 2 | 12 |
| | 50 Years | 41 | 24 | 23 | 1 | 10 |
| | 100 Years | 38 | 21 | 26 | 5 | 11 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 15 | 0 | 69 | 0 | 16 |
| | 50 Years | 7 | 0 | 70 | 0 | 24 |
| | 100 Years | 4 | 0 | 34 | 0 | 63 |

## Proposed Action

The proposed action implements a landscape approach using active management to move forest structure toward HRV. The main difference between the proposed action and the P alternative are the number of acres recommended for wilderness. This alternative replaces Eastside Screens with a series of desired HRV conditions and removes the restriction of cutting trees greater than 21 inches in diameter.

The landscape approach to forest structure management in this alternative proposes to use HRV as the desired future condition. All future actions that affect forest vegetation would be assessed and compared to HRV, with the goal of moving the overall landscape toward HRV. Restoring forest structure would result in also moving species composition, process, and spatial pattern toward more resilient conditions, with a higher likelihood of sustaining desired levels of late forest structure across the landscape.

Restoring landscape heterogeneity through forest structure results in a high flexibility to adjust to climate change influence and provides reduced risk of fire to adjacent communities.

### Old Forest Management and Timber Production

The proposed action does not include the Eastside Screens, and does not limit the cutting of trees 21 inches in diameter and larger. The proposed action alternative, with its landscape approach, has desired conditions for levels of late forest structure that are to be met at a landscape scale. Large trees can be cut when the landscape is in excess of late forest structure, or, when site-specific objectives call for removal, as long as post-treatment conditions still meet or move toward desired conditions. The diameter limit imposed by Eastside Screens creates a situation where HRV cannot be met for certain structure types, such as early or open, because there is not a means to create and/or maintain these types. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is essentially restricted to fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types. The ability to actively manage stands that grow into larger diameter classes means that the proposed action is better able to create and maintain structure types, such as early and late open, than alternatives that maintain the Eastside Screens. This is especially true in the Douglas-fir dry type that makes up the majority of the forest, where late forest levels are closer to the midpoints of the HRV range.

#### *Modeling Results*

Modeling results (table 24) indicate that in the Douglas-fir dry vegetation type, late open structure would occupy the most area (59 percent), followed by late closed (22 percent). All structure types are within HRV for this vegetation type.

In the northern Rocky Mountains mixed conifer type, the majority of structure would be in the late closed class (77 percent), followed by mid closed (12 percent). Mid open is the only structure type within HRV in this vegetation type, while both late open and late closed are above HRV, and early and mid-closed are below HRV.

For western hemlock / western redcedar, 100 percent is within the late closed structure class. No structure class is within HRV for this vegetation type, largely because no active management is assumed to occur within this type.

For subalpine fir / lodgepole pine, the majority is within the early structure class (56 percent), followed by mid closed (22 percent) and mid open (11 percent). Early is the only structure class within HRV in this vegetation type.

In the spruce / subalpine fir type, results show that there would be a lack of early structure type (3 percent), although there would be an abundance of late closed type (65 percent). The remainder is in the mid closed class (32 percent). Both early and late closed are outside of HRV in this vegetation type.

**Table 24. Proposed action alternative modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 7 | 14 | 45 | 17 | 16 |
| | 50 Years | 8 | 18 | 22 | 36 | 16 |
| | 100 Years | 8 | 6 | 4 | 59 | 22 |
| Northern Rocky Mountains mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 7 | 7 | 64 | 1 | 21 |
| | 50 Years | 2 | 6 | 53 | 2 | 36 |
| | 100 Years | 2 | 1 | 12 | 7 | 77 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 1 | 0 | 65 | 0 | 34 |
| | 50 Years | 0 | 0 | 34 | 0 | 66 |
| | 100 Years | 0 | 0 | 0 | 0 | 100 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 37 | 9 | 41 | 1 | 12 |
| | 50 Years | 57 | 12 | 21 | 1 | 9 |
| | 100 Years | 56 | 11 | 22 | 3 | 9 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 14 | 0 | 69 | 0 | 18 |
| | 50 Years | 6 | 0 | 68 | 0 | 26 |
| | 100 Years | 3 | 0 | 32 | 0 | 65 |

## Alternative R

This alternative implements an expanded late forest structure reserve network, recommends high levels of recommended wilderness, and retains a production oriented general forest utilizing two-aged management practices. The late forest structure reserve network is based on northern goshawk occupied territories, elevational criteria, and currently identified late forest structures based on GNN data. Late forest structure reserves have little active management. This alternative continues the use of Eastside Screens which includes not cutting trees greater than 21 inches in diameter.

### Old Forest Management and Timber Production

The R alternative retains the Eastside Screens that were intended to be interim direction until the forest plan was revised. Eastside Screens restricts cutting of 21-inch diameter and larger trees in many situations, even when site-specific objectives may warrant removal. Retaining all trees greater than 21 inch diameter can result in situations where tree vigor is reduced to a point where density related mortality factors could cause significant mortality resulting in loss of late forest structure.

The Eastside Screens process requires assessment of current conditions and comparison to pre-settlement HRV. When conditions are below HRV, there are narrow criteria for removing large, greater than 21-inch diameter trees. When conditions are above HRV, there are more opportunities to remove large trees based on specific criteria and for specific objectives. Desired future conditions reflect HRV, thus following the Eastside Screen process should move the forest toward late structure levels as listed in the HRV tables. The main difference between the R alternative and the proposed action is the fixed locations of late forest structure reserves in the R alternative, with little opportunity to maintain or enhance it if there is no actual late forest structure within the reserve, whereas the proposed action's landscape approach supports planning for replacement in a dynamic landscape. Additionally, the diameter limit imposed by Eastside Screens creates a situation where certain structure types are difficult to create and maintain, such as early or late open. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is restricted to essentially fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types.

Managing late closed forest structure at or near the maximum end of the HRV range has a number of risks. Higher stocking results in stand density levels that are within the zone of competition induced mortality, where trees are experiencing increased levels of mortality from high levels of competition for resources such as light and water. The risk of mortality from bark beetles and other insects is greatly increased, and stand structure can change from a late closed structure back to early structure. Within the late forest structure management areas, some natural processes, such as succession, are allowed to function, but others, such as wildfire, are not.

An emphasis on late forest structure can result in reduced amounts of other forest structural states such as early successional stages. Inadequate representation of early successional structure is a frequent issue across the forested landscape (Swanson et al. 2010).

The use of a reserve system for late forest structure and the remainder for timber production results in less likelihood of having resilient forests in the long term. Late forest structure presence on the landscape is likely to be cyclical, with long time periods required to move from early to late structure. There is also limited flexibility to respond to climate change or other landscape-scale changes.

Within timber production areas, reduced late forest structures are likely as an emphasis on two-aged management tends to cut trees at or near the culmination of mean annual increment, which is around 80 years, before reaching late forest structure.

#### *Modeling Results*

Modeling results (table 25) indicate that in the Douglas-fir dry vegetation type, most structure would be within the late open class (45 percent), followed by late closed (35 percent). All structure types except for late closed are within HRV. While the proposed action and P alternatives maintain both late open and late closed around the midpoint of the HRV range, this alternative results in an amount of late open closer to the lower HRV limit, while having an overabundance of late closed.

In the northern Rocky Mountains mixed conifer type, late closed contains the most area (80 percent), with mid closed (13 percent) taking up most of the remainder. Mid open (1 percent) and late open (4 percent) are the only structure types within HRV, and there is a lack of early (3 percent).

For western hemlock / western redcedar, all structure is within the late closed class (100 percent). No structure class is within HRV for this vegetation type.

For subalpine fir / lodgepole pine, the early structure class is dominant (59 percent), followed by mid closed (27 percent) and late closed (7 percent). Early is the only type within HRV at 100 years for this vegetation type.

In the spruce / subalpine fir type, results show that there would be a lack of early structure class (3 percent), although there would be an abundance of late closed class (63 percent). The mid closed class (34 percent) is within HRV for this vegetation type, while both early and late closed are outside of HRV.

**Table 25. Alternative R modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 6 | 7 | 52 | 16 | 19 |
| | 50 Years | 8 | 7 | 35 | 28 | 22 |
| | 100 Years | 8 | 3 | 8 | 45 | 35 |
| Northern Rocky Mountain mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 7 | 3 | 67 | 1 | 22 |
| | 50 Years | 2 | 3 | 56 | 2 | 37 |
| | 100 Years | 3 | 1 | 13 | 4 | 80 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 2 | 0 | 65 | 0 | 34 |
| | 50 Years | 0 | 0 | 36 | 0 | 64 |
| | 100 Years | 0 | 0 | 0 | 0 | 100 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 37 | 5 | 45 | 1 | 12 |
| | 50 Years | 59 | 6 | 25 | 1 | 9 |
| | 100 Years | 59 | 5 | 27 | 2 | 7 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 15 | 0 | 68 | 0 | 17 |
| | 50 Years | 7 | 0 | 69 | 0 | 24 |
| | 100 Years | 3 | 0 | 34 | 0 | 63 |

## Alternative P

This alternative implements a landscape approach to managing forest structures by using active management to improve adaptability and resilience and move the landscape toward HRV. The main difference between the proposed action and the P alternative is the number of acres recommended for wilderness. The alternative replaces Eastside Screens with a series of desired conditions and removes the restriction of cutting trees greater than 21 inches in diameter.

The landscape approach to forest structure management in this alternative proposes to use HRV as the desired future condition. All future actions that affect forest vegetation would be assessed and compared to HRV, with the goal of moving the overall landscape toward HRV. Restoring forest structure would result in also moving species composition, process, and spatial pattern toward more resilient conditions, with a higher likelihood of sustaining appropriate levels of late forest structure across the landscape.

Restoring landscape heterogeneity through forest structure results in a high flexibility to adjust to climate change influence and provides reduced risk of fire to adjacent communities.

### Old Forest Management and Timber Production

Alternative P does not include the Eastside Screens, and does not limit the cutting of trees 21 inches in diameter and larger. Alternative P, with its landscape approach, has desired conditions for levels of late forest structure that are to be met at a landscape scale. Large trees can be cut when the landscape is in excess of late forest structure, or, when site-specific objectives call for removal, as long as post treatment conditions still meet or move toward desired conditions. The diameter limit imposed by Eastside Screens creates a situation where HRV cannot be met for certain structure types, such as early or open, because there is not a means to create and/or maintain these types. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is essentially restricted to fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types. The ability to actively manage stands that grow into larger diameter classes means that the P alternative is better able to create and maintain structure types, such as early and late open, than alternatives that maintain the Eastside Screens. This is especially true in the Douglas-fir dry type that makes up the majority of the forest, where late forest levels are closer to the midpoints of the HRV range.

#### *Modeling Results*

Modeling results (table 26) indicate that in the Douglas-fir dry vegetation type, all structure types are within HRV.

In the northern Rocky Mountain mixed conifer type, the majority of structure is within the late closed class (77 percent) and mid closed (12 percent). Mid open (1 percent) is the only structure type within HRV, although late open (7 percent) is just 1 percent higher than HRV. There is a lack of early (2 percent) and mid closed (12 percent).

For western hemlock / western redcedar, all of the structure is within the late closed type (100 percent). No structure class is within HRV in this vegetation type, largely because no active management is assumed to occur within this type.

For subalpine fir / lodgepole pine, the early structure class dominates (57 percent), with lesser amounts in mid closed (12 percent) and late closed (9 percent). Early is the only structure type within HRV.

In the spruce / subalpine fir type, results show that there would be a lack of early structure class (3 percent), although there would be an abundance of late closed class (63 percent). Only mid closed (33

percent) is within HRV in this vegetation type, with early being below HRV and late closed being above HRV.

**Table 26. Alternative P modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 6 | 14 | 45 | 18 | 17 |
| | 50 Years | 9 | 18 | 21 | 36 | 16 |
| | 100 Years | 8 | 6 | 5 | 59 | 22 |
| Northern Rocky Mountain mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 7 | 7 | 63 | 1 | 21 |
| | 50 Years | 2 | 6 | 54 | 2 | 36 |
| | 100 Years | 2 | 1 | 12 | 7 | 77 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 1 | 0 | 63 | 0 | 35 |
| | 50 Years | 0 | 0 | 34 | 0 | 66 |
| | 100 Years | 0 | 0 | 0 | 0 | 100 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 35 | 10 | 41 | 1 | 12 |
| | 50 Years | 57 | 13 | 20 | 1 | 9 |
| | 100 Years | 57 | 11 | 21 | 2 | 9 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 14 | 0 | 66 | 0 | 21 |
| | 50 Years | 8 | 0 | 65 | 0 | 27 |
| | 100 Years | 3 | 0 | 33 | 0 | 63 |

## Alternative B

This alternative emphasizes two management areas that focus on forest vegetation; the Restoration MA, which emphasizes late forest structure, and the Active MA, which emphasizes a two-aged approach to timber production by using the shelterwood with reserves regeneration method. Input from the Northeast Washington Forestry Coalition's alternative on vegetation, road, aquatic management and wilderness recommendations are included in this alternative. Proposed management not provided in the coalition's alternative comes from the proposed action. This alternative also responds to those advocating for increased wilderness and to public concerns that the amount and location of summer and winter motorized use may impact aquatic, riparian and wildlife habitats. This alternative continues the use of Eastside Screens, which includes not cutting trees greater than 21 inches in diameter.

## Old Forest Management and Timber Production

The B alternative retains the Eastside Screens that were intended to be interim direction until the forest plan was revised. Eastside Screens restricts cutting of 21-inch diameter and larger trees in many situations, even when site-specific objectives may warrant removal. Retaining all trees greater than 21 inches diameter can result in situations where tree vigor is reduced to a point where density-related mortality factors could cause significant mortality resulting in loss of late forest structure.

The Eastside Screens process requires assessment of current conditions and comparison to pre-settlement HRV. When conditions are below HRV, there are narrow criteria for removing large, greater than 21-inch-diameter trees. When conditions are above HRV, there are more opportunities to remove large trees based on specific criteria and for specific objectives. Desired future conditions reflect HRV, thus, following the Eastside Screen process should move the forest toward late structure levels as listed in the HRV tables. The main difference between the B alternative and the proposed action is the fixed locations of late forest structure reserves in the B alternative, with little opportunity to maintain or enhance it if there is no actual late forest structure within the reserve, whereas the proposed action's landscape approach supports planning for replacement in a dynamic landscape. Additionally, the diameter limit imposed by Eastside Screens creates a situation where certain structure types are difficult to create and maintain, such as early or late open. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is restricted to essentially fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types.

Managing late closed forest structure at or near the maximum end of the HRV range has a number of risks. Higher stocking results in stand density levels that are within the zone of competition-induced mortality, where trees are experiencing increased levels of mortality from high levels of competition for resources such as light and water. The risk of mortality from bark beetles and other insects is greatly increased, and stand structure can change from a late closed structure back to early structure. Within the late forest structure management areas, some natural processes, such as succession, are allowed to function, but others, such as wildfire, are not.

An emphasis on late forest structure can result in reduced amounts of other forest structural states such as early successional stages. Inadequate representation of early successional structure is a frequent issue across the forested landscape (Swanson et al. 2010).

The use of a reserve system for late forest structure and the remainder for timber production results in less likelihood of having resilient forests in the long term. Late forest structure presence on the landscape is likely to be cyclical, with long time periods required to move from early to late structure. There is also limited flexibility to respond to climate change or other landscape-scale changes.

Within timber production areas, reduced late forest structures are likely as an emphasis on two-aged management tends to cut trees at or near the culmination of mean annual increment, which is around 80 years, before reaching late forest structure.

### *Modeling Results*

Modeling results (table 27) indicate that in the Douglas-fir dry vegetation type, most of the structure is within the late open class (42 percent), followed by late closed (32 percent), early (12 percent), mid closed (10 percent), and mid open (4 percent). All structure classes are within HRV for this vegetation type. While the proposed action and P alternatives maintain both late open and late closed around the midpoint of the HRV range, this alternative results in an amount of late open closer to the lower HRV limit, while having an amount of late closed that is at the upper HRV limit.

In the northern Rocky Mountain mixed conifer type, late closed occupies the most area (77 percent), while mid closed (10 percent) and early (8 percent) make up nearly all of the rest. Mid open and late open are the only structure types within HRV for this vegetation type, while there is an overabundance of late closed and a lack of early and mid-closed.

For western hemlock / western redcedar, most structure is within the late closed class (90 percent), while mid closed (8 percent) and early (2 percent) make up the rest. Mid closed is the only structure class within HRV, while both early and late closed are outside of HRV.

For subalpine fir / lodgepole pine, the vast majority of area is within the early structure class (62 percent), while mid closed (30 percent) and late closed (6 percent) make up the remainder. Only the early type is within HRV for this vegetation type, with both mid closed and late closed outside of HRV.

In the spruce / subalpine fir type, results show that there would be a lack of early structure type (3 percent), although there would be an abundance of late closed type (64 percent). Mid closed (32 percent) is within HRV, while both early and late closed are outside of HRV.

**Table 27. Alternative B modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 7 | 9 | 49 | 15 | 19 |
| | 50 Years | 11 | 8 | 32 | 26 | 22 |
| | 100 Years | 12 | 4 | 10 | 42 | 32 |
| Northern Rocky Mountain mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 9 | 4 | 64 | 1 | 21 |
| | 50 Years | 7 | 4 | 51 | 2 | 36 |
| | 100 Years | 8 | 1 | 10 | 4 | 77 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 4 | 0 | 61 | 0 | 35 |
| | 50 Years | 6 | 0 | 30 | 0 | 63 |
| | 100 Years | 2 | 0 | 8 | 0 | 90 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 40 | 2 | 45 | 1 | 12 |
| | 50 Years | 66 | 3 | 22 | 0 | 8 |
| | 100 Years | 62 | 1 | 30 | 0 | 6 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 15 | 0 | 68 | 0 | 16 |
| | 50 Years | 8 | 0 | 68 | 0 | 25 |
| | 100 Years | 3 | 0 | 32 | 0 | 64 |

## Alternative O

This alternative proposes two management areas to address vegetation management: the Restoration MA to move forest structure to within the historical range of variability, and the Responsible MA that emphasizes two-aged management for timber production by using the shelterwood with reserves regeneration method. The total percentage of the Forest allocated to vegetation management is similar to the B alternative, though the O alternative has a greater percentage in the Restoration MA than the B alternative. The Forest Service fully developed this alternative using the proposed action to fill in the gaps not addressed in the collaborative process. This alternative continues the use of Eastside Screens, which includes not cutting trees greater than 21 inches in diameter.

### Old Forest Management and Timber Production

The O alternative retains the Eastside Screens that were intended to be interim direction until the forest plan was revised. Eastside Screens restricts cutting of 21-inch diameter and larger trees in many situations, even when site-specific objectives may warrant removal. Retaining all trees greater than 21 inches diameter can result in situations where tree vigor is reduced to a point where density-related mortality factors could cause significant mortality resulting in loss of late forest structure.

The Eastside Screens process requires assessment of current conditions and comparison to pre-settlement HRV. When conditions are below HRV, there are narrow criteria for removing large, greater than 21-inch-diameter trees. When conditions are above HRV, there are more opportunities to remove large trees based on specific criteria and for specific objectives. Desired future conditions reflect HRV, thus following the Eastside Screen process should move the forest toward late structure levels as listed in the HRV tables. The main difference between the O alternative and the proposed action is the fixed locations of late forest structure reserves in the O alternative, with little opportunity to maintain or enhance it if there is no actual late forest structure within the reserve, whereas the proposed action's landscape approach supports planning for replacement in a dynamic landscape. Additionally, the diameter limit imposed by Eastside Screens creates a situation where certain structure types are difficult to create and maintain, such as early or late open. Once trees within a stand grow larger than 21 inches d.b.h., the number of management options is restricted to essentially fire, and there is little opportunity to reduce densities and create early structure or maintain open structure types.

Managing late closed forest structure at or near the maximum end of the HRV range has a number of risks. Higher stocking results in stand density levels that are within the zone of competition induced mortality, where trees are experiencing increased levels of mortality from high levels of competition for resources such as light and water. The risk of mortality from bark beetles and other insects is greatly increased, and stand structure can change from a late closed structure back to early structure. Within the late forest structure management areas, some natural processes, such as succession, are allowed to function, but others, such as wildfire, are not.

An emphasis on late forest structure can result in reduced amounts of other forest structural states such as early successional stages. Inadequate representation of early successional structure is a frequent issue across the forested landscape (Swanson et al. 2010).

The use of a reserve system for late forest structure and the remainder for timber production results in less likelihood of having resilient forests in the long term. Late forest structure presence on the landscape is likely to be cyclical, with long time periods required to move from early to late structure. There is also limited flexibility to respond to climate change or other landscape-scale changes.

Within timber production areas, reduced late forest structures are likely as an emphasis on two-aged management tends to cut trees at or near the culmination of mean annual increment, which is around 80 years, before reaching late forest structure.

### *Modeling Results*

Modeling results (table 28) indicate that in the Douglas-fir dry vegetation type, most of the structure would be within a late open class (45 percent) and late closed (32 percent). All structure classes are within HRV for this vegetation type. While the proposed action and P alternatives maintain both late open and late closed around the midpoint of the HRV range, this alternative results in an amount of late open closer to the lower HRV limit, while having an amount of late closed that is at the upper HRV limit.

In the northern Rocky Mountains mixed conifer type, late closed structure occupies the most area (77 percent), followed by mid closed (11 percent), early (6 percent), late open (5 percent) and mid open (2 percent). Mid open and late open are within HRV, while there is an overabundance of late closed and a lack of early and mid-closed.

For western hemlock / western redcedar, the bulk of structure is within the late closed class (90 percent), with mid closed (8 percent) and early (2 percent) occupying the rest. Only mid closed is within HRV for this vegetation type, while both early and late closed are outside of HRV.

For subalpine fir / lodgepole pine, 55 percent is within the early structure class, while 37 percent is within mid closed and 6 percent in late closed. Early and mid-closed are within HRV for this vegetation type, while there is an overabundance of late closed.

In the spruce / subalpine fir type, results show that there would be a lack of early structure type (3 percent), although there would be an abundance of late closed type (67 percent). Mid closed (30 percent) is the only structure class that is within HRV, while both late closed and early are outside of HRV.

**Table 28. Alternative O modeling results (percentage)**

| | | Early | Mid Open | Mid Closed | Late Open | Late Closed |
|---|---|---|---|---|---|---|
| Douglas-fir dry | Historical | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| | Current | 12 | 7 | 57 | 5 | 19 |
| | 20 Years | 6 | 10 | 50 | 15 | 19 |
| | 50 Years | 9 | 9 | 32 | 28 | 22 |
| | 100 Years | 11 | 4 | 8 | 45 | 32 |
| Northern Rocky Mountains mixed conifer | Historical | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| | Current | 19 | 4 | 65 | 1 | 11 |
| | 20 Years | 9 | 5 | 64 | 1 | 21 |
| | 50 Years | 5 | 4 | 52 | 2 | 36 |
| | 100 Years | 6 | 2 | 11 | 5 | 77 |
| Western hemlock / western redcedar | Historical | 4-24 | 0 | 7-27 | 0 | 55-83 |
| | Current | 21 | 0 | 60 | 0 | 19 |
| | 20 Years | 4 | 0 | 62 | 0 | 35 |
| | 50 Years | 6 | 0 | 31 | 0 | 63 |
| | 100 Years | 2 | 0 | 8 | 0 | 90 |
| Subalpine fir / lodgepole pine | Historical | 45-65 | 0 | 33-53 | 0 | 3 |
| | Current | 33 | 4 | 49 | 2 | 13 |
| | 20 Years | 38 | 2 | 47 | 1 | 12 |
| | 50 Years | 62 | 2 | 28 | 0 | 8 |
| | 100 Years | 55 | 1 | 37 | 0 | 6 |
| Spruce / subalpine fir | Historical | 14-46 | 0 | 13-41 | 0 | 29-57 |
| | Current | 35 | 0 | 52 | 0 | 13 |
| | 20 Years | 14 | 0 | 68 | 0 | 19 |
| | 50 Years | 7 | 0 | 67 | 0 | 26 |
| | 100 Years | 3 | 0 | 30 | 0 | 67 |

# Cumulative Effects

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The area for considering cumulative effects includes the lands within the Colville National Forest administrative boundary.

Socio-economic choices can have the potential to influence cumulative effects. In the recent past, there have been some significant shifts in ownership of lands previously managed for industrial forestry objectives or large ranches being sold with possible conversion to other uses. Management objectives of the new owners, mostly unknown at this time, could influence a number of dynamics such as water quality and quantity, habitat connectivity, and fire management.

The cumulative environmental effects of the proposed management under all alternatives are to move a portion of the vegetation toward desired conditions. These efforts would contribute to overall landscape restoration goals and increase the resilience and adaptability of forest vegetation.

# Botany

This section considers two groups of rare plants that occur or may occur in the planning area, federally listed threatened, endangered, or proposed (TE) and USDA Forest Service Region 6 sensitive plant species (S). Threatened and endangered species are those formally listed by the USDI Fish and Wildlife Service under the Federal Endangered Species Act (ESA).

## Affected Environment

Sensitive plants are designated by the regional forester, however, lists are periodically updated as new data on species occurrences, threats, and risks as well as habitat conditions and trends are assessed to inform species conservation status, vulnerability, and conservation priority.

Since 1988, sensitive species surveys and review of other data documented additional populations of many species, with the result that some were judged more secure and others rare and at risk. For example, in 1988 *Viola renifolia* was thought to be extirpated in Washington State, but through plant survey efforts, 65 sites are now documented on the Colville National Forest. Other species like *Botrychium minganese* turned out to be more widespread than previously thought and these were removed from the regional sensitive species list.

The Colville National Forest (Forest) does not currently have any federally threatened, endangered, or proposed threatened plant species. Any newly designated or discovered taxa listed by the ESA would be managed appropriately throughout the life of this plan.

Sensitive species include those vascular and non-vascular plant taxa and fungi from the R6 Regional Forester's Sensitive Species List. Many threatened, endangered, and sensitive (TES) plant species depend on special or unique habitats that may be rare or represent a small portion of a particular landscape. In forested landscapes these TES plant habitats include meadows; wetlands, including marshes, bogs, fens, carrs, swamps, springs and seeps; riparian areas; alpine fellfields; rock outcrops; cliffs; and talus.

For the purpose of analyses and discussion of the current affected environment, rare plant habitats were grouped into five types as described in the Forest Service Natural Resource Management Threatened, Endangered, and Sensitive Plants application (NRM TESP) database (2013) and the *Field Guide to the Rare Plants of Washington* (Camp and Gamon 2011). Plants within each group share broad environmental similarities and natural disturbance regimes, resource potential, and management opportunities that facilitate assessment of sensitive species site and habitat conditions and trends. table 29 displays the distribution of rare plant taxa and sites across the environmental gradient of the Colville National Forest.

**Table 29. Sensitive plant habitat groups, number of species within each habitat and number of occurrences (sites)**

| Habitat Group | Number of Sensitive Species | Number of Sites |
|---|---|---|
| Alpine and subalpine meadows, fellfields, and parklands | 5 | 44 |
| Cliffs, talus, and rock outcrops | 2 | 6 |
| Dry meadows, open dry forests, and shrub steppe | 6 | 115 |
| Moist openings and wet forests | 5 | 215 |
| Wetlands, moist meadows, and riparian | 20 | 186 |

While plant diversity is an important attribute across all the habitat groups, the table shows that plant habitats encompassing wetlands, moist meadows, and riparian ecosystems provide habitat for the bulk of the documented sensitive plant species. Since 1998 and the implementation of the NRM TESP database,

rare plant surveys have been conducted on 92,000 acres of the Forest to meet a number of management concerns. Information on occurrences is lacking on the remainder of the planning area.

## Environmental Consequences

### Assumptions

- Diversity objectives would be achieved for all native plant species through ecosystem diversity (coarse filter) plan components except for federally listed species (if discovered) and R6 sensitive species. The latter classes of plants are managed with consideration of species and habitat specific plan components including desired conditions, objectives, standards, and guidelines (fine filter).
- A conservation outcome for any group of sensitive species reflects the conservation outcome for each species in that group.
- Current vacant grazing allotments would continue in non-grazing status.

#### *Introduction*

Under the 1982 planning rule, national forests were required to manage habitat in order to maintain viable populations of existing species in planning areas. The planning rule further defines a viable population as "one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area."

Critical information about factors limiting rare species distributions and populations is often lacking and until studies describing the complex abiotic and biotic interactions between species and their environments can be completed, conservation principles would advocate for a cautious approach to rare plant species management. As budgets limit study efforts, it is often enough to determine that there are a critical number of well-distributed, stable rare plant occurrences that ensure continued viability of the species of concern in the planning area. Particularly, this threshold is sought when the determination is that threats associated with resource management are countered with abatement, avoidance, or mitigation actions. In addition, species security is enhanced if habitat effectiveness is maintained in special and unique habitats supporting rare plant populations. Habitat effectiveness may be enhanced directly through management activities that reduce risks or indirectly by enhancing ecosystem integrity and resilience. It is, however, relevant to achieving conservation goals that sensitive plant source populations be protected from disturbances outside the historic range of variation. The details of life history traits and reproduction as well as interactions such as herbivory, mutualism (two organisms of different species benefitting from a relationship), and pollinator ecology remain incomplete due to the sheer number of candidates for priority study. Progress is measured incrementally as annual sensitive species inventories are entered into corporate databases for future analyses of condition and trend.

#### *Process*

Conservation outcomes for the sensitive species are summarized below for all alternatives and will focus on risks to maintaining viable plant populations and habitats within the plan area. Generally, the action alternatives were not driven by plant viability issues. Therefore, a set of TES plant, soil, vegetation, riparian management area, and livestock grazing desired future condition statements, objectives, standards, and guidelines are assessed as contributing to plant viability. This was done in threat-risk matrix associated with changes in alternative management areas. Some effects to species viability were similar across alternatives. Where a set of plan components had differing influence on conservation outcomes, the results are described below.

This assessment occurs within a vulnerability, threat and risk matrix inherent in land and resource management planning. Threats were identified from literature (Camp and Gamon 2011) and local NRM TESP database sources (USDA FS 2013). Viability risk to TES plant species (High, Medium, or Low) is defined as occupied habitat exposed to activities that damage or degrade habitat or populations. High risk is defined as impact levels that affect the Forest's ability to contribute to TES plant viability. This is defined as greater than 67 percent of occupied habitat appreciably impacted. In conclusion, plan components, including desired future conditions, objectives, standards, guidelines, land suitability, and land management allocations, as well as habitat group affinities are evaluated to describe the degree to which risks will be managed to affect desired conservation outcomes under each plan alternative.

### *Conservation Outcomes*

Table 30 summarizes viability outcomes for each habitat group by alternative. For all habitat groups except "wetlands, moist meadows, and riparian," the proposed action and other action alternatives "may impact individuals or habitat, but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species" (MIIH). For "wetlands, moist meadows, and riparian," the no-action alternative would result in an action that "would impact individuals or habitat and may contribute to a trend toward Federal listing or cause a loss of viability to the population or species" (WIFV=Will Impact Future Viability).

**Table 30. Species summary of viability outcomes by alternatives**

| Habitat Groups | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| Alpine and subalpine meadows, fellfields, parklands | MIIH | MIIH | MIIH | MIIH | MIIH | MIIH |
| Cliffs, talus, rock outcrops | MIIH | MIIH | MIIH | MIIH | MIIH | MIIH |
| Dry meadows, open dry forests, shrub steppe | MIIH | MIIH | MIIH | MIIH | MIIH | MIIH |
| Moist openings, wet forests | MIIH | MIIH | MIIH | MIIH | MIIH | MIIH |
| Wetlands, moist meadows, riparian | WIFV | MIIH | MIIH | MIIH | MIIH | MIIH |

## Spatial and Temporal Context for Effects Analysis

The spatial context for effects analysis includes all lands within the Colville National Forest administrative boundary. Temporal consideration is given to management of rare plant resources on the Forest for a period of fifteen to twenty years in the future, the approximate life of the forest plan.

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Resource management plans for other Federal, State, and tribal lands adjacent to the Forest include provisions for the protection and management of rare plant resources. The Okanogan-Wenatchee National Forest, Panhandle National Forest, Bureau of Land Management, U.S. Fish and Wildlife Service, Washington State Department of Natural Resources, Washington Dept. of Fish and Wildlife, Kalispel Indian Reservation, and Colville Confederated Tribes recognize resource values associated with maintenance of rare plant populations and supporting habitat. Sensitive species lists may differ in details because of different agency criteria and agency habitat ownership. The state lists and state ranks are developed and maintained by the Washington Natural Heritage Program in collaboration with public agency, university, and private cooperators with botanical interests. The Pend Oreille County Public Utility District (PUD) and Seattle City Light have conducted rare plant surveys and are implementing conservation measures as needed in compliance with hydroelectric licenses on the eastern portion of the Forest along the Pend Oreille River. Allotment Management Plans (AMPs) have recently been completed

with current management direction and future AMPs would incorporate changes as plan revision is implemented.

## Summary of Effects

Plan components, including desired future conditions, objectives, standards, guidelines, land suitability, and land management allocations, as well as habitat group affinities are evaluated to describe the degree to which risks would be managed to affect desired conservation outcomes under each plan alternative. Many of the effects are common to all alternatives and plant habitat groups, and are discussed in the following section. Other effects are evaluated by plant habitat group and alternative in Effects for Alternatives by Plant Habitat Group.

### Environmental Change

The effects of climate change are common to all five rare plant habitat groups and all alternatives. Climate change predictions for the Inland Pacific Northwest include average temperature increases, changes in precipitation amounts, precipitation patterns, snowpack accumulations, snowmelt, and run-off regimen. These changes would affect extant sensitive plant populations and habitat components resulting in shifting spatial physiological optimums and habitat effectiveness. The detailed changes are unknown at the forest plan scale, but some general conclusions allow the relative ranking of vulnerable habitats and species:

- High-elevation alpine and subalpine habitats would shift upward in elevation with increasing temperatures and result in loss of suitable habitat on the higher mountainous areas (Astrup Felde et al. 2012, Miller-Struttmann et al. 2015, Munson and Sher 2015, Walther et al. 2002).
- Cliffs, talus, and rock outcrops where small changes in available moisture seeps and increased evapotranspiration[19] demand would impact plants established in stressful, rocky environments.
- Dry shrublands, grasslands, and forests supporting sensitive plants would experience greater evapotranspiration and changes in moisture patterns and drought that impact plant species composition and cover and, thus, habitat effectiveness of these communities (EcoAdapt 2015).
- Moist openings and wet forests would shrink in extent as both groundwater and precipitation input changes reduced and higher temperatures create greater evapotranspiration demand leading to compositional and structural shifts in associated plant communities (EcoAdapt 2015).

In addition, climate change components would interact with pollinator ecology, plant phenology, invasive plant infestations, habitat connectivity, and fire regime shifts to indirectly impact existing sensitive species populations and their habitats (Miller-Struttmann et al. 2015). Shifts in some of these habitat factors may outpace the ability of plant species to adapt to changing environments (Walther et al. 2002). This leads to more isolated populations that increases stress in already vulnerable species. Condition and trend monitoring, and conservation of genetic material in seed banks have been identified as strategies to deal with these changing environments.

Fire suppression on Federal lands has led to fuels accumulation in some fire types, resulting in wildfires that are uncharacteristic in both fire effects and scale. Climate change may affect those factors and lead to more frequent or higher severity fires within these habitats (Devine et al. 2012). Plan alternatives that promote landscape-scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current

[19] Loss of water from the soil both by evaporation and by transpiration from plants.

vegetation condition and positively influence the trend trajectory (Franklin and Johnson 2012, Ingalsbee 2015).

In all of these situations, understanding site and vegetation dynamics, monitoring the most vulnerable species, off-site gene conservation with seed collections and storage, and population supplementation would help meet conservation goals. The responses of sensitive plants to additional environmental stressors are unknown and may result in negative conservation outcomes.

### Alteration of hydrologic regime

All alternatives provide guidance and direction regarding wetlands and riparian areas in each of the five rare plant habitat groups. Wetlands and riparian areas would be managed as riparian management areas or riparian habitat conservation areas where aquatic and riparian-dependent resources receive primary emphasis and where special management direction applies. While there are small differences in riparian widths associated with each alternative, the risk analysis was unable to detect a small change between alternatives. Therefore, the species risk ratings were unchanged between the set of alternatives and were evaluated as a single factor common to all alternatives. Plant and aquatic/riparian standards and guidelines common to all alternatives promote the maintenance or enhancement of riparian/wetland processes and functions, including hydrologic connectivity and regime, and would protect existing sensitive species sites and suitable habitat from degradation.

### Gopher disturbance

Northern gophers have been identified as an herbivore threat to several sensitive species occupying meadows and riparian rare plant habitat groups. Gopher populations could reach thresholds, which would affect both habitat effectiveness and plant population conditions and trends for *Botrychium hesperium, B. paradoxum, B. pedunculosum,* and *Ophioglossum pusillum*. Preferred food for these underground-dwelling herbivores include herbaceous material (grass, roots, and forbs) produced during the growing season as well as tree and shrub material during the winter months. Their tunneling and mound building activity could disturb existing plants. Exposure of mineral soil could create an opportunity for invasive plants to become established in meadow habitats and compete with sensitive plants.

Gophers are ecosystem engineers and provide valuable ecosystem services including improvement of soil properties and as prey species supporting a host of predators in a complex food web (Case et al. 2013, Jones et al. 2008). Monitoring gopher mounds for indicators of potential impacts and implementing integrated pest management practices if needed would reduce the likelihood of negative effects to the sensitive species. Risks associated are generally low, but may be medium when large gopher populations become established in meadow ecosystems. Essentially, the species risk ratings were unchanged for the full set of alternatives and were evaluated as a single factor common to all alternatives.

### Invasive plants

Invasive plants were identified as a threat to three of the rare plant habitat groups:

- Dry meadows, open dry forests, shrub steppe, rocky sites
- Moist openings and wet forest sites
- Wetlands, moist meadows, riparian areas

The invasive plant risk rating is from analyses of effects (both direct competition and nearby threat occurrence) represented by invasive plant infestation proximity to sensitive plant sites. That rating was completed during analyses to identify priority watersheds for the Watershed Condition Framework (USDA FS 2015). The total percentage of area for these two categories (direct competition and threat

impact) was rated as Low, Medium, or High. An elevated risk was associated with particular species occurrences in priority watersheds and includes *Botrychium hesperium* from dry meadows, open dry forests, as well as *Botrychium ascendens*, *Botrychium crenulatum*, *Cicuta bulbifera*, and *Dryopteris cristata* from wetlands, moist meadows and riparian areas. If the invasive threat was alternatively identified in the literature or database observations, then the risk was rated as low. That was the situation for *Botrychium pedunculosum*, *Sisyrinchium montanum*, and *Viola renifolia* in moist openings and wet forest sites. The sensitive species risk ratings and plan components related to invasive plants were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives. An integrated invasive plant management program with emphases on prevention, effective control, and restoration would improve conservation outcomes.

### Livestock grazing and trampling

For all rare plant habitat groups except cliffs, talus and rock outcrops, livestock grazing and trampling may affect sensitive plants directly and habitat effectiveness indirectly. These interactions depend on the palatability of the plant species for certain livestock and the fragility of habitat components that, together, influence habitat effectiveness. Improperly timed herbivory (i.e., grazing) removes current year's vegetative growth and flower or fruit structures before maturation. Recurrent annual grazing during the growing season would interrupt critical life history events and may affect seedling recruitment and subsequent maintenance of population structure. Demographic studies support the critical need for periodic reproductive success in perennial vegetation systems. It is crucial, as well, for annual plants to produce reproductive structures and annual seed crops, in particular during poor growing years. A link between carbohydrate storage and plant vigor is affected by heavy season-long grazing and can lead to individual plant impacts and changes in plant community composition and structure (Kovalchik and Clausnitzer 2004).

Trampling affects not only the vegetation directly, but the soils and habitat supporting rare plant populations. This is particularly an issue in maintenance of wet soils throughout the grazing season after attainment of range readiness in terrestrial vegetation types (Kovalchik and Clausnitzer 2004). Lowered habitat effectiveness, reflected in the reduced ability to support desired vegetation components and ecosystem functions, could be a detrimental outcome. Maintenance of soil productive capacity and essential attributes is critical for the contribution of ecosystem services from Forest lands. This grazing and trampling risk is assessed as the proportion of each species' total occupied habitat occurring within allotments and represents the exposure of these sensitive species to impacts. It is recognized that plant sensitivity to both grazing and trampling varies spatially and temporally with attributes of the grazing system and site-specific characteristics including associated plant species, soil moisture, and soil texture, in addition to seasonal sensitivity shifts connected to plant phenology. Risks were assigned for the active growing season.

### Plant collecting

For all rare plant habitat groups and alternatives, unauthorized plant collection risk levels are associated with ease of access to sites and habitat. Documented sites within roadless areas (such as wilderness, recommended wilderness, research natural areas, etc.), or with lower road densities are at lower risk than those occurring in management areas with higher density roads and public access. While there are permits for commercial or personal use of native plant materials, terms and conditions associated with plant collection prohibit sensitive and listed plant taxa from collection. Should they be found on the forest, the collection of federally listed plant species can only be authorized under the authority of the U.S. Fish and Wildlife Service. Scientific plant materials collection of sensitive species (also personal use permit) authorization is delegated from Region 6 to the Forest level and should not affect sensitive plant populations. Risks associated with unauthorized plant collection have been identified for three sensitive

species (*Cypripedium parviflorum*, *Eurybia merita*, and *Gaultheria hispidula*) discussed below by habitat group. There is little risk for the remaining 35 taxa, because they have not been identified as targets for collection.

## Effects for Alternatives by Plant Habitat Group

The threats and risks to sensitive plant occurrences within a particular management area are altered by forestwide and management area plan components, including desired future conditions, standards, and guidelines for suitable conservation outcomes. Effects, therefore, vary by plant habitat group and alternative and are discussed below for each group.

### Alpine and Subalpine Meadows, Fellfields, and Parklands Habitat Group

#### *Summary of Effects*

The conservation outcome is the same for all alternatives: May impact individuals or habitat, but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

Alpine and subalpine meadows, fellfields, and parklands habitats are generally a high vulnerability group with exposure to environmental change from climatic and fire regime factors (Miller-Struttmann et al. 2015, Munson and Sher 2015). Whitebark pine is exposed to threats from insect and disease, as well as environmental changes (Devine et al. 2012). Additionally, this group of species has exposure to livestock grazing, recreational activity, hydrologic regime alteration, and plant collecting. Together, this creates high to medium levels of risk for desired conservation outcomes.

Conservation measures in the current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness. They do not consider climate change as an additional environmental stressor. The no-action alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that trends for some sensitive plant populations and habitat are declining under current management. On the other hand, action alternatives (i.e., the proposed action and alternative P) that promote landscape-scale restoration of sustainable vegetation types within historic and future ranges of variation would continue to provide capable habitat as a corollary to protection of the source populations. This includes restoration of disturbances, such as fire, that are responsible for landscape character. The proposed conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

Although alternatives R and B would allocate similar acres to the recommended wilderness management area, where human-caused effects may be reduced, the risks are driven by threats somewhat independent of that management allocation. In addition, the remaining action alternatives allocate more acreage of this habitat to the Backcountry management area where effects on sensitive plant species are similar to those in recommended wilderness, so the conservation outcome across all alternatives is the same.

#### *Threats and Risks to Viability*

**Alteration of hydrologic regime**

Some of these sensitive plant occurrences are found in headwater or streamside environments where this habitat element may frame conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within wetlands and riparian sites. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the

total occupied habitat of each species that occurs within wetland or riparian ecosystems (L: 0 to 33 percent, M: 34 to 67 percent, H: 68 to 100 percent). Risks associated with this threat are generally medium; however, the effect is somewhat magnified by the high vulnerability of most species found in this rare plant habitat group.

**Insects and Disease**

Detailed information on threats of insect and disease affecting sensitive species is lacking for most taxa. However, there are assessments describing the existing threats for the *Pinus albicaulis* ecosystem from both western white pine blister rust and mountain pine beetle (USDI FWS 2011, Spies et al. 2010). Across the range of *Pinus albicaulis*, these agents have contributed significantly to recent tree mortality. This species is a candidate for Federal listing with a "warranted but precluded" finding issued in 2011. Continued implementation of the Pacific Northwest whitebark pine restoration strategy would be a critical management action to accomplish conservation goals. In the Pacific Northwest, whitebark pine is highly vulnerable to insects and diseases (Devine et al. 2012), thus, the risk is rated as high for this species and low for the remainder of the sensitive species in this rare plant habitat group.

**Environmental change**

See summary of effects section.

**Livestock grazing and trampling**

See summary of effects section.

**Plant collecting**

See summary of effects section. In addition, a low risk is associated with unauthorized plant collection for *Eurybia merita* in this habitat group. There is little risk for the remaining four taxa, since they have not been identified as targets for collection.

**Recreational use**

This threat category includes site use and development, and trail use and construction. Two species in this group, *Carex proposita* and *Eurybia merita*, occur in meadow habitats that are favored for recreational use or trails development. The risk for these taxa was high when 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases. Potential effects include disturbance from trampling and camping. Vulnerability is high because of the limited number of sites and plants, and the total size of all occurrences. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Establishing trails and camping areas in locations that avoid these populations in addition to monitoring and initiating further surveys in suitable habitat are management actions that would improve conservation outcomes for these two species.

## Cliffs, Talus, and Rock Outcrops Habitat Group

### *Summary of Effects*

The conservation outcome is the same for all alternatives: May affect individuals or habitat, but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species (MIIH).

Cliffs, talus, and rock outcrops habitats supporting *Cryptogramma stelleri*, *Dryas drummondii* var. *drummondii*, and *Lycopodium dendroideum* are a high vulnerability group with exposure to threats including environmental change from climatic factors and recreation use.

The no-action alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that current population trends are static or improving. However, conservation measures in the current direction do not focus on essential habitat components Critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

#### *Threats and Risks to Viability*

**Environmental change**

See summary of effects section .

**Plant collecting**

See summary of effects section.

**Recreational use**

This threat category includes site use and development, and trail use and construction. The risk for these taxa was high if 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases. Potential effects include disturbance from recreational trampling, climbing, and shoreline development. Vulnerability is high because of the limited number of sites and plants, and the total size of all occurrences. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Establishing trails, climbing routes, and camping areas in locations that avoid these populations would contribute to the sustainability of these three species. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the no-action alternative lacks specific direction.

**Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. The potential use of native rock sources for road construction and surfacing includes identification of borrow pits and gravel sources. The risk for these species occurrences in this habitat group is currently low since the species occur, principally, in unroaded allocations.

### Dry Meadows, Dry Forests, and Shrub Steppe Habitat Group

#### *Summary of Effects*

The conservation outcome is the same for all alternatives: May impact individuals or habitat (MIIH), but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

Dry meadows, open dry forests, and shrub steppe habitats supporting *Antennaria parvifolia, Astragalus microcystis, Botrychium ascendens, B. hesperium, B. paradoxum*, and *B. pedunculosum* are rated for vulnerability as medium to high vulnerability with exposure to threats including environmental change, gopher disturbance, invasive plants, livestock grazing and trampling, recreation use, road building, and timber harvest activities.

The no-action alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. Indications are that current population trends are static or improving while habitat condition may be trending downward. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations is mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

The risks to sensitive plant occurrences within a particular management area are altered by forestwide and MA plan components including desired future conditions, standards, and guidelines for effective conservation outcomes.

### *Threats and Risks to Viability*

#### Environmental change

This threat is used to qualitatively summarize the effects to the environment supporting sensitive plant species. It includes factors such as climate change, fire regime shifts, plant succession, and soil raveling and erosion. Additionally, in fire-maintained meadows, past fire suppression and subsequent plant succession has affected habitat effectiveness for *Antennaria parvifolia*. Plan alternatives that promote landscape-scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current vegetation condition and influence habitat trend trajectory in a positive sense.

In some portions of the landscape, soil-forming processes, including soil raveling and erosion, continue to affect sensitive plant environments for *Astragalus microcystis* and affect existing populations. The genus *Astragalus* has an affinity for early seral stages in disturbance regimes, so it is possible the species could be adequately maintained. Site observations indicate the species has increased its cover in disturbed areas left to recover. Timber harvest activities conducted adjacent to occupied shrublands, livestock grazing, and prescribed fire are management activities that affect this species. Improper livestock grazing, unnaturally high fire frequency, and invasion by exotic plants are the biggest threats to the sensitive species occupying these habitats. Higher fire frequencies are to be expected with a higher proportion of non-native invasive species in the plant community.

#### Gopher disturbance

See summary of effects section.

#### Invasive plants

See summary of effects section.

#### Livestock grazing and trampling

See summary of effects section.

**Plant collecting**

See summary of effects section.

**Recreational use**

This threat category includes site use and development, trail use and construction, and recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by off-highway vehicle (OHV) users, or on cliffs in potential rock-climbing routes. In this habitat group, *Astragalus microcystis* and the *Botrychium* species are exposed to these risks. The risk for these taxa was high, if 67 percent or greater exposure of existing sites occurred in management areas with non-wilderness recreation emphases.

The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville National Forest Travel Management Subpart A analysis; OHV use in vulnerable habitat is restricted. Otherwise, the risk is high for recreational developments including trails. Establishing trails and camping areas in locations that avoid these populations would reduce risk and contribute to the sustainability of these three species. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the no-action alternative lacks specific direction.

**Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. Risk for the species would be elevated (Medium to High) for the no-action alternative. These risks would be reduced in the proposed action and other action alternatives. Since additional plan components mediate desired conservation outcomes in all action alternatives, the total effects would be reduced and would support sensitive species sustainability.

**Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical effects as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments. *Antennaria parvifolia* sites in the dry forest rare plant habitat group are at risk to exposure.

Some of the indirect effects may benefit early seral species in a forested landscape. *Antennaria parvifolia* may benefit from treatments, but a conservative approach should also consider protection and monitoring of source populations both pre-and post-treatment. Potential exposure to this threat is high, but total effects would be reduced by both plan components and potential species responses to management activities. All alternatives support sensitive species sustainability outcomes.

## Moist Openings and Wet Forests Habitat Group

### *Summary of Effects*

The conservation outcome is the same for all action alternatives: May impact individuals or habitat (MIIH), but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

Moist openings and wet forest habitats support *Botrychium crenulatum, Lycopodium dendroideum, Sisyrinchium montanum,* and *Viola renifolia*. Two of those species are rated as highly vulnerable (*Sisyrinchium montanum* and *Lycopodium dendroideum*); *Botrychium crenulatum* and *Viola renifolia* are rated low vulnerability. High vulnerability reflects a low number of sites and total plants, and small total size of occupied sites. Exposure to threats include alteration of hydrologic regime, environmental change, gopher disturbance, invasive species, livestock grazing and trampling, recreation use, road building, and timber harvest activities.

The no-action alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species; local data indicate that current site trends are mixed with static and improving trends for *Lycopodium dendroideum* and *Viola renifolia*, respectively. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness, nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

### *Threats and Risks to Viability*

#### Alteration of hydrologic regime

Some of these sensitive plant occurrences are found in streamside environments where this habitat element frames conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within wet forest and wet openings. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the total occupied habitat of each species that occurs within wetland or riparian ecosystems (L 0 to 33 percent, M 34 to 67 percent, H 68 to 100 percent). Risks associated with this threat are high and medium; however, the effect is somewhat magnified by the high vulnerability of two species found in this habitat group.

#### Environmental change

This threat is used to qualitatively summarize the effects to the environment supporting sensitive plant species. In this habitat group, discussion focus is on climate change (see summary of effects section) and fire regime shifts.

Fire suppression on Federal lands has led to fuels accumulation in some fire types with resultant wildfires that are uncharacteristic in both fire effects and scale. Additionally, in fire-maintained meadows, past fire suppression and subsequent plant succession may affect habitat effectiveness for taxa in this group like *Sisyrinchium montanum*. Plan alternatives that promote landscape-scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in ecosystem recovery efforts would improve current vegetation condition and influence habitat trend trajectory in a positive sense.

#### Gopher disturbance

See summary of effects section.

#### Invasive plants

See summary of effects section.

**Livestock grazing and trampling**

See summary of effects section.

**Plant collecting**

See summary of effects section.

**Recreational use**

This threat category principally includes recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by OHV users, or on cliffs in potential rock-climbing routes; in this habitat group *Sisyrinchium montanum* is exposed to risks of OHV use in meadows. The risk for this taxa was medium to low in management areas with non-wilderness recreation emphases.

The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville National Forest Travel Management Subpart A analysis; OHV use in vulnerable habitat was restricted. Establishing trails and camping areas in locations that avoid populations of these four sensitive species would reduce risk and contribute to the sustainability of these taxa. The proposed conservation goal to maintain or enhance existing populations is mediated by application of plan components including protective standards and guidelines as well as implementation of monitoring that targets population and habitat conditions and trends. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the no-action alternative lacks specific direction.

**Road building and maintenance**

Risk associated with road building and maintenance is related to direct effects of physical disturbance to sensitive plant populations. Risks for these four species are low to medium for all alternatives because of the lower percent of occurrences in roaded areas. There are slightly lower risks in the proposed action and alternatives P and R but the difference has no effect on the conservation outcome. Even a medium risk becomes a conservation concern for *Sisyrinchium montanum* because of the high vulnerability of this species. These risks are reduced in action alternatives since additional plan components mediate desired conservation outcomes.

**Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical impacts as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments.

Potential exposure to this threat is variable for this suite of species. Risk remains high to medium for *Viola renifolia* across all action alternatives. For *Lycopodium dendroideum* and *Sisyrinchium montanum*, risks are generally low to medium. These differences reflect the degree of fidelity to MAs in which timber harvest occurs across alternatives. Total effects are reduced by common plan components across the action alternatives. All alternatives support sensitive species sustainability outcomes.

## Wetlands, Moist Meadows, and Riparian Habitat Group

### *Summary of Effects*

The conservation outcome for the no-action alternative is: Will affect individuals or habitat with a consequence that the action may contribute to a trend toward Federal listing or cause a loss of viability to the population or species. The conservation outcome is the same for all action alternatives: May effect

individuals or habitat, but would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

Wetlands, moist meadows, and riparian habitats support the majority of the Forest sensitive plant species, 20. Only one of these taxa is rated as low vulnerability; the remainder are rated high (9 species) and medium vulnerability (10). Seven species in this group are represented on the Forest by a single occurrence; six taxa with fewer than 10 individual plants are documented. High vulnerability reflects a low number of sites and total plants, and small total size of occupied sites. Exposure to threats include alteration of hydrologic regime, environmental change, gopher disturbance, invasive plants, livestock grazing and trampling, plant collection, recreation use, road building, timber harvest activities, and windthrow (trees uprooted or broken by wind).

Local data indicate that current habitat trends are mixed with 43 wetland, moist meadow, or riparian sites trending downward in habitat effectiveness. Population trends are mixed with seven species indicating declining trends, nine are static, and eight have improving trends (the remaining three have no indication). The no-action alternative would maintain existing conditions and trends, vulnerabilities, and risks to these sensitive species. In particular, the nine highly vulnerable species are at risk of loss of sustainability. Conservation measures in current direction do not focus on essential habitat components and critical life history events that support development of sustainable populations and maintenance of high habitat effectiveness nor do they consider climate change as an additional environmental stressor. On the other hand, action alternatives that promote conservation goals to maintain or enhance existing populations are mediated by application of plan components. These include protective standards and guidelines as well as implementation of plant monitoring that targets population and habitat conditions and trends.

*Threats and Risks to Viability*

**Alteration of hydrologic regime**

Most of these sensitive plant occurrences are found in wetlands, moist meadows, and riparian habitats where this habitat element frames conservation concerns. This threat includes activities that affect the amount, timing, or quality of water maintaining sensitive plant habitat within this group, including maintenance of ecosystem services from beavers. The risk rating is related to the exposure of plant sites to potential change. This is assessed as the proportion of the total occupied habitat of each species that occurs within wetland or riparian ecosystems (L 0 to 33 percent, M 34 to 67 percent, H 68 to 100 percent). Risks associated with this threat are high for 19 species and medium for the remaining one. However, plan components proposed for all but the no-action alternative are expected to maintain habitat effectiveness for the species in this group.

**Environmental change**

This threat is used to qualitatively summarize the affects to the environment supporting sensitive plant species. In this habitat group, discussion focus is on climate change and fire regime shifts. This habitat group is a top priority when considering climate change effects and mitigation measures in project planning and implementation. In addition, climate change may lead to more frequent or higher severity fires within these habitats. Plan alternatives that promote landscape-scale restoration of sustainable vegetation types within historic and future ranges of variation would also provide habitat capable of supporting sensitive species populations. Restoration of the historic fire regime and the use of fire as a tool in terrestrial ecosystems would inform recovery efforts in these habitats.

**Gopher disturbance**

See summary of effects section.

**Invasive plants**

See summary of effects section.

**Livestock grazing and trampling**

See summary of effects section. The species risk ratings were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives; nine species were rated as high risk, two were rated as medium risk, and nine as low risk; two of the high vulnerability species in this group are exposed to excessive risk from livestock grazing and trampling. The risk from this threat is a contributing factor in determination of the conservation outcome for species in this habitat group. The action alternatives address this risk with plan components, standards and guidelines to contribute to species viability.

**Plant collecting**

See summary of effects section. In addition, risks associated with unauthorized plant collection have been identified for two species in this rare plant habitat group. The risk is high for *Cypripedium parviflorum* and low for *Gaultheria hispidula*. There is little risk for the remaining 18 taxa, since they have not been identified as targets for collection.

**Recreational use**

This threat category principally includes recreational vehicle use. Ten species have been identified to occur in habitats that are favored for recreational development such as shorelines, or in meadows accessed by OHV users, or on cliffs in potential rock-climbing routes; in this habitat group, *Botrychium paradoxum*, *Botrychium pedunculosum*, *Dryopteris cristata*, *Geum rivale*, and *Ophioglossum pusillum* are exposed to risks of OHV use in meadows. The risk for these taxa is medium to low in management areas with non-wilderness recreation emphases. The risk from OHV incursions into occupied habitat has recently declined to a low level with the completion of the Colville National Forest Travel Management Subpart A analysis; OHV use in vulnerable habitat was restricted.

Establishing trails and camping areas in locations that avoid populations of these 20 sensitive species would reduce risk and contribute to the sustainability of these taxa. The proposed conservation goal is to maintain or enhance existing populations. Application of plan components, including protective standards and guidelines and implementation of monitoring that targets population and habitat conditions and trends, is mediated. Effectiveness monitoring and initiating further surveys in suitable habitat also support conservation goals. All action alternatives provide guidance and direction to accomplish these actions, while the no-action alternative lacks specific direction.

**Road building and maintenance**

Risks associated with road building and maintenance are related to direct effects of physical disturbance to sensitive plant populations. Risks for these 20 species are low for all alternatives because of the lower percent of species occurrences in roaded areas and the currently existing and proposed direction on maintenance of ecosystem integrity within the wetland-riparian habitat group. There are slightly lower risks in the proposed action and alternatives P and R, but the difference has no effect on the conservation outcome. Additionally, road density and location standards contribute to species viability by lowering risks from associated impacts. Nonetheless, monitoring high vulnerability species when road management activities may affect sites would inform continuing conservation measures.

**Timber harvest activities**

The risks associated with timber harvest activities include direct effects to plant populations from physical impacts as well as indirect effects from environmental site changes due to light, moisture, or soil property alterations related to the treatments.

Potential exposure to this threat is low for this suite of species. Total effects are reduced by common plan components that maintain and promote ecosystem integrity, process, and function across the alternatives. All alternatives support sensitive species sustainability outcomes for this particular threat.

**Windthrow**

Since the majority of the Forest sensitive species are found in wetland or riparian habitats, a windthrow (trees uprooted or broken by wind) risk to existing sites and habitats has been identified. The risk results from the interaction of site factors, extreme weather events, and the ability of a tree to withstand strong winds without breakage or blowdown, including rooting habit and disease occurrence. Where this threat negatively affects existing sensitive species populations or affects habitat effectiveness, it is associated with sites in conifer- or hardwood-dominated riparian stands. However, if blowdown occurs at the edge of wetland habitats, it is generally an addition to habitat diversity. The windthrow threat is generally a low risk except for sites supporting *Botrychium lineare* and *B. crenulatum* where it is elevated to a medium level because of past events. In addition, the interaction of this threat alone with vulnerability ratings implies different outcomes for the two *Botrychiums* and it reinforces the conservation risk associated with a single, chance event affecting a lone site supporting a small population (*B. lineare*). While the alternatives that address ecosystem integrity and resilience with landscape level restoration goals can be judged to provide less risk for this threat, the species risk ratings were unchanged for the set of alternatives and were evaluated as a single factor common to all alternatives.

## Cumulative Effects (Common to all Alternatives)

Cumulative effects include the past, present, and reasonably foreseeable future activities that contribute to TES plant species viability. Resource management plans for other Federal, State, and tribal lands adjacent to the Colville National Forest include provisions for the protection and management of rare plant resources. The cumulative effect of adjacent lands management would not change any of the direct and indirect effects because management direction supports rare plant viability. While sensitive species lists may differ in details because of different agency criteria and agency habitat ownership, the state lists and state ranks are developed and maintained by the Washington Natural Heritage Program in collaboration with public agency, university, and private cooperators with botanical interests. Resource management projects focused on restoration of riparian and terrestrial resources associated with the Vision 2020 Project are assumed to follow management direction that would contribute to the viability of TES plant species and would not contribute to additional cumulative effects. The Pend Oreille PUD relicensing would not contribute to further effects and would implement conservation measures as needed to renew hydroelectric licenses. Allotment Management Plans would be managed to standard and would not contribute to further cumulative effects.

# Climate Change

This climate change discussion compiles and synthesizes scientific information on past and projected trends in regional climate and climate-related impacts to National Forest System lands. It also identifies possible management options to reduce ecosystem vulnerability to climate change and to increase ecosystem resilience to both climate and non-climate stressors.

## Background on Climate Change

Warming of the climate system is evident from observation of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level (IPCC 2014). Climate change is expected to profoundly alter vegetation structure and composition, terrestrial ecosystem processes, and the delivery of important ecosystem services over the next century. Since 1750, atmospheric carbon dioxide ($CO_2$) concentrations have increased from 280 to over 390 parts per million (ppm) and are expected to continue rising, reaching 450 to 875 ppm by 2100 (Peterson et al. 2014). The scientific community generally agrees that substantial warming of Earth's surface (2.0 to 4.5 °C) will accompany the increasing concentration of greenhouse gases in the atmosphere. Carbon dioxide ($CO_2$) is a prominent greenhouse gas (IPCC 2014).

Terrestrial ecosystems strongly influence the global carbon cycle and combined with oceans, are estimated to absorb about half of the carbon dioxide ($CO_2$) currently being released by human activities (Dilling et al. 2003). Simulated global patterns of carbon flux suggest that western U.S. forests are a carbon sink (Potter and Klooster 1999). Temperate forest ecosystems contain a significant amount of soil carbon (Rasmussen 2006) and tree-based carbon (Hurteau et al. 2008). These carbon stocks are significant resources that prevent additional significant carbon inputs into the global carbon cycle and provide a mechanism for carbon storage from natural and anthropogenic sources.

## Biogeographical Setting and Natural Resources

The 1.1-million-acre Colville National Forest in northeastern Washington is bordered to the north by British Columbia, to the west by the Okanogan National Forest, to the east by the Idaho Panhandle National Forests, and to the south by a portion of the Colville Confederated Tribes Indian Reservation. The Forest has three ranger districts: Republic, Newport-Sullivan Lake, and Three Rivers. The Forest Supervisor's office is located in Colville, Washington (Gaines et al. 2012).

Northeastern Washington is geologically complex and includes the Columbia Basin and the Okanogan Highlands, which function as a transition zone between the Cascade and the Rocky Mountain Ranges. Between one-third and one-half of the Forest was burned during the 1920s and 1930s, thus the current forest is relatively young. Federally listed species include the endangered woodland caribou (*Rangifer tarandus*), threatened grizzly bear (*Ursus arctos*), and Canada lynx (*Lynx canadensis*). There are currently no federally listed plants on the Colville; however, the moonwort (*Botrychium lineare* W.H. Wagner) was determined to be warranted but precluded (Gaines et al. 2012).

## Carbon Stewardship

The management of forest and ecosystem carbon is an important responsibility of land management agencies. This is not to imply that maximizing carbon storage should be the most important or overriding purpose of land management. Land managers and their stakeholders should determine the state of the carbon resource, where carbon stewardship fits in the goals of resilient ecosystems, and how carbon management might be blended with other ecosystem services. Carbon management is complex, maximization of carbon storage is not necessary the best management strategy. Carbon stewardship needs to consider ecosystem function and risk of disturbance to carbon (i.e., wildfire) (Hurteau et al. 2009).

Forest carbon stewardship is best described through an expression of directives. Management to maximize carbon storage or alter carbon storage in an ecosystem needs to take place in context with other natural processes as well as land management goals and objectives. The below carbon stewardship directives are intended to provide considerations for integrating carbon management with planning and implementation processes. The processes are attempting to adapt forests to the impacts of a changing climate, increased disturbance cycles, 100 years of fire suppression in fire-adapted ecosystems, and

increasing environmental pollution load. These preliminary forest carbon stewardship directives are intended to be refined, updated, and integrated based on field experience and best available science as it continues to emerge.

Emphasize ecosystem function and resilience first. Carbon sequestration capacity depends on sustaining and enhancing ecosystem function to maintain resilient forests adapted to changing climate and other conditions.

Recognize carbon sequestration as one of many ecosystem services. Carbon sequestration is one of the many benefits provided by forests, grasslands, and forest products, now and in the future. Carbon sequestration should be considered in context with other ecosystem services.

Consider system dynamics and scale in decision making. Evaluate carbon sequestration and cycling at landscape scales over long time frames. Explicitly consider uncertainties and assumptions in evaluating carbon sequestration consequences of ecosystem stewardship options.

Use the best information and methods to make decisions concerning carbon stewardship. Base carbon stewardship and policy decisions on the best available science based knowledge and information about system response and carbon cycling in ecosystems and wood products. Use this information wisely by dealing directly with uncertainties, risks, opportunities, and tradeoffs through sound and transparent risk management practices.

Work for program integration and balance. Carbon stewardship and management is part of a balanced and comprehensive program of sustainable ecosystem management and response to ecosystems outside the historic range of variability. As such carbon stewardship has ecological, economic, and social implications and interactions with other Forest Service programs and strategies.

## Forest-level Predictions of Climate Change

Though the science of predicting potential climate change has been improving, currently there is no site-specific information available that would indicate the potential rate or direction of climate change at a level detailed enough to use for vegetation modeling or specific land management at the Forest or project level. Scientific research and historical data has allowed for the development of models at regional scale that develop general predictions of potential future scenarios over the long term. Analysis for specific years or specific areas on the Colville National Forest is not possible with current models or analysis.

## Regional Climate Change Overview

Atmospheric concentrations of carbon dioxide ($CO_2$) and other greenhouse gases have increased rapidly over the past century or more. Atmospheric $CO_2$ concentrations are expected to continue to rise for the foreseeable future, although future rates of increase may vary with changes in the global economy and the success or failure of international efforts to reduce or limit the growth of greenhouse gas emissions. Although atmospheric $CO_2$ concentrations are of concern primarily because of their potential to influence global temperatures (i.e., the “greenhouse effect”), higher $CO_2$ concentrations may also influence vegetation growth and water-use efficiency and are therefore linked more directly to forest ecosystem functioning and natural resource management. Other greenhouse gases affected by land management are methane ($CH_4$) and, to a much lesser extent, nitrous oxide ($N_2O$) emissions from motorized vehicles including heavy equipment (IPCC 2014).

Temperatures have been increasing in Washington State over the past century. In the last 100 years, temperatures have increased by about 1.5 °Fahrenheit (Mote 2003a). The warming trends have been strongest in the winter months and weakest in the autumn months. Precipitation has also been increasing

during the past century with the largest relative increases occurring during the spring in the eastern portion of the state (Mote 2003b).

The Climate Impacts Group at the University of Washington has projected future changes in climate of the Pacific Northwest based on climate projections produced for the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report. They predict that temperatures will raise an average of 0.5 °F per decade over the next century (Elsner et al. 2009), a potentially larger increase than experienced in the past 100 years. Predictions are for warming trends to be greater in the eastern part of the state. Precipitation projections for the region are more variable than temperature projections. In general, precipitation is predicted to increase in the winter and decrease in the summer (Mote et al. 2005a).

Winter temperatures play a large role in determining whether precipitation falls as snow or rain. Despite increases in precipitation in eastern Washington State, warming temperatures have led to decreases in snowpack. Mote (2003a) reported reductions of 30 to 60 percent in April 1 snowpack from 1920 through 2000 over much of Washington State. The largest decreases in snowpack have been at lower elevations (less than 5,900 feet). Projected temperature increases for the coming century are expected to increase the proportion of winter precipitation falling as rain, increase the frequency of winter flooding, reduce snowpack, increase winter streamflow, result in earlier peak flows, and decrease late spring and summer flows (Hamlet et al. 2007; Hamlet and Lettenmaier 1999). The snowpack in the Cascades is projected to decrease by 44 percent by 2020 and by 58 percent by 2040 relative to the recent past. Peak runoff is expected to occur 4 to 6 weeks earlier (Climate Change Impacts Group 2004), while reduced summer streamflows will be more common and widespread (Miles et al. 2000; Snover et al. 2003; Stewart et al. 2004). April 1 snow water equivalent (SWE) is projected to decrease by an average of 27 to 29 percent across the state by the 2020s, 37 to 44 percent by the 2040s, and 53 to 65 percent by the 2080s (Elsner et al. 2009). SWE on April 1 is an important metric for evaluating snowpack changes because in the PNW, the water stored in the snowpack on April 1 is strongly correlated with summer water supply. The reduction of snowpack in the regions of highest elevation is projected to be less significant. There is no discussion of uncertainty or confidence intervals in the modeling methodology presented in the above references.

### Baseline Climate Data

Temperatures increased across the region from 1895 to 2011, with a regionally averaged warming of about 1.3 °F (Kunkel et al. 2013). While precipitation has generally increased, trends are small as compared to natural variability. Both increasing and decreasing trends are observed among various locations, seasons, and time periods of analysis. Studies of observed changes in extreme precipitation use different time periods and definitions of “extreme,” but none find statistically significant changes in the Northwest (Groisman et al. 2004). These and other climate trends include contributions from both human influences (chiefly heat-trapping gas emissions) and natural climate variability, and consequently are not projected to be uniform or smooth across the landscape or through time.

As a result of changes in long-term average trends, some conditions/events we now consider to be extreme will occur more frequently or with greater magnitude, while others will occur less frequently (e.g., more unusually warm periods and fewer cold spells). In many cases, changes in the frequency and magnitude of extreme events (droughts, severe fires, etc.) will have the most significant and long-lasting consequences for land and resource management.

### Projected Climate Trends

The climate observations and projections reported here are long-term trends in average conditions. Climate has varied and will continue to vary, from year-to-year and decade-to-decade around the long-term trend. The effects of longer-term climate trends may be either amplified or moderated by climate

variability resulting from the shorter-term El Niño Southern Oscillation and the Pacific Decadal Oscillation.

The Pacific Northwest is projected to be within a range of an 11 percent decrease to a 12 percent increase for 2030 to 2059 and a 10 percent decrease to an 18 percent increase for 2070 to 2099 in annual precipitation (Mote and Salthe 2010). For every season, some models project decreases and some project increases (Kunkel et al. 2013), yet one aspect of seasonal changes in precipitation is largely consistent across climate models. For scenarios of continued growth in global heat-trapping gas emissions, summer precipitation is projected to decrease by as much as 30 percent by the end of the century (Kunkel et al. 2013; Mote and Salthe 2010). Northwestern summers are presently dry and although a 10 percent reduction (the average projected change for summer) is a small amount of precipitation, unusually dry summers have many noticeable consequences, including low streamflow and greater extent of wildfires due to lower fuel moisture levels throughout the region (Littell et al. 2010). Projected temperature increases are large relative to natural variability; the relatively small projected changes in precipitation are likely to be masked by natural variability for much of the century (Deser et al. 2012).

### Description of Observed and Projected Changes

Climate models are unanimous in projecting increasing average annual temperatures over the coming decades in the Pacific Northwest. The average of multiple climate model projects predicts annual temperatures will increase 2.2 °F by the 2020s and 3.5 °F by the mid-21st century, compared to the average for 1970 to 1999. Temperature increases are projected to occur during all seasons, with the greatest increases projected in summer. Beyond mid-century, model projections diverge substantially in response to differences among scenarios in assumed emissions, with increases in average annual temperature ranging from 5.9 °F to 9.7 °F in the Pacific Northwest by the end of the 21st century.

Projected changes in Pacific Northwest precipitation are more variable among models, but generally suggest no substantial change in the average annual amount of precipitation from the variability experienced during the 20th century. Given the variability in results among models, projections of precipitation are considered less certain than temperature projections. Most of the models project decreases in summer precipitation, increases in winter, and little change in the annual mean.

Observed regional warming has been linked to changes in the timing and amount of water availability in basins with significant snowmelt contributions to streamflow. Since around 1950, area-averaged snowpack on April 1 in the Cascade Mountains decreased about 20 percent (Mote 2006; Pierce et al. 2008), spring snowmelt occurred 0 to 30 days earlier depending on location, late winter/early spring streamflow increases ranged from 0 percent to greater than 20 percent as a fraction of annual flow (Hidalgo et al. 2009; Reclamation, 2011) and summer flow decreased 0 percent to 15 percent as a fraction of annual flow (Stewart et al. 2005), with exceptions in smaller areas and shorter time periods (Mote et al. 2008). It is unknown if snowmelt predictions for the Cascade Mountains reflect potential conditions for the mountains of the Colville National Forest.

Hydrologic response to climate change will depend upon the dominant form of precipitation in a particular watershed, as well as other local characteristics including elevation, aspect, geology, vegetation, and land use (Mote, P.W. 2003a; Safeeq et al. 2013). The largest responses are expected to occur in basins with significant snow accumulation, where warming increases winter flows and advances the timing of spring melt (Hidalgo et al. 2009; Hamlet and Lettenmaier 2005). By 2050, snowmelt is projected to shift three to four weeks earlier than the 20th century average, and summer flows are projected to be substantially lower, even for predicted greenhouse gas emissions scenarios that assumes substantial emissions reductions (Elsner et al. 2009). Basins with a significant groundwater component may be less responsive to climate change than indicated by other research literature (Tague et al. 2008).

Changes in river-related flood risk depends on many factors, but warming is projected to increase flood risk the most in mixed basins (those with both winter rainfall and late spring snowmelt-related runoff peaks) and remain largely unchanged in snow-dominant basins; 27 regional climate models project increases of 0 percent to 20 percent in extreme daily precipitation, depending on location and definition of "extreme" (for example, annual wettest day). Averaged over the region, the number of days with more than 1 inch of precipitation is projected to increase 13 percent in 2041 to 2070 compared with 1971 to 2000 under a scenario that assumes a continuation of current rising emissions trends, though these projections are not consistent across models (Wehner, M.F., 2013). This increase in heavy downpours could increase flood risk in mixed rain-snow and rain-dominant basins.

## Climate Change in Northeastern Washington

Increasing temperatures and a greater annual variation in precipitation in northeastern Washington are predicted from expected increases in anthropogenic $CO_2$. The Pacific Northwest has warmed, on average, 1.3 °F between 1895 and 2011, with statistically significant warming occurring in all seasons except for spring. All but five of the years from 1980 to 2011 were warmer than the 1901 to 1960 average. The trend is for continued future warming. The frost-free season (and the associated growing season) has lengthened by 35 days from 1895 to 2011 in the Pacific Northwest. (Snover et al. 2013, Parks 2010) Temperature records show significant seasonal and annual decreases in the number of frost days and changes in spring minimum temperatures. Warmer spring temperatures coupled with increases in mean and variance of spring precipitation correspond strongly to earlier snowmelt out, an increased number of snow-free days, and observed changes in stream flow timing and discharge (Pederson et al. 2011).

The variation in precipitation will have effects on water release timing, length of the growing season, and soil moisture conditions. Predicted increases in early season snowmelt/late season precipitation (Miller et al. 2003) (which will increase fuel loading due to greater understory growth) and hotter, drier summers have the high potential to increase wildfire activity and associated carbon emissions from forested areas (Miller and Urban 1999; Kim 2005). Research shows increases in understory biomass with amplified pollution and climate change, suggesting future increases in fire severity and fire size (Hurteau and North 2009). Climate change modelers agree that climate will become more extreme as oscillations between wet and drought conditions become more common. It is suggested that land managers not recreate a fixed pre-settlement condition, but strive for forest conditions that are more resilient and resistant to uncharacteristic disturbance impacts (North et al. 2009 and Millar et al. 2008).

There has been a general decline in snowpack; Cascade spring snowpack has declined 23 percent between 1930 and 2007. There is predicted a relatively steady loss rate of snowpack at 2.0 percent per decade, yielding a loss of 16 percent from 1930 to 2007. (Stoelinga et al. 2010) Over the past four decades, records show a tendency toward decreased snowpack with peak snow water equivalent arriving and melting out earlier. The declining snowpack will result in earlier stream flow timing, small increase in annual stream flow, increasing winter stream flow, and declining summer stream flow (Snover et al. 2013).

## Observed Trends in Forest Carbon

Analyses of trends in North American terrestrial ecosystem productivity during the late 20th century based on satellite imagery generally confirm a net carbon sink for the North American continent, although there is considerable year-to-year and geographical variation (Potter et al. 2007; Running et al. 2004; Nemani et al. 2003; Potter et al. 2003; Slayback et al. 2003; Hicke et al. 2002; Myneni et al. 2001). The inter-annual and spatial variability of productivity are commonly attributed to anomalies in seasonal temperature and precipitation, and ecosystem disturbances such as drought, fire, and insect outbreaks

(Potter et al. 2008a; Piao et al. 2007; Potter et al. 2007; Boisvenue and Running 2006; Angert et al. 2005; Goetz et al. 2005; Running et al. 2004; Nemai et al. 2003; Nemani et al. 2002).

Recent estimates find that the terrestrial ecosystems of the United States remove approximately 505 million metric tons (Mt) of carbon per year (± 50 percent) from the atmosphere and store it as plant material and soil organic matter (King et al. 2007; Pacala et al. 2007). Estimates of the net sink from forests, forest soils and wood products range from 203 to 293 Mt C per year, or roughly half of the total sink. Wood products account for approximately 6 to 12 percent (30 to 57 Mt per year) of the total U.S. carbon sink (U.S. EPA 2008; Birdsey et al. 2007) Forests and wood products offset approximately 10 to 20 percent of U.S. fossil fuel emissions (U.S. EPA 2008; Pacala et al. 2007).

The reservoir of stored carbon in U.S. forests is approximately 42,700 to 66,600 Mt (U.S. EPA 2008; Birdsey et al. 2007). Public forestlands contain approximately 37 percent of this carbon reservoir. National Forests store an estimated 8,900 Mt of carbon, or from 13 to 21 percent of all forest carbon of the United States. (Smith and Heath 2004) Carbon stocks on the Colville National Forest contribute approximately 0.14 percent to 0.21 percent of the total U.S. forest carbon reservoir on public lands (USDA Forest Service 2015). Trends in carbon stocks and flux on the Colville National Forest can be inferred from 20th century trends in forest age and structure classes. Recent scientific literature documents the general pattern of changes in carbon stocks and net ecosystem productivity. On the Colville National Forest, the distribution of forest age and structure classes has changed substantially since the early 20th century. Intermediate age classes (40 to 100 years of age) have increased in area, while the amount of young stands has decreased. In most forest types, the abundance of older, late successional stands has declined. The cause of these changes varies by forest type and geographic location, but the most wide-spread agents of change are root disease, white pine blister rust, timber harvest, and the substantial decline in acres burned since 1940. A significant portion of the increase in intermediate age classes is the result of forest re-growth following large stand-replacing fires in the early 20th centuries.

Total carbon stocks decline as a result of disturbance and then increase, rapidly during intermediate years and then at a declining rate, over time until another significant disturbance (regeneration timber harvest or tree mortality resulting from drought, fire, insects, disease or other causes) kills large numbers of trees. Carbon flux and net ecosystem productivity are lowest, and usually negative (a carbon source to the atmosphere) in young stands (0 to 30 years) following disturbance because carbon emissions from decay of dead biomass exceed the amount of carbon removed from the atmosphere by photosynthesis within the stand. As the stand develops, net ecosystem productivity increases and the stand becomes a carbon sink. Net ecosystem productivity and carbon sink strength generally peak at the intermediate stage of stand development, then decline with age but often remain positive (Canadell et al. 2007; Pregitzer and Euskirchen 2004).

Hessburg et al. (2000) constructed historical and current vegetation maps from 1932 to 1966 and 1981 to 1993 aerial photographs, respectively for sample sub-basins within the interior Columbia River basin. Comparing historic and current vegetation maps, they found that forests of northeastern Washington, northern Idaho, and northwestern Montana experienced a significant increase in area of intermediate structural classes. Stand initiation structures (new forests) declined significantly due to fire exclusion, despite timber harvest activity. However, they noted that timber harvest activities reduced the abundance of medium- and large-sized trees distributed in other forest structures as remnants of stand-replacing fires.

Net ecosystem productivity is defined as gross primary productivity (GPP) minus ecosystem respiration (ER) (Chapin et al. 2006). It reflects the balance between (1) absorbing $CO_2$ from the atmosphere through photosynthesis (GPP) and (2) the release of carbon into the atmosphere through respiration by live plants, decomposition of dead organic matter, and burning of biomass (ER). When net ecosystem productivity is

positive, carbon accumulates in biomass. Ecosystems with positive net ecosystem productivity are referred to as a carbon sink. When net ecosystem productivity is negative, ecosystems emit more carbon than they absorb. Ecosystem with negative net ecosystem productivity is referred to as a carbon source.

The following information is based on the publication Climate Change Advisor's Office, Office of the Chief, 2014, Baseline Assessment of Forest Carbon Stocks Including Harvested Wood Products – USDA Forest Service, Pacific Northwest Region. It is stated in the methodology that at scales of the individual national forest level, uncertainty can exceed 25 percent and at the individual carbon pool level (seven separate pools were modeled) that uncertainty can exceed 100 percent. The estimates of carbon pools and fluxes come from a draft pre-decisional document

As of 2012, the Colville National Forest stores approximately 93.5 teragrams (Tg) of carbon. A teragram is one trillion grams, a unit of mass equal to $10^{12}$ grams. A gram is equal to the weight of a paperclip; 454 grams makes a pound. From 1990 to 2012, the modeled number varies from 90 to 94 Tg.

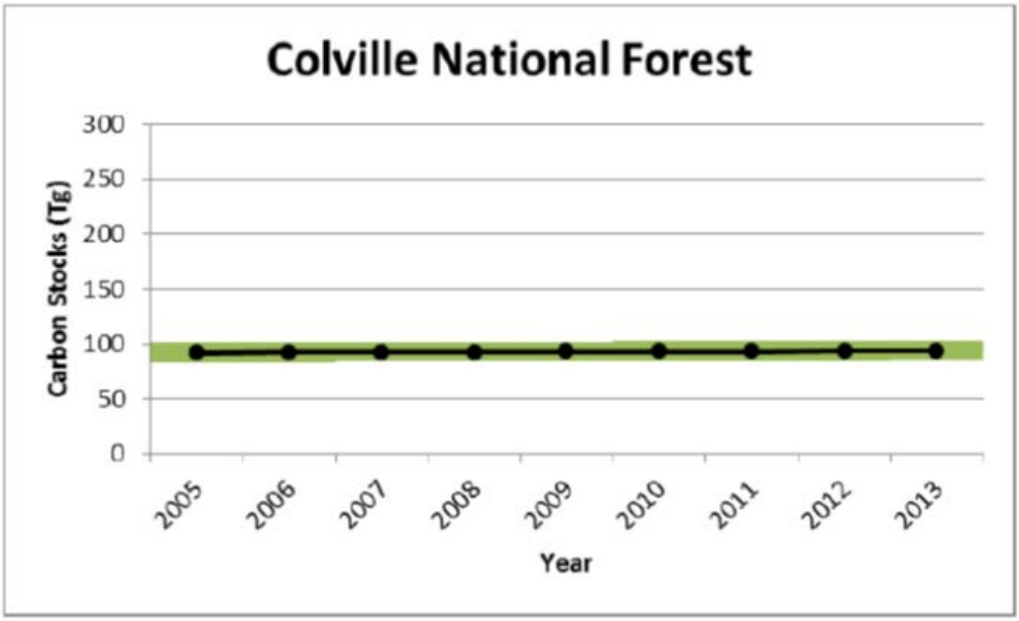


**Figure 9. Total forest ecosystem carbon stocks and uncertainty estimates (95 percent confidence level)**

The average density of forest carbon is approximately 200 megagrams of carbon per hectare (Mg C/ha) (approximately 200 U.S. tons) on the Colville National Forest (USDA Forest Service 2015).

Projected trends in forest carbon stocks and flux estimates indicate that currently Colville National Forest is a net carbon sink, absorbing approximately 0.2 Tg of carbon a year. In the early 1990s, it is modeled that the Colville was a net carbon source releasing approximately 0.7 Tg of carbon a year (USDA Forest Service 2015). All these modeled numbers are within the uncertainty intervals suggesting that in a given year the Colville can be a net source or sink for carbon.

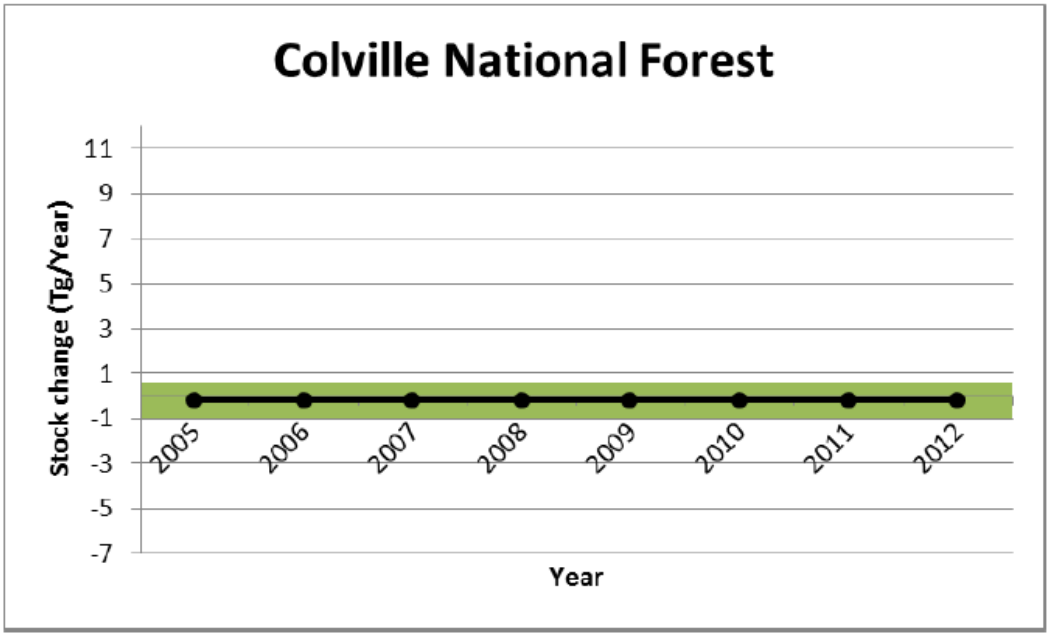


**Figure 10. Carbon stock flux and uncertainty estimates (95 percent confidence level)**

Harvested wood products (HWP) are products made from wood including lumber, panels, paper, paperboard, and wood used for fuel (Skog 2008). HWP fraction of the carbon pool is small compared to ecosystem carbon (Butler et al. 2014). In the context of total forest carbon, including both ecosystem carbon and carbon from harvested wood products, it is estimated that HWP carbon stocks represent 5.25 percent of total forest carbon storage associated with national forest in the Pacific Northwest Region in 2012. This is 5 times less than the uncertainty in the national level modeling and up to 20 times less than the uncertainty in modeling specific carbon pools (USDA Forest Service 2015). At the national level, based on EPA's total U.S. HWP 2005 stock estimate of 2,354 Tg of carbon (U.S. EPA 2012), the Pacific Northwest Region HWP carbon stocks represent 5.8 percent of total HWP carbon stocks (Butler et al. 2014). Recent literature suggestions that in the Pacific Northwest Region of the Forest Service the decay of HWP harvested from 1909 to 2012 now exceeds additions to the HWP carbon pool from products harvested from National Forest System lands (Butler et al. 2014).

## Environmental Consequences

For applicable resources, the possible environmental consequences associated with climate change are discussed in this section.

### Resource Vulnerabilities on the Colville National Forest

The following identified vulnerabilities were developed during a two-day workshop of Forest Service mangers and scientists. These managers and scientists reviewed current climate change science and identified resources vulnerable to expected climate change (Gaines et al. 2012).

Based on the scientific understanding developed on the first day of the two-day climate change workshop, participants were asked to identify and rank resources (as high, moderate, or low) in relation to perceived vulnerability to climate change. Vulnerability was defined as the extent to which a natural or social system is susceptible to sustained damage from weather extremes, climate variability, and change (and other interactive stressors) (Binder et al. 2009). Vulnerabilities were categorized into those related to the management of vegetation and habitats, and those related to aquatics and infrastructure. The

vulnerabilities related to vegetation and habitat management included two general themes: the conservation of biodiversity, and the restoration of resilient forests and disturbance regimes. The vulnerabilities related to aquatic and infrastructure resources included water quality and quantity, the risk to roads and other facilities from changes to hydrologic regimes, and at-risk aquatic species and habitats (Gaines et al. 2012).

**Table 31. Resource vulnerabilities on the Colville National Forest**

| Resource Vulnerability Area | Ranking | Vulnerability |
|---|---|---|
| **Vegetation and habitat** | High | • Plant migration could reduce the availability of white bark pine and shift the location of other forest types reducing the availability of alpine habitats (such as expansion of plant populations to higher elevations due to changes in snowpack levels and temperature changes).<br>• Habitat specialists (caribou, lynx, and wolverine denning habitat) will have the most difficult time adjusting.<br>• Riparian and wetland habitats may be particularly vulnerable.<br>• Habitat connectivity will be reduced for some species and may be most detrimental for low-mobility habitat specialists.<br>• Dry forest stands with high tree densities and fuel loads become increasingly susceptible to fire, insects, disease, and drought.<br>• Larger and more frequent disturbances could make it difficult for forests/habitats to recover and cause them to be more susceptible to invasive species.<br>• Past management for timber production and fire exclusion has made old forests more susceptible to fire, including severe fire.<br>• Species with narrow ecological amplitude and endemics may be at high risk for local extinction. |
| | **Moderate** | • Elk and deer may be vulnerable to increased diseases.<br>• Species on the edges of their ranges or with limited mobility may be at risk for local extinction. Reevaluations may be necessary to provide for fine filter provisions to maintain species viability. |
| | **Low** | • Habitat generalists (grizzly bear, wolves, red squirrel, black bear) that are more mobile may fair better.<br>• Increased carbon dioxide might increase growth of already overstocked stands. |
| **Aquatic and infrastructure** | **High** | • Municipal/agricultural watersheds may lose the capacity to deliver water at current levels.<br>• Reduced cold water in streams could reduce fish habitat availability and alter the timing of spawning or the ability of fish to spawn.<br>• Roads and other facilities could be threatened by increased frequency of extreme hydrologic events such as floods and debris flows.<br>• Some aquatic species could become more susceptible to disease and changes in stream productivity.<br>• Water availability for ecosystem processes (e.g., soil water for plant growth) could be reduced or shifted seasonally. |
| | **Moderate** | • Ski area operation could be affected by reduced winter snowpack.<br>• Riparian areas could become harder to manage as stream networks become smaller and less connected (loss of perennial headwater streams).<br>• Grazing allotments may be changed owing to changes in water availability and forage productivity. |
| | **Low** | • Sustaining tribal use areas may become more difficult as resources become scarcer.<br>• Roads may require more maintenance owing to increased use. Facilities may receive greater use (and wear) from longer recreational seasons. |

### Management Strategies for the Adaptation to Climate Change

In 2008, the U.S. Climate Change Science Program produced a report: Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources. One chapter was developed by U.S. Forest Resource research scientists and other outside scientists directly concerning the current science available on adaptation responses for National Forest Systems lands (Joyce et al. 2008).

Below is a summary of specific adaptation responses that have potential to allow the Colville National Forest to create resilient landscapes and assist in the management of natural systems within the dynamics of climate change. This summary is in line with the Forest Carbon Principles presented above: developing resilience, promoting diversity and function in ecosystems, and using the best scientific knowledge to understand systems and manage them for the long term.

- Reducing, minimizing, or eliminating the potential for introduction, establishment, spread and impact of invasive species across all landscapes and ownerships.
- Under a changing climate, landscape fragmentation may exacerbate or cause unexpected changes in species and ecosystems.
- Primary premise for adaptive approaches is that change, novelty, uncertainty, and uniqueness of individual situations are expected to define the planning backdrop of the future. No single approach would fit all situations.
- The Forest Service needs to implement a variety of management approaches to reduce the impact of existing stressors on National Forest System lands.
- Resistance practices include thinning and fuels abatement treatments at the landscape scale to reduce crown fire potential and risk of insect epidemic, maintaining existing fuel-breaks.
- Maintaining prior species may require significant extra and repeated efforts to supply needed nutrients and water, remove competing understory, fertilize young plantations, develop a cover species, thin, and prune.

While there may be specific questions that research scientists need additional data and work to answer, the Forest Science and related universities and institutions have a robust base of scientific research and management strategies that can respond to the changing conditions of climate change: the direct, indirect, and cumulative effects of variations in temperature and water availability that would occur in the coming decades.

## Summary

The modelled predictions of climate change in the future are for increasing temperatures, changes in how precipitation occurs across the landscape (less snow persistence), higher stream peak flows, and increases in summer moisture stress. Maximizing carbon stock retention and conservation of existing carbon stocks while restoring forest stands to durable, natural stand structures should be goals of forest management, in order to increase and retain long-term carbon stocks (Beedlow et al. 2004). Current and future management of National Forest System lands can use adaptation principles and the base of scientific research to manage the land and resources of the Colville National Forest for the benefit of the people of the United States and ensure the Forest is conserved for multiple uses by future generations.

The effects analysis for each resource will consider climate change in their effects analysis based on this summary.

# Fire

Fire managers have been faced with increasing costs, urban development, and unprecedented fire behavior. Decades of government policy directed at extinguishing every fire on public lands have contributed to the disruption of natural fire processes. This section summarizes effects related to fire from the specialist report and based on indicators of fire regime condition class and management options in the wildland-urban interface (Curtis 2015).

## Introduction/Background

### National Fire Policy and Wildland-urban Interface

The current Federal Wildland Fire Management Policy was signed in 1995 and updated in 2001. The Federal Wildland Fire Management Policy guides the philosophy, direction, and implementation of fire management planning, activities, and projects on Federal lands. The policy helps ensure consistency, coordination, and integration of wildland fire management programs and related activities throughout the Federal government.

On August 8, 2000, the President directed the Secretaries of the Department of Agriculture and the Department of the Interior to prepare a report recommending how best to respond to that year's severe fires, reduce the impacts of those fires on rural communities, and ensure sufficient fire management resources in the future. On September 8, 2000, the President accepted their report, "Managing the Impacts of Wildfires on Communities and the Environment," which provided an overall framework for fire management and forest health programs (66 FR 751-777).

These recommendations initiated a number of policies including the National Fire Plan, the Healthy Forests Initiative (HFI), long-term stewardship contracting authority, and the Healthy Forests Restoration Act (HFRA). These policies led to the preparation of Community Wildfire Protection Plans (CWPPs) to define the wildland-urban interface (WUI) and to establish priorities for wildfire preparedness and hazardous fuels reduction work in these areas.

The wildland-urban interface, commonly referred to as WUI, exists where humans and infrastructure intermix with wildland fuels. There are 17 communities within 10 miles of the Colville National Forest boundary that have been identified both as communities at risk by County CWPPs and identified as "Urban Wildland Interface Communities with the Vicinity of Federal Lands That Are at High Risk from Wildfire" (Federal Register Vol. 66 No. 160). They include Addy, Chewelah, Colville, Curlew, Cusick, Danville, Ione, Kettle Falls, Laurier, Malo, Marcus, Metaline, Metaline Falls, Newport, Orient, Republic, and Usk. In addition, the County CWPPs also list communities at risk that are not included on the Federal Register. They include: Alladin, Arden, Barstow, Bluecreek, Boyds, Clayton, Daisy, Dalkena, Diamond Lake, Echo, Evans, Furport, Loon Lake, Marble, Northport, Onion Creek, Orin, Toroda, Valley, and Waitts. While the CWPP listed communities that are not included on the Federal Register list will not have treatments reported in the Forest Service Activity Tracking System (FACTS), projects on the forest will continue to benefit these communities by reducing wildfire risk along the forest boundary near these communities. The entirety of Ferry, Stevens, and Pend Oreille counties were analyzed and included in each county's CWPP.

# Affected Environment

## Fire History and Behavior

The Colville National Forest is grouped into five broad forest types. These groupings are based on potential vegetation and response to disturbance, particularly fire. All five types can be categorized as forested conifer systems, with elevation, aspect, and moisture determining the species.

Disturbance in general and fire in particular plays a critical role in shaping and maintaining forested ecosystems. The manner in which fire behaves in a system both historically and contemporarily can be described in terms of two key metrics: frequency and severity. Fire frequency is measured and reported here as mean fire return interval (MFRI). Both historic and current mean fire return intervals are noted in each description below. Historic, or natural fire return intervals and severity are used as a point of comparison as they represent the levels with which natural, functioning ecosystems develop and persist. For the purpose of this analysis, mean fire return interval refers to how often (on average) the vegetation type would have fire move across its entirety. For example, historically, fire burned across all dry Douglas-fir stands approximately every 40 years, and is noted as having a historic mean fire return interval of 40 years. Given current fire suppression and the rate of prescribed fire being used, it would take 188 years for fire to burn across all dry Douglas-fir stands, and is noted as having a current fire return interval of 188 years. It is important to note that the natural fire return interval and associated severity is quite different for each vegetation type. Table 32 summarizes the change in fire return intervals for each vegetation type:

**Table 32. Historic versus current fire return interval**

| Vegetation Type | Historic Fire Return Interval | Current Fire Return Interval |
|---|---|---|
| Dry Douglas-fir | 40 | 188 |
| Subalpine Fir/Lodgepole Pine | 225 | 225 |
| Mesic Mixed Conifer | 50-150 | 233 |
| Western Red Cedar/Western Hemlock | 200 | 200 |
| Spruce/Subalpine Fir | 150 | 218 |

The vegetation type's historic fire return interval is largely driven by the same environmental factors that determine dominant vegetation, namely climate, elevation, and soil type.

Across much of the lower elevations of the forest, sites are occupied by dry Douglas-fir stands which were historically characterized by frequent, low intensity fires. Within these stands, late forest structure was historically represented by both open canopy (less than 40 percent canopy cover) and closed canopy (greater than 40 percent canopy cover) large and very large trees. Historically, the dry Douglas-fir vegetation type would have supported 38 to 78 percent of the stands were classified as Late Development Open, with 1 to 32 percent classified as late development closed. Mid development open stands occurred across 2 to 8 percent of this vegetation type, and 4 to 13 percent was classified as mid development closed. These stand characteristics were developed and maintained by frequent surface fires in the mid-open and late-open structures that kill seedlings/saplings and prevented widespread closed canopy conditions. Surface fires in the limited mid development closed stands were historically rare, and given the surface fuel build up most fire in the closed stands burned with mixed severity, which would transition the stands to mid-development open. With regular fire return intervals, mid-open stands would transition to late-open stands. Late-open conditions would continue while frequent fire intervals persisted. Missing fire returns would allow for establishment of younger cohorts of understory trees and transition stands to a late-closed condition. Late-closed conditions in the dry Douglas-fir type are important features on the

landscape, however widespread closed canopy systems are prone to large-scale stand-replacing fire events that were not historically widespread in this system and are detrimental to ecosystem health and integrity. The historic mean fire return interval in this forest type was approximately 40 years and in the northern ranges younger age/size classes may be more extensive owing to larger and more frequent mixed or stand-replacement fires. This type is extensive on the Colville National Forest, but has not been captured adequately in previous mapping projects (LANDFIRE Biophysical Setting Model Descriptions)

This forest type has a current mean fire return interval of 188 years, meaning that fire is not currently playing its natural role in this system. This increase in fire return interval has led to unnatural amounts of mid-development closed stands across the vegetation type putting the system at risk for uncharacteristically severe fire events.

At higher elevations along the Kettle Crest, subalpine fir/lodgepole pine stands are the dominant vegetation. These subalpine fir/lodgepole stands were historically characterized by a long fire return interval (over 225 years) and historically supported primarily stand-replacing fire events. Within subalpine fir/lodgepole pine stands, historic conditions had only 2 percent of this vegetation type in late development closed canopy conditions, and typically did not support late development open canopy stands, due to high severity fire being the dominant disturbance regime. Historically, 33 to 53 percent of the stands would have been in mid development closed canopy conditions, with 45 to 65 percent in early development. Mid and late forest structure in this vegetation type would persist until fire occurrence (naturally stand-replacing), and would revert to early development. The current mean fire return interval in this vegetation type is 225 years indicating that fire is currently occurring at natural levels.

East of the Columbia River at mid-elevation and higher, northern rocky mountain (mesic) mixed conifer stands dominated the landscape. This vegetation type naturally supported primarily mixed severity fire with a 50- to 150-year return interval creating a mosaic of mid and late development closed canopy stands and small, patchy open canopied stands. Open canopied stands would historically regrow into closed stands quickly (less than 30 years) due to recruitment and canopy infill, therefore, the location of open canopy conditions shifted across the landscape through time. Within these mixed conifer stands, late development open stands historically occurred across only 4 to 6 percent of this vegetation type, while 44 to 60 percent of the stands would have represented late development closed conditions. Mid development open was considered to be 1 to 3 percent, and 18 to 30 percent was classified as mid development closed. Early development stands accounted for 9 to 25 percent of the vegetation type. Fires were mostly mixed severity with a 50- to 150-year frequency. Current mean fire return interval is 233 years, indicating that fire levels are less frequent than historic levels and fire is not currently playing its natural role in shaping the landscape. .

Scattered through drainages east of the Kettle Crest, western red cedar/western hemlock stands were the dominant vegetation. Within western red cedar/western hemlock stands, historically 55 to 83 percent of stands were in late development closed conditions, with no late development open stands. High severity fire occurred approximately every 200 years, reverting late development stands to early development, which occupied 4 to 24 percent of vegetation type. Mid development closed stands occurred on 7 to 27 percent of the landscape. There was historically no mid development open stands. This forest type had longer fire return intervals, approximately 200 years, with high-severity fire. This forest type is still within range of its historic mean fire return interval indicating that fire is playing its natural role in shaping and maintaining this system.

Spruce/subalpine fir stands occupied drainages at higher elevations along the Kettle Crest, and in some limited areas of the Kaniksu Mountains. Spruce/subalpine fire stands historically had 29 to 57 percent of stands in the late development closed condition, with no late development open stands. Thirteen to 41 percent of the vegetation type was in mid development closed canopy conditions, and 14 to 46 percent

in early development. Replacement fire historically occurred every 150 years. The current mean fire return interval in this forest type is 218 years indicating that fire is occurring less frequently than necessary to shape and maintain this system.

Over a century of fire suppression practices have impacted the ability of fire to play its natural role across the Forest. Fire frequency and severity has been altered from historic condition in most vegetation types contributing to shifts in vegetative conditions outside the natural range of variation and in places creating conditions susceptible to uncharacteristic fire events.

On the Colville National Forest, fire season is generally June 1 to October 1. The potential for lightning is most likely during this period as temperatures begin to climb and relative humidity values are low. From 2000 to 2014, the majority (85 percent) of fire starts on the Forest were caused by lightning, with an average of 20 fire starts per year. The remaining fires (15 percent) were caused by equipment, smoking, campfires, arson, or miscellaneous causes. All fires on Colville National Forest land during this timeframe took place between the months of April and October. During this time, over 47,000 acres have burned on the Forest. Approximately 30 percent were unplanned ignitions.

### Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but it includes the influence of aboriginal burning (Agee 1993). Fire regimes are described in terms of fire frequency and severity. Coarse-scale definitions for natural fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001) and Hann et al. (2008). The five natural fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity of the fire on the dominant overstory vegetation. These five regimes are:

**Fire Regime I** – 0- to 35-year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

**Fire Regime II** – 0- to 35-year frequency and high (stand-replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);

**Fire Regime III** – 35- to 100+ year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

**Fire Regime IV** – 35- to 100+ year frequency and high (stand-replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced;

**Fire Regime V** – 200+ year frequency and high (stand-replacement) severity.

All fire regimes are represented across the forest, though Fire Regime V is present only in isolated patches. The following table shows the fire regime groups for each vegetation type on the Colville National Forest.

**Table 33. Fire regime groups by vegetation type for the Colville National Forest**

| Vegetation Type | Fire Regime Group | Historic Frequency | Historic Severity |
|---|---|---|---|
| Douglas-fir dry | **Fire Regime Group I** | 40 years | Surface |
| Subalpine fir / Lodgepole pine | **Fire Regime Group IV** | >225 years | Replacement |
| Northern Rocky Mountain Mixed Conifer | **Fire Regime Group III** | 50-150 years | Mixed-Severity |
| Western Redcedar / Western Hemlock | **Fire Regime Group V** | >200 years | Replacement |
| Spruce / Subalpine fir | **Fire Regime Group IV** | 150 years | Replacement |

Fire Regime Condition Class (FRCC) is a metric that quantifies how departed a system is from historical conditions in relation to fire, the role fire historically played in that system, and vegetative structure (Hann and Bunnell 2001, Hardy et al. 2001, Hann et al. 2008). FRCC is an estimate of the departure from the natural fire regime. FRCC assessments measure departure in two main components of ecosystems: (1) fire regime (fire frequency and severity) and (2) by comparing the abundances of each seral stage (by potential vegetation type) to historical amounts. There are three classes of FRCC, based on low (FRCC 1), moderate (FRCC 2), and high (FRCC3) departure from the central tendency of the natural fire regime structure (Hann and Bunnell 2001, Hardy et al. 2001, Han et al. 2004). FRCC 1 is considered to be within the historic range of fire regimes, while FRCC 2 and FRCC 3 are outside the range. While fire rates and severity play a role in determining FRCC, vegetation structure plays an equal role. Changes and manipulation of structural stages on the landscape through means other than fire (e.g., commercial harvest, mechanical fuels reduction, insect and disease outbreaks, etc.) play an equal role in determining FRCC.

In FRCC 1 (less than 33 percent departure), there is little to no departure from the historic range. Vegetation composition, structure, and fuels are similar to those of the historic regime and do not pre-dispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the historical fire regime behavior, severity, and patterns, being departed from historical frequencies by no more than one return interval.

In FRCC 2 (33 to 66 percent departure) vegetation composition, structure, and fuels have moderate departure from the historic regime and pre-dispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historical fire regime behaviors, severity, and patterns, being departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns (Hardy et al. 2001).

In FRCC 3 (greater than 66 percent departure) vegetation composition, structure, and fuels have high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historical fire regime behaviors, severity, and patterns. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns (Hann and Bunnell 2001, Hardy et al. 2001).

A Fire Regime Condition Class analysis of Forest lands was completed using the Fire Regime Condition Class Software Application. See Methodology under Environmental Consequences for a full description of model inputs, assumptions, and limitations.

Currently, much of the Colville National Forest has some degree of departure from historic conditions as a result of past fire and timber management. Because of these departed conditions, fire does not currently

play its historic role across much of the landscape, and as a result, the Colville is at risk of losing key ecosystem components such as soil quality, large trees, and habitat.

**Table 34. Current conditions by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | FRCC* | VCC** | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 48,6045 | 71 | 3 | 2 | 89% | 87% |
| Subalpine fir / Lodgepole pine | 1010452 – Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 35 | 1 | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 51 | 2 | 2 | 66% | 45% |
| Western Redcedar / Western Hemlock | 1010471 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest - Cedar Groves (5%) | 95,820 | 53 | 2 | 2 | 66% | 45% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 26 | 1 | 1 | 1% | 44% |

*FRCC = fire regime condition class
**VCC = vegetation condition class

# Need for Change

## Old Forest Management and Timber Production

In the revision of the Forest Plan, three broad-scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- Contemporary fire rates and severity are not in line with historic ranges for many vegetation types. In the Douglas-fir dry type, a lack of frequent, low severity fire and contemporary/historic

vegetation management has led to fuel accumulation and stand structure that is conducive to large, stand-replacing fire events that were not historically common. Likewise, a lack of mixed-severity and stand-replacing fire in systems that were historically maintained by them along with contemporary forest management practices has led to an imbalance of structure states. Projected impacts from climate change have the potential to interact with and increase uncharacteristic levels of disturbance. This elevates the importance of restoring landscape resiliency.

There is an additional concern for at-risk stands that contribute to late forest structure because these stands typically have heavy fuel accumulation and dense canopies, both of which increase potential for fire transmission and spread. While stand-replacing fire is not uncharacteristic in many of the vegetation types on the Forest, the potential for high severity fire in late forest structure is particularly concerning because the forest has considerably less old forest and associated habitat on the landscape than would have historically occurred. This lack of landscape redundancy in late forest structures means that even moderate acreage loss due to fire events would further exacerbate the imbalance of forest structures.

### Access

Three broad concerns drove the need to address road density:

1) current funding is not sufficient to properly maintain the existing road system at current operational maintenance levels,

2) the current road system is not aligned with current and future resource management objectives, and

3) the existing road management direction is confusing and difficult to follow because it is scattered throughout current Forest Plan (Colville National Forest Land and Resource Management Plan), Forest Plan amendments (Eastside Screens, Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions [INFISH, USDA Forest Service 1994c and 1995]), national-level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Agreement, the Interior Columbia Basin Strategy).

In addition, access to wildfires and fuel treatment locations continues to be a concern. As road density increases or decreases, response time to wildfires will change accordingly. Costs for fuel treatments would also change depending on the level of access.

### Recommended Wilderness Areas

By law, all National Forest System lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the National Wilderness Preservation System.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need.

## Environmental Consequences

### Methodology

This analysis examines how the plan alternatives address the risk of uncharacteristic wildfire and how well they contribute to returning wildfire to a more natural role. This is done by comparing the existing

Fire Regime Condition Class (FRCC) with the projected FRCC for each alternative to determine the percent of how well each alternative contributes to moving the forest toward desired conditions. Analysis results are shown by average departure, which is the amount of departure in percent from historic conditions. FRCC 1 is less than 33 percent departed, FRCC 2 is 33 to 66 percent departed, and FRCC 3 is greater than 66 percent departed from historic conditions.

All alternatives use mechanical and fire treatments to reduce fuel loads and tree densities, thus reducing the risk of uncharacteristic wildfires which pose threats to ecosystems and communities. However, some alternatives have more of a management emphasis on the restoration of and development of healthy, resilient ecosystems. As a result, some alternatives are expected to be more effective in changing the risk of uncharacteristic fire than others. These treatments assist in moving forested systems into more natural landscape conditions thereby allowing fire to play a more natural role. FRCC is a tool used to determine if a landscape is moving toward desired conditions. It measures how close or far a system has departed from its natural fire regime.

All of the alternatives contain objectives for treating (mechanical and burning) vegetation to improve structure and composition, including reducing surface/ladder fuels and canopy density. However, some alternatives focus these efforts only in certain areas while managing for other objectives (including timber production) elsewhere. This FRCC outcome was compared by alternative at 20 years of implementation, the expected length of the plan, plus time allotted to develop a new forest plan. At 20 years in the future, some movement toward desired conditions would be seen, but effecting change in natural processes at current and expected levels as prescribed by these alternatives would likely take much longer than 20 years.

The Fire Regime Condition Class Software Application (FRCCsa) was used to analyze the vegetation and fire regime departure for the Colville National Forest lands. The FRCCsa uses biophysical settings (BpS) and their associated succession classes (S-Class) as the baseline for pre-European settlement disturbance processes. A description of the biophysical settings and associated S-Classes can be found at www.landfire.gov. The FRCCsa quantifies the departure of current vegetation structure and composition, fire severity, and fire frequency from a set of reference conditions representing the historical range of variation. The tool derives several metrics of departure at the S-Class, BpS, and landscape levels.

Fire Frequency and Severity need to be calculated to use the tool, and are utilized to determine the amount of departure from reference frequencies and severities. To estimate current fire frequency, an analysis of historic and current fires was conducted. Following the methods contained in the Fire Regime Condition Class Guidebook, a Fire Atlas mapping both planned and unplanned ignitions was created with data from 1909 to 2014. Local knowledge and expert opinion determined that an average of 75 percent of the acres within burn perimeters were actually burned during the fires, and this average was used to determine actual acres burned within each biophysical setting. The total area burned was divided by Fire Atlas time period to estimate current mean annual burned acres. The total acres of each BpS were divided by the reference fire return interval to determine historic mean annual burned acres. The reduction factor (historic/current) was multiplied by the reference return interval to determine current mean fire return interval. Reference fire return intervals were used for Fire Regime IV areas as the reference return interval was longer than the fire atlas data years.

Current potential fire severity was calculated by running the Flammap fire behavior model using a landscape file from Landfire (www.landfire.gov). Fuel model, canopy bulk density, canopy cover, canopy base height, canopy height, aspect, slope, and elevation layers comprise the landscape file. Using 90th percentile weather conditions derived from analyzing local weather stations, a Flammap run with flame length and crown fire activity outputs was created. For the purpose of the analysis, surface fire was considered Low Severity (0 to 25 percent tree mortality), passive crown fire was considered Mixed

Severity (26 to 75 percent tree mortality), and active crown fire was considered High Severity (76 to 100 percent tree mortality). A value for each severity was assigned (Low, 15 percent; Mixed, 50 percent, High 90 percent), then the mid-point severity was multiplied by percentage of each BpS it was present on. The results were added together to calculate the current severity for each BpS.

For each alternative, S-class layers were modified to match vegetation modelling results. The fire atlas data were updated to add new fires, both planned and unplanned ignitions. The amount of planned ignitions in each BpS was determined by analyzing historic planned ignition acres completed, and averaging the acres completed each year. To determine the amount of unplanned ignitions that could be used to meet resource objectives, historic lightning data was analyzed in the areas where fire could be managed in this manner during periods when fire effects would produce low-mixed severity fire. Using the Fire Spread Probability (FSPro) tool, the ignitions were run using moderate fire conditions typically experienced in the last 30 to 60 days of the typical fire season. Using these conditions meets the intent of using fire to meet resource objectives with low and mixed severity effects. Fire frequency was then updated and entered into the FRCCsa. Fire severity was calculated by taking the amount of acres treated per alternative (commercial thinning, prescribed fire, and mechanical fuels reduction) in each BpS and then reducing the amount of high and mixed severity fire based on the assumption that 50 percent of treatments would focus on moving high severity areas to mixed severity, 40 percent of treatments would focus on moving mixed severity to low severity, and that 10 percent of treatments would focus on maintaining low fire severity conditions.

## Assumptions

- Modelled treatments, fire severity, and fire return intervals would closely match actual conditions in the future.
- Budget would allow for implementation of all mechanical and prescribed fire treatments.

## Spatial and Temporal Context for Effects Analysis

The administrative boundary of the Colville National Forest is the spatial extent of this analysis. The temporal context for the affected environment is 105 years, which is the oldest data for wildfires in the Forest's corporate GIS database. For the effects analysis, the temporal context looks forward 20 years in regards to Fire Regime Condition Class.

## Summary of Effects

### Fire Regime Condition Class

Mean fire return intervals decrease with the use of prescribed fire and allowing unplanned ignitions to be managed for resource benefit. Mean fire return interval only considers prescribed fire and wildfire on the landscape. Fire severity is generally reduced across the landscape in areas where any type of treatment (mechanical and/or fire) is implemented.

Table 35 shows average fire regime condition class percent departure by forest type after 20 years. This is a relatively short time for management to affect changes at the forest scale, so only a 2 to 3 percent decrease is seen in the Douglas-fir dry forest type under the action alternatives. Mechanical and prescribed fire treatments in the Douglas-fir dry forest type would focus on reducing fire severity, but due to the stands missing multiple fire returns, the relatively high mean fire return interval continues to keep this vegetation type severely departed from historic conditions.

The most notable changes occur in western red cedar/western hemlock stands. These stands have a longer mean fire return interval and are still within range of historic fire returns. In all alternatives, these stands

would continue to move toward more late development closed conditions that more closely match historic conditions.

**Table 35. Twenty-year predicted average fire regime condition class percent departure by forest type and alternative**

| Vegetation Type | Current | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 71 | 69 | 67 | 67 | 67 | 68 | 67 |
| Subalpine fir / lodgepole pine | 35 | 29 | 23 | 23 | 24 | 21 | 22 |
| Northern Rocky Mountain mixed conifer | 51 | 53 | 49 | 48 | 49 | 48 | 48 |
| Western redcedar / western hemlock | 53 | 52 | 50 | 50 | 49 | 48 | 49 |
| Spruce / subalpine fir | 26 | 33 | 33 | 32 | 31 | 32 | 32 |

Overall, the differences in management prescribed are not sufficient to change FRCC in the 20-year time period, though some vegetation types do begin trending toward a change in FRCC.

### Access

As road densities decrease, or roads are closed to allow for new roads, fire response times would likely increase, though there is “no evidence for an effect of linear feature presence or densities” (roads, powerlines, pipelines) on fires escaping during initial attack (Arienti et al. 2006). In addition, although fire boundaries are influenced by multiple topographic and vegetation constraints, roads tend to have the largest influence of any single variable, particularly in lower elevation landscapes with relatively high road densities (Narayanaraj and Wimberly 2011).

### Wilderness

Current management of the Salmo-Priest Wilderness would remain largely unchanged across all alternatives.

Recommended wilderness areas are discussed in each alternative.

## Wildland-urban Interface

All alternatives would restrict treatment in portions of the wildland-urban interface (WUI), as it is mapped in the county CWPPs. In all alternatives, except no action, recommended wilderness, current wilderness, and research natural areas would not allow timber harvest to be used as a tool. Recommended wilderness is the most restrictive management allocation in all alternatives that drives the differences in acres unsuitable for mechanical treatment. In the no-action alternative, Management Areas 1, 3b, 3c, 4, 9, 10, and 11 do not allow timber harvest. Table 36 shows by alternative how many acres within the WUI would not allow timber harvest as a tool.

**Table 36. Wildland-urban interface acres unsuitable for mechanical treatment**

| Alternative | Acres |
|---|---|
| No Action | 62,709 |
| Proposed Action | 30,451 |
| R | 83,730 |
| P | 35,966 |
| B | 92,787 |
| O | 13,889 |

## No-action Alternative

Overall, the forest would remain moderately departed from historic fire return intervals and severities. Stand departures would change from current conditions as follows:

**Table 37. No-action alternative predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 69% | Down 2% | 2 | 87% | 86% |
| Subalpine fir / Lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 29% | Down 6% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 53% | Up 2% | 2 | 66% | 38% |
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 52% | Down 1% | 2 | 66% | 38% |

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 33% | Up 7% | 2 | 1% | 44% |

*VCC = vegetation condition class

Vegetation departures would generally continue to increase in most vegetation types. Mechanical treatments would account for the lower departure value in Western Redcedar/Western Hemlock stands, as these stands typically would not experience enough wildfire or prescribed fire to account for the change in departure. The landscape would be 57 percent departed from historic conditions with a landscape FRCC of 2.

### Old Forest Management and Timber Production

Mechanical fuels reduction and prescribed fire treatments could occur as scheduled treatments across 82 percent of the landscape. Treatments would be planned following direction from the 1988 forest plan as amended. A fixed reserve approach would be used to manage late forest structure, where no scheduled timber harvest is permitted.

Within dry Douglas-fir stands, modeling 20 years in the future predicts, 15 percent of the stands would be classified as late development open, and 19 percent of the stands as late development closed. The largest amount of stands (53 percent) would be classified as mid development closed. Closed canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands modeling 20 years in the future predicts, 2 percent of stands would be classified as late development closed, with no stands classified as late development open. Late forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years in the future predicts, 22 percent of the stands within this vegetation type would be considered late development closed, with 0 percent late development open.

Within western red cedar/western hemlock stands, modeling 20 years in the future predicts 34 percent of the stands would be classified as late development closed. These stands would continue to experience natural stand-replacement fire if left to natural disturbances.

Within spruce/subalpine fire stands, modeling 20 years into the future predicts, 16 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity expected to persist without management intervention.

Fire would play its natural role across 23 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Seventy-seven percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production.

### Wilderness

There would be no recommended wilderness areas in the no-action alternative. Management of the Salmo-Priest Wilderness would not change.

Stands would remain in their current Fire Regime Condition Class, but would continue to miss fire cycles which would lead to progression to FRCC 2 and 3, leaving them at risk of losing key ecosystem components.

### Monitoring Recommendations

Use FRCC assessment to track changes in landscape departure over time.

Use FLAMMAP and FSPro to track predicted changes in fire behavior over time.

Collect field fuels data on a limited basis, where doing so will improve modelling or applications of future treatments.

Report monitoring results to the public on a timely basis.

## Proposed Action

Stand departures relating to fire frequency and severity would change from current conditions as follows:

**Table 38. Proposed action alternative predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 67 | Down 4% | 2 | 89% | 86% |
| Subalpine fir / Lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 23 | Down 12% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 49 | Down 2% | 2 | 66% | 38% |

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 50 | Down 3% | 2 | 66% | 38% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 33 | Up 7% | 2 | 1% | 44% |

*VCC = vegetation condition class

The use of prescribed fire and allowing for unplanned ignitions to be used to meet resource benefits would work toward lowering the mean fire return interval slightly. Fire severity would be moderated through the use of mechanical treatments and prescribed fire. The landscape overall is 54 percent departed from historic conditions, resulting in a landscape FRCC of 2.

### Old Forest Management and Timber Production

Mechanical fuels reduction and prescribed fire treatments could occur as scheduled treatments across 71 percent of the landscape. Treatments would be planned using a “whole landscape” approach which would promote late forest structure in shifting locations across the forest over broad time horizons as treatments work to enhance and maintain old forest conditions. Rather than designating specific geographic locations where old forest would be managed for, this alternative seeks to develop and maintain overall landscape proportions of old forest while recognizing that specific locations change through time due to natural and anthropogenic disturbance. This approach closely mimics historic landscape patterns represented by a mosaic of forest structure shaped by fire of differing severities. The whole landscape approach aims to promote fire resilient species composition and structure at the landscape scale, specifically in vegetation types that would historically have fire-resilient species such as ponderosa pine, Douglas-fir, and western larch.

Prescribed fire use would slightly decrease the mean fire return interval, though the landscape would still remain severely departed from historic return intervals. Treatments are expected to shift some high fire severity areas to moderate severity, and some moderate severity areas to low severity as overall fuel loading and canopy closure is reduced. Overall, the landscape FRCC remains moderately departed with an FRCC 2. Fire is able to play its natural role across 27 percent of the forest, maintaining resilient stands in those areas. These areas would include both low and mixed severity fire regimes. However, 73 percent

of the forest is at risk of losing key ecosystem components, which could threaten both timber production and late forest structure.

Within dry Douglas-fir stands, modeling 20 years in the future predicts 17 percent of the stands would be classified as late development open, and 17 percent of the stands as late development closed. The largest amount of stands (50 percent) would be classified as mid development closed. Closed canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands, modeling 20 years into the future predicts 12 percent of stands would be classified as late development closed, with no stands classified as late development open. Late forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years into the future predicts, 20 percent of the stands within this vegetation type would be considered late development closed, with 2 percent late development open.

Within western red cedar/western hemlock stands, ,modeling 20 years into the future predicts 18 percent of the stands would be classified as late development closed and would continue to experience natural stand-replacement fire if left to natural disturbances.

Within Spruce/subalpine fire stands, 20 years into the future predicts 16 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity persisting without management intervention.

Fire would play its natural role across 27 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Seventy-three percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production. Losing key ecosystem components in late forest structure would impact dependent surrogate wildlife species habitat (Gaines 2015).

## Recommended Wilderness Areas

Approximately 101,390 acres would be recommended for wilderness. Tools for fire management would remain unchanged until Congress acts to designate the areas as wilderness. If areas are designated by Congress, the use of some tools for fire management (i.e., chainsaws, helispots, etc.) would require approval prior to their use.

## Alternative R

Stand departures of each vegetation type would change as follows:

**Table 39. Alternative R predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 67 | Down 4% | 2 | 87% | 86% |
| Subalpine fir / Lodgepole pine | 1010452 – Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 23 | Down 12% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 48 | Down 3% | 2 | 66% | 38% |
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 50 | Down 3% | 2 | 66% | 38% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 32 | Up 6% | 2 | 1% | 44% |

*VCC = vegetation condition class

Stand departure would be lower in all vegetation types except Spruce/Subalpine fir. Mean fire return intervals would decrease slightly through the use of prescribed fire and the use of unplanned ignitions. Fire severity would be reduced through the use of mechanical treatments and prescribed fire. Overall, the landscape would be 53 percent departed from historic conditions with an FRCC of 2.

### Old Forest Management and Timber Production

Within dry Douglas-fir stands, modeling 20 years into the future predicts 16 percent of the stands would be classified as late development open, and 18 percent of the stands as late development closed. The largest proportion of stands (52 percent) would be classified as mid development closed. Closed canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands, modeling 20 years into the future predict 12 percent of stands would be classified as late development closed, with no stands classified as late development open. Late

forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years into the future predicts 22 percent of the stands within this vegetation type would be considered late development closed, with 1 percent late development open.

Within western red cedar/western hemlock stands, modeling 20 years into the future predicts 33 percent of the stands would be classified as late development closed and would continue to experience natural stand-replacement fire if left to natural disturbances.

Within the spruce/subalpine fire stands, modeling 20 years into the future 17 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity persisting without management intervention.

Fire would play its natural role across 39 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Sixty-one percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production. Losing key ecosystem components in late forest structure would impact dependent surrogate wildlife species habitat (Gaines 2015).

### Recommended Wilderness Areas

Approximately 207,800 acres would be recommended as wilderness under alternative R. Mechanized uses would not be allowed prior to Congress acting to designate the areas as wilderness. Some fire management tools (chainsaws, helispots, etc.) would require approval prior to their use in the recommended wilderness.

### Monitoring Recommendations

Use FRCC assessment to track changes in landscape departure over time.

Use FLAMMAP and FSPro to track predicted changes in fire behavior over time.

Collect field fuels data on a limited basis, where doing so would improve modelling or applications of future treatments.

Report monitoring results to the public on a timely basis.

## Alternative P

Alternative P would change stand departure in each vegetation type as follows:

**Table 40. Alternative P predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 67 | Down 4% | 2 | 89% | 86% |
| Subalpine fir / Lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 24 | Down 11% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 49 | Down 2% | 2 | 66% | 38% |
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 49 | Down 4% | 2 | 66% | 38% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 31 | Up 5% | 2 | 1% | 44% |

*VCC = vegetation condition class

Stand departure would decrease in all vegetation types except Western Red Cedar/Western Hemlock and Spruce/Subalpine fir. This is due to no treatments being modeled in Western Red Cedar/Western Hemlock stands, and limited treatments in Spruce/Subalpine Fir Stands. Mean fire return intervals would decrease slightly through the use of prescribed fire and the use of unplanned ignitions. Fire severity would be reduced through the use of mechanical treatments and prescribed fire. Overall, the landscape would be 55 percent departed from historic conditions, with a landscape FRCC of 2.

### Old Forest Management and Timber Production

Within dry Douglas-fir stands, modeling 20 years in the future predicts 18 percent of the stands would be classified as late development open, and 17 percent of the stands as late development closed. The largest amount of stands (45 percent) would be classified as mid development closed. Closed-canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands, modeling 20 years into the future predicts 12 percent of stands would be classified as late development closed, with no stands classified as late development open. Late forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years into the future predicts 21 percent of the stands within this vegetation type would be considered late development closed, with 1 percent late development open.

Within western red cedar/western hemlock stands, modeling 20 years into the future predicts 36 percent of the stands would be classified as late development closed and would continue to experience natural stand-replacement fire if left to natural disturbances.

Within the spruce/subalpine fire stands, modeling 20 years into the future predicts 20 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity persisting without management intervention.

Fire would play its natural role across 26 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Seventy-four percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production. Losing key ecosystem components in late forest structure would impact dependent surrogate wildlife species habitat (Gaines 2015).

## Recommended Wilderness Areas

Approximately 68,300 acres would be recommended as wilderness. Mechanized uses would be allowed to continue until Congress acts to designate the areas as wilderness. If the areas are designated as wilderness by Congress, approval to use some tools (chainsaws, helispots, etc.) would need to be obtained prior to their use.

## Monitoring Recommendations

Use FRCC assessment to track changes in landscape departure over time.

Use FLAMMAP and FSPro to track predicted changes in fire behavior over time.

Collect field fuels data on a limited basis, where doing so would improve modelling or applications of future treatments.

Report monitoring results to the public on a timely basis.

## Alternative B

Stand departures relating to fire frequency and severity would change from current conditions as follows:

**Table 41. Alternative B predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 68 | Down 3% | 2 | 89% | 86% |
| Subalpine fir / Lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 21 | Down 14% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 - Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 48 | Down 3% | 2 | 66% | 38% |
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 48 | Down 5% | 2 | 66% | 38% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 32 | Up 6% | 2 | 1% | 44% |

*VCC = vegetation condition class

Stand departure is lowered in all vegetation types except Spruce/Subalpine Fir. Overall, mean fire return intervals decrease slightly, and severity is changed through the use of mechanical and prescribed fire treatments. Overall, the landscape is 51 percent departed from historic conditions, and has a landscape FRCC of 2.

### Old Forest Management and Timber Production

Late forest structure restoration is the highest priority within the Restoration Zone management area of alternative B, which encompasses 31 percent of the forest. Restoring late forest structure in dry forest types would allow fire to resume its natural role in those areas, as species composition and structure would support resiliency to low severity fire in the Douglas-fir dry type. Some restoration activities (timber harvest for example) would not occur in moist mixed conifer forests, meaning that mixed and high severity fire would continue to be expected in those areas. Because mixed and high severity fire

serves critical natural processes in the moist mixed conifer type, this is expected to enhance and improve fire regime condition class within the restoration zone management area.

The Active Management area includes 43 percent of the forest. All activities (timber harvest, thinning, prescribed fire) are available for use as treatments focus on a stable flow of forest products in all vegetation types. The vegetation treatments prescribed in the active management area are primarily designed to promote production of wood products. These treatments have limited value in restoring natural disturbance and fire process into these forested ecosystems.

Within dry Douglas-fir stands, modeling 20 years in the future predicts 15 percent of the stands would be classified as late development open, and 19 percent of the stands as late development closed. The largest proportion of stands (49 percent) would be classified as mid development closed. Closed canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands, modeling 20 years into the future predicts 12 percent of stands would be classified as late development closed, with no stands classified as late development open. Late forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years into the future predicts 21 percent of the stands within this vegetation type would be considered late development closed, with 1 percent late development open.

Within western red cedar/western hemlock stands, modeling 20 years into the future predicts 35 percent of the stands would be classified as late development closed and would continue to experience natural stand-replacement fire if left to natural disturbances.

Within spruce/subalpine fire stands, modeling 20 years into the future predicts 16 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity persisting without management intervention.

Fire would play its natural role across 38 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Sixty-two percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production. Losing key ecosystem components in late forest structure would impact dependent surrogate wildlife species habitat (Gaines 2015).

### Recommended Wilderness Areas

Approximately 220,330 acres would recommended as wilderness under alternative B. Mechanized uses would not be allowed prior to Congress acting to designate the areas as wilderness. Some fire management tools (chainsaws, helispots, etc.) would require approval prior to their use in the recommended wilderness.

### Monitoring Recommendations

Use FRCC assessment to track changes in landscape departure over time.

Use FLAMMAP and FSPro to track predicted changes in fire behavior over time.

Collect field fuels data on a limited basis, where doing so would improve modelling or applications of future treatments.

Report monitoring results to the public on a timely basis.

## Alternative O

Alternative O would change stand departure of vegetation types as follows:

**Table 42. Alternative O predicted departure by vegetation type**

| Vegetation Type | Landfire Biophysical Setting | Acres | Avg Departure | Departure Compared to Current Conditions | VCC* | Frequency Departure | Severity Departure |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 1010451 – Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Ponderosa Pine – Douglas-fir | 486,045 | 67 | Down 4% | 2 | 87% | 84% |
| Subalpine fir / Lodgepole pine | 1010452 - Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest – Larch | 173,699 | 22 | Down 13% | 1 | 6% | 47% |
| Northern Rocky Mountain Mixed Conifer | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest | 308,365 | 48 | Down 3% | 2 | 66% | 38% |
| Western Redcedar / Western Hemlock | 1010471 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest (95%) / 1010472 – Northern Rocky Mountain Mesic Montane Mixed Conifer Forest – Cedar Groves (5%) | 95,820 | 49 | Down 4% | 2 | 66% | 38% |
| Spruce / Subalpine fir | 1010560 - Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (90%) / 1011610 - Northern Rocky Mountain Conifer Swamp (10%) | 20,240 | 32 | Up 6% | 2 | 1% | 44% |

*VCC = vegetation condition class

Departure would decrease across all vegetation types except Spruce/Subalpine fir. Mean fire return intervals would decrease slightly with the use of prescribed fire and the use of unplanned ignitions. Fire severity would be reduced through the use of mechanical treatments and prescribed fire. Overall, the landscape would be 52 percent departed from historic conditions, with a landscape FRCC of 2.

### Old Forest Management and Timber Production

Within dry Douglas-fir stands, modeling 20 years in the future predicts 15 percent of the stands would be classified as late development open and 19 percent of the stands as late development closed. The largest

proportion of stands (50 percent) would be classified as mid development closed. Closed-canopied stands, especially those in the mid development stage are particularly susceptible to stand-replacing fire events due to dense canopies and abundant ladder fuels. Once late development open structure was reached, regular fire treatments would be needed to maintain this condition.

Within subalpine fir/lodgepole pine stands, modeling 20 years into the future predicts 12 percent of stands would be classified as late development closed, with no of stands classified as late development open. Late forest structure in this vegetation type would persist until fire occurrence, and would revert to early development.

Within mixed conifer stands, modeling 20 years into the future predicts 21 percent of the stands within this vegetation type would be considered late development closed, with 1 percent late development open.

Within western red cedar/western hemlock stands, modeling 20 years into the future predicts 34 percent of the stands would be classified as late development closed.

Within spruce/subalpine fire stands, modeling 20 years into the future predicts 18 percent of the vegetation type would be classified as late development closed. Replacement fire historically occurred every 150 years, with that fire return interval and severity persisting without management intervention.

Fire would play its natural role across 35 percent of the landscape, supporting the retention of late forest structure in the Douglas-fir dry type as low severity fire moves through those areas that typically experienced low severity fire. Mixed and high severity fire would also be expected if fire plays its natural role in all other vegetation types. Sixty-five percent of the landscape exhibits a departure from natural fire process and would remain predisposed to losing key ecosystem components, which could threaten late forest structure and timber production. Losing key ecosystem components in late forest structure would impact dependent surrogate wildlife species habitat (Gaines 2015).

### Recommended Wilderness Areas

Approximately 15,950 acres would be recommended as wilderness. Mechanized uses would be allowed to continue until Congress acts to designate the areas as wilderness. If the areas are designated by Congress as wilderness, approval to use some tools (chainsaws, helispots, etc.) would need to be obtained prior to their use.

### Monitoring Recommendations

Use FRCC assessment to track changes in landscape departure over time.

Use FLAMMAP and FSPro to track predicted changes in fire behavior over time.

Collect field fuels data on a limited basis, where doing so would improve modelling or applications of future treatments.

Report monitoring results to the public on a timely basis.

## Cumulative Effects (Common to all Alternatives)

### Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Of all the ongoing and foreseeable future actions that have the potential to affect fire, especially unwanted wildfire, climate change is likely to be the single most important factor. The effects of climate change would likely combine with some of the effects that result from implementing the alternatives, to produce

cumulative impacts. In general, the fire seasons are expected to become longer, large wildfires are expected to occur more often, and total area burned is expected to increase. By increasing the amount of prescribed fire use, as well as the amount of natural, unplanned ignitions that are used to meet resource objectives, the action alternatives would be expected to partially offset predicted effects from the climate change. The more fire use (and mechanical treatments) that occurs as a result of the action alternatives, the greater the fuels would be reduced and the forest vegetation restored to more resistant and resilient conditions, which would mitigate climate change effects.

Through CWPPs there has been an emphasis to treat Forest Service land as well as State lands and private property within the WUI. The efforts identified in all alternatives, in combination with past, current, and future treatments on private and State lands would help to reduce the risk of uncharacteristic wildfire impacts to communities and the national forest. Treatments carried out on the majority of private lands bordering the Colville National Forest are done with grants from the WA-DNR. WA-DNR Landowner Assistance Foresters assist with planning those treatments with the intent of reducing fire hazards, which reduces the risk to both the private lands being treated and the potential of fire moving off private land onto Forest Service land. Treatments on NFS land would also serve to reduce the potential of fire moving off of Forest Service land onto private land.

Neighboring land managers (Colville Confederated Tribes, BLM, Okanogan/Wenatchee National Forest, Idaho Panhandle National Forest) are also implementing projects that produce emissions (smoke). There may be additional impacts to Colville National Forest lands in terms of air quality, visibility, and human health. Tribal participation in the Washington Smoke Implementation Plan is voluntary, though the other agencies follow guidance from the State.

# Invasive Plants

Invasive plants are recognized as a major threat to native vegetation and wildlife, as well as to social and economic conditions. Invasive plants are defined as “non-native plants whose introduction does, or are likely to, cause economic or environmental harm or harm to human health” per E.O. 13112. The Chief of the Forest Service declared invasive species as one of the four main threats to ecosystem health (USDA Forest Service 2004). The threat is considered serious because invasive plants have the potential to displace or change native plant communities and can increase wildfire hazard, degrade fish and wildlife habitat, eliminate rare and endangered plants, impair water quality and watershed health, and adversely affect a wide variety of other resource values, such as recreational opportunities.

## Introduction

Language concerning why Forest Plans need to consider invasive plants is contained within Forest Service Handbook (FSH) 2150 and 2109 which state that: “All pesticide-use activities on National Forest System lands must be consistent with the standards and guidelines and other management direction in applicable Forest Land and Resource Management Plans (Forest Plans). Forest Plans generally mandate the use of Integrated Pest Management (IPM) for management of forest pests such as insects, diseases, animals, and invasive or unwanted vegetation. Forest Plans should also contain relevant language relating to the management of areas as diverse as Wilderness, Research Natural Areas, Botanical Areas, other reserved areas such as Wild and Scenic Rivers, seed orchards, and nurseries, in addition to general forest and multiple-use areas.” Other Direction is found in Forest Service Manual (FSM) 2900 at 2903.2 which states that: When applicable, invasive species management actions and standards should be incorporated into resource management plans at the forest level, and in programmatic environmental planning and assessment documents at the regional or national levels.”

The area affected by invasive plant species has increased throughout the Interior Columbia Basin during the last 100 years. The same trend has occurred in northeastern Washington during the last 30 years. Invasive plant populations are increasing at a rate of 8 to 12 percent per year on National Forest System Lands (USDA Forest Service 2005 and 1999). Vegetation types that are most susceptible to invasive plant infestation are dominated by dry forest, dry grass, dry shrub, and cool shrub types.

Invasive plants are spread by natural vectors (such as birds, wildlife, insects, wind and water) as well as human-related vectors (such as contaminated hay, vehicles, equipment, riding stock, pack stock, hiking and livestock grazing). While transportation vectors are important in the spread of invasive plants, soil disturbance also plays a critical role. Invasion and dominance by invasive plants is highly correlated with soil disturbance, but are not limited to disturbed areas (Cox, 1999). Invasive plants can readily invade, occupy, and/or dominate conifer plantations, road prisms, trail heads, trails, mined sites, gravel pits, river corridors, wildlife wallows and bedding areas and rangelands, but they can also establish in naturally occurring disturbances and small forest openings. Recognized human management activities that have some potential to influence invasive plant establishment and spread are; timber and other vegetation management, road construction, road decommissioning, road maintenance, livestock grazing, fire and fuels management, recreation and recreation management and mining. Prevention measures are assumed to slow the rate of spread (assumed to slow by half to 4 to 6 percent; R6 2005 FEIS).

## Affected Environment

Invasive plants occupy approximately 20,000 acres within the Colville National Forest. Most infested acres occur along roads and on dry south facing slopes in low elevations, but there are infestations known to exist in areas of past timber harvest, forest openings, recreation sites, trails, and shorelines of lakes, ponds, rivers and streams. Thirty-five different invasive plants are known to exist on the Forest with all but three being broadleaf herbaceous plants. The average annual amount of acres treated for invasive plants is 2,152 acres per year and was based on efforts for years 2012 through 2014.

Currently, the Colville National Forest uses an integrated approach in managing invasive plants, which includes prevention measures, inventory, treatment, and monitoring. Integrated pest management is the coordinated use of multiple tactics to assure stable ecosystem function and maintain pest damage below economic levels, while minimizing hazards to human, animals, plants and the environment. The Forest uses a variety of treatment methods to control invasive plants and treatment methods are determined by plant attributes and site-specific conditions found at treatment locations. The different treatment methods used by the Colville National Forest and some examples of each method include:

- Releasing approved biological control agents – Host-specific organisms
- Cultural – Using fertilizer
- Manual Removal – Hand pulling and digging
- Mechanical Treatment – Mowing
- Chemical – Applying herbicide

These approaches to managing invasive plants would be continued in the no-action alternative and all action alternatives.

In 2005, the regional forester amended the 1988 forest plan with the record of decision (ROD) for the Preventing and Managing Invasive Plants FEIS (USDA Forest Service 2005). This amendment added management direction for invasive plants to the 1988 forest plan, including goals, objectives, standards

and a monitoring framework, which guide the Forest in responding to Invasive Plant management challenges. Appendix A displays the goals, objectives, and standards from the R6 2005 ROD. Current forest plan direction for managing invasive plants would continue for the no-action alternative and all action alternatives.

In addition to the invasive plant direction contained in the 2005 FEIS and ROD, the Colville National Forest developed Noxious Weed Prevention Guidelines in 1999, which also guide the Forest. Guidance contained in the Colville National Forest Noxious Weed Prevention Guidelines would continue for the no-action alternative and all action alternatives.

All alternatives were assessed for their predicted ability to meet the desired condition and by the degree to which ground disturbance could lead to conditions that would increase the invasive species spread rate.

Current and ongoing management direction has the potential to meet this desired condition. The Preventing and Managing Invasive Plants FEIS (USDA Forest Service 2005) disclosed that the adopted invasive plant management direction had a “moderate to high potential to reduce rate of spread,” and concluded that effective treatment of the existing populations along with prevention measures applied to land uses and activities could reduce the current 8 to 12 percent rate of spread to about 4 to 6 percent. Thus, to meet the desired condition, both current infestations and new infestations need to be contained, controlled, or eradicated.

## Need for Change

### Old Forest Management and Timber Production

In the revision of the Forest Plan, three broad-scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- The recent history of uncharacteristic levels of disturbances resulting from fire and insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Uncertainty about the recovery and viability of old forest-dependent species given the increased risk of uncharacteristically severe disturbances that is likely to be exacerbated by climate change impacts.

### Motorized Recreation Trails

The current land management plan provides direction for summer and winter motorized uses, including identifying areas where such use may not be authorized or is limited, mainly for protection of aquatic, plant, and wildlife habitats.

The goal for recreation settings and experiences would include providing a spectrum of high-quality, nature-based outdoor recreational settings where visitors access the Forest, including access to the biological, geological, scenic, cultural, and experiential resources of the Forest. Where the visitor’s outdoor recreational experience involves few conflicts with other users, access is available for a broad range of dispersed recreation activities such as dispersed camping, rock climbing, boating, mushroom and berry picking, hunting, and fishing and these experiences are offered in an environmentally sound manner, are within budget limits, and contribute to the local economy.

### Access

Three broad concerns drove the need to address road density:

1) The Forest can no longer afford to properly maintain the road system at current operational maintenance levels,

2) The current road system is not aligned with current and future resource management objectives, and

3) The existing road management direction is confusing and difficult to follow because it is scattered throughout current Forest Plan (Colville National Forest Land and Resource Management Plan), Forest Plan amendments (Eastside Screens, Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions [INFISH, USDA Forest Service 1994c and 1995]), national-level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Agreement, the Interior Columbia Basin Strategy).

### Recommended Wilderness Areas

By law, all National Forest System lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the National Wilderness Preservation System.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need.

### Wildlife

The current Forest Plan provides limited protection for habitat connectivity, providing wildlife and aquatic crossing structures, and managing activities adjacent to the structures so they are used by wildlife.

### Riparian and Aquatic Resource Management

The current Forest Plan includes riparian management direction from the Inland Native Fish Strategy (INFISH, USDA Forest Service 1994c and 1995). This approach appears to have either maintained or improved riparian and aquatic habitat conditions at the watershed and larger scales.

Objectives for riparian management areas would give emphasis to maintaining or restoring the riparian and aquatic structure and function of intermittent and perennial streams, confer benefits to riparian-dependent plant and animal species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, contribute to improved water quality and flows, and contribute to a greater connectivity of the watershed for both riparian and upland species.

Desired conditions for riparian management areas within any given watershed are to have compositions of native flora and fauna and a distribution of physical, chemical, and biological conditions commensurate with natural processes.

## Environmental Consequences

### Methodology

Since activities associated with timber management and production create the largest amount of bare soil conditions, the acres of suitable timberlands by alternative would be used as a surrogate to predict the

amount of risk for invasive plant spread. Specific locations that are likely to be at risk for invasive plant establishment and spread through vegetation and fuels management are roads, landings and skid trails because of the high levels of use which occur and result in bare soils.

Potential changes to access on the Colville National Forest through the various alternatives will also be discussed in this section to evaluate how invasive plants could be influenced by management activities.

This section will not consider livestock grazing in evaluating the effects of the various alternatives since allotment status and stocking rates would not change as a result of the Forest Plan Revision effort or the alternatives considered.

## Assumptions

- The 1998 Environmental Assessment for the Colville National Forest Integrated Noxious Weed Treatment (Forest Service 1998) analyzed and approved the use of manual, biological, and chemical control agents (herbicides) for the treatment of noxious or invasive species. This document and Decision made to implement “alternative C” would continue to guide invasive plant management on the Colville National Forest until such time as it is replaced by a newer document/decision.
- The 2005 Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) along with its standards, goals and objectives would continue to guide the Colville National Forest for the no-action alternative.
- Compliance with terms and conditions that implement the reasonable and prudent measures described in applicable Biological Opinions providing protection for federally listed species.

## Methods of Analysis

This analysis relies on the timber suitability analysis and the acres generated for each alternative in it. To compare the different alternatives, they are evaluated against the no-action alternative that would continue existing management.

Also considered in this analysis are the desired conditions for road densities since forest roads have the potential to influence rates of spread and acres infested for invasive plants.

## Incomplete and Unavailable Information

Numbers of road miles projected to exist through implementation of the revised Forest Plan.

## Spatial and Temporal Context for Effects Analysis

This analysis is completed for all National Forest System lands within the administrative boundaries of the Colville National Forest. It is assumed that the effective life of the plan would be 15 to 20 years, and this analysis discusses the effects to invasive plants over this time period.

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

- Invasive plants on private property that threaten to spread to NFS lands.
- Invasive plants on NFS lands with the potential to affect adjacent private lands
- People driving on roads and motorized trails on NFS lands
- Livestock grazing
- Climate change

## Summary of Effects

Given the Colville National Forest's current level of invasive plant occurrence, and a predicted rate of spread equaling 5 percent per year, it is expected that completing approximately 2,000 acres of invasive plant treatments and/or restoration activities relating to restoring native vegetation would allow the Forest to proceed toward and achieve a desired condition where invasive plant infestations are not increasing in number or size, occur at low densities, and are reduced or removed.

Table 43 documents that beginning with approximately 20,000 acres of invasive plants and accomplishing 2,000 acres of treatment each year, while experiencing a 5 percent rate of spread would allow the Forest to trend to nearly no invasive plants within 15 years following implementation. The information in the table is only used as an analysis tool and, given the reality of invasive plant populations being in a constant state of change, it is anticipated that the process of invasive plant invasion and treatment will be dynamic and may not follow predictions.

**Table 43. Prediction of Colville National Forest acres of invasive plant infestation**

| Year | Beginning Acres | New Acres | Treated Acres | Ending Acres |
|---|---|---|---|---|
| 1 | 20,000 | 1,000 | 2,000 | 19,000 |
| 2 | 19,000 | 950 | 2,000 | 17,950 |
| 3 | 17,950 | 898 | 2,000 | 16,848 |
| 4 | 16,848 | 842 | 2,000 | 15,690 |
| 5 | 15,690 | 784 | 2,000 | 14,474 |
| 6 | 14,474 | 724 | 2,000 | 13,198 |
| 7 | 13,198 | 660 | 2,000 | 11,858 |
| 8 | 11,858 | 593 | 2,000 | 10,451 |
| 9 | 10,451 | 523 | 2,000 | 8,973 |
| 10 | 8,973 | 449 | 2,000 | 7,422 |
| 11 | 7,422 | 371 | 2,000 | 5,793 |
| 12 | 5,793 | 290 | 2,000 | 4,083 |
| 13 | 4,083 | 204 | 2,000 | 2,287 |
| 14 | 2,287 | 114 | 2,000 | 401 |
| 15 | 401 | 20 | 421 | 0 |

The actions and activities resulting from the various alternatives have the potential to create conditions conducive to the spread of invasive plants, but management direction would be in place to limit the potential extent of spread and infestation. However, since invasion and dominance by invasive plants is highly correlated to soil disturbances (Cox 1999), the greater the potential extent and intensity of timber harvest, fuels reductions, road maintenance and prescribed fire, the greater the potential for indirect effects from soil disturbances (e.g., conditions favorable to invasive plants).

To compare alternatives, an index was created to display the relative amount of soil disturbing activities related to timber harvest and associated actions for each alternative. The index relies upon the timber suitability analysis completed for the Forest Plan Revision effort. The amount of suitable acres for the no-action alternative would be the base line and would have a coefficient value of one. It is assumed that the risk for invasive plant establishment and spread would be associated with suitable forestland and that the amount of potential soil disturbance would change equally with the change in acres suitable.

The index values for the proposed action and alternatives R, P, B and O are displayed relative to the no-action alternative in table 44. There is no standard for measuring soil disturbance as a predictor of nonnative plant invasion, either as an observable measurable value or as a percent of managed lands. The index serves only to compare alternatives and suggest which alternatives are more or less likely to create conditions favorable to the invasion of nonnative invasive plants. In fact, management direction for the Invasive Plants program requires that each project prevent or minimize potential for invasive species introduction, establishment, and/or spread.

**Table 44. Index values for soil-disturbing actions that favor invasion by invasive plants for each alternative of the Forest Plan Revision**

| | No Action | Proposed Action | Alt. R | Alt. P | Alt. B | Alt. O |
|---|---|---|---|---|---|---|
| **Suitable Forest Lands (acres)** | 535,725 | 653,242 | 129,420 | 656,628 | 384,485 | 347,535 |
| **Index Values** | 1 | 1.22 | 0.24 | 1.23 | 0.72 | 0.65 |

Compared to the no-action alternative, the proposed action and alternative P would represent a greater risk for invasive plant establishment and spread by creating opportunities for invasive plants, while alternatives R, B, and O represent less risk. At the project level, all management activities would be designed to include measures that would help prevent invasive plant spread.

## No-action Alternative

The no-action alternative would result in the same level of risk for invasive plants as has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands does not change in this alternative from the 1988 Plan.

### Timber Production

An index value rating of one found in table 44 for the no-action alternative equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being equal to the current risk. The costs associated with treating invasive plants and the acres needing treatment are predicted to be the same as it is currently.

### Motorized Recreation Trails

The no-action alternative would result in the same level of risk from motorized recreation trails, and use of these trails, as current management. Therefore, there is no change.

### Access

The no-action alternative would result in the same level of risk from access as current management. Therefore, there is no change.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

The no-action alternative would result in the same level of risk to the quality of wildlife habitat from invasive plants as current management. Therefore, there is no change.

### Riparian and Aquatic Resource Management

The no-action alternative would result in the same level of risk to riparian and aquatic resource management as current management. Therefore, there is no change at the forestwide level.

## Proposed Action

The proposed action alternative would result in an elevated level of risk for invasive plants compared to the no-action alternative and that which has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands is predicted to increase and proposed road density limits are not likely to have an appreciable change.

### Timber Production and Management

An index value rating of 1.22 found in table 44 for the proposed action equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being 22 percent greater than the risk in the current Forest Plan. This 22 percent increase in risk has the potential to result in a need to treat more acres of invasive plants than experienced currently. This potential need to treat more acres could also result in increased costs for invasive plant treatment, increased monitoring and inspection efforts, and increased coordination efforts around invasive plant issues.

### Motorized Recreation Trails

The proposed action could experience a slightly higher level of risk from motorized recreation trails, and use of these trails, to invasive plants spread when compared to current management. While the management area identified as “Backcountry Motorized” is projected to increase by approximately 4 percent, it cannot be said with any level of certainty that the actual presence on motorized trails would increase under this alternative.

### Access

The proposed action would not likely result in a substantial change in risk to invasive plant spread from access compared to current management. With road density limits of 2 miles per square mile for focused restoration areas and 3 miles per square mile for general restoration areas, there would not be an appreciable change in open road miles.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

The proposed action would result in a 22 percent increase in risk to the quality of wildlife habitat from invasive plants compared to current management.

### Riparian and Aquatic Resource Management

The proposed action would result in a similar level of risk to riparian and aquatic resource management from invasive plant establishment and spread as current management. Therefore, there would be little change.

## Alternative R

Alternative R would result in a substantially reduced level of risk for invasive plants compared to the no-action alternative and that which has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands is predicted to decrease as a myriad of protections are proposed in this alternative.

Changes to road density are likely to result in fewer roads on the Forest. Having fewer open roads would reduce the amount of bare soil associated with roads and human-related vectors of spread through vehicles would be decreased.

### Timber Production and Management

An index value rating of 0.24 found in table 44 for alternative R equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being 76 percent less than the risk in the current Forest Plan. This 76 percent decrease in risk has the potential to result in a need to treat fewer acres of invasive plants than experienced currently. This potential need to treat fewer acres could also result in decreased costs for invasive plant treatment and decreased monitoring and inspection efforts.

### Motorized Recreation Trails

Alternative R would experience a reduced level of risk from motorized recreation trails, and use of these trails, to invasive plants spread when compared to current management. The “Backcountry Motorized” Management Area in this alternative would only comprise approximately 1 percent of the Colville National Forest. This is 60 percent less than the area identified in the “No Action” alternative and the 1988 plan.

Assuming that actual miles of motorized recreation trails would be reduced as a result of the change in the amount of “Backcountry Motorized” acres, the trail system would have a lower risk to invasive plant establishment and spread by there being fewer miles of trail available for use.

### Access

Alternative R would result in a reduction in the risk to invasive plant spread from access compared to current management. With road density limits of 1 mile per square mile for focused restoration areas and 2 miles per square mile for general restoration areas, there would be fewer roads available to be driven. Therefore, potential for invasive plants to be spread from the road system would be less.

Since this alternative would result in a reduction in the amount of road miles over the life of the plan, there would be less bare soil associated with the maintenance and use of these roads. It is expected that decommissioned roads would have permanent vegetative cover, which would naturally deter invasive plants by not providing available niches to occupy in the future.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

The proposed action would result in a 76 percent decrease in risk to the quality of wildlife habitat from invasive plants compared to current management.

### Riparian and Aquatic Resource Management

Through implementation of alternative R there would be a similar risk to riparian management, compared to the no-action alternative, since similar strategies would be employed in regard to limiting ground disturbance within the riparian management areas. Following the guidance in the Aquatic Riparian Conservation Strategy Modified (ARCS-Mod) concerning Aquatic Invasive Species the risk of infestation and spread of these plants would be reduced by the efforts to clean equipment and avoid contaminating new sites.

## Alternative P

Alternative P would result in an elevated level of risk for invasive plants compared to the no-action alternative and that which has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands is predicted to increase. The increase is likely curbed to some degree by the reduction in road miles that should be expected over the life of the plan for this alternative.

### Timber Production and Management

An index value rating of 1.23 found in table 44 for alternative P equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being 23 percent greater than the risk in the current Forest Plan. This 23 percent increase in risk has the potential to result in a need to treat more acres of invasive plants than experienced currently. This potential need to treat more acres could also result in increased costs for invasive plant treatment, increased monitoring and inspection efforts, and increased coordination efforts around invasive plant issues.

### Motorized Recreation Trails

Alternative P could experience a slightly higher level of risk from motorized recreation trails, and use of these trails, to invasive plants spread when compared to current management. While the management area identified as “Backcountry Motorized” is projected to increase by approximately 3 percent, it cannot be said with any level of certainty that the actual presence on motorized trails would increase under this alternative.

### Access

Alternative P would result in a reduction in the risk to invasive plant spread from access compared to current management. With road density limits of 1 mile per square mile for focused restoration areas and 2 miles per square mile for general restoration areas, there would be fewer roads available to be driven. Therefore, potential for invasive plants to be spread from the road system would be less.

Since this alternative would result in a reduction in the amount of road miles over the life of the plan, there would be less bare soil associated with the maintenance and use of these roads. It is expected that decommissioned roads would have permanent vegetative cover, which would naturally deter invasive plants by not providing available niches to occupy in the future.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

The proposed action would result in a 23 percent increase in risk to the quality of wildlife habitat from invasive plants compared to current management.

### Riparian and Aquatic Resource Management

Through implementation of alternative R there would be a similar risk to riparian management, compared to the no-action alternative, since similar strategies would be employed in regard to limiting ground disturbance within the riparian management areas. Following the guidance in the Aquatic Riparian Conservation Strategy Modified (ARCS-mod) concerning Aquatic Invasive Species the risk of infestation and spread of these plants would be reduced by the efforts to clean equipment and avoid contaminating new sites.

## Alternative B

Alternative B would result in a reduced level of risk for invasive plants compared to the no-action alternative and that which has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands is predicted to decrease.

### Timber Production and Management

An index value rating of 0.72 found in table 44 for alternative B equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being 24 percent less than the risk in the current Forest Plan. This 24 percent decrease in risk has the potential to result in a need to treat fewer acres of invasive plants than experienced currently. This potential need to treat fewer acres could also result in decreased costs for invasive plant treatment and decreased monitoring and inspection efforts.

### Motorized Recreation Trails

Alternative B would experience a reduced level of risk from motorized recreation trails, and use of these trails, to invasive plants spread when compared to current management. The “Backcountry Motorized” Management Area in this alternative would comprise less than 1 percent of the Colville National Forest. This is 60 percent less than the area identified in the “No Action” alternative and the 1988 plan.

Assuming that actual miles of motorized recreation trails would be reduced as a result of the change in the amount of “Backcountry Motorized” acres, the trail system would have a lower risk to invasive plant establishment and spread by there being fewer miles of trail available for use.

### Access

Alternative B would result in the same level of risk from access as current management since the numbers of miles of roads are described to stay the same. Therefore, there is no change.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

Alternative B would result in a 24 percent decrease in risk to the quality of wildlife habitat from invasive plants compared to current management.

### Riparian and Aquatic Resource Management

Alternative B would result in the same level of risk to riparian and aquatic resource management as current management. Therefore, there is no change.

## Alternative O

Alternative O would result in a reduced level of risk for invasive plants compared to the no-action alternative and that which has been experienced under the existing 1988 Plan. This is because the amount of suitable forestlands is predicted to decrease.

### Timber Production and Management

An index value rating of 0.65 found in table 44 for alternative B equates to the risk of invasive plant establishment and spread from timber production, and associated road and fuels reduction work, being 35 percent less than the risk in the current Forest Plan. This 35 percent decrease in risk has the potential to result in a need to treat fewer acres of invasive plants than experienced currently. This potential need to treat fewer acres could also result in decreased costs for invasive plant treatment and decreased monitoring and inspection efforts.

### Motorized Recreation Trails

Alternative O could experience a slightly higher level of risk from motorized recreation trails, and use of these trails, to invasive plants spread when compared to current management. While the management area identified as “Backcountry Motorized” is projected to increase by approximately 3 percent, it cannot be said with any level of certainty that the actual presence on motorized trails would increase under this alternative.

### Access

Alternative O would result in the same level of risk from access as current management since the numbers of miles of roads are described to stay the same. Therefore, there is no change.

### Wildlife

The quality of wildlife habitat resulting from invasive plant establishment and spread for this analysis is influenced by the amount of risk present. Since the largest risk factor is related to timber production, and associated management practices, risks to wildlife habitat would be in alignment with the risks from timber management.

Alternative O would result in a 35 percent decrease in risk to the quality of wildlife habitat from invasive plants compared to current management.

### Riparian and Aquatic Resource Management

Alternative O would result in a similar level of risk to riparian and aquatic resource management from invasive plant establishment and spread as current management. Therefore, there would be little change.

## Cumulative Effects (Common to all Alternatives)

Cumulative effects may arise from the introduction of invasive species from lands adjoining the plan area. These lands consist of other Federal (BLM), tribal, State, county, or privately owned lands. The plant invasion process occurs in three phases: introduction, establishment, and spread. Invasive species are introduced via vectors, such as wind, water, or wildlife, in addition to the actions of people, which move seeds or plant fragments from one location to another. Wind and water, in particular, are major natural dispersal agents. For example, windblown seed of rush skeleton weed can be carried up to 20 miles (USDA Forest Service 2005). Water is a primary aid in the dispersal of many species, including Japanese knotweed. Rivers and waterways have been identified as one of the biggest spread mechanisms for invasive plants (Sheley et al. 1995).

Various wildlife species can contribute to the spread of invasive plant species by dispersing seeds in their dung, on their coats or feathers, or between their hooves. Ants have even been identified as one of the dispersal agents for the seeds of Scotch broom (Parker, et al. 1998). Though invasive plant propagules (seeds or plant fragments capable of establishing) may originate from outside sources, there is potential for them to affect the Colville National Forest. Therefore, the cumulative effects analysis area is considered northeastern Washington and it includes lands of all ownership.

People traveling to the Colville National Forest may transport invasive plant propagules from adjacent or even distant lands. This may be done through a variety of means: motor vehicles, clothing and footwear, pets, stock, etc. Motor vehicles, in particular, have been shown to pick up and move invasive species seeds that can be deposited along roads (Schmidt 1989 and Hodkinson and Thompson 1997). Roadside habitats are particularly susceptible to plant invasions for a number of reasons. Roads eliminate some of the physical and environmental barriers that help prevent invasion by increasing available light and dispersal opportunities. Disturbances associated with the use and maintenance of roads provide habitat easily exploited by invasive species, which can then seed themselves relatively swiftly along roadsides or be transported by animals or people (vehicles). Roads are primary vectors for the spread of invasive plants and the most likely vector for human transport of invasive plant propagules from outside the plan area.

Cumulative effects may be incurred from the transport and establishment of nonnative invasive plants from sources adjacent to the plan area. Likewise, weeds from the National Forest System lands could spread to adjacent areas. However, these effects are expected to be small compared to the anticipated spread from invasive plants sites within the plan area. While the forest plan addresses invasive plant spread via prevention standards, invasive plants would continue to move freely across borders, to and from ownerships, because the movement of seeds and propagules via wind, water, or wildlife are largely beyond the control of the Forest Service.

An effect associated with mechanical treatments and livestock grazing is the potential to spread invasive species from adjacent lands. New weed populations could occur from vehicle-transported seeds, disturbed soils and increased light availability following mechanical treatments or creation of seedbeds by livestock use. Livestock and wildlife can spread weed seeds, but livestock and wildlife use results in fewer new weed populations than those established along roads and trails by seeds spread from vehicle tires, equipment tracks, and/or attached soil (Tyser and Worley 1992, Tyser and Key 1988, Gelbard and Harrison 2003). This circumstance is attributed to the higher amount of biotic and below ground biotic resistance experienced in areas other than roads and trails (Gelbard and Harrison 2003). All alternatives would contribute similarly to the control, treatment, and eradication of invasive plant species introduced from outside the forests.

Cumulative effects may also result from climate change. Much of the research on invasive species interactions with climate change has contributed to the growing body of evidence that global warming has enabled invasive species to expand to areas where they were not previously able to persist (Dukes and Mooney 1999, Weltzin et al. 2003, Thuiller et al. 2007, and Walther et al. 2009). Some researchers have modeled range expansions for some invasive species (*Centaurea solstitialis* and *Tamarix*) while predicting reduced invasion risk and significant range contractions for others (*Bromus tectorum, Euphorbia esula*, and *Centaurea biebersteinii*) by the year 2100 (Bradley et al. 2009). As the climate changes, the ranges of invasive plant species would change; some species may become less invasive, and others may become more invasive. Given their adaptive traits, invasive plants may be able to out-compete native species in the migration process to new suitable habitat (Hellamann et. al. 2008). Compared to a stable climate, the degree to which climate change has contributed to the current spread of invasive plants is unclear.

The forest plan responds to the challenges of increased risk of invasion from invasive plants, whether or not introduced from external sources and whether or not climate change may influence their spread, by incorporating standards to prevent the transport and establishment of invasive plant propagules and by including objectives to reduce the area infested by invasive plants over time. The cumulative effects do not add significantly to effects expected from this alternative.

By the Colville National Forest implementing invasive plant control measures and prevention strategies through the Forest Plan revision, a positive cumulative effect would be realized when considered in light of the control and prevention measures being employed on adjacent ownerships which include the Idaho Panhandle National Forest, Okanogan-Wenatchee National Forest, private lands under the control of county weed boards, State lands and Canadian lands to the north managed by the Ministry of Forestry.

### Monitoring Recommendations

The Inventory and Monitoring Plan Framework contained as appendix M of the 2005 Preventing and Managing Invasive Plants EIS is incorporated into the Forest Plan Revision as required monitoring for invasive plants.

## Fisheries

This section summarizes effects to fisheries and aquatic habitat from the related specialist report (MacDonald, Day and Honeycutt 2015), with special emphasis on the issues of “riparian and aquatic resource management,” “access,” and “old forest management and timber production.”

### Affected Environment

#### Overview

The 1.1-million-acre Colville National Forest accounts for approximately 2.6 percent of the total land area in Washington State. The Forest is divided into four ranger districts comprising about one-third of the total area of Ferry, Pend Oreille and Stevens Counties. Located in the northeastern corner of Washington, the Forest is bordered by British Columbia on the north; the Okanogan-Wenatchee National Forest to the west; the Idaho Panhandle National Forest to the east; and to the south by a portion of the Confederated Tribes of the Colville Reservation.

The Forest is divided by the 130-mile long Lake Roosevelt National Recreation Area and a portion of the Columbia River reservoir created by Grand Coulee Dam. The Forest is dominated by two north-south mountain ranges; the 7,000 foot Selkirk Range that includes the Salmo-Priest Wilderness and the Kettle River Range. The Forest is comprised of three zones with a unique climate, topography, and vegetation. Dry forests of ponderosa pine and Douglas-fir dominate the rolling landscape of the Okanogan Highlands west of the Kettle Crest. The crest, a high ridge of subalpine fir, separates the western portion of the Forest from the valleys and forested mountains to the east. To the east, within the Salmo-Priest Wilderness in the Selkirk Range, the cedar and hemlock forest are comparable to those on the west side of the Cascade Range. A more detailed description of the physiography, climate, geomorphology, and land use history is included in the watershed section in Chapter 3 of the DEIS and in Day (2015).

The multiple uses of the forest landscape can affect the physical, chemical, and biological characteristics and functions of watersheds and aquatic ecosystems. Principal Forest resources are timber, wildlife, fish, water, forage, and recreation. The Forest annual timber harvest has averaged 41 million board feet (MMBF) over the last 10 years. The average grazing program has included 29,500 animal unit months.

The Forest is popular with recreationists with over a half million recreation visitor days per year. Popular activities include rustic camping, forest product gathering, off-highway vehicle use, four-season trail use, driving for pleasure, snowmobiling, backcountry non-motorized travel, hunting and fishing, and wildlife viewing. Fishing license sale revenue for the tri-county area (Pend Oreille, Ferry and Stevens counties), where the Colville National Forest lies, averaged $292,987 per year for the period from 2007 through 2009. Approximately 4,000 miles of National Forest System roads provide access to recreation areas and areas to collect renewable forest products such as firewood, berries, rocks, mushrooms, and Christmas trees. The Colville National Forest manages 32 campgrounds, 2 candidate wild and scenic rivers, the Salmo-Priest wilderness, a ski area (49 Degrees North), and administers 15 recreation residences. These management activities and uses of the Forest can impact the quality and function of riparian and aquatic habitat. The following describes the current conditions on the Forest and the process used to determine the conditions.

### Riparian Habitat

Riparian zones are found adjacent to streams, rivers, lakes and wetlands, providing a transitional zone between terrestrial and aquatic components of the landscape (Gregory et al. 1991). Although riparian zones occupy a small part of the overall Forest land base, they support a diverse vegetation community not found in the upland areas. Riparian zones provide important foraging, cover, travel corridors, and nesting habitat for birds, small and large mammals, reptiles, and amphibians. Healthy riparian zones with an abundance of trees and other native woody species and forbs provide for channel and floodplain stability and integrity. Healthy riparian vegetation adjacent to streams and on floodplains slow flood waters and reduce the likelihood of downstream flooding.

Riparian zones improve water quality by filtering runoff, sediment, and nutrients from adjacent upland slopes. Riparian zones provide stream cover and shade, which helps keep the summer water temperatures cool for salmonids and other aquatic species, and are a source of large woody debris to stream channels. Riparian zones also contribute to the aquatic food base as a source of terrestrial insects that fall into channels and by providing detritus input which is used by myriad of macroinvertebrate species, which in turn are forage for fish and certain bird species such as the American dipper (*Cinclus mexicanus*). Healthy, functioning riparian zones are vital for providing good water quality and diverse aquatic habitat (Naiman et al. 1992, FEMAT 1993).

Riparian conditions on the Forest are highly variable. Overall, some riparian zones on the forest are functioning at or near their potential or are considered to be improving. However, there are many areas where they are functioning below their potential. Degraded riparian conditions have primarily resulted from livestock grazing, mining, timber harvest, fire management, road development, and water diversions. Livestock grazing has been the most important factor leading to bank damage, conversion of riparian vegetation species to upland species or non-native species, and sedimentation. On forested landscapes, silviculture, road building, and fire suppression have altered riparian conditions by changing the riparian vegetation composition and structure; reducing the amount of large trees that provide large woody debris and shade; and altering channel morphology. To a lesser degree, disturbances associated with developed and dispersed recreation have impacted riparian habitat. Additional information regarding the current condition of riparian habitat is contained in the watershed section of DEIS Chapter 3 and in Day (2015) and later in this section.

### Stream Channel Conditions

There are a variety of aquatic and riparian ecosystems on the Forest: streams, rivers, ponds, reservoirs, wetlands, and riparian areas. These ecosystems support complex communities of vertebrate and invertebrate aquatic life along with an assortment of riparian and aquatic plants. The Forest includes

approximately 6,670 miles of stream including approximately 2,480 miles of perennial stream and 4,190 miles of intermittent stream. Approximately 500 stream miles are fish-bearing. All streams within the Forest eventually flow into the Columbia River. There are no anadromous fish (i.e., salmon and steelhead) on the Forest as passage onto the Forest was blocked with the construction of Grand Coulee Dam.

Stream channel morphology responds to the flow of water and soil and vegetative inputs from adjacent land forms creating distinctive patterns such as pools, riffles, glides and side channels. Different channel characteristics during varying flows provide a diverse range of aquatic habitats.

In 1989, the Forest began to use stream surveys as the dominant inventory/monitoring tool to assess stream function and condition. By the end of 2012, greater than 95 percent of fish-bearing streams have been inventoried on the Forest. Many streams have been inventoried twice. The results of the surveys show that many of the reaches surveyed are not meeting the riparian management objectives (RMOs) as defined by INFISH.

A limiting factor for understanding the individual potential of most streams on the Forest has been the lack of reference conditions from similar stream reaches in unmanaged or lightly managed watersheds. However, many stream reaches are not meeting the RMOs and the aquatic habitat is judged to be functioning at risk or not properly functioning as described in the following Species Status, Watershed Condition and Foundation for Effects Assessment discussion. Based on the existing stream inventory data, common deficiencies in stream habitat conditions on the Forest include:

- Pools per mile are limited and large pools (greater than 3 feet in depth) even more so, thus limiting overwintering, spawning and rearing habitat for salmonids.
- Large woody debris per mile is limited along many reaches. Large wood can be an important channel structural component that helps create pools and provide cover for fish.
- Watersheds in the eastern half of the forest, particularly in the south half of the Pend Oreille River subbasin are composed of predominately sensitive, decomposed granitic land types making them at greater risk for increased erosion from land management activities.
- Watersheds with active livestock grazing and heavy dispersed recreation use are more likely to have some reaches with excessive bank disturbance resulting in reduced stream bank cover and widening stream channels due to localized bank erosion and sediment deposits. Increases in channel width result in decreased stream depths and more surface area exposed to solar radiation making the streams more susceptible to increased water temperatures.
- Watersheds with high road densities and with roads located within riparian areas are more likely to have some reaches displaying stream bank alteration with reduced stream bank cover and accelerated sediment delivery to the channels from road surfaces.

Stream channel and watershed conditions will be further discussed later in this section.

### Lakes

There are 102 lakes, ponds and reservoirs on the Forest, the largest of which is Sullivan Lake. Most lakes are low-elevation. There are very few high-elevation lakes on the Forest. The lakes range from 0.6 acre to large reservoirs. A majority of the lakes and reservoirs are stocked with salmonids for sport fishing. The riparian habitat around many of the lakes has been affected by both dispersed and developed recreational use. Activities such as dispersed recreational camping and fishing result in limited, isolated damage, particularly along near-shore areas. Fluctuating reservoir levels due to hydropower energy production affects near-shore aquatic and wetland plant and animal communities, and the success of near-shore fish

spawning. The impacts due to hydropower are or will be addressed during hydropower project relicensing and will be highlighted later in this section.

Some shallow-water lakes and large reservoirs are presently being affected by the spread of invasive aquatic plants such as Eurasian water-milfoil (EWM), Yellow Flag Iris (YFI), and curly pondweed (CP).

**Table 45. Lakes and reservoirs occupied by invasive aquatic species**

| Lake or Reservoir Name | Invasive Aquatic Species |
|---|---|
| Boundary Reservoir | EWM,CP |
| Box Canyon Reservoir | EWM,CP |
| Sherry Lake | EWM |
| Gillette Lake | EWM |
| Thomas Lake | EWM |
| Heritage Lake | EWM |
| Nile Lake | EWM |
| Bead Lake | EWM |
| Marshall Lake | EWM |
| Pierre Lake | YFI |

### Water Quality

Streams and lakes on the Forest generally have good quality. Where water quality is impaired, as defined by Clean Water Act standards, the primary pollutants are fecal coliform high stream temperature, dissolved oxygen and pH. Approximately three miles of stream are listed as water quality impaired for fecal coliform, 15 miles for temperature, 15 miles for pH and 22 miles for dissolved oxygen. A more complete discussion of the current water quality on the Forest and actions to improve water quality is included in the watershed section of this chapter and in Day (2015).

## Species Status, Watershed Condition and Foundation for Effects Assessment

### Background

The 1976 National Forest Management Act (NFMA 1976) requires the USDA Forest Service to set up a process for the development and revision of land and resource management plans (LRMP) for Forests and Grasslands throughout the United States. The first planning rule, adopted in 1979 and amended in 1982 and 1983, known as the 1982 planning rule, has guided the development, amendment and revision of the majority of current land management plans in effect throughout the National Forest System (NFS) lands. The 1982 planning rule (36 CFR 219.19) requires National Forests to manage habitat in order "*to maintain viable populations of existing native and desired non-native vertebrate species in the planning area,"* and further defines a viable population as *"one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area*".

The USDA has attempted to revise the planning rule provisions several times since the original planning rule was implemented in 1982. Between 2000 and 2008, three new planning rules were proposed, challenged, and ultimately remanded back to the USDA by the U.S. District Court. Direction for management of species differs between the 2000/2005/2008 and 1982 planning rules in regards to viability and sustainability of species. Under the 2000, 2005, and 2008 Planning Rules, National Forests

were required to assess "*the contribution of National Forest System (NFS) lands to the sustainability of ecosystems and species*" as opposed to "*maintaining viable population of species.*"

After the 2008 planning rule was remanded back to the USFS, the Forest was again revising the LRMP with the 1982 planning rule. Although a new planning rule was released in 2012, the Forest, which started plan revision under the 2000 planning rule, decided to complete their plan revision under the 1982 planning rule. The plan will be revised under the transition provisions of the 2012 Planning rule (36 CFR 219), which state that the responsible official may complete and approve the plan revision in conformance with the provisions of the prior planning regulation, including the transition provisions of the reinstated 2000 rule (36 CFR part 299, published at 36 CFR parts 200 to 299, revised as of July 1, 2010). The transition provisions allow the use of the 1982 planning procedures (See CFR parts 200 to 299, Revised as of July 1, 2000). Given that the 1982 planning rule is again in place, the objective of this evaluation (starting in 2010) was to refine the current "ecological sustainability" model where appropriate to ensure the evaluation approach addresses "species viability" criteria of the 1982 planning, while meeting the intent of the 2012 planning rule. The remainder of this section will describe the status of aquatic species on the Forest and the condition of watersheds on the Forest.

Watershed hierarchy is a key concept to understand. Watersheds are natural divisions of the landscape and the basic functioning unit of hydrologic systems and processes. Watersheds can be described or analyzed in a variety of scales ranging from large river basins to individual streams.

Watersheds are hierarchical (smaller ones are nested within larger ones) making them an appropriate context for considering many ecological processes. Physical processes such as rainfall, runoff, erosion, and sedimentation interact within the watershed boundaries to shape the landscape. Biological processes also occur within watershed boundaries. Environmental changes commonly culminate and appear at the watershed scale. Changes in soil, vegetation, topography, and chemicals change the quantity and quality of water, sediment, and organic material that flow through a watershed influencing the characteristics of stream channels and aquatic habitat. The different watershed scales are identified through a numbering system called the Hydrologic Unit Code (HUC). The hydrologic unit system is a standardized watershed classification developed by the U.S. Geologic Survey (USGS). Hydrologic units are watershed boundaries organized in a nested hierarchy by size. They range in size from regions to smaller units[20]. For this analysis three scales of watershed will be discussed in order of decreasing hierarchy: subbasin (HUC 8), watershed (HUC10), and subwatershed (HUC 12). Additional information and explanation of the watershed hierarchy is contained in the watershed section of this document and in Day (2015).

The Forest includes five subbasins that provide the framework for describing the fish species status and subsequently assessing the effects of different alternatives, as shown in the following table.[21]

**Table 46. Major subbasin hydrologic unit code (HUC) and size**

| Subbasin Name (8th level HUC*) | HUC | Total Subbasin Size (Acres) | Colville National Forest Acres |
|---|---|---|---|
| Sanpoil River | 17020004 | 627,732 | 105,291 |
| Kettle River | 17020002 | 659,201 | 321,743 |
| Upper Columbia River-Lake Roosevelt | 17020001 | 1,327,733 | 212,863 |
| Colville River | 17020003 | 650,712 | 145,579 |
| Pend Oreille River | 17010216 | 698,349 | 557,449 |

[20] See http://water.usgs.gov/GIS/huc.html
[21] The Forest includes a small portion of the Upper Spokane subbasin but there are no fish-bearing streams within the subbasin on Forest so the Upper Spokane subbasin is not discussed.

In order to meet the sustainability requirements of the 2000 planning rule, the Forest (with the Okanogan-Wenatchee National Forest and Blue Mountain National Forests), participated in a Region 6 pilot effort to develop a process to address the contribution of National Forest System (NFS) lands to the "sustainability of aquatic species". The result of the regional pilot process is a paper titled, *Process for Evaluating the Contribution of National Forest System Lands to Aquatic Ecological Sustainability* (Reiss et al. 2008). Reiss et al. (2008) developed the Aquatic Ecological Condition (AEC) model to evaluate the status of local populations of focal species and their habitat at the HUC12 or sub-watershed scale. The results are then aggregated to produce an ecological sustainability or viability outcome for each focal species at the subbasin (HUC 8) scale.

The following describes process used for assessing the current status of aquatic species, watershed and habitat condition. More detail, including the complete scientific basis for the AEC, is provided in Reiss et al. (2008).

## Aquatic Species Assessment and Current Status

The process developed by Reiss et al. (2008) relies on the use of "focal species" to assess current aquatic species status and later to assess the potential effects of alternatives on species viability. There are many aquatic native and non-native species that inhabit streams and rivers on the Forest. It is not possible to analyze viability for all the aquatic species present in subbasins within Forest lands. The focal species serve as surrogates for other aquatic vertebrate and invertebrate species.

There are limitations to the focal species approach. The assumption that the condition and needs of one species will overlap completely with other species, even those with the same habitat association, is inherently problematic. The intent is that by analyzing and assessing the viability of focal species that utilize a variety of habitats at different temporal and spatial scales, and designing conservation strategies that address the results of the analysis, other aquatic species will benefit. Species that should not be selected as focal species include those about which very little is known and those that are dependent exclusively or primarily on habitat that is not substantially affected by management of National Forest System lands (FSH 1909.14 Chapter 43.22d, as cited in Reiss et al. 2008).

The process to determine focal species includes four steps (Reiss et al. 2008):

Step 1(a) - Create a list of all known fish species and other aquatic species found on lands managed by the Forest and adjacent to the Forest.

Step 1(b) - Determine species-at-risk

Step 2 - Identify applicable spawning and rearing habitat associations for each species

Step 3 - Categorize the species-at-risk identified above into habitat associations

Step 4 - Choose species from each association as focal to serve as indicators of other species occupying the same habitat.

### Colville National Forest Focal Species

**Step 1(a)** - Create a list of all known fish species and other aquatic species found on lands managed by the Forest and adjacent to the Forest.

The following species and associated narratives are from Reiss et al. (2008) unless otherwise cited.

### *Family ACIPENSERIDAE*

White sturgeon (*Acipenser transmontanus*) occur predominantly in the mainstem Columbia River and are identified in the Lake Roosevelt subbasin plan as present, though all records are below the Forest boundary. The white sturgeon is a long-lived, large bodied species that inhabit deep water, using fast moving tributaries for spawning. The only known spawning site in the Lake Roosevelt subbasin is near the confluence of the Pend Oreille and Columbia Rivers.

### *Family SALMONIDAE*

Westslope cutthroat trout (WSCT) (*Oncorhynchus clarki lewisi*). WSCT are the native cutthroat trout within the Forest (see Behnke 2002). WSCT are estimated to currently occupy approximately 59 percent of the species' total historic range and 58 percent of the historic range in Washington State (May 2009). WSCT are presently found in all five subbasins on the Forest, however distribution of this species is extremely limited. Historically, fluvial or adfluvial populations existed within the Kettle River, Sanpoil, Pend Oreille and Colville subbasins.[22] The native adfluvial and fluvial life history is nearly extirpated with most remaining native populations exhibiting a resident life history form. WSCT is a Forest Service Region 6 sensitive species.

With the exception of annually stocked lowland lakes, WSCT are generally found in headwater streams where stream temperatures are cold and human impact is limited. The conversion of riverine habitat on the Pend Oreille and Columbia Rivers into reservoirs without providing fish passage as well as dams and dikes on major tributaries have possibly eliminated the migratory life-history forms of WSCT.

Historic land management practices including logging, grazing, and road construction has impacted WSCT habitat. Additionally, the introduction of the coastal rainbow (*O. mykiss irredius*) Yellowstone cutthroat (*O.clarki bouvieri*) have led to hybridization of WSCT populations. The WSCT historic distribution on the Forest may have been reduced through the introduction of non-native brook trout (*Salvelinus fontinalis*), as brook trout have been found to displace cutthroat trout (Benjamin and Baxter 2010, Peterson et al. 2004). Most genetically pure WSCT populations are located behind either dams or natural falls or are found in high gradient headwaters.

Trotter et al. (2001) conducted a genetic analysis from 19 stream trout populations on the Forest. The populations were ranked from A to F depending upon the level of genetic introgression. A population received an A ranking – Pure stock if all individuals carried genetic markers of the species or subspecies of interest, and there was no history of stocking the water with hatchery fish of the same species or subspecies. A population received a B ranking if one to nine percent of the individuals sampled carried evidence of genetic influence from another species or subspecies, but appearance-wise are all "good" representatives of the species or subspecies of interest. The B ranking also applied to populations with no detectable hybridization, but there was a history of stocking the water with hatchery fish of the same species or subspecies. Trotter et al. (2001) concluded that the WSCT populations in the South Fork Sanpoil, Rocky Creek, Silver Creek and East Fork Smalle Creek merited an A-rating. Additionally, the populations in Fourth of July Creek, Harvey Creek, North Fork Sullivan Creek, Upper Sullivan Creek, Slate Creek and Cedar Creek and East Branch Le Clerc Creek were given B ratings.

The re-licensing terms for the Boundary Hydroelectric Project include the construction and operation of a hatchery to produce native salmonids to outplant into tributaries draining into Boundary Reservoir.

[22] In general terms, a fluvial life history refers to a species that exhibits a migratory life history where spawning and early rearing occur in tributary streams and then juvenile fish migrate to larger streams to rear and mature before returning to the natal stream to spawn. An adfluvial life history is similar to fluvial but the juvenile fish migrate to a lake to rear and mature before returning to the natal stream to spawn. A resident life history refers to fish that spawn and rear in the same stream although they may move throughout the stream during their life cycle

Initially the priority species would be WSCT but could include bull trout or other native salmonids. The terms of the re-licensing also include establishing population goals to establish self-sustaining populations of the native fish. Seattle City Light is to monitoring the success of the outplanting program until the population goals are met.

Interior redband trout (*O. mykiss gairdneri*) are a form of rainbow trout native to the east side of the Cascade Mountain crest (Behnke 2002). Redband trout are distributed within the Kettle, Sanpoil, Upper Columbia, and Colville subbasins. This species is identified as a SOI due to its status as a Forest Service Region 6 sensitive species. Naturally occurring pure WSCT and interior redband usually do not inhabit the same streams on the Forest.

Coastal rainbow trout have been stocked in lakes and streams on the Forest for over 80 years by county and State fish and game agencies. The past stocking has led to introgression between the two subspecies in 14 sub-watersheds. All local populations appear exhibit only the resident in life history form although historically migratory life history forms were likely present. May et al. (2012) estimate that within the subbasins included on the Forest (including all ownerships), redband trout currently occupy 1,655 kilometers (23 percent) of the historically occupied 7,174 kilometers of stream. Trotter et al. (2001) found pure redband trout in Lone Ranch and Canyon Creeks. The Kettle subbasin has the pure redband trout populations in Deadman Creek and tributaries, Trout Creek and tributaries, Little Boulder Creek, South Fork Saint Peters Creek, Tonata Creek and tributaries, Lone Ranch, and Pierre Creek. The Upper Columbia subbasin has populations in Canyon Creek, Lane Creek, Hall Creek, Nancy Creek, and Barnaby Creek. South Fork Obrien Creek has the only population in the Sanpoil subbasin. The Colville subbasin has two small populations in the South Fork of Chewelah Creek and Strauss Creek. There are no known populations in the Pend Oreille subbasin. Competition with the introduced brook trout may be limiting redband trout populations as well.

Like the WSCT, interior redband trout tributary habitat has also been degraded by historic management practices such as logging, road building and grazing resulting in accelerated sediment delivery to streams, and degraded riparian vegetation and fish habitat.

On March 3, 2013, the Regional Forester for USDA Forest Service Region 6 signed the *Rangewide Conservation Agreement for the Conservation and Management of Interior Redband Trout*. The agreement outlines a process of cooperation, coordination, and data sharing among the entities with either management responsibility or interest for the conservation of interior redband trout. The intent of the agreement is to enhance the cooperation and coordination of interior redband trout conservation efforts. Other signatories include the Regional Foresters of Forest Service Regions 1, 4, and 5; the states of California, Idaho, Nevada, Oregon and Washington, the USDI Bureau of Land Management, the USDI Fish and Wildlife Service; five Indian tribes and Trout Unlimited.

Coastal rainbow trout (*O. m. irredius*) are not native to the Forest but have been planted widely across the state as a game fish. Pure populations that have not inter-bred with native rainbow have been identified via genetic testing in three of five subbasins on the forest: Colville, Pend Oreille and Lake Roosevelt. Coastal rainbow trout commonly hybridize with interior redband trout or WSCT.

Kokanee (*O. nerka kennerlyi*). Kokanee salmon, a landlocked form of sockeye salmon are a very desirable sport fish. Historically, anadromous sockeye salmon were found in northeastern Washington and southern British Columbia. The anadromous sockeye life history ended with the construction of Grand Coulee Dam on the Columbia River. The presence of kokanee on the Forest appears to have originated through stocking programs. Kokanee are annually stocked by WDFW in Lake Roosevelt. Kokanee spawn in Sullivan and Pierre Lakes on the Forest.

Kokanee from Lake Roosevelt attempt to spawn in the Sanpoil River tributaries on the Forest although success has not been documented. With the exception of the Lake Roosevelt adfluvial population, kokanee are generally found in oligotrophic lakes, where water temperatures are cold. The species provides an important subsistence fishery for the Colville Tribe and a sport fishery for local communities.

Pygmy whitefish (*Prosopium coulteri*) Sullivan and Bead Lakes are two of only nine lakes in Washington State thought to support remnant pygmy whitefish populations. In 2004 the species was also found in Mill Pond Reservoir which is downstream of Sullivan Lake. Pygmy whitefish sometimes use tributary streams to spawn but can also spawn in shallow lakebed habitat. The main threats that have been identified for pygmy whitefish are introduced predatory species, silting of spawning streams and lake eutrophication.

Mountain whitefish (*P. williamsoni*) are found in two subbasins on the forest, the Kettle and Pend Oreille. Whitefish display seasonal movements from streams for spawning and feeding to deep, slow water for over-wintering habitat. Spawning occurs in late fall as females broadcast adhesive eggs over a gravel substrate. Mountain whitefish are not found in the small streams on the Forest but in the larger systems that primarily do not flow through the Forest.

Brown trout (*Salmo trutta*) are an introduced fish originating in northern Europe. Reproducing, self-sustaining populations exist in four subbasins on the Forest. In the Pend Oreille subbasin brown trout are abundant in tributaries to Boundary and Box Canyon Reservoirs. Substantial populations exist in Sullivan, Le Clerc, Cee Cee Ah, Skookum and Indian Creeks. Brown trout are also found in the Colville River subbasin, primarily in Chewelah Creek. In the Kettle River subbasin, brown trout are annually stocked in Renner Lake for recreational fishing. Large adult brown trout have been found in the main Sanpoil River, however no spawning activity has been observed on National Forest lands. With the exception of a population in Renner Lake, all other populations appear exhibit adfluvial or fluvial life histories.

Brown trout tend to be an effective predator in lakes, rivers and streams. Brown trout are abundant in the large rivers and reservoirs. The bull trout draft recovery plans for north central Washington recommend removal of brown trout and other non-native fish as a strategy for recovery.

Bull trout (*Salvelinus confluentus*) are a native char species in the interior Columbia Basin. Bull trout exhibit a variety of life history strategies in the inland Columbia Basin: fluvial, adfluvial and resident and all three life history strategies may be found within the same population (USFWS 2014). Bull trout have the most specific habitat requirements of the native salmonids: requiring colder water temperatures compared to other salmonids; the cleanest substrates; complex stream habitat including deep pools, overhanging banks and large woody debris; and connectivity between spawning and rearing areas and downstream foraging, migration , and overwintering habitats (USFWS 2014).

Bull trout were listed as a Threatened Species under the ESA in 1998 (63 FR 31647). . Bull trout were once widely distributed in four of the five subbasins that overlay the Forest but are currently considered to be extirpated in the Sanpoil, and Kettle River subbasins (USFWS 2014). They are found in very small numbers in the Pend Oreille subbasin, and although considered extirpated in the Lake Roosevelt subbasin (USFWS 2014), bull trout have recently been observed in Sheep Creek. Native Americans historically fished for bull trout in the Sanpoil River, and Le Clerc Creek.

The Forest lies within the Pend Oreille Core Area (USFWS 2014). A core area represents the closest approximation of a biologically functioning unit consisting of habitat that could supply all the necessary elements for every life stage (e.g., spawning, rearing, migratory and adult) and include one or more groups of bull trout (USFWS 2014). While overall the bull trout populations in the Pend Oreille Core area are considered stable with a moderate, but not imminent risk of extinction in the last status review

(USFWS 2008), local bull trout population numbers on the Forest appear to be very low putting the populations at high risk of extirpation (see Rieman and McIntyre 1993). There have been few recent observations of bull trout on the Forest. The most recent observations include:

1. Cedar Creek (Stevens County) - the watershed is primarily in the U.S. but the lower reaches are in B.C. Two juvenile bull trout were found in the lower portion of Cedar Creek in Canada by British Columbia biologists in 1996. There are numerous road crossings with the potential to block fish passage in the lower part of the drainage. Day snorkeling the East Fork Cedar Creek on NFS lands in 1996 did not find bull trout presence.

2. South Fork Salmo River - over 90 percent of the larger Salmo River watershed is in B.C. The Salmo River has a relatively healthy population of bull trout. Juvenile bull trout were observed while snorkeling in the Canadian portion of the South Fork in 1998. Juvenile and adult bull trout were captured as early as 1975 and as late as 1995 in the portion of the watershed within the U.S. This portion is within the Salmo-Priest Wilderness. Most of the Salmo River bull trout habitat is in Canada so the Salmo River system was not included within the core area.

3. Slate Creek - Five individual bull trout were caught in the mouth of this creek between 1994 and 1997. One individual was caught twice. All were adult except for one juvenile.

4. Sullivan Creek - one adult bull trout was found poached in lower Sullivan Creek in 1994 below Mill Pond Dam, an impassable blockage to fish approximately 3.25 miles from the mouth.

5. Cedar Creek (Ione Creek) (Pend Oreille County) - one adult bull trout observed while snorkeling in 1995 above the old municipal dam for Ione. The dam was removed in 2005.

6. Le Clerc Creek - three juvenile bull trout were found while electrofishing in the East and West Branches in 1993. Two juvenile bull trout were observed during snorkeling in the East Branch in 1995. One juvenile bull trout was observed while snorkeling in the East Branch in 1998. According to USFWS (2012) there has been no recent documentation of bull trout juveniles or spawning since 2001 when a bull trout was observed on a redd and the population likely no longer exists.

7. Mill Creek (Pend Oreille County) - One adult bull trout was observed during snorkeling within the lowest mile of the creek in 1995.

8. Indian Creek - one bull trout was observed while snorkeling on the lowest mile of this creek on private lands in 1997.

Bull trout are threatened by historical and current land use activities. The construction and operation of Albeni Falls, Box Canyon, and Boundary Dams on the Pend Oreille River have fragmented habitat, and impeded bull trout migration. The construction of other dams and diversions without fish passage in Pend Oreille River tributaries have further fragmented habitat and reduced connectivity. Habitat has been also degraded by past timber harvest and livestock grazing. The introduction of non-native species continues to impact bull trout populations through competition, predation, and hybridization (USFWS 2002, USFWS 2014).

The presence of brook trout, which are widespread on the Forest, pose a particular threat to bull trout. Bull trout and brook trout would hybridize resulting in hybrid offspring that are often, but not always sterile. Where hybridization occurs declines in the bull trout population or even local extirpations have occurred (see USFWS 2014). Brook trout may have a competitive advantage over bull trout and displace bull trout displacing bull trout into higher elevation streams, especially at warmer water temperatures (Rieman et al. 2006, McMahon et al. 2007, Rodtka and Volpe 2007).

The re-licensing terms for the Boundary Hydroelectric Project include programs to improve conditions for bull trout and aid recovery of the population. The programs identified include improving passage for fish both upstream and downstream of the dam; riparian and stream channel habitat improvement; improving road conditions; and non-native trout suppression and eradication programs (USFWS 2012). However, the USFWS (2012, page 160) acknowledges that it may take 14 years before benefits of the programs result in slow but steady increases in bull trout numbers.

The USFWS (2002) states that for recovery bull trout local populations need to be re-established in Cedar Creek (Pend Oreille County), Indian Creek, Mill Creek, Sullivan Creek (including Sullivan Lake and tributaries) Slate Creek, Calispell Creek, Tacoma Creek, Ruby Creek, and the Le Clerc Creek complex (including the East and West Fork of Le Clerc Creek and Fourth of July Creek).

Bull trout critical habitat on the Forest has been designated in Cedar Creek, Slate Creek, Sullivan Creek, Le Clerc Creek, Mill Creek and Indian Creek, Ruby, Tacoma, Smalle, and Winchester Creeks (75 FR 63898).

Brook trout (*S. fontinalis*) are an introduced char species from the eastern U.S. that have been planted widely across the state as a game fish for the last 80 to 90 years becoming widely distributed in all five subbasins that overlay the Forest. The species is abundant in most subwatersheds within the subbasins.

Brook trout seem to be limited by natural or unnatural barriers and very high gradients found in most headwaters on the forest. Most populations exhibit only a resident in life history. Presently, brook trout are only stocked on the Forest in lakes without inlets or outlets. The brook trout is a desirable sport fish. Brook trout have been found to inter-breed with and out-compete native bull trout. Brook trout are also known to have negative impacts on native WSCT populations through inter-specific competition and predation. Though there is little research on the effect of brook trout stocking on native rainbow populations, habitat overlap would likely create competition between these species as well. Under the terms of the FERC re-licensing for the Boundary Hydroelectric Project, Seattle City Light will be sponsoring non-native trout, particularly brook trout, suppression and eradication projects.

Lake trout (*S. namaycush*) are an introduced species found only in Bead Lake on the Forest. Lake trout are a popular sport fish. The species is occasionally caught in Lake Roosevelt, and Box Canyon and Boundary Reservoirs when the fish become entrained out of Priest or Pend Oreille Lake. Lake trout live in lakes and have a piscivorous diet. Lake trout compete with bull trout and are considered one of the biggest threats to bull trout populations in the Lake Pend Oreille Core Area. Efforts to control the lake trout population in Lake Pend Oreille including angler incentive programs, and trap and gill netting programs (see USFW 2012 page 113). Spawning takes place in the fall in shoals, but no redds are created.

### *Family CYPRINIDAE*

Tench (*Tinca tinca*) are an introduced species that is found on the Forest in the Pend Oreille and Colville subbasins. They inhabit the Little Pend Oreille Lakes, Parker, and Sullivan Lakes on the Forest. Tench inhabit the shallow areas of lakes and ponds in dense vegetation. Spawning occurs from late May through late June.

Chiselmouth (*Arcocheilus alutaceus*) inhabit lakes and slow streams east of the Cascade Range and are considered “common to abundant” in the upper Columbia River. The species is found in waters adjacent to the Forest in the Pend Oreille, Lake Roosevelt and San Poil subbasins. This species is also present on the Forest in Cusick creek, a tributary to Box Canyon reservoir in the Pend Oreille subbasin.

Peamouth (*Mylocheilus caurinus*) is found on the Forest only in Bead Lake in the Pend Oreille subbasin. The species is also found in Lake Roosevelt and Box Canyon and Boundary Reservoirs adjacent to the

forest. Peamouth primarily inhabit lakes and reservoirs. They occupy the deeper habitat during the day and move to shallows at night. Spawning occurs from late May through early June in streams and among lake shores on a gravel or rubble bottom.

Northern pikeminnow (*Ptychocheilus oregonensis*) are a native species that have increased in numbers on the mainstem Columbia and Pend Oreille Rivers as dams have created large, slow-water systems. Most pikeminnow are found adjacent to the Forest in Lake Roosevelt, Box Canyon and Boundary Reservoirs and the lower San Poil River. Presence on the Forest has been documented in one body of water, Bead Lake. Pikeminnow inhabit lakes and slow water areas of streams. As juveniles they consume aquatic insects, but in adult form are highly piscivorous.

Longnose dace (*Rhinichthys cataractae*) are a common stream species that are found in the Lake Roosevelt and Pend Oreille subbasins adjacent to the forest. They mainly inhabit fast water portions of cool streams, though they may move to slower water refuges during the winter months.

Speckled dace (*R. osculus*) presence has only been documented on the forest in Sullivan Lake in the Pend Oreille subbasin but the species also occurs in the Colville River subbasin adjacent to the forest. This species is a generalist and inhabits streams and lakes.

Redside shiner (*Richardsonius balteatus*) are found in lakes and slow-water habitat. The species is found in the San Poil River, Cottonwood Creek and Sullivan Lake in the Colville, Pend Oreille and San Poil subbasins, respectively on the forest. Shiners have the potential to compete with juvenile trout and kokanee for food resources where habitat overlaps and are also important as a forage fish for larger trout.

Umatilla dace (*R. umatilla*) Umatilla dace are found in the Columbia River Basin east of the Cascade Mountains from Umatilla, OR to British Columbia, Canada. In Washington State, Umatilla dace specimens have been reported from the Columbia, Yakima, Okanogan, Similkameen, Kettle and Colville Rivers. It is not known if Umatilla dace inhabit waters within the Forest boundary.

### *Family CATOSTOMIDAE*

Longnose sucker (*Catostomus catostomus*) are found on the Forest only in the Pend Oreille subbasin in both Bead and Sullivan Lakes. This species is also found in Lake Roosevelt and Box Canyon and Boundary Reservoirs adjacent to the forest. Primary habitat is coldwater lakes and streams, with early spring spawning and only short migrations recorded.

Bridgelip sucker (*C. columbianus*) lives in pools and backwaters of larger rivers, primarily on the east side of the Cascade Range. This species is present in the Lake Roosevelt and San Poil subbasins adjacent to or downriver from the forest.

Largescale sucker (*C. macrocheilus*) are found throughout waters adjacent to the Forest but have only been documented on the Forest in the Pend Oreille subbasin. These are the most common of all sucker species inhabiting both lakes and streams. Larger, slow moving systems are favored.

### *Family GADIDAE*

Burbot (*Lota lota*) is the only freshwater species of cod found in North America. Burbot are found in Sullivan and Bead Lakes in the Pend Oreille subbasin on the forest. This species is also found in Lake Roosevelt adjacent to the forest. Burbot feed on other lake fish species, foraging more actively in the summer. Spawning takes place in late winter. It is presently unclear whether burbot was native to the Forest or introduced.

### *Family CENTRARCHIDAE*

Largemouth bass (*Micropterus salmoides*) is an introduced species from the eastern U.S. The species is found in Pierre, Ellen and Pepoon Lakes on the Forest, in the Lake Roosevelt and Kettle subbasins. Largemouth bass is tolerant of warm water and does best in shallow weedy lakes and the backwaters of rivers.

Smallmouth bass (*M. dolomieui*) is an introduced species from the eastern and midwestern U.S. The species is found in Boundary and Box Canyon Reservoirs in the Pend Oreille subbasin. Smallmouth bass is tolerant of warm water but usually inhabits cool, clear streams or lakes with some current.

Black crappie (*Pomoxis nigromaculatus*) is also an introduced species from the eastern U.S. The species is found in Pierre Lake, Kettle subbasin, on the Forest. Black crappie is generally found in the clear waters of large streams or in reservoirs and medium-sized lakes.

### *Family COTTIDAE*

Slimy sculpin (*Cottus cognatus*) is found in riffles in stream systems. It is found in 13 subwatersheds in the subbasins of the Sanpoil, the Colville (Chewelah Creek, Mill Creek), the Kettle River (Deadman Creek), and the Pend Oreille (Big and Little Muddy Creeks, Jim Creek, Lost Creek, Sullivan Creek, Smalle Creek, Ruby Creek, Skookum Creek, and Winchester Creek).

## Aquatic Invertebrates

California floater (*Anodonta californiensis*) is a native mussel that is found from Mexico to southern British Columbia. It is known to occur near the mouth of the Kettle River and in Curlew Lake in the Kettle subbasin, near the mouth of the Colville River in the Colville subbasin and in Cusick Creek in the Pend Oreille subbasin. The California floater requires clean fresh water. In the larval stage, the mussel is parasitic to specific minnow hosts in the *Gila* genus. Maintaining healthy native populations is important to ensure suitable hosts are available. Juvenile clams fall from fish where they attach to gravel or rocks in clean, well-aerated waters. After growing for some time, young clams are washed downstream where they settle in sandy or soft muddy bottoms in the slower waters of lakes or large rivers where they mature. This species is considered a SOI due to state candidate listing.

There are numerous aquatic insects for which we have no inventory or population information. Due to the lack of information these species cannot be discussed.

**Step 1 (b)** - Determine species-at-risk.

Establishing a list of species-at-risk is an important element in the process of selecting focal species. Species listed as threatened or endangered (TES), species-of-concern (SOC), and species-of-interest (SOI) are identified using planning rule definitions (FSH 1909.12:43.22). All ESA listed TES , SOC and SOI form a suite of species (hereafter referred to as species-at-risk) recognized as potentially sensitive to management actions from which focal species are chosen to serve as surrogates for assessing current conditions and potential effects of alternatives to other aquatic vertebrate and invertebrate species, and other species-at-risk. The following criteria, established in FSH 1909.12 Chapter 43.22, determine how species–at-risk are sorted.

Listed species (TE) - Listed species are those listed by the U.S. Department of the Interior, U.S. Fish and Wildlife Service or the National Oceanic and Atmospheric Administration, National Marine Fisheries Service as threatened or endangered under the ESA (FSH 1909.12, 43.22a).

Species-of-concern (SOC) - Species-of-concern are species for which the responsible official determines if management actions may be necessary to prevent listing under the ESA. Identified species-of-concern may include entities such as distinct population segments or evolutionarily significant units that may be listed under the ESA. Species that meet one or more of the criteria below are considered SOC (FSH 1909.12, 43.22b):

Species has a rank of G-1 through G-3 on the NatureServe ranking system (NatureServe 2006 http://explorer.natureserve.org/ranking.htm).[23]

- Species has been identified as candidate and proposed species under the ESA.
- Infra-specific (sub-specific) taxa have a rank of T-1 through T-3 on the NatureServe ranking system (NatureServe 2006).
- Species was petitioned for Federal listing and a positive "90-day finding" was made.
- Species was recently delisted (delisted in the past five years and regulatory agency monitoring is still considered necessary).

Species-of-interest (SOI) - Species-of-interest are species for which the responsible official determines that management actions may be necessary or desirable to achieve ecological or other multiple-use objectives (FSH 1909.12, 43.22c). The responsible official may review the following for potential species-of-interest:

- Species with a rank of S-1 (critically imperiled) and S-2 (imperiled) on the NatureServe ranking system (NatureServe 2006).
- State-listed threatened and endangered species that do not meet the criteria as species-of concern.
- Additional species that valid, existing information indicates are of regional or local conservation concern due to factors that may include significant threats to populations or habitat, declining trends in populations or habitat, rarity, or restricted ranges (e.g., narrow endemics, disjunct populations, or species at the edge of their range).
- Additional species that need plan components established for them, such as species of public interest including hunted, fished, and other species identified cooperatively with state fish and wildlife agencies consistent with the Sikes Act.

The species-at-risk are listed in the following table.

**Table 47. Summary of listed species, species of concern, and species of interest**

| Species | Present on Colville National Forest? | Status |
|---|---|---|
| Bull trout | Yes | ESA Threatened |
| Westslope cutthroat | Yes | SOI (state candidate, Forest Service Region 6 sensitive) |
| Redband/rainbow | Yes | SOI; (Forest Service Region 6 sensitive) |
| Kokanee | Yes | SOI (tribal and sport fishing importance) |
| Pygmy whitefish | Yes | SOI; (state and Forest Service Region 6 sensitive) |
| California floater | No | SOC (state candidate) |
| Umatilla dace | Unknown | Forest Service Region 6 sensitive |

[23] The 2006 NatureServe database was used for determining potential surrogate species

Management Indicator Species (MIS) –The 36 CFR 219.19 (1982 planning rule) directs forests to establish objectives for the maintenance and improvement of MIS' habitat (see further MIS discussion below). Species are selected as MIS because their population changes may indicate the effects of land management activities (36 CFR 219.19 (a) (1)). There is only one aquatic MIS in the Colville National Forest Land and Resource Management Plan; "Trouts," with no specific species or subspecies indicated. "Trouts" were selected to represent species utilizing lacustrine, riverine and riparian habitat.

Strategic Species - In Region 6, strategic species are designated to place emphasis on filling information gaps (such as distribution), which will better support management's understanding about conservation status. Strategic species may not be considered "sensitive" under Forest Service Manual (FSM) 2670 and therefore the effects of proposed actions and alternatives may not be analyzed for them. The following aquatic vertebrates are designated as a strategic species for the Colville National Forest:

- Native Trout Group: Westslope Cutthroat Trout
- Redband Trout

**Step 2.** Identify Applicable Spawning and Rearing Habitat Associations for Each Species - Habitat associations are defined as the type of habitat that a particular species primarily uses for spawning and rearing. By choosing to focus on spawning and rearing habitat, we identify a potential limiting factor for the species' survival. Though foraging areas and migratory corridors are important, without access to suitable spawning and rearing habitat, the species will not survive (Reiss et al. 2008).

Habitat associations are categorized as headwaters, minor tributaries, major tributaries, main-stem rivers, and lakes and reservoirs. From a hydrologic standpoint, these categories may be general and potentially difficult to define. For the purposes of this assessment general stream habitat associations are headwaters (1st and 2nd order fish-bearing streams), minor tributaries (3rd order), major tributaries (4th order), main-stem rivers (5th order and higher), and lakes and reservoirs (Reiss et al. 2008).

**Step 3** – Categorize the Species-at-Risk into Habitat Associations and Step 4 Choose Species from each Association as Focal Species to serve as indicators of other species occupying the same habitat type.

The following table provides the results from both Steps 3 and 4 in a one-reference table (Reiss et al. 2008).

**Table 48. Habitat associations (spawning and rearing) for species-at-risk.**

Note: Species in bold text are Colville National Forest selected MIS/focal species.

| Headwaters | Minor tributaries | Major tributaries | Mainstem Rivers | Lakes and Reservoirs |
|---|---|---|---|---|
| **Bull Trout**<br>**Westslope Cutthroat**<br>**Interior Redband** | **Bull Trout**<br>**Westslope Cutthroat**<br>**Interior Redband** | **Bull Trout**<br>**Westslope Cutthroat**<br>**Interior Redband** | **Bull Trout**<br>**Westslope Cutthroat**<br>California Floater<br>Umatilla dace | **Bull Trout**<br>**Westslope Cutthroat**<br>Pygmy Whitefish<br>Kokanee |

The Forest selected focal species are bull trout, WSCT and interior redband trout. These species were given priority as focal species because:

1) Bull trout are federally listed under the ESA, and WSCT and interior redband trout are a Regional Forester's sensitive species and Colville National Forest strategic species. All three species fall under the MIS category of Trouts.

2) There is available information and data for these species through various subbasin plans, draft recovery plan (USFWS 2014), Colville National Forest monitoring, FERC re-licensing, etc.

3) The life history strategies of these species, their presence in a wide range of watersheds across the forest, and the multiple habitat types these species are associated with.

4) These species are dependent on habitat that is substantially affected by management of NFS lands (FSH 1909.12 Chapter 43.22d).

The California floater was not selected, as it is known to occur in only one stream on the Forest. The Umatilla dace was not considered as a focal species, as it is not known or suspected to be found on the Forest. Pygmy whitefish were not selected, as they are found in only two lakes and are not suspected to be substantially affected by management on the Forest. Forest management activities designed to meet the needs of the focal species are expected to provide for the necessary habitat quality for these species.

Kokanee salmon, brown trout, and brook trout fall under the MIS "Trouts" category. However while popular sport fish, they are not native to the Forest. Management designed to meet the needs of the focal species is expected to provide habitat conditions for any desired non-native species. In fact the non-native fish are not necessarily good focal species as the re-licensing for the Boundary Hydroelectric Project includes terms for non-native fish suppression and eradication programs.

### *Colville Forest Plan Revision Management Indicator Species*

The 1982 Planning Rule (36 CFR 219.19) directs forests to establish objectives for maintenance and improvement of habitat for MIS. Species are selected as MIS because their population changes may indicate the effects of land management activities (36 CFR 219.19 (a) (1)). Each forest plan alternative is to establish objectives for the maintenance and improvement of habitat for the MIS. The MIS are to be used to estimate the effects of each alternative on fish and wildlife populations. Alternatives are to be evaluated in terms of both the amount and quality of habitat and of the population trends for the MIS. The selection of MIS are to represent, where appropriate (36 CFR 219.19 (a) (1)):

- Endangered and threatened plant and animal species identified on State and Federal lists for the planning area.
- Species with special habitat needs that may be influenced significantly by planned management programs.
- Species commonly hunted, fished or trapped.
- Non-game species of special interest.
- Additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

There is only one aquatic MIS identified for the current Colville National Forest Land and Resource Management Plan: Trouts, with no specific species or subspecies indicated. Trouts were selected to represent species utilizing lacustrine, riverine and riparian habitat. In the case of the Forest the Trouts may include native bull trout, WSCT, and interior redband trout; as well as non-native trouts; brook trout, coastal rainbow trout, brown trout, lake trout, and kokanee salmon that have been introduced for sport fishing. Without identifying any particular species Trouts could also include the mountain whitefish and pygmy whitefish which are in the same family (*Salmonidae*) as the aforementioned Trouts.

When the current Colville Forest Plan was written no fish species were listed as Threatened or Endangered under the ESA. Since then one species, the bull trout, has been listed as a Threatened Species with critical habitat designated on the Forest. WSCT, interior redband, pygmy whitefish and Umatilla dace are Forest Service, Region 6 sensitive species.

The focal species were chosen to assess current aquatic species status and to assess the potential effects of alternatives on species viability. In a sense the focal species, bull trout, WSCT and interior redband trout, are used in a similar manner as the MIS under 1982 planning rule in the development of the Draft Environmental Impact Statement (DEIS) and subsequent forest plan.

The three focal species will be carried forward as both focal and MIS (hereafter referred to as (MIS/focal species) because the bull trout are a threatened species, the three species have special habitat needs that may be influenced significantly by planned management programs; the interior redband and WSCT are species of concern and game fish; and because population changes could be indicators of the effects of management activities on other species, biological communities, or on water quality.

The native mountain whitefish and pigmy whitefish were not selected as focal species or considered to be identified as MIS. The mountain whitefish are not generally found in the small streams on the Forest but in the larger systems that primarily do not flow through the Forest. Pygmy whitefish are only found in two lakes on the Forest. The main threats that have been identified for pygmy whitefish are introduced predatory species, silting of spawning streams and lake eutrophication. The Umatilla dace is not known to occur on the Forest. Providing for the habitat needs of the MIS/focal species through the plan components (Desired Conditions, Objectives, Key Watersheds, Riparian Management Areas, and Standards and Guidelines) (see DEIS Chapter 4) is expected to reduce the potential for adverse amounts of sediment or silt being deposited in spawning streams and reduce the potential for Forest management programs contributing to lake eutrophication. In addition, the Forest would collaborate with the State of Washington, tribes, and U.S. Fish and Wildlife Service on projects to decrease predators impacting mountain pygmy whitefish on the Forest.

The non-native brook trout, brown trout, lake trout, kokanee salmon and coastal rainbow trout were not considered as MIS. Although these species are popular sport fish they are also threats to the native MIS/focal species through competition for food and habitat, predation on the focal species, and hybridization with the focal species. Lake trout compete with bull trout and are considered one of the biggest threats to bull trout populations in the Lake Pend Oreille core area. Efforts to control the lake trout population in Lake Pend Oreille including angler incentive programs, and trapping and gill netting programs. The terms for the Boundary Hydroelectric Project re-licensing include implementing non-native fish population suppression and eradication efforts in streams tributary to the Boundary Reservoir. It would not make sense to select a non-native fish species as a MIS when some populations may be actively suppressed or eradicated.

Land management activities such as timber harvest, the transportation system (both roads and trails), grazing, and recreation can adversely impact the habitat for native salmonid species. The three focal/MIS species were selected based upon the rationale presented in the selection of focal species discussion. The habitat requirements for the ESA Threatened bull trout including: requirements for cold water temperatures, clean substrates; complex stream habitat including deep pools, overhanging banks and large woody debris; and connectivity between spawning and rearing areas and downstream foraging, migration, and overwintering habitats, make the species the potentially the most susceptible of the focal species to impacts from the management programs identified in the forest plan. Monitoring the status of bull trout habitat may, therefore, be expected to be a good indicator of the status of habitat for other aquatic species on the Forest.

The historic range of WSCT and interior redband trout has been greatly reduced due to degraded habitat and stocking non-native species, especially non-native forms of cutthroat trout, coastal rainbow trout, and brook trout. However there are sub-watersheds that still support genetically pure WSCT or interior redband trout populations. While neither bull trout, WSCT, nor interior redband populations are widely distributed across the Forest, between the three species their habitat and populations are found across the range physical and biological watershed conditions on the Forest.

The Forest Service contribution to the three species' population viability will be assessed for each alternative. Additionally the habitat conditions for the three species will be assessed through the aquatics and watershed forest plan monitoring program. The monitoring program, discussed in Chapter 4 of the DEIS, has been incorporated into all alternatives to determine if land management actions implemented in accordance with the plan components are improving watershed conditions, riparian and stream habitats toward the desired conditions. PacFish/InFish Biological Opinion Monitoring (PIBO) (discussed later in this document), is expected to continue to provide information regarding the trends in aquatic habitat condition.[24] The Forest annually conducts stream habitat surveys on approximately 17 miles stream using a standard Region 6 stream survey protocol. The surveys also collect information of fish distribution at the time of the survey although the surveys are not designed to provide a population estimate. Monitoring information that is described in the Watershed portion of the DEIS will provide valuable information regarding the status of aquatic habitat. The watershed monitoring includes periodically updating the WCF and a Regional Best Management Practice (BMP) monitoring program.

Programs implemented by other agencies are expected to provide information regarding fish population trends especially in the Pend Oreille subbasin. For example the terms for re-licensing the Boundary Hydroelectric Project include a conservation hatchery program to re-build the populations of native fish. The terms for the hatchery program include establishing population goals for self-sustaining populations of the native fish. Seattle City Light is to monitor the success of the out-planting program until the population goals are met.

### Aquatic Species Viability Evaluation/ Aquatic Ecological Condition Model

The 2012 Planning Rule, 36 CFR 219.19(a)(7)(ii)(A-B & D), states; "Evaluations of species diversity must include, as appropriate, assessments of the risks to species *viability* and the identification of ecological conditions needed to maintain species *viability* over time based on the following: The *viability* of each species listed under the Endangered Species Act as threatened, endangered, candidate, and proposed species must be assessed. Individual species assessments must be used for these species… For all other species, including other species-at-risk and those species for which there is little information, a variety of approaches may be used, including individual species assessments and assessments of MIS/focal species or other indicators used as surrogates in the evaluation of ecological conditions needed to maintain species *viability.* In analyzing *viability*, the extent of information available about species, their habitats, the dynamic nature of ecosystems and the ecological conditions needed to support them must be identified. Species assessments may rely on general conservation principles and expert opinion. When detailed information on species habitat relationships, demographics, genetics, and risk factors is available, that information should be considered."

[24] See Appendix1 page 15 in the April 18, 2014 letter from the Deputy Regional Directors to FS Pacific Northwest and Rocky Mountain Research Station Director, NOAA Fisheries Branch Chiefs (West Coast Region), BLM District/Field Managers (Oregon, Washington, Idaho, and Montana), FWS Field Supervisors (Pacific Region), EPA Office of Water Directors (Regions 8, 9, and 10), EPA Operations Office Directors (Idaho, Oregon, Montana, and Washington),EPA Region Forest/Range Manager (Region 10) Updated Interior Columbia Basin Strategy: A Strategy for Applying the Knowledge Gained by the Interior Columbia Basin Ecosystem Management Project to the Revision of Land Use Plans and Project Implementation

To meet the above direction, the Aquatic Ecological Condition (AEC) model was developed to assess the current condition of aquatic habitat and MIS/focal species population status and to inform the species viability assessment. Reiss et al. (2008) utilized a decision-support model in order to formalize the assessment procedures, assumptions and factors that would contribute to healthy, ecologically sustainable aquatic species populations and their habitat. The decision-support model (DSM) is a computer-based model (Netweaver) that applies a consistent evaluation process across time and space.[25] This type of model was chosen because it uses an explicit process for assessing condition and documents the data and relations between attributes assumed in the assessment. Decision Support Models use data to evaluate a conclusion. For the AEC model, the conclusion being analyzed is; Subwatersheds (HUC12) on the Forest provide Aquatic Ecological Conditions that are properly functioning and support viable populations of aquatic MIS/focal species. Data used in the assessment lend varying levels of support to this conclusion, ranging from full support (+1) to no support (-1). The HUC12 AEC assessment depends on two topics; MIS/focal species local population condition and habitat condition within each sub-watershed on the Forest. Both of these topics are dependency networks composed of aggregated evaluation scores from other attributes (shown below). These scores may be interpreted as strength of evidence, where +1 indicates strong evidence of the conclusion and -1 indicates no evidence of the conclusion. A score of 0 is assigned by the model when the strength of evidence lies midway between the +1 and -1 scores and/or does not provide evidence for or against the conclusion. Scores from -1 to -0.34 were considered *NOT PROPERLY FUNCTIONING* for a model attribute or total AEC; scores from -0.33 to +0.33 are considered *FUNCTIONING AT RISK* for viability; scores from +0.33 to +1.0 are considered *FUNCTIONING APPROPRIATELY* for viability. The AEC model was originally run for the Forest in 2008. The Forest decided not to use the 2008 AEC model results due to a variety of factors including:

- Subwatershed boundaries have changed since the original assessment
- Documentation of the 2008 AEC modeling process for the Forest is not clear and the personnel who developed and ran the model have moved to other agencies or retired; thus it is difficult to analyze the model results without better understanding of the model inputs. This concern was further highlighted as the model results seem to over-estimate the number of watersheds in a “poor” condition given the more recent 2010 watershed condition framework (WCF) effort.[26]
- Existing information on in-stream habitat was not utilized in the 2008 model. Updating the 2008 analysis allowed the Forest to integrate the available stream habitat information and the WCF exercise to provide a more complete assessment of the current AEC across the Forest.
- Current fish distribution and status information is more robust than what was available in 2008.

A second exercise to assess the AEC was undertaken in 2014. For the 2014 AEC modeling, the Forest followed the basic procedures outlined in Reiss et al. (2008) but the information and analysis described below utilized EXCEL spreadsheets instead of the DSM.[27]

HUC12s (sub-watersheds averaging 10,000 to 40,000 acres) were chosen to evaluate viability due to the configuration of the HUC12 boundaries being considered the best surrogate for local populations of MIS/focal species in the interior Columbia Basin (Reiss et al. 2008). MIS/focal species local population condition was evaluated using data on fish distribution, population status and abundance, habitat and genetic connectivity, and impact of non-native species. These attributes were selected to evaluate the health, diversity, resilience and distribution of populations of MIS/focal aquatic species within the planning area.

[25] Documentation including the scientific rationale used to develop the AEC model can be found in Reiss et al. (2008)
[26] A description of the WCF effort and results are included in the Chapter 3 Hydrology section of the DEIS and in Day 2015
[27] Kate_Aqautic_Function_9_22-14 and KeyWatershedSpreadsheet_9-29-2014-Excel

Distribution - The distribution of MIS/focal species was primarily evaluated using "expert opinion" derived from biologists (and/or hydrologists) familiar with local conditions and studies.

The status assessment includes two attributes: status and abundance. Local spawning populations were characterized as strong or depressed based on current versus historic abundance, full expression of life history traits, and population trends. When information was not sufficient to apply the criteria, "unknown status" was assigned. Some HUC12s were identified as exclusively non-spawning/rearing areas (i.e., migratory corridor, over-wintering, or foraging). We included an additional attribute: genetically pure population. This attribute was evaluated based on assumptions about populations, and information from genetic studies.

The abundance attribute of the HUC12 MIS/focal species assessment describes local population status by addressing the average number of adults spawning annually. In many cases abundance was unknown so a score of 0 was applied.

Connectivity also includes two attributes; habitat barriers and genetic connectivity. Habitat barriers evaluates the degree to which access to habitat is limited by barriers to upstream and downstream fish movement within the HUC12. Only human-made barriers within the boundary of the HUC12 are considered in this attribute, though natural barriers may limit access as well. Barriers that protect resident fish populations from an invasive species are scored as beneficial.

Genetic connectivity describes the degree of connectivity between local populations within the HUC8 and thus the potential for a functioning meta-population. Although data for this attribute were determined at the HUC8 scale, the impact of isolation was assessed for each local population. Connectivity was primarily evaluated through expert opinion.

Non-native effects assesses the effects of non-native species on MIS/focal species. We focused on threats via introgression and not competition because the effects of introgression are more direct and thus quantifiable. However, we did consider competition where it appears non-native fish may have displaced a MIS/focal species population.

### *HUC 12-Scale Model: Habitat Condition*

The habitat condition component of the HUC12 AEC model was designed to assess ecological processes and watershed function, rather than evaluate the specific habitat needs of any particular species (see Reiss et al. 2008 for scientific rationale used to develop the model). Aquatic and riparian resources, water quality and species viability are dependent on the protection of naturally occurring processes. Processes such as, wildfire, flooding, sediment delivery to streams, natural flow regimes and retention of riparian vegetation (provides shade, moderates stream temperatures, provides recruitment of downed trees, etc.) are essential to the proper functioning of the stream channel and habitat that provides for the viability of aquatic species. Attributes were selected to serve as indicators of the routing of water, sediment, wood, and nutrients through the watershed—the processes that create and maintain the habitat conditions necessary to sustain healthy populations of aquatic- and riparian-dependent species. Channel shape and function, and the large woody debris attributes are included as indicators of current stream channel and overall aquatic habitat condition.

The Forest followed a process similar to and consistent with Reiss et al. (2008). The following model and attributes and attribute weights were developed by the Forest based on Reiss et al. (2008), and with input from Forest Service Region 6 Regional Office fish biologist, hydrologist and planning staff.

The road density attribute is used in the habitat condition model not only as an indicator of the potential risks roads present to aquatic habitat and watershed processes but as an indicator of the intensity of

anthropogenic disturbances in a watershed, not just those risks due directly to effects of the roads themselves. Roads have been shown to affect the routing of water, sediment, wood, and nutrients to stream channels resulting in accelerated erosion and sediment delivery to stream channels; altered channel structure and lateral migration of the channel in the flood plain; reduced large wood recruitment into the stream channel and shorter residence times of wood in the stream; and altered flow paths leading to diversion or extension of channels onto un-channeled portions of the landscape.

Roads are also associated with activities, past and present, that create negative effects on watershed and aquatic conditions beyond those solely attributable to the road, such as fishing, fish stocking (particularly non-native species), disease introduction, beaver removal, timber harvest, splash-damming, permanent dams for water storage and power production, recreation (particularly dispersed recreation camping next to streams), livestock grazing, irrigation withdrawals, fire suppression and ignition, and mining.

The road density (miles/sq. mile) attribute was calculated by subwatershed by dividing the total miles of road under all jurisdictions within the Forest proclaimed boundary by the area of the proclaimed Colville National Forest boundary.

Roads in proximity to water attribute is similar to the channel constriction attribute described in Reiss et al. (2008), recognizing that roads near aquatic habitat can have additional effects to the habitat. Streamside roads can reduce stream shade and increase water temperatures, simplify channel form (cut off side channels, straighten streams through confinement), and create impediments to the movement of aquatic species. The rationale given in Reiss et al. (2008) is further supported by recent work specific to the interior Columbia Basin. Meredith et al. (2014) found the presence of roads adjacent to streams resulted in significant reductions of in-channel wood. The proximity to water attribute by subwatershed was calculated by dividing total road miles of all roads under all jurisdictions in the riparian habitat conservation areas designated by INFISH (USDA Forest Service 1995) by the square mile of RCAs.

The road attributes were categorized or “scored” consistent with the WCF, where a score of 1 is considered to be “good” condition, a score of 2 representing “fair” and a score of 3 is considered “poor” condition. The following table displays how the road density and proximity to water attributes were categorized.

**Table 49. Road attributes categories**

| Road Density (mile per square mile?) | Road Density Risk category | Riparian Road Density category |
|---|---|---|
| less than 1 | 1 | 1 |
| 1-2.4 | 2 | 2 |
| >2.4 | 3 | 3 |

The roads attributes were further evaluated for erosion and sedimentation risk. High road densities in sensitive HUC12s can more severely disrupt watershed processes and potentially have more serious impacts to water quality, aquatic habitat, and the species themselves than the same densities in less sensitive HUC12s. The weight that the road density evaluation score receives in the model varies according to a HUC12’s sensitivity to soil disturbance.

The roads in landtype associations (LTA) with high erosion and sedimentation potential attribute is similar to the road density by sensitive soils attribute in Reiss et al. (2008). LTAs are ecological land units delineated based on similarities in landform pattern, geomorphic processes, regolith and bedrock features and their influence on physical and biological processes, climate, and potential vegetation (Davis et al.

2004).[28] Both the hydrology and soils sections in this document include additional discussion of LTAs. The LTAs were rated based on erosion risk using the following factors:

- Sediment delivery efficiency
- Surface runoff from snowpack
- Surface runoff from summer storms
- Deep-seeded landslide risk
- Shallow, rapid landslide risk
- Soil erosion

Each of the erosion risk factors were put into three categories that were weighted equally.

**Table 50. Erosion risk categories**

| Category | Points |
|---|---|
| Low | 1 |
| Moderate | 2 |
| High or Flashy | 3 |

The points for the six factors were summed to determine the "final" erosion risk score. Therefore the highest total score is 18, the lowest six.

**Table 51. Final erosion risk categories**

| Total Points | Final Erosion Risk |
|---|---|
| 6-8 | Low |
| 9-12 | Moderate |
| 12-18 | High |

The following table displays how subwatersheds with roads in LTAs with high erosion and sedimentation risk were categorized.

**Table 52. Erosion and sedimentation risk categories**

| Miles of Road in LTAs with high erosion and sedimentation risk | Road Erosion and Sedimentation Risk Category |
|---|---|
| 0-8 | 1 |
| 8.1-15 | 2 |
| >15 | 3 |

Two upslope vegetation attributes were included in the AEC model: fire condition class, and insects and disease. The definitions, rating and scoring for the two attributes were obtained from the WCF database. These two attributes were chosen to help describe the health of forest vegetation as a component of a

[28] Landtype Associations are defined for the Colville National Forest in Davis (2004)

healthy watershed and to assess the potential risk of historically uncharacteristic wildfire, and insect and disease outbreaks.

The fire regime condition class (FRCC) measures the degree vegetation conditions have departed from a reference condition expected with natural fire frequency intervals. The departure from reference conditions may result in changes to key ecosystem components, such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought. The degree of departure may be due to (but are not limited to) fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, and introduced insects and disease. The FRCC is a measure of ecological trend and the potential for uncharacteristic disturbance to the ecosystem from fire. There are three fire regime condition classes described below:

- FRCC 1 represents ecosystems with low (less than 33 percent) departure and that are still within the estimated historical range of variability during a specifically defined reference period.
- FRCC 2 indicates ecosystems with moderate (33 to 66 percent) departure.
- FRCC 3 indicates ecosystems with high (greater than 66 percent) departure from reference conditions.

Insects and disease along with fire are important regulators of forest change. Insects and disease can negatively affect resource values and ecosystem functions including reducing the ability of forest canopies to intercept snow and prevent excessive runoff. Recent increases in forest area affected by insect outbreaks and possible links to fire suppression have created a resurgence of interest in their possible effects to water quantity, quality, and risks.

The riparian wetland vegetation attribute addresses riparian vegetation condition. Important functions of riparian vegetation include (FEMAT 1993, Gregory et al. 1991):

a. The input of fine organic matter and nutrients to aquatic habitat
b. Providing for bank stability
c. Filtering sediment due to surface erosion thus controlling the amount reaching the aquatic system
d. A source of large woody debris
e. Shading the aquatic habitat thus helping to control water temperature
f. Controlling the microclimate within the riparian zone and adjacent to the aquatic habitat

The riparian wetland vegetation attribute scores were obtained from the WCF database.

Reiss et al. (2008) recognized the importance of including in-stream attributes as indicators of aquatic habitat condition, however, did not due to lack of data on non-Federal lands. Reiss et al. (2008) did recognize the value of including stream channel attributes if available. Since the Forest had recently assessed all subwatersheds within the Forest administrative boundary with a consistent framework through the WCF exercise, the decision was made to include attributes that would help describe the current condition of stream habitat. The previously discussed attributes assess factors that influence aquatic habitat but do not specifically describe current aquatic habitat condition for the MIS/focal species. Therefore, the Forest decided to include attributes to describe aquatic habitat conditions which when combined with the upslope and riparian attributes, and MIS/focal species status scores, were felt to provide a more complete picture of the AEC.

Two in-channel attributes were chosen to describe in-stream habitat conditions:

- Channel shape and function
- Large woody debris

Stream channels are formed and shaped in response to the timing and quantity of flow and sediment delivery over time. Short-term changes in water or sediment delivery due to a disturbance such as a fire or flood may cause a channel response resulting in a changed condition. However if the channel forming processes are intact and allowed to recover, the stream channels and aquatic habitat are usually resilient (see Montgomery and Buffington 1998, Leopold 1994, Rosgen 1996).

Allowing stream channels to interact with floodplains and preserving the lateral, longitudinal, and temporal variability between stream channels, floodplains and riparian habitats are paramount to maintain natural heterogeneity and complexity of aquatic habitat (Naiman et al. 1992). In-stream large woody debris, where it is a natural part of the aquatic system, is an important feature that creates complex channel structure and fish habitat by collecting sediment, forming riffles and pools, providing cover, and facilitating biological productivity (Naiman et al. 1992). Complex habitats that are resilient to disturbance are important for the survival and productivity of aquatic species populations (Reeves et al. 1995)

The scores for the habitat portion of the AEC were obtained by multiplying the score for each attribute by its weight and summing the scores for each subwatershed. The properly functioning, functioning at risk, and not properly functioning scores were then converted to a +1 to -1 scale and combined with the MIS/Focal Species Status to obtain the AEC score for a subwatershed.

**Table 53. Total possible score by attribute**

| Attribute | Total Score Possible |
|---|---|
| Large Woody Debris | 0.3 |
| Channel Shape and Function | 0.3 |
| Riparian Wetland Veg Condition | 0.3 |
| Road Density | 0.45 |
| Proximity to Water | 1.2 |
| Roads in LTAs with high erosion and sedimentation potential | 0.15 |
| Fire Condition Class | 0.15 |
| Insects and Disease | 0.15 |
| Total | 3 |

**Table 54. Final aquatic habitat condition rating**

| Final Aquatic Habitat Condition Rating | Final Habitat Score | Score Included in the AEC Model |
|---|---|---|
| Properly Functioning | 1.0-1.4 | +0.33 to +1.0 |
| Functioning at Risk | 1.5-2.4 | -0.33 to +0.33 |
| Not Properly Functioning | 2.5-3 | -1 to -0.34 |

*AEC Results – Current Watershed Condition and Species Status on the Colville National Forest*

Table 55 displays the HUC12 AEC model results by MIS/focal species, by subbasin.[29]

[29] Kate_Aquatic_ Function_9_22-14-Excel and KeyWatershedSpreadsheet_9-29-2014-Excel

**Kettle Interior Redband**

The total AEC scores for interior redband in the Kettle subbasin range from a high of 0.4 (functional) in the Sand Creek-Kettle River subwatershed to -0.6 (*not properly functioning*) in the West Deer Creek subwatershed. The MIS/focal species scores are within the *properly functioning* range in eight subwatersheds; in five subwatersheds the population is rated functioning at risk; and the local population score is *not properly functioning* in two subwatersheds. The low local population scores are generally due to unknown redband abundance, abundant brook trout and a past history of stocking non-native rainbow trout. The habitat scores are considered *not properly functioning* in 10 of the 15 subwatersheds occupied by interior redband. No subwatershed habitat scores fall within the *properly functioning* range. A lack of large woody debris in the stream channels, high road densities and riparian road densities are commonly driving the low habitat scores. In all subwatersheds the channel shape and function attribute is rated *functioning at risk*. The fire regime indicator is rated *functioning at risk* in many of the subwatersheds and the riparian vegetation indicator is rated as *not properly functioning* in the Trout Creek, Tonata Creek, Saint Peter Creek, Little Boulder Creek and West Deer Creek subwatersheds.

**Kettle WSCT**

Westslope cutthroat trout inhabit six subwatersheds within the Kettle River subbasin. Only the Sand Creek-Kettle River has a *properly functioning* AEC score, the remaining five subwatersheds are rated functioning at risk. The MIS/focal species population is rated *not properly functioning* in the East Deer Creek-Kettle River, *functioning at risk* in four subwatersheds, and within the *properly functioning* range in Sand Creek-Kettle River. The low population scores are driven by low or unknown abundance, barriers and presence of non-native fish including possible presence of introduced non-native cutthroat trout. The *functioning at risk* watershed condition scores are due to ratings for channel function and shape, low amounts of woody debris, road and riparian road densities. The riparian vegetation attribute is *functioning at risk* in the South Fork Boulder Creek subwatershed. The fire regime indicator is *functioning at risk* in the North Fork Boulder-Boulder creek and South Fork Boulder Creek subwatersheds.

**Sanpoil WSCT**

Within the Forest only the North Fork Sanpoil River-Sanpoil subwatershed is inhabited by WSCT. The local population is *functioning at risk* due to unknown abundance and a lack of connectivity with other WSCT populations. The watershed condition within the North Fork Sanpoil River-Sanpoil subwatershed is *functioning at risk* due to poor riparian vegetation conditions and high riparian road densities. Channel shape and function, fire regime, insects and disease and road densities are all rated *functioning at risk*. Only the large wood attribute and sediment risk from roads on sensitive soils are considered *properly functioning*.

**Sanpoil Interior Redband**

Interior redband trout are found in four subwatersheds within the Sanpoil subbasin. Two subwatersheds have a total AEC within the *functioning at risk* category and two are rated *not properly functioning*. All local populations are rated *not properly functioning* except O'Brien Creek which is *functioning at risk*. Brook trout predominate and interior redband trout may no longer be present in all but the O'Brien Creek subwatershed. The O'Brien Creek population is at risk due to unknown abundance, reduced range, and lack of connectivity with other redband populations. Habitat is *functioning at risk* in O'Brien and Thirteenmile-Sanpoil River subwatersheds and rated as *not properly functioning* in the Scatter Creek and Ninemile Creek subwatersheds. Only the insect and disease and road on sensitive soils attributes are rated as *properly functioning* in O'Brien Creek, riparian road densities are *not properly functioning*. Thirteenmile Creek-Sanpoil River subwatershed is *functioning at risk* due to impaired channel shape and function, road densities and high riparian road densities. High road and riparian road densities, and a lack of large woody debris primarily drive the low watershed condition rating for Scatter Creek-Sanpoil River

subwatershed. The Ninemile Creek watershed condition is degraded due to high road and riparian road densities combined with all other indicators except the road on sensitive soils indicator are rated *functioning at risk*.

**Pend Oreille Bull Trout**

Bull trout local population status and overall AEC scores are generally rated as *not properly functioning*. Only the Headwaters South Salmo River received a positive population score, although population status is *functioning at risk*. The local populations in North Fork Sullivan Creek,-Sullivan Creek, Slate Creek, West Branch Le Clerc Creek and East Branch Le Clerc Creeks were rated *at risk*. The low population scores are due to low or unknown abundance, competition with non-native trout, and barriers.

As with the population status ratings, the watershed condition scores are also generally *not properly functioning*. Watershed condition is rated as *properly functioning* only in the Headwaters South Salmo River subwatershed, North Fork Sullivan Creek-Sullivan Creek, and Slate Creek subwatersheds. The *functioning at risk* and *not properly functioning* ratings are due to *at risk* or *not properly functioning* ratings for large woody debris (16 subwatersheds), channel shape and function (17 subwatersheds), riparian vegetation condition (18 subwatersheds), insects and disease (four subwatersheds), road densities (19 subwatersheds) riparian road densities (19 subwatersheds) and roads on sensitive soils (eight subwatersheds). Additionally all subwatersheds were rated *functioning at risk* for the fire regime attribute.

**Pend Oreille WSCT**

Of the 24 Pend Oreille subwatersheds rated for WSCT, only the Headwaters South Salmo River received a functional AEC. The AEC for the Winchester Creek, North Fork Calispell Creek, Skookum Creek, Cusick Creek-Pend Oreille River and Maitlen Creek-Pend Oreille River is rated as *not properly functioning*. All other subwatersheds received a *functioning at risk* score. Local species population status is rated as *properly functioning* in the Headwaters South Salmo River, West Branch Le Clerc Creek, East Branch Le Clerc Creek, and Harvey Creek. Twelve local populations are rated as *functioning at risk* and eight local populations are rated as *not properly functioning*. The *functioning at risk* and *not properly functioning* scores are due to a combination of unknown or low abundance, competition with non-native trout and lack of connectivity with other WSCT populations due to barriers.

The watershed condition is rated as *properly functioning* in Headwaters South Salmo River, North Fork Sullivan Creek-Sullivan, and Slate Creek. The watershed condition is rated as *functioning at risk* in seven subwatersheds and *not properly functioning* in 14 subwatersheds. Factors contributing to the *at risk* and *not properly functioning* ratings include; diminished amounts of large woody debris (17 subwatersheds), impaired channel shape and function (20 subwatersheds), riparian vegetation condition (17 subwatersheds), insects and disease (nine subwatersheds), high road densities and riparian road densities (21 subwatersheds) and roads on soils sensitive to erosion (nine subwatersheds). Additionally all subwatersheds are rated *functioning at risk* for the fire regime indicator.

**Colville WSCT**

The subwatersheds with WSCT in the Colville subbasin, include the Little Pend Oreille Lakes, Cottonwood Creek, and South Fork Mill Creek. Cottonwood Creek received an overall AEC score in the *functioning at risk* range while the Little Pend Oreille lakes and South Fork Mill Creek subwatersheds are rated as *not properly functioning*. The local population scores are all in the *functioning at risk* range due to low abundance, a predominance of brook trout, and isolation due to man-made barriers preventing connectivity with other populations. The Cottonwood Creek subwatershed condition is *functioning at risk* while both Little Pend Oreille Lakes and South Fork Mill Creek are rated as *not properly functioning*. The Cottonwood rating is due to large woody debris amounts scored as *not properly functioning*. The channel

shape and function, road densities and riparian road density attributes are *functioning at risk*. The *not properly functioning* watershed condition ratings for Little Pend Oreille Lakes and South Fork Mill Creek subwatersheds are due to *functioning at risk* or *not properly functioning* scores for all the watershed condition attributes except insects and disease and for roads on soils sensitive to erosion.

**Colville Interior Redband Trout**

The Colville subbasin includes four subwatersheds with interior redband trout. The total AECs for the South Fork Chewelah Creek-Chewelah Creek and North Fork Mill Creek are rated *functioning at risk* while the AEC for the South Fork Mill Creek and North Fork Chewelah Creek is rated as *not properly functioning*. The local populations are considered to be *functioning at risk* due to low abundance, isolation by barriers, high numbers of brook trout or hybridization with non-native trout. The watershed condition is considered *not properly functioning* in all four subwatersheds due to *at risk* or *not properly functioning* scores for all watershed condition attributes except insects and disease, roads on soils sensitive to erosion, and the fire regime attribute in the North Fork Mill Creek and North Fork Chewelah Creek watersheds.

**Lake Roosevelt Interior Redband**

Interior redband trout populations are found in nine subwatersheds. No subwatersheds received a *properly functioning* AEC score, four are rated as *functioning at risk* and five received a *not properly functioning* rating. Six local populations are *functioning at risk* and three are *not properly functioning*. Factors contributing to the low scores include limited distribution, low population numbers, isolation due to barriers, competition with non-native brook trout, and hybridization with non-native trout. Isolation above barriers are protecting small populations of interior redband from hybridization with non-native rainbow trout in the South Fork Sherman Creek, Upper Sherman Creek, and Lower Sherman Creek subwatersheds.

No subwatersheds received a *properly functioning* watershed condition score. Five received a *functioning at risk* rating and the remaining four are rated as *not properly functioning*. All subwatersheds were *functioning at risk* or *not properly functioning* for riparian road densities and channel shape and function. Seven subwatersheds were rated *functioning at risk* or *not properly functioning* for large woody debris, five for the riparian vegetation condition attribute, three for fire regime, three for insects and disease, seven for total road densities, and two for roads on soils sensitive to erosion.

**Lake Roosevelt WSCT**

The Lake Roosevelt subbasin includes five subwatersheds with WSCT populations. Four of the five subwatersheds received a *functioning at risk* AEC while Meadow Creek was rated *not properly functioning*. All the local populations are rated as *functioning at risk* except Meadow Creek which is *not properly functioning*. The watershed condition scores for North Deep Creek, American Fork and Lower Big Sheep Creek are rated as *functioning at risk*. Rocky Creek and Meadow Creek are *not properly functioning*. The local population scores are influenced by low abundance, isolation due to barriers and the apparent displacement of WSCT populations by brook trout. The watershed condition scores are due to all subwatersheds receiving a *functioning at risk* rating for the large woody debris, channel shape and function, road density, and riparian road density attributes. Three of the five subwatersheds are rated as *functioning at risk* or *not properly functioning* for the riparian vegetation attribute; three are *functioning at risk* for fire regime and one for the insect and disease indicator.

## Summary

The AEC for most subwatersheds on the Forest is rated as *functioning at risk* or *not properly functioning*. The local population's MIS/focal species status is rated *functioning at risk* or *not properly functioning* in most subwatersheds. Subwatersheds with local populations rated as *properly functioning* include eight

redband populations and one WSCT population in the Kettle subbasin, and four WSCT populations in the Pend Oreille subbasin. The poor local population status ratings are generally due to low abundance of the MIS/focal species, hybridization, apparent displacement or competition from non-native fish, especially brook trout, barriers and a lack of connectivity between populations.

As with the local population status the watershed condition is rated as *functioning at risk* or *not properly functioning* in most subwatersheds. Only the Headwaters South Salmo River, North Fork Sullivan Creek-Sullivan Creek and Slate Creek subwatersheds in the Pend Oreille subbasin were rated as *properly functioning*. Factors influencing the watershed condition scores commonly include low ratings for large woody debris and channel shape and function, high road and riparian road densities. Degraded riparian vegetation conditions also influenced the ratings in a number of subwatersheds. Many watersheds were considered *functioning at risk* for the fire regime attribute, while the insect and disease attribute did not receive a *properly functioning* rating in a few subwatersheds. Road densities within LTAs sensitive to erosion were identified as a potential problem in some subwatersheds in the Pend Oreille, Colville and Lake Roosevelt subbasins.

**Table 55. Kettle Interior Redband Subbasin AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200021301 | Trout Creek | 0.75 | -0.60 | 0.1 |
| 170200021701 | Tonata Creek | 0.81 | -0.60 | 0.1 |
| 170200022002 | North Fork Deadman Creek | 0.44 | -0.50 | 0.0 |
| 170200022003 | Deadman Creek | 0.44 | -0.40 | 0.0 |
| 170200021904 | Sand Creek-Kettle River | 0.50 | 0.20 | 0.4 |
| 170200021706 | Lone Ranch Creek | 0.50 | -0.30 | 0.1 |
| 170200022004 | Hodgson Creek-Kettle River | 0.00 | 0.20 | 0.1 |
| 170200021304 | Saint Peter Creek | 0.19 | -0.60 | -0.2 |
| 170200021905 | South Fork Boulder Creek | 0.34 | -0.40 | 0.0 |
| 170200021906 | North Fork Boulder Creek-Boulder Creek | 0.34 | -0.50 | -0.1 |
| 170200021902 | Deep Creek | -0.25 | -0.40 | -0.3 |
| 170200021903 | Little Boulder Creek | -0.19 | -0.20 | -0.2 |
| 170200022001 | Toulou Creek | 0.00 | -0.40 | -0.2 |
| 170200021302 | Lambert Creek | -0.53 | -0.30 | -0.4 |
| 170200021705 | West Deer Creek | -0.75 | -0.50 | -0.6 |

**Table 56. Kettle Subbasin WSCT AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200021907 | East Deer Creek-Kettle River | -0.63 | 0.30 | -0.2 |
| 170200021904 | Sand Creek-Kettle River | 0.50 | 0.20 | 0.4 |
| 170200021906 | North Fork Boulder Creek-Boulder Creek | 0.21 | -0.50 | -0.1 |
| 170200022001 | Toulou Creek | 0.31 | -0.40 | 0.0 |
| 170200021902 | Deep Creek | -0.25 | -0.40 | -0.3 |
| 170200021905 | South Fork Boulder Creek | -0.29 | -0.40 | -0.3 |

**Table 57. Sanpoil Subbasin WSCT AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200040101 | North Fork Sanpoil River-Sanpoil River | -0.31 | -0.30 | -0.3 |

**Table 58. Sanpoil Subbasin Interior Redband AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200040102 | O`Brien Creek | -0.13 | -0.30 | -0.2 |
| 170200040108 | Thirteenmile Creek-Sanpoil River | -0.50 | 0.00 | -0.3 |
| 170200040106 | Scatter Creek-Sanpoil River | -0.75 | -0.40 | -0.6 |
| 170200040107 | Ninemile Creek | -0.75 | -0.50 | -0.6 |

**Table 59. Pend Oreille Subbasin Bull Trout AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170102160702 | Headwaters South Salmo River | 0.16 | 0.90 | 0.5 |
| 170102160403 | North Fork Sullivan Creek-Sullivan Creek | -0.29 | 0.70 | 0.2 |
| 170102160903 | Slate Creek | -0.16 | 0.40 | 0.1 |
| 170102160201 | Exposure Creek-Pend Oreille River | -0.56 | -0.20 | -0.4 |
| 170102160302 | West Branch Le Clerc Creek | -0.24 | -0.10 | -0.2 |
| 170102160303 | East Branch Le Clerc Creek | -0.24 | -0.50 | -0.4 |
| 170102160902 | Sweet Creek-Pend Oreille River | -0.35 | -0.20 | -0.3 |
| 170102160102 | Winchester Creek | -0.63 | -0.50 | -0.6 |
| 170102160103 | Smalle Creek | -0.69 | -0.40 | -0.5 |
| 170102160206 | Tacoma Creek | -0.53 | -0.50 | -0.5 |
| 170102160304 | Ruby Creek | -0.63 | -0.70 | -0.7 |
| 170102160402 | Headwaters Sullivan Creek | -0.94 | -0.50 | -0.7 |
| 170102160401 | Harvey Creek | -0.75 | -0.20 | -0.5 |
| 170102160101 | North Fork Calispell Creek | -0.88 | -0.70 | -0.8 |
| 170102160104 | Calispell Creek | -0.50 | 0.00 | -0.3 |
| 170102160202 | Skookum Creek | -0.63 | -0.50 | -0.6 |
| 170102160207 | Cusick Creek-Pend Oreille River | -0.53 | -0.60 | -0.6 |
| 170102160306 | Lost Creek | -0.63 | -0.40 | -0.5 |
| 170102160901 | Big Muddy Creek | -0.53 | -0.50 | -0.5 |
| 170102160904 | Flume Creek-Pend Oreille River | -0.75 | -0.10 | -0.4 |
| 170102160905 | Pewee Creek-Pend Oreille River | -1.00 | -0.70 | -0.9 |
| 170102160204 | Cee Cee Ah Creek | -0.38 | -0.40 | -0.4 |
| 170102160307 | Maitlen Creek-Pend Oreille River | -0.63 | -0.50 | -0.6 |

**Table 60. Pend Oreille Subbasin WSCT AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170102160702 | Headwaters South Salmo River | 0.50 | 0.90 | 0.7 |
| 170102160403 | North Fork Sullivan Creek-Sullivan Creek | -0.13 | 0.70 | 0.3 |
| 170102160903 | Slate Creek | 0.13 | 0.40 | 0.3 |
| 170102161003 | Cedar Creek | -0.25 | 0.20 | 0.0 |
| 170102160302 | West Branch Le Clerc Creek | 0.43 | -0.10 | 0.2 |
| 170102160303 | East Branch Le Clerc Creek | 0.36 | -0.50 | -0.1 |
| 170102160103 | Smalle Creek | 0.06 | -0.40 | -0.2 |
| 170102160206 | Tacoma Creek | 0.27 | -0.50 | -0.1 |
| 170102160401 | Harvey Creek | 0.44 | -0.20 | 0.1 |
| 170102160402 | Headwaters Sullivan Creek | 0.06 | -0.50 | -0.2 |
| 170102160902 | Sweet Creek-Pend Oreille River | 0.01 | -0.20 | -0.1 |
| 170102160304 | Ruby Creek | 0.01 | -0.70 | -0.3 |
| 170102160201 | Exposure Creek-Pend Oreille River | -0.38 | -0.20 | -0.3 |
| 170102160102 | Winchester Creek | -0.53 | -0.50 | -0.5 |
| 170102160905 | Pewee Creek-Pend Oreille River | 0.06 | -0.70 | -0.3 |
| 170102160101 | North Fork Calispell Creek | -0.41 | -0.70 | -0.6 |
| 170102160204 | Cee Cee Ah Creek | 0.05 | -0.40 | -0.2 |
| 170102160306 | Lost Creek | 0.01 | -0.40 | -0.2 |
| 170102160901 | Big Muddy Creek | 0.11 | -0.50 | -0.2 |
| 170102160104 | Calispell Creek | -0.50 | 0.00 | -0.3 |
| 170102160202 | Skookum Creek | -0.75 | -0.50 | -0.6 |
| 170102160207 | Cusick Creek-Pend Oreille River | -0.41 | -0.60 | -0.5 |
| 170102160904 | Flume Creek-Pend Oreille River | -0.50 | -0.10 | -0.3 |
| 170102160307 | Maitlen Creek-Pend Oreille River | -0.63 | -0.50 | -0.6 |

**Table 61. Colville Subbasin WSCT AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200030106 | Cottonwood Creek | 0.20 | 0.20 | 0.2 |
| 170200030201 | Little Pend Oreille Lakes | -0.25 | -0.50 | -0.4 |
| 170200030301 | South Fork Mill Creek | -0.26 | -0.60 | -0.4 |

**Table 62. Colville Subbasin Interior Redband AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200030109 | South Fork Chewelah Creek-Chewelah Creek | -0.18 | -0.50 | -0.3 |
| 170200030301 | South Fork Mill Creek | -0.26 | -0.60 | -0.4 |
| 170200030302 | North Fork Mill Creek | -0.01 | -0.60 | -0.3 |
| 170200030108 | North Fork Chewelah Creek | -0.25 | -0.70 | -0.5 |

**Table 63. Lake Roosevelt Subbasin Interior Redband AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200011401 | Upper Hall Creek | 0.09 | 0.20 | 0.1 |
| 170200011301 | South Fork Sherman Creek | 0.03 | -0.40 | -0.2 |
| 170200011302 | Upper Sherman Creek | -0.31 | -0.50 | -0.4 |
| 170200011303 | Lower Sherman Creek | 0.00 | -0.50 | -0.3 |
| 170200011306 | Barnaby Creek | -0.25 | -0.50 | -0.4 |
| 170200011304 | Nancy Creek-Franklin D Roosevelt Lake | 0.25 | 0.20 | 0.2 |
| 170200011207 | Flat Creek-Franklin D Roosevelt Lake | -0.53 | -0.30 | -0.4 |
| 170200011307 | Quillisascut Creek-Franklin D Roosevelt Lake | -0.75 | 0.00 | -0.4 |
| 170200011205 | Crown Creek | -0.53 | -0.20 | -0.4 |

**Table 64. Lake Roosevelt Subbasin WSCT AEC scores**

| HUC12 Number | HUC12 Name | HUC12 MIS/Focal Species Score | Watershed Condition Score | Final AEC Score |
|---|---|---|---|---|
| 170200011004 | North Fork Deep Creek | -0.38 | -0.30 | -0.3 |
| 170200011105 | American Fork | -0.25 | -0.30 | -0.3 |
| 170200011107 | Lower Big Sheep Creek | -0.25 | -0.10 | -0.2 |
| 170200011001 | Rocky Creek | -0.09 | -0.50 | -0.3 |
| 170200011002 | Meadow Creek | -0.22 | -0.60 | -0.4 |

## PIBO Surveys

The AEC assessment provides information on the current status of MIS/focal species populations and watershed and stream channel condition. That assessment of current aquatic habitat condition on the Forest is further informed through habitat trend information provided by the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO). PIBO began implementation in 2001 (while the Forest only comes under the INFISH strategy, the PIBO program includes areas managed under both the PACFISH and INFISH strategies).[30] The monitoring program was designed to answer the question: “Are key biological and physical components of aquatic and riparian communities being improved, degraded, or restored within the range of steelhead (*O. mykiss*) and bull trout?” As the program has progressed, PIBO is using an “index” approach to answer the question.[31] The index approach outlined in Al-Chokhachy et al. (2010) compares six in-channel habitat attributes; residual pool depth, percent pools, D50,[32] fines in pool tails, wood frequency, and bank angle. The individual attributes are combined into a total index and there is an additional index for the aquatic macroinvertebrate community. The scores for the individual attributes and the final index are then compared to scores from reference stream reaches, in reference watersheds within the same ecoregion, and across the PIBO monitoring area. PIBO also evaluated the data to determine if habitat trends on reaches where they had repeat surveys (often three) were improving (moving in a direction considered to be favorable habitat for salmonids). For the trend analysis, the attributes bank stability (percent bank covered with plants or rock) and percent undercut bank were added.

[30] PIBO PacFish Infish Biological Opinion Monitoring http://www.fs.fed.us/biology/fishecology/emp/index.html)
[31] Personal communication, telephone conversation between Ken MacDonald and Erik Archer, PIBO (March 20, 2014) and email Erik Archer to Ken MacDonald (Preliminary Colville Results) (March 21, 2014)
[32] D50 is a measure of the stream substrate mean particle size of the stream substrate. Definitions for all the stream habitat attributes can be found in Kershner et al. (2004).

The following summarizes the PIBO results within the subbasins on the Forest.[33] In all cases below, the "managed" stream results are compared to the results from reference streams in the same ecoregion and the term significant refers to statistical significance (p less than 0.10). Consistent with the WCF ratings, the distribution of the total index scores for streams on the Forest are less (impaired habitat condition) than would be expected based upon the reference watersheds. There are however indications of some positive trends in habitat condition as, on a forestwide basis, there has been a statistically significant positive trend in the bank stability, percent undercut bank, and bank angle indicators, and the overall index scores.

*Kettle Subbasin*

The total index score for sampled streams in the Kettle subbasin were significantly lower than observed in reference streams within the ecoregion. The bank angle, percent pools, macroinvertebrates, and D50 indicators were all significantly lower (poor quality) than observed in reference streams. The PIBO surveys revealed that within the sites monitored in the Kettle subbasin the macroinvertebrate community, percent undercut bank, large wood frequency, residual pool depth and the percent pools and bank angle, as well as the total index were moving in a positive direction. The large wood and pool depth changes were significant. Bank stability, the D50 and percent fines in pools showed negative, but not statistically significant trends.

*San Poil Subbasin*

Only four managed streams in the San Poil subbasin were available for comparison therefore the statistical significance of differences in attribute and final scores and trends could not be determined

*Pend Oreille Subbasin*

The fine sediment indicators of pool fines and D50, were in significantly "worse" condition than reference watersheds. The large woody debris indicator scores were significantly greater than reference streams. All other indicators and the total habitat index score were not significantly different than reference streams, however the distribution of the total index scores appear skewed toward the lower end of the distribution of the reference stream scores. The total index: bank stability, percent undercut bank, bank angle, large wood, pool depth and pool frequency trends were positive; with the improving trends in bank stability, large wood, percent fines in pools and pool depth changes statistically significant. The macroinvertebrate community and D50 also showed a slight negative trend that is not statistically significant.

*Colville Subbasin*

The overall habitat index score was significantly lower for the sampled streams in Colville subbasin than the expected condition based upon reference stream conditions. Pool fines, the macroinvertebrate community and D50 scores were significantly lower quality compared reference streams. In the Colville subbasin, the macroinvertebrate community, bank stability, large wood, percent fines in pools D50, pool depths and percent pools showed a positive trend. The changes in percent pools, fines in pools and bank stability were significant. Negative trends were shown for the bank angle, and percent undercut bank,

*Upper Columbia-Lake Roosevelt Subbasin*

The total habitat index for the Upper Columbia-Lake Roosevelt subbasin was not significantly different than the index results for reference streams. The sediment indicators, D50 and percent fines in pool tails

[33] Data obtained in emails from Eric Archer, PIBO to Ken MacDonald (Preliminary Colville Results) (March 21, 2014) (Results) (March 25, 2014) and Telephone Conversation between Eric Archer, PIBO and Ken MacDonald (March 25, 2014) and revised report (Habitat Conditions in the Colville National Forest) from Eric Archer to Ken MacDonald (January 31, 2015)

had significantly lower scores than reference streams, while wood frequency scores were significantly higher than reference streams. The trend for the index score for the Upper Columbia-Lake Roosevelt Subbasin is positive but the change is not significant. The trend for the macroinvertebrate community, bank stability, percent undercut bank, bank angle, large wood frequency, D50, pool depths and percent pools were positive, with the changes in large wood frequency significant. A negative trend was recorded for percent fines (an increase in fines) in pools but the change is not statistically significant.

## Need for Change

### Old Forest Management and Timber Production

Three broad-scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- The recent history of uncharacteristic levels of disturbances resulting from fire and insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Uncertainty about the recovery and viability of old forest-dependent species given the increased risk of uncharacteristically severe disturbances that is likely to be exacerbated by climate change impacts.

### Motorized Recreation Trails

The current land management plans provide direction for summer and winter motorized uses, including identifying areas where such use may not be authorized or is limited, mainly for protection of aquatic, plant, and wildlife habitats.

The goal for recreation settings and experiences would include providing a spectrum of high quality, nature-based outdoor recreational settings where visitors access the Forest, including access to the biological, geological, scenic, cultural, and experiential resources of the Forest. Where the visitor’s outdoor recreational experience involves few conflicts with other users, access is available for a broad range of dispersed recreation activities such as dispersed camping, rock climbing, boating, mushroom and berry picking, hunting, and fishing and these experiences are offered in an environmentally sound manner, are within budget limits, and contribute to the local economy.

### Access

Three broad concerns drove the need to address road density:

1. The Forest can no longer afford to properly maintain the road system at current operational maintenance levels,
2. The current road system is not aligned with current and future resource management objectives, and
3. The existing road management direction is confusing and difficult to follow because it is scattered throughout current Forest Plan (Colville National Forest Land and Resource Management Plan), Forest Plan amendments (Eastside Screens, Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions [INFISH, USDA Forest Service 1994c and 1995]), national-level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Agreement, the Interior Columbia Basin Strategy).

### Recommended Wilderness Areas

By law, all National Forest System lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the National Wilderness Preservation System.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need.

### Wildlife

The current Forest Plan provides limited protection for habitat connectivity, providing wildlife and aquatic crossing structures, and managing activities adjacent to the structures so they are used by wildlife.

### Riparian and Aquatic Resource Management

The current Forest Plan includes riparian management direction from the Inland Native Fish Strategy (INFISH, USDA Forest Service 1994c and 1995). This approach appears to have either maintained or improved riparian and aquatic habitat conditions at the watershed and larger scales.

Objectives for riparian management areas would give emphasis to maintaining or restoring the riparian and aquatic structure and function of intermittent and perennial streams, confer benefits to riparian-dependent plant and animal species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, contribute to improved water quality and flows, and contribute to a greater connectivity of the watershed for both riparian and upland species.

Desired conditions for riparian management areas within any given watershed are to have compositions of native flora and fauna and a distribution of physical, chemical, and biological conditions commensurate with natural processes.

## Environmental Consequences of Alternatives

### Methodology

There was a 2-step process for the environmental consequences assessment for fish and aquatic habitat for each alternative. First, the key indicators for the issues were assessed providing the framework to describe

the relative conservation value to aquatic species of the alternatives based upon an assessment of the relative risks and protections the alternatives are judged to provide (table 65).

**Table 65. Issues and key indicators for the aquatic habitat and species environmental consequences**

| Issue | Key Indicators |
|---|---|
| Old Forest Management and Timber production | The number of acres that have Focused Restoration (or Late Forest Structure), General Restoration, and a timber production emphasis. |
| Motorized Trails and Access | Desired Conditions for road densities<br>Acres allocated to motorized access. |
| Recommended Wilderness | Total acres in Recommended Wilderness. |
| Riparian and Aquatic Resource Management | ACS Direction, RMA Delineation and RMA Direction.<br>Key Watershed Acres, Management Direction for Key Watersheds, MIS/Focal Species, Key Watershed and Restoration Objectives.<br>Change in distribution of aquatic invasive species.<br>Improvement in riparian vegetation conditions within grazing allotments. |

Once the environmental consequences of an alternative were determined based upon the key indicators, the Forest Service contribution to providing for the viability of the MIS/focal species was modeled based on the procedures outlined in Reiss et al. (2008).

## Viability Model and Forest Service Contribution to Viability

The viability as described in Reiss et al. (2008) utilizes a DSM, similar to what was used in the AEC to determine the current status of the MIS/focal species. The viability model however evaluates the conclusion that the MIS/focal species populations at the subbasin scale are sustainable or viable based on their current status. The HUC 12 AEC results are aggregated to the subbasin (HUC 8) scale to provide a broader assessment of population and habitat status to better capture the distribution and ability of the local populations to interact across a broader landscape. The subbasin scale assessment allows a broader assessment of natural and human-made disturbance that may be missed if only the AEC results are considered alone (Reiss et al. 2008).

After the viability of the MIS/focal species populations on the Forest was estimated, the Forest Service contribution to the ecological viability of the MIS/focal species' populations was assessed by alternative. This assessment was also performed at the subbasin scale (Reiss et al. 2008). The viability and Forest Service Contribution to Viability models was explained further in the Methods section below.

## Assumptions

- Forest Budgets would remain relatively constant at current levels, recognizing there may be increases or decreases in any one year.
- The MIS/focal species approach to determining the AEC, viability analysis and the Forest Service Contribution to Viability truly captures the conservation requirements for other species that are not analyzed.
- Alternatives with more reliance on standards than guidelines are more conservative (from an aquatic perspective) compared to guidelines.
- Where identified, the desired condition road densities are attainable.

# Methods of Analysis

## Rationale for Key Indicators Addressing the Issues

The following describes the rationale for selecting the key indicators for each key issue. The rationale was developed based upon the literature regarding the potential effects of land management activities on aquatic habitat and fish populations; and management direction based upon work completed for the Interior Columbia Basin Ecosystem Management Project (see Quigley and Arbelbide 1997), The Interior Columbia Deputy Team Strategy and Framework documents (discussed below), and the Forest Service Region 6 Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008).

### *Old Growth Forest Management and Timber Production*

The key indicator for assessing the effects of vegetation management and timber production is: the number of acres that have a Focused Restoration, General Restoration, or timber production emphasis.

Vegetation management through timber sales for timber production or as a fuel treatment (e.g., thinning, prescribed fire) to reduce the potential for uncharacteristically severe wildfires can adversely affect watershed processes, aquatic and riparian habitat (see Spence et al. 1996, Meehan 1991; and Day 2015 ). The potential for adverse effects is greatest on lands specifically allocated for timber production due to the emphasis on commodity production; potentially resulting in intense vegetation manipulation and more ground disturbance due to logging and roads than is expected where vegetation management emphasizes the restoration of forest vegetation . However, managing vegetation to provide a vegetation composition and structure that is more characteristic of the natural fire regime and to promote late forest structure appropriate to the biophysical environment is a component of managing for natural watershed function and may result in terrestrial and aquatic ecosystems that are more resilient to disturbance from fires or insects and disease.

Historically fires were a natural disturbance on the landscape. Since European man settled the west, logging, grazing, fire suppression, and the introduction of exotic plants has changed the natural plant structure and composition of terrestrial ecosystems resulting in the potential for larger and more severe fires in many landscapes (Hessburg and Agee 2003). Large fires can result in accelerated erosion due to surface erosion or debris slides increasing the sediment supply to streams and changing channel structure (Wondzell and King 2003, Benda et al. 2003). However, disturbances such as fires and the resulting erosion processes also help create diverse fish habitat through the introduction of large woody debris and coarse substrates that maintain productive fish habitat (Reeves et al. 1995).

Fires can cause direct mortality to fish resulting in local extirpations. However, fish populations, especially salmonids, have been observed to rapidly recover after an episodic disturbance such as a wildfire; as long as the population and habitat are connected to adjoining populations, (Sestrich et al. 2011, Rieman et al. 2003, Rieman et al. 1995). As was discussed in the Affected Environment section, a number of the local populations for the MIS/focal species are isolated above barriers or in streams with little connectivity to adjacent populations and are, therefore, more susceptible to extirpation by a large disturbance.

The AEC results show s that a number of subwatersheds are *functioning at risk* or *not properly functioning* for the fire regime and Insects and disease attributes. Management that emphasizes late forest structure and terrestrial vegetation conditions as may be expected under the natural or historic disturbance regime may be beneficial to overall watershed health and reduce the potential for uncharacteristically severe wildfires. For the potential benefits to watershed conditions and aquatic species to be realized the other attributes of watershed condition would need to be improved as well, or at least maintained.

### *Motorized Trails and Access*

The key indicators for the Motorized Recreation Trails and Access issues are; the desired conditions for road densities and acres allocated to motorized access.

Roads can have numerous adverse effects on fish and fish habitat including the interruption or alteration of geomorphic and hydrologic processes. Geomorphic impacts of roads include chronic and long-term sediment delivery to aquatic habitat, accelerated mass failures of cuts and fills depositing large quantities of sediment, and altered channel morphology if the roads confine streams and prevent access to the floodplain. Roads constructed in riparian areas damage or remove vegetation thus reducing stream shade and large woody debris input. Roads constructed in the floodplain may inhibit natural stream channel migration processes (Gucinski et al. 2001). Meredith et al. (2014) found that in the interior Columbia Basin, the presence of near-stream roads resulted in reduced amounts of large woody debris in streams.

The effects of roads on hydrologic processes include the interception of rainfall directly on the road surface and road cutbanks affecting subsurface water moving down the hillslope; concentrating flow on the surface or in an adjacent ditch or channel; and diverting or rerouting water from normal flow paths were the roads not present. Roads can deliver pollutants to aquatic habitat as the chemicals applied to roads or from vehicles runs off a road into a stream (Gucinski et al. 2001). Additional discussion regarding the effects of roads on geomorphic and hydrologic processes is contained in the watershed section of chapter 3 and in Day (2015).

Roads can influence fish populations by creating passage barriers at culverts at road/stream crossings. Blocking passage is a serious issue as maintaining connectivity between populations of a species and providing access to blocked habitat are important factors in a species' long-term persistence, such connectivity to adjacent populations and habitat may be an important strategy for species to persist in a changing climate (ISAB 2007).

In addition to the effects of the roads on the physical environment and passage, roads are an indicator of the level of potential human uses or management intensity that may affect fish population. Lee et al. (1997) found strong fish populations in the interior Columbia Basin were more frequently found in areas of low road density than high road density. Similarly, Al-Chokhachy et al. (2010) found reference watersheds generally provided higher quality physical stream habitat than managed watersheds with higher road densities. Following Lee et al. (1997), the USFWS (1999) considers watersheds with road densities less than 1 mile per square mile and no valley bottom roads as one measure of properly functioning watersheds for bull trout recovery. The USFWS considers road densities of 1 to 2.4 miles per square mile to be functioning at risk, and road densities greater the 2.4 miles per square mile to be not properly functioning.

OHV trails that are not designed or maintained properly, including the drainage system, can be sources of chronic and long-term sediment delivery to streams. Negative impacts of soil and watershed functions from OHV activities include soil compaction, reduced water infiltration capacity, increased erosion, and damage to vegetation. Extensive networks of OHV routes across a landscape, especially on steep slopes, can direct or alter the direction of surface flows forming gullies that channel sediment and contaminants into aquatic systems (Ouren et al. 2007).

The effects of roads and trails on watershed function can be reduced by considering the location, design, and employing design or maintenance methods to disperse runoff (Furniss et al. 1991). Road removal or decommissioning creates a short-term disturbance which may temporally increase sediment but over the long-term, decommissioning can reduce chronic erosion and the threat of landslides.

### *Recommended Wilderness*

The key indicator for the Recommended Wilderness Area issue is the total acres in recommended wilderness. As mentioned above, fish populations and aquatic habitat are generally in better condition on lands with less management impact; especially low road densities. Although some management activities such as non-motorized recreation and grazing can occur in recommended wilderness, and in some alternatives motorized recreation can continue on the current trail system, and active vegetation management to restore forest structure to be more resilient to disturbance would not occur, it assumed that overall these areas would be protective of watershed function and fish habitat.

### *Riparian and Aquatic Resource Management*

The key indicators used to assess the alternative approaches to riparian and aquatic resource management are: the Aquatic Conservation Strategy direction, the definition of RMAs and management direction for RMAs; the acres of key watersheds, MIS/focal species habitat and bull trout designated critical habitat within key watersheds; objectives for key watersheds and watershed restoration; the change in distribution of aquatic invasive species (AIS); and the potential for improvement in riparian vegetation conditions within grazing allotments due to RMA standards and guidelines. The alternatives do not change grazing allotments; however, the management direction for grazing within RMAs will be discussed. All alternatives will then be assessed for the potential Forest Device Contribution to viability of the MIS/focal species.

The protection of riparian ecosystems is central to all salmonid conservation efforts (FEMAT 1993, Spence et al. 1996, and Quigley and Arbelbide 1997). As national forest land and resource management plans (LRMPs) and Bureau of Land Management resource management plans were about to be revised, the Interior Columbia Deputy Team[34] issued in 2003, *the Interior Columbia Strategy, A Strategy For Applying The Knowledge Gained By The Interior Columbia Ecosystem Management Project To The Revision Of Forest and Resource Management Plans And Project Implementation*. Direction for using the *Strategy* was clarified in August 21, 2008, when the Deputy Team issued further direction through a memo titled *A Framework for Incorporating the Aquatic and Riparian Component of the Interior Columbia Basin Strategy into BLM and Forest Service Plan Revisions* (hereafter referred to as Framework). The intent of the Framework was to include the information generated in the Interior Columbia Basin Ecosystem Management Project (Quigley and Arbelbide 1997) to facilitate consistency among plans in terms of the structure of riparian and aquatic components while providing for a high level of agency decision discretion in the substance of individual plan revisions.

Consistent with the aquatic conservation strategies of the Northwest Forest Plan, PACFISH and INFISH Strategies, and suggested by Quigley and Arbelbide (1997), the Framework includes six components:

- Riparian Conservation Areas, Riparian Management Areas or other land use allocations to provide direction regarding aquatic and riparian conservation. These special management areas are not “no management” zones but areas where riparian dependent species receive management emphasis. The riparian management and delineation of these areas needs to recognize the important functions they are established for including:
    a. The input of fine organic matter and nutrients to aquatic habitat.
    b. Providing for bank stability.

[34] The Interior Columbia Deputy Team includes the Assistant Regional Director for the USFWS, the EPA Deputy Regional Administrator, the Deputy Regional Foresters for FS Regions 1, 4, 6, the BLM Idaho Deputy State Director for Resource Services, the BLM Oregon/Washington Deputy State Director for Resource Planning, Use and Protection, the NMFS Assistant Regional Administrator, the PNW and RMRS Deputy Station Director.

c. Filtering sediment due to surface erosion thus controlling the amount reaching the aquatic system.

d. A source of large woody debris.

e. Shading the aquatic habitat thus helping to control water temperature.

f. Controlling the microclimate within the riparian zone and adjacent to the aquatic habitat.

g. Recognition of small and intermittent streams and managing unstable lands to account for aquatic function and values.

- Protection of Population Strongholds for Listed or Proposed Species and narrow endemics. The revised plans should identify watersheds (HUC10 or HUC12) to be managed for the protection of ESA listed or proposed species. The intent is to identify habitat networks of existing strongholds with robust populations and high quality habitat for the species to support expansion and recolonization to adjacent watersheds.
- Multiscale Analysis. Recognizing the hierarchical nature of watersheds, plans should describe how multiscale analysis was used in plan revisions and how multiscale analysis will be used in subsequent project-level decisions.
- Restoration Priorities and Guidance. The plans should identify restoration priorities by general types and geographic areas.
- Management Direction (desired conditions, objectives, management actions). The plans should provide management direction that identifies desired outcomes or future conditions (conditions and objectives) for aquatic resources.
- Monitoring/Adaptive Management to:

  a. Determine if a plan is being implemented correctly and is achieving desired results

  b. Provide a mechanism for accountability and oversight,

  c. Evaluate the effectiveness of recovery and restoration efforts

  d. Provide a feedback loop so that management direction may be evaluated and modified.
- Climate Change. The discussion of climate change was added by the Deputy Team to account for the effects of climate change on the success or failure of management actions to achieve an aquatic/riparian conservation strategy.

Region 6 of the Forest Service includes lands managed under the Northwest Forest Plan, PACFISH and INFISH. Based on broad-scale monitoring programs, the Aquatic Conservation Strategies (ACS) of INFISH, PACFISH and the Northwest Forest Plan appear to have been effective in improving aquatic habitat and watershed condition (Archer et al. 2009, Lanigan et al. 2012, Meredith et al. 2012). As forest plans were to be revised, Region 6 wanted a regionally consistent approach to the management of watersheds, and riparian and aquatic habitat. The Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008) was developed based upon the lessons learned implementing the Northwest Forest Plan, PACFISH and INFISH, and new information that had become available since the earlier strategies were developed; especially the roll of disturbance and the dynamic nature of watersheds, riparian and aquatic systems (see Reeves et al. 1995).

The ARCS is designed to maintain and restore the ecological health of watersheds, and aquatic and riparian ecosystems on National Forest lands. Naiman et al. (1992) define the components ecologically

healthy watersheds as the basin geomorphology, hydrologic pattern, water quality riparian vegetation characteristics, and habitat characteristics; and the management of ecologically healthy watersheds requires the preservation of the interactions between these components and accounting for spatial and temporal variability (Naiman et al. 1992). Another purpose of the ARCS is to develop networks of properly functioning watersheds that support populations of fish and other aquatic and riparian-dependent resources across the Region. The intent of the ARCS is to maintain and restore the dynamic ecological processes responsible for creating and sustaining habitats over broad landscapes, as opposed to just at the individual project or small watershed scale (USDA Forest Service 2008). The ARCS is intended to provide a core set of desired conditions, suitability, objectives, standards and guidelines for aquatic and riparian management for national forests to design the forest plan direction (USDA Forest Service 2008).

Consistent with the Interior Columbia Deputy Team Framework the ARCS includes five elements:

1. Riparian management areas (RMAs) along permanently flowing stream, ponds, lakes, wetlands, seeps, springs, intermittent streams and unstable sites where management activities are to maintain, restore or enhance the ecological health of aquatic and riparian ecosystems and dependent resources.
2. Key watersheds. Key watersheds are a network of watersheds selected to serve as strongholds for important aquatic resources or having the potential to do so. Management emphasizes minimizing risk and maximizing restoration or maintaining ecosystem health. Key watersheds are selected based upon the requirements of the MIS/focal species. The key watershed concept has been found to be an effective strategy as in the Northwest Forest Plan area the watershed condition of key watersheds appears to be improving at a faster rate than non-key watersheds (Lanigan et al. 2012.)
3. Mid-Scale Analysis of Watersheds. Watershed or mid-scale analysis provides a basis for development of watershed-scale restoration strategies and provides the basis for defining desired conditions, management objectives and monitoring.
4. Watershed Restoration. Watershed restoration is defined as an integrated set of actions and treatments designed to facilitate the recovery of watersheds and related aquatic ecosystem structure and function.
5. Monitoring. Monitoring is a strategic assessment of the implementation and effectiveness of management activities and the ecological trends toward desired conditions.

Each alternative includes an ACS that is either based upon INFISH, the ARCS, or a revised version of the ARCS. The direction in INFISH, the ARCS and the revised ARCS includes goals or desired conditions, objectives including restoration objectives, RMAs, key watersheds and standards and guides. There is no specific direction for mid-scale analysis in any alternative so the topic is not discussed. Such an analysis generally occurs during plan implementation. Two types of Mid-Scale Analysis were completed for the DEIS. The AEC is a broad, mid-scale analysis at the subwatershed scale. The viability assessment and the Forest Service Contribution to Viability Assessment are subbasin-scale analyses. The aquatic monitoring component of the revised plan is common to all alternatives.

<u>Aquatic Conservation Strategy Direction, Desired Conditions, RMAs Key watersheds and Standards and Guidelines</u>. The environmental consequences for an alternative will be assessed in terms of the relative effectiveness of the ACS components; desired conditions, the definition of RMAs, standards and guidelines, the size of the key watershed network, and the overlap of the Key watersheds with important habitat for MIS/focal species, to meet the desired conditions and contribute to the viability of the MIS/focal species.

<u>Objectives for Key Watersheds and Watershed Restoration</u>. There is  a need to accelerate improvement in watershed condition across the Forest. The current forest plan and amendments do not adequately provide integrated management direction to maintain and restore properly functioning watersheds that provide a

range of benefits on and off the national forest within a timeframe that is meaningful. This is supported by new science, the listing of bull trout under the ESA, designation of bull trout Critical Habitat, information in the draft bull trout recovery plan (USFWS 2002, USFWS 2014), and the results of new assessment tools such as the National Watershed Condition Framework (WCF). Properly functioning watersheds provide ecological systems that are resilient to disturbance, and allow for habitat conditions that support aquatic species, contribute to the recovery and de-listing of threatened and endangered species, and restore waters listed as impaired under the Clean water Act (303[d] listed waters). All alternatives include objectives for watershed restoration.

Aquatic Invasive Species. Invasive species are a threat to aquatic and terrestrial ecosystems. Aquatic invasive species (AIS) include invasive plants, invertebrates, pathogens, and non-native fish[35]. Invasive species may disrupt the food web, compete with native species for food and space, may be predators on native fish, or introduce diseases. The management direction for controlling and managing to prevent AIS will be discussed for each alternative.

Potential Improvement of Riparian Vegetation within Grazing Allotments. The potential effects of livestock grazing on fish habitat have been well documented (e.g., Platts 1991, Spence et al. 1996). Al-Chokhachy et al. (2010) found the presence of cattle in watersheds sampled across the interior Columbia Basin and the Missouri River Basin often resulted in degraded physical aquatic habitat conditions, especially where grazing occurred in watersheds with high road densities. The potential adverse effects of grazing include soil erosion and sediment delivery to streams; soil compaction; alteration or removal of riparian vegetation that provides shade, cover, a terrestrial food source and stabilizes stream banks; altered channel morphology including channel widening, increased bank instability and loss of undercut banks. The alternatives do not change grazing allotments however the anticipated effectiveness of the management direction for grazing within RMAs for each alternative will be discussed.

*Viability and Forest Service Contribution to Viability Assessment*

**MIS/Focal Species Viability Assessment (see Reiss et al. 2008 for further description and rationale)**

The viability assessment evaluates the conclusion that the current MIS/focal species' populations are viable. The viability of individual MIS/focal species populations is evaluated at the subbasin scale where the species is currently present. Ecosystems are dynamic over time so not all habitat within subbasin will be in good condition all the time and even natural, undisturbed population numbers will be variable. MIS/focal species are judged to be viable when a large enough proportion of habitat is in good ecological condition, habitat forming processes are functional, and the local populations of a MIS/focal species (subwatershed scale) are not isolated; having access to other habitat and local populations (see Reiss et al. 2008).

The AEC analysis assessed the status of local populations within the subwatersheds. However, the AEC does not capture the ability of the local populations to interact with other local populations or assess the distribution of local populations across the broader landscape. Similarly, the AEC assesses the watershed and habitat conditions at the subwatershed scale, but may miss natural and human-made disturbance patterns that become apparent at a larger scale. It should be noted that this viability assessment is addressing the MIS/focal species viability on the Forest only, primarily assessing national forest lands. While factors that may influence the larger population of a MIS/focal species are considered, this assessment is not as broad or inclusive as a viability assessment that the USFWS may undertake for an ESA status review.

[35] Non-native fish introduced by state agencies in the past as sport fish are not considered invasive although it may now be understood that they can be a threat to native species and management actions may be implemented to reduce their numbers

The two attributes assessed to determine the population viability of the MIS/focal species within a subbasin on the Forest are; the Subbasin Condition and Connectivity within the subbasin. The viability was assessed in the manner described in Reiss et al. (2008) only instead of using a DSM the information was put into an Excel spreadsheet (Honeycutt 2014 in prep).[36] The attributes discussed below are aggregated to attain an overall subbasin viability score for the MIS/focal species ranging from +1 (high support for the conclusion that the MIS/focal species populations on the Forest are viable) to -1 (low support for the conclusion that to populations are viable). Unlike Reiss et al. (2008), we did not estimate the historic viability, assuming that before development by European man all the MIS/focal species were viable at the subbasin scale.

#### Condition

The Subbasin condition is assessed with three attributes; distribution, patch and the AEC. The distribution attribute assesses the percentage of the potential spawning and rearing habitat in the subbasin currently occupied by the MIS/focal species. The distribution reflects the impact of fragmentation and includes populations isolated by natural barriers. The patch attribute assesses the connected length of stream available to the MIS/focal species. Habitat patches within the subbasin are delineated by aggregating all connected stream kilometers of occupied habitat. If there are no barriers, the entire subbasin is one large patch. Where natural or man-made barriers exist, the occupied habitat above the barrier is its own patch. It is generally assumed that large, connected patches provide a better chance for a viable population over time than small isolated patches. Finally, the AEC attribute is the area-weighted average of the subwatershed scores within the subbasin.

#### Connectivity

The connectivity of river systems is a major factor determining the potential for viable populations. Where streams are connected, local populations have the potential to function as a meta-population with some degree of genetic exchange over generations. Connectivity also allows an adjacent population to re-found a local population that becomes extinct due to a disturbance such as a fire or flood. There are two connectivity attributes; population connectivity and habitat connectivity. Population connectivity evaluates the overall connectivity of each local population within the subbasin. The habitat connectivity evaluates the ability of MIS/focal species to access unoccupied, potential habitat in the subbasin (see Reiss et al. 2008).

*Colville National Forest Contribution to MIS/Focal Species' Ecological Viability* (see Reiss et al. 2008 for further description and rationale)

The extent to which the different alternatives may contribute to the viability is assessed at the subbasin scale as well. This is a relative risk assessment based upon the risk different management allocations may pose to the MIS/focal species, the current condition of the MIS/focal species populations and habitat, and the amount of habitat on National Forest System lands. The emphasis of this assessment is on management of Forest lands, in other words management that the Forest has control over. There are numerous actions and conditions of other lands that affect the MIS/focal species future viability; residential development, road systems; hydroelectric projects; etc., over which the Forest has more limited management authority. Hence, this a relative assessment of how well Forest management as described for each alternative may be expected to contribute to the viability of the MIS/focal species.

The contribution to viability assessment includes three attributes; protection, the percent of habitat occupied by a MIS/focal species on the Forest, and the AEC of the subbasin. As with the AEC and Viability assessments, Reiss et al. (2008) used a DSM to estimate the level of protection or conservation value of an alternative toward MIS/focal species viability. We again used an Excel spreadsheet to inform

[36] 2014_11_19ViabilityAssessment-Excel

our analysis.[37] The Forest Service contribution is assessed by MIS/focal species in each occupied subbasin, by alternative. The scores of the attributes are averaged resulting in a +1 (high support for the conclusion that that an alternative would contribute to MIS/focal species' ecological viability) to -1 (low support for the conclusion).

**Protection**

The Management areas (MAs) described in the alternatives are assessed for the level of protection the allocation is expected to provide for aquatic habitat and watershed condition. A basic premise is allocations with no or few roads are more protective than allocations with higher road densities. Lands where terrestrial vegetation will be managed with a restoration emphasis is more protective or less risky to aquatic habitat and watershed condition than lands with a timber production emphasis.

The MAs that informed the aquatic effects portion of the DEIS, based upon the four issues; Old Forest Management and Timber Production, Motorized trails and Access, Recommended Wilderness, Riparian and Aquatic Resource Management, were assessed for their relative protection afforded aquatic resources and watershed condition. The MAs included in the assessment are: Recommended Wilderness, Backcountry Motorized, Backcountry Non-Motorized, Focused Restoration, General Restoration (including late Forest Structure in alternative R), Active Management Area and Responsible Management Area. The current designated wilderness was also included. Within each MA the following management activities that relate to the key indicators in the aquatics effects analysis were assessed based on the level of protection (or inversely the level of risk to the aquatic habitat); non-motorized trails, motorized trails, timber harvest, and roads. At the beginning of the analysis each allocation starts with a protection value of +1 and then points are subtracted based upon the potential intensity of an activity within the MA. If an activity is not allowed in an MA there is zero deduction. For example roads, motorized use and timber harvest are not allowed in wilderness so there are no deductions for those activities within the Wilderness MA.

<u>Non-Motorized Trails</u>. If non-motorized trails are present -0.1 is deducted for the MA. The reason is that the presence of the trails do affect a watershed to a small degree and use of the trail does pose a risk to riparian habitat by trampling vegetation, may increase fishing pressure and possible introduction of AIS or a non-native fish.

<u>Motorized Trails</u>. If motorized trails are present but the use is no longer permitted (recommended wilderness in some alternatives) -0.1 was deducted. If motorized trail use is allowed the deduction is -0.2.

<u>Timber Harvest</u>. Timber harvest deductions are based on the potential intensity of the activity. While the restoration MAs often emphasize terrestrial vegetation restoration which may help improve watershed condition, vegetation management activities do pose some risk to aquatic resources. It is assumed the intensity of vegetation management will be higher in General Restoration MAs than Focused Restoration MAs where there is more emphasis on aquatic resources and wildlife. The most risk or least protection is on those MAs that have greater timber production emphasis and allow even-aged management. Focused Restoration areas therefore received a -0.1 deduction; General Restoration a -0.2 deduction and the Responsible Management and Active Management MAs a -0.3 deduction.

The no-action alternative MAs are based on the current forest plan so for timber harvest we "lumped" the MAs based upon the intensity of timber management. The Caribou, Old Growth, Recreation/Wildlife, Scenic/Winter Range, Winter Range MAs received a -0.2 deduction for timber harvest based on current management. The Private Lands Originally, Recreation, Scenic/Timber and Wood/Forage MAs received a -0.3 deduction.

[37] 2015_10_12_Forest service ContributionViability-Excel

Roads. The road deductions were based upon whether roads are allowed or not, and if allowed the desired road densities. If roads are allowed and the road density desired condition is up to 1.0 mile per square mile then -0.2 was deducted. Even low road densities affect hydrologic processes and can affect aquatic habitat. The 1.0 mile per square mile density is at the upper range of road densities that in general watersheds may be *properly functioning* and potentially support strong fish populations. If the road density desired condition is no greater than 2 miles per square mile there is a -0.3 deduction. The 2.0 miles per square mile road density is within the range where watersheds are generally considered *functioning at risk* for road density as is the potential for the presence of strong fish populations. Road densities of 3.0 miles per square miles are considered *not properly functioning* for watershed condition and strong fish populations and received a -0.4 deduction. Alternatives that have no road density desired condition received a -0.5 deduction as these alternatives keep the current road mileage on the Forest where most watersheds are already *functioning at risk* or *not properly functioning* for road densities in the AEC assessment.

The total score for a MA is obtained by subtracting the deductions for a total protection value. So wilderness with only a -0.1 deduction is considered highly protective (0.9), while an MA with even-age timber management, and high road densities gets a low protection score. All MAs were assumed to have non-motorized trails and motorized trails unless they are specifically not allowed.

The total protection scores for the MAs for an alternative is the area-weighted average of the score for each land use allocation by subbasin. In this assessment, the score was determined by assessing the subbasin as a whole as opposed to doing the same assessment by subwatershed and aggregating the results together as described in Reiss et al. (2008). Another difference between this assessment and Reiss et al. (2008) is the treatment of key watersheds. Key watersheds, other than the no-action alternative and alternative B, are primarily in the Focused Restoration MA, although there may be some Backcountry, Wilderness and Recommended Wilderness. Instead of assessing the protection value of key watersheds based on allowed activities in the key watersheds, it is assumed the key watersheds have an added protection value of their own as management within key watersheds emphasizes minimizing risk and maximizing restoration or retention of ecological health (see previous key indicator rationale). Therefore the percent area of key watershed within a subbasin was added to the protection score. Finally, grazing and RMAs are not specifically discussed. The grazing allotments are not changed in the different alternatives so grazing is just discussed as a key indicator in the Aquatic effects. The RMAs for different alternatives is also discussed as a key indicator.

**Percentage of Occupied Habitat on the Colville National Forest**

This attribute quantifies the proportion of the total occupied spawning and rearing habitat of a MIS/focal species on the Forest within a subbasin.

**Aquatic Ecological Condition**

The AEC attribute is the area-weighted average of the habitat condition AEC scores of the National Forest lands within the subbasin to help determine the “Forest Service” contribution to viability.

The final protection score for an alternative by subbasin and MIS/focal species is the average of protection, percent of occupied habitat on National Forest lands, and the AEC. The viability assessment and the Forest Service Contribution scores represent an interpretation of the relative role of Colville National Forest lands to provide for the viability of a MIS/focal species in a subbasin by alternative. It should be noted that when the Forest Service contribution to ecological viability scores are low, this does not necessarily indicate that Forest Service management direction is insufficient, but rather that management is not addressing all factors that contribute to species ecological viability. Much of the other management not addressed may be off National Forest lands such as roads managed by other entities. A

low Forest Service contribution may also be due to presence on non-native fish and isolation due to natural barriers and man-made barriers off the National Forest.

## Incomplete and Unavailable Information

Some incomplete or unavailable information includes:

- The rate and magnitude of restoration activities would depend upon budgets social and technical constraints, therefore for estimating a rate for changing watershed condition is unknown.
- The use of the MIS/focal species concept is assumed to provide for the viability of other aquatic species including invertebrate species for which little is known on the Colville National Forest.
- Although the locations of the land allocations is known the actual level of management activity within a subbasin overtime is not known.
- The actual effects of climate change (see below)

## Spatial and Temporal Context for Effects Analysis

The analysis of the effects of the alternatives on the MIS/focal species and aquatic habitat is completed at several scales. First the current status of the MIS/focal species' populations and the watershed/aquatic habitat condition was assessed at the subwatershed (HUC 12) scale to determine the AEC. The current viability of the species was then assessed at the subbasin scale (HUC 8). The effects of the alternatives based upon the plan components is assessed at the scale of the Forest and the final estimate of the potential effects to MIS/focal species' viability on the Forest, or the Forest Service contribution to viability is assessed at the subbasin scale. The temporal context for the assessment is the current time period, with the relative benefits or risks to the species due to implementation of an alternative estimated through the life of the revised forest plan as defined by the alternative.

## Summary of the Effects of All Alternatives

### Focus Watersheds and Priority Watersheds

All alternatives include key watersheds (including the INFISH Priority Watersheds) and Focus Watersheds. While the key watersheds vary by alternative, the Focus watersheds are common to all alternatives.

Forest Service Region 6 developed the Region 6 Aquatic Restoration Strategy (ARS) in 2005 to provide guidance for watershed and aquatic and riparian improvement at a regional scale (see Hydrology section in the DEIS). As the ARS is scaled down for implementation at the forest level, the National Forests are to work with partners to identify Focus Watersheds (HUC10). The idea of the Focus Watersheds are to take a whole watershed approach to restoration to meaningfully affect change in watershed condition as opposed to practicing "random-acts-of-kindness" by scattering restoration efforts over a broad landscape ( Roni et al. 2010). Working with the partners, Forests are to then develop a watershed action plan (WAP) that identifies the needed restoration work that is technically and socially feasible. The current Forest Focus Watersheds are the Le Clerc-Pend Oreille River (HUC 171021602), The Upper Sanpoil River (HUC 1702000401) and Chewelah Creek-Colville River (HUC 1702000301). WAP have been prepared for the Upper and West Forks Sanpoil River, and Le Clerc Creek. A WAP has not been completed to date for the Chewelah Creek-Colville River.

National Forests throughout the United States were mandated in 2010 to implement the WCF, which was discussed for the AEC model. The results of the assessment were used to identify Priority subwatersheds

to focus management to improve impaired watershed function (see Hydrology section of the DEIS for more information on Focus Watersheds and Priority subwatersheds).

### Monitoring

Watershed conditions, stream and riparian habitat would be monitored through the life of the plan to determine;

1. If plan implementation is achieving the watershed and aquatic objectives.
2. The effects of various resource management activities on watershed, riparian and aquatic resources.

The Forest would continue to cooperate with the PIBO monitoring program to determine current habitat conditions and to track the trends of aquatic habitat condition.[38] Additionally, the Forest would continue assessing aquatic habitat condition using the Region 6 Level II stream survey protocol, or future versions. Currently the Forest surveys about 17 stream miles annually. The Level II surveys also collect information on fish distribution at the time of the survey but are not designed to estimate population size. Changes in watershed condition would be determined through periodic updates of the WCF and the effectiveness the protection of watershed, riparian and aquatic resources during the implementation of land management projects would be monitored through Best Management Practice (BMP) monitoring. For more information regarding the WCF, BMP and additional water quality monitoring see the Watershed section of the DEIS.

The Forest would continue to cooperate and coordinate with monitoring programs implemented by other entities such as those associated with the Boundary Hydroelectric Project. For example, the Boundary Project re-licensing terms include a hatchery program to re-build the populations of native fish, initially focusing on WSCT. The terms for the hatchery program include establishing population goals for self-sustaining populations of the native fish. Seattle City Light is to monitor the success of the out-planting program until the population goals are met.

### Current Viability of MIS/focal Species

The assessment of the current MIS/focal species viability on the Forest, bull trout, WSCT and interior redband trout, evaluates the conclusion that the MIS/focal species' populations are viable at the subbasin scale. MIS/focal species are judged to be viable when a large enough proportion of habitat is in good ecological condition, habitat forming processes are functional, and the local populations of a MIS/focal species (subwatershed scale) are not isolated; having access to other habitat and local populations. The inputs to the viability assessment include the distribution of the MIS/focal species within the subbasin, the patch size, the weighted average of the AEC scores (that describe the habitat and population and habitat connectivity. The MIS/focal species viability score for a subbasin species status within subwatersheds) can range from +1 (high support for the conclusion that the MIS/focal species populations on the Forest are viable) to -1 (low support for the conclusion that the populations are viable). The following table displays the final viability model scores for the MIS/focal species by subbasin.

[38] See Appendix1 page 15 in the April 18, 2014 letter from the Deputy Regional Directors to FS Pacific Northwest and Rocky Mountain Research Station Director, NOAA Fisheries Branch Chiefs (West Coast Region), BLM District/Field Managers (Oregon, Washington, Idaho, and Montana), FWS Field Supervisors (Pacific Region), EPA Office of Water Directors (Regions 8, 9, and 10), EPA Operations Office Directors (Idaho, Oregon, Montana, and Washington),EPA Region Forest/Range Manager (Region 10) *Updated Interior Columbia Basin Strategy: A Strategy for Applying the Knowledge Gained by the Interior Columbia Basin Ecosystem Management Project to the Revision of Land Use Plans and Project Implementation*

**Table 66. MIS/focal species viability scores**

| Subbasin | Pend Oreille | | Columbia | | Kettle | | Colville | | SanPoil | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | WSCT | BT | WSCT | IRT | WSCT | IRT | WSCT | IRT | WSCT | IRT |
| Viability | -0.22 | -0.42 | -0.70 | -0.43 | -0.73 | -0.09 | -0.40 | -0.53 | -0.89 | -0.61 |

WSCT=westslope cutthroat, IRT=interior redband, BT=bull trout

As displayed in table 66, in no subbasin, for any MIS/focal species, is there support for the conclusion the populations are currently viable. If one were to categorize the scores as +1 to +0.33 is viable, 0.33 to -0.33 as viability is at risk and greater than -0.33 as not viable, the viability of the WSCT in the Pend Oreille subbasin and interior redband in the Kettle subbasin would be considered at risk. All other populations would be considered not currently viable at the subbasin scale. This is not surprising as in the AEC assessment the status of most local populations was rated as *functioning at risk* or *not properly functioning*, as were the habitat condition scores. There were no positive scores for patch size other than for bull trout in the Pend Oreille meaning most populations occupy or have access to a stream network smaller than what is considered beneficial for long-term viability. The overall scores reflect the threats to the MIS/focal species due to: the overall poor population status; impaired watershed functions and aquatic habitat generally in a “poor” condition compared to reference streams; and poor distribution of the MIS/focal species within the subbasins due to natural isolation above waterfalls, man-made barriers including those off the Forest; and the abundance of non-native fish, especially brook trout. In some cases the natural barriers are protecting the WSCT and interior redband populations from invasion by the non-native trout. The following summarizes the viability by subbasin.

### *Pend Oreille*

The MIS/focal species in the Pend Oreille subbasin are WSCT trout and bull trout. The WSCT populations are well distributed but their viability is at risk due to the presence of non-native trout, culvert barriers, and habitat degradation. The bull trout populations have also been affected by non-native trout, culvert barriers and habitat degradation. Bull trout have not been recently observed on the Forest hence the species has a poor distribution score. The bull trout migratory life history and connectivity between populations is also impaired due to hydroelectric dams on the mainstem rivers.

### *Upper Columbia/Lake Roosevelt*

The WSCT and redband trout are MIS/focal species in the Lake Roosevelt subbasin. The WSCT populations are mainly found in watersheds flowing into the eastside of Lake Roosevelt and are isolated from the lake and other populations by natural barriers. The interior redband trout populations are mainly found in watersheds draining into the west side of the lake and are also isolated by natural barriers. The isolated populations of both species have small patch sizes and the AEC scores reflect degraded habitat conditions. Non-native trout are probably preventing the two MIS/focal species from expanding their ranges but the barriers are also preventing the non-native trout from invading the currently occupied WSCT and interior redband trout habitat.

### *Kettle*

WSCT and interior redband trout inhabit the Kettle subbasin. The WSCT populations are isolated in two subwatersheds by natural barriers resulting in a low distribution and patch score. The AEC scores are low due to low or unknown population numbers and degraded habitat conditions. The distribution of the WSCT populations is likely restricted by the presence of non-native trout but as with the Lake Roosevelt populations, the natural barriers are preventing the non-native trout from invading the currently occupied WSCT habitat.

The interior redband trout are distributed across 15 subwatersheds although many populations are probably hybridized with non-native coastal rainbow trout. Pure populations are isolated from the Kettle River by man-made and natural barriers resulting in small patch sizes. The MIS/focal species population status is relatively healthy in eight subwatersheds, but the isolated populations combined with some degraded habitat conditions and non-native trout below the barriers are threats to the interior redband populations.

*Colville*

The small interior redband trout and WSCT populations in the Colville subbasin are isolated by natural and man-made barriers. The population viability of both species is threatened due to small, isolated populations, degraded habitat conditions and the wide distribution of non-native trout.

*Sanpoil*

There is a small WSCT population within one subbasin in the Sanpoil subbasin. The population is isolated from the rest of the subbasin by a natural barrier. The limited distribution, small population number, small patch size, and lack of connectivity with other WSCT populations, combined with watershed conditions rated as functioning at risk are threats to the population viability.

Small populations of interior redband trout are distributed in only four subwatersheds within the Sanpoil subbasin. The populations are isolated due to natural barriers resulting in small patch sizes and poor population and habitat connectivity. Widely distributed non-native trout are likely preventing both WSCT and interior redband trout from becoming more widely distributed.

## No-action Alternative

The current plan delineates broad management areas (MAs) where the general management intent is similar. Table 67 displays the MAs that share the same management direction in all alternatives.

**Table 67. Management areas that share the same direction across all action alternatives**

| Management areas with direction that remains the same across alternatives | Management direction and comparison to existing plan direction |
|---|---|
| **Administrative and Recreation Sites** (Includes permitted and developed recreation sites) | The sites are established as separate management areas rather than overlays or inclusions in other management areas. The management direction remains unchanged from current plans. |
| **Eligible and suitable wild and scenic rivers** (Includes all rivers identified in the current forest plans and those additional proposed eligible rivers) | Plan direction emphasizes maintaining the eligibility of the areas. Overarching management direction from legislation, policy, and directives bounds the direction. |
| **Research Natural Areas** | Emphasizes maintaining the research values of the areas. Boundaries of these areas remain unchanged from current. Overarching management direction from policy, directives, and establishment records bounds the direction. |
| **Scenic Byways** | Emphasizes maintaining the scenic values and functions of the area and remains unchanged across alternatives. Overarching management direction from policy and directives bounds the proposed plan revision direction. |
| **Special Interest Areas (SIA)** | Proposes new SIAs, combines others, and removes current SIAs that do not fit the category. Overarching management direction from directives bounds the proposed plan revision direction. Plan revision direction emphasizes maintaining the special values of the area and remains unchanged across alternatives. The boundaries and amount of SIAs are affected by wilderness recommendations changing across alternatives. |
| **Wilderness** | Congressionally designated wilderness boundaries do not change across alternatives. Management direction within Wilderness also does not change across alternatives. A notable change from current management is a proposal to allow the Forest to authorize use of prescribed fire within wilderness areas. |

Management areas specific to the current plan are displayed in the following table.

**Table 68. No-action management areas by subbasin (acres)**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Caribou Habitat | | | | 30,280 | | 30,280 |
| Downhill Skiing | | | | 2,024 | | 2,024 |
| No Management Area Assigned | | | | 17 | | 17 |
| Old Growth Dependent Species Habitat | 4,674 | 6,772 | 7,097 | 10,335 | 4,290 | 33,168 |
| Private Lands Originally | 91 | 77 | 20 | 1025 | | 1213 |
| Recreation | 8,511 | 9,722 | 9,158 | 11,146 | 4,642 | 43,179 |
| Recreation/Wildlife | | 2,248 | 978 | | 9,235 | 12,461 |
| Research Natural Area | | 401 | | 2269 | 2350 | 5020 |

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Scenic Timber | 22,595 | 42,961 | 46,498 | 89,594 | 14,472 | 216,120 |
| Scenic/Winter Range | 8,101 | 7,588 | 11,736 | 47,067 | 1,861 | 76,353 |
| Semi-Primitive, Motorized Recreation | | 3,449 | 10,118 | | | 13,567 |
| Semi-Primitive, Non-Motorized Recreation | | 29,942 | 16,824 | 33,696 | 7,534 | 87,996 |
| Wilderness Management | | | | 31,400 | | 31,400 |
| Winter Range | 16,422 | 16,877 | 37,483 | 34,506 | 20,396 | 125,966 |
| Wood/Forage | 48,082 | 74,556 | 158,418 | 109,254 | 32,601 | 422,911 |
| Total | 108,477 | 194,593 | 298,330 | 404,099 | 97,381 | 1,103,162 |

## Old Forest Management and Timber Production

**Key Indicators**

The number of acres that have Focused Restoration (or Late Forest Structure), General Restoration, and a timber production emphasis—30,741 acres (about 3 percent of the Forest is allocated to Old Growth Dependent Species Habitat.

Number of acres where management to produce timber is allowed—about 891,000 (about 81 percent of the Forest). However, vegetation management in the Caribou, Old Growth Dependent Species, Recreation/Wildlife, Scenic/Winter Range and Winter Range MAs is more likely to be similar to vegetation management in the Focused Restoration or Late Forest Structure MAs in the proposed action and alternatives R and P, the Restoration Zone in alternatives B and O. These No Action MAs include about 25 percent of the Forest (approximately 278,230) which is similar to the proposed action. More intense timber production is expected in the recreation, Scenic/Timber and Wood/Forage MAs totaling about 682,200 acres (62 percent of the Forest) which is more than the Active Management Area of alternative B and Responsible Management Area included in alternative O. The risks to watershed processes and aquatic habitat associated with timber production would occur over more of the Forest than any other alternative.

## Motorized Recreation Trails and Access

**Key Indicators**

Desired conditions for road densities- No desired conditions that specifically address watershed condition or aquatic habitat.

Acres allocated to Motorized Recreation—In total approximately 931,221 acres, about 85 percent of the Forest is available for off-road motorized. Off-road vehicle use would continue to be allowed in designated areas and trails over approximately 698,575 acres (about 65 percent of the Forest); allowed but subject to seasonal closures or other restrictions on approximately 232,646 acres (about 21 percent of the Forest; and discouraged or not allowed on about 168,370 acres (15 percent of the Forest)

There are approximately 4,000 miles of National Forest System roads on the Forest and another approximately 2,500 miles of roads owned by other jurisdictions within the boundaries of subwatersheds that include the Forest. The AEC assessment found most subwatersheds on the Forest to be *functioning at risk* or *not properly functioning* for the road density and riparian road density attribute. The no-action

alternative, along with alternatives B and O do not include desired conditions for road densities and cap the road system at 4,000 miles. While some MAs within the no-action alternative have desired conditions limiting open road densities, primarily to benefit wildlife, roads that are closed to use but still on the landscape continue to impact watershed processes and are considered “open” from a watershed and aquatic habitat perspective. The no-action alternative along with alternatives B and O present the most risk to aquatic resources and watershed conditions due to roads.

Off-road vehicle use would continue to be allowed in designated areas and trails over approximately 698,575 acres (about 65 percent of the Forest); allowed but subject to seasonal closures or other restrictions on approximately 232,646 acres (about 21 percent of the Forest; and discouraged or not allowed on about 168,370 acres (15 percent of the Forest). Off-road use increases the potential for accelerated sediment delivery to streams and damage to riparian vegetation and stream banks. These risks may increase if recreation use increases as expected and budgets to manage and maintain the system as described in Appendix 3 of the specialist report do not keep pace.

## Recommended Wilderness Areas

The current Forest Plan has no areas recommended for wilderness.

## Riparian and Aquatic Resource Management

**Key Indicator-ACS Direction, RMA Delineation and RMA Direction**

Under the no-action alternative, current forest plan direction for watershed, aquatic and riparian resources would remain as defined by INFISH.

INFISH includes eight riparian goals (similar to desired conditions) establishing the expectation for providing the characteristics of healthy, functioning watersheds, riparian areas and fish habitat; riparian management objectives (RMOs) that are numeric descriptors for good fish habitat[39]; riparian habitat conservation areas (RHCAs) (similar to RMAs) where riparian-dependent resources receive primary emphasis and specific standards and guides for land management activities are to be applied; Priority Watersheds designated to protect and conserve inland native fish habitat and populations; Watershed Analysis, a systematic procedure for determining how a watershed functions in relation to its physical and biological components; watershed restoration to improve the current condition of watersheds to restore degraded habitat and to provide long-term protection to riparian and aquatic resources (although no restoration strategy was originally included); and Monitoring (USDA Forest Service 1995) (see appendix 1 of the specialist report for a complete description of the ACS for each alternative.)

The delineation of riparian management areas, where riparian-dependent ecosystems receive primary emphasis would continue under the INFISH RHCA definitions (table 69). Standards and guidelines direct management within the RHCAs to meet the numeric RMOs.

[39] The specific measurable RMOs are for the following in-stream features; pool frequency; water temperature; large woody debris; bank stability; lower bank angle and width/depth ratio The RMOs are to remain in place unless they are revised through watershed or site-specific analysis

**Table 69. Riparian habitat conservation area width**

| Stream and water body classification | Riparian habitat conservation area width |
|---|---|
| Fish-bearing streams | 300 ft. slope distance on each side (600 ft. total) |
| Permanently flowing non-fish-bearing streams | 150 ft. slope distance on each side (300 ft. total) |
| Ponds, lakes, reservoirs and wetlands greater than 1 acre | 150 feet slope distance around feature |
| Seasonally flowing or intermittent streams, wetlands less than 1 acre | 100 ft. slope distance in priority watersheds, 50 ft. slope distance in non-priority watersheds. |

The INFISH standards and guidelines for RHCAs constrain management activities (timber, roads, livestock grazing, recreation, minerals, fire/fuels, lands, general riparian, watershed and habitat restoration, fisheries and wildlife restoration) in order to achieve the Riparian Goals and RMO's and ensure protection of physical and biological resources.

The results of stream surveys conducted by the Forest show that many of the reaches surveyed are not meeting the RMOs as defined by INFISH, although recent analysis of habitat trends show conditions may be slowly improving.

**Key Indicator –Key Watershed; Acres, Management Direction, MIS/Focal Species and Objectives**

There are currently 13 Priority watersheds that cover 214,283 acres or about 19 percent of the Forest.

The RHCA widths for intermittent streams are wider in Priority Watersheds than in non-priority watersheds (100 feet versus 50 feet) however, there are no other specific goals, desired conditions, or other direction specific to the priority watersheds. The Priority Watersheds are located in the Pend Oreille subbasin. Most Priority Watersheds support both bull trout critical habitat and WSCT populations. There are no Key or priority watersheds in the other subbasins within the Forest.

**Key Indicator - Improvement in riparian vegetation conditions within grazing allotments**

Managing grazing allotments would continue under INFISH riparian goals and the four INFISH grazing standards and guidelines that focus on attainment of Riparian Management Objectives, which may or may not be appropriate to site-specific hydrologic, geomorphic and riparian vegetation conditions. There are no other specific physical or biological indicators specified. Allotments with bull trout Critical Habitat would continue to be governed by biological opinions issued by the USFWS and may include more specific measures to limit impacts on bull trout and bull trout habitat.

Although stream habitat on the Forest in many locations are "degraded" compared to reference streams, conditions may be slowly improving. The PIBO index indicators for fine sediment and bank angle are trending in a negative direction in some streams, a possible indication of grazing affecting aquatic habitat. The impacts of grazing may be most acute in watersheds with high road densities.

**Key Indicator – Change in distribution or Aquatic Invasive Species (AIS)**

There is no INFISH direction specific to dealing with the threat of aquatic invasive species. There is one standard and guideline. AIS and preventing their distribution is indirectly addressed in the INFISH riparian goals.

## Forest Service Contribution to Viability

Although there is some indication aquatic habitat is improving with implementation of INFISH, the AEC for most subwatersheds on the Forest are *functioning at risk* or *not properly functioning* and little improvement would be expected given there are no road desired conditions, no extra protection to aquatic and riparian resources from recommended wilderness, and the more of the land base is open to intensive timber production under the no-action alternative than any other alternative. The no-action alternative provides the least Forest Service contribution to improve the viability of the MIS/focal species than any other alternative (table 70).

**Table 70. Forest Service contribution to viability (the higher the score the greater the Forest Service Contribution)**

| Forest Service Contribution | Pend Oreille | | Roosevelt | | Kettle | | Colville | | Sanpoil | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **WSCT** | **BT** | **WSCT** | **IRT** | **WSCT** | **IRT** | **WSCT** | **IRT** | **WSCT** | **IRT** |
| No Action | 0.01 | -0.26 | -0.34 | -0.34 | -0.36 | -0.10 | -0.29 | -0.49 | -0.46 | -0.41 |
| Proposed Action | 0.10 | -0.17 | -0.21 | -0.20 | -0.22 | 0.04 | -0.26 | -0.46 | -0.04 | -0.34 |
| Alternative R | O.13 | -0.14 | -0.04 | -0.03 | -0.13 | 0.12 | -0.15 | -0.35 | -0.38 | -0.33 |
| Alternative P | 0.13 | -0.14 | -0.06 | -0.06 | -0.17 | 0.09 | -0.22 | -0.43 | -0.37 | -0.32 |
| Alternative B | 0.03 | -0.24 | -0.32 | -0.31 | -0.31 | -0.05 | -0.28 | -0.48 | -0.42 | -0.37 |
| Alternative O | 0.07 | -0.20 | -0.11 | -0.10 | -0.21 | 0.05 | -0.27 | -0.48 | -0.40 | -0.34 |

WSCT=westslope cutthroat trout, IRT-interior redband trout, BT=bull trout

As mentioned in the Methods section, the final score for an alternative is the average of the relative protection to watershed and aquatic resources afforded by the MAs, the percent of occupied habitat on the National Forest lands, and the AEC (which includes watershed and habitat condition and the species status). The Forest Service Contribution scores represent an interpretation of the relative role of Forest lands to provide for the viability of a MIS/focal species in a subbasin by alternative. It should be noted that when the Forest Service contribution to ecological viability scores are low it does not necessarily indicate that Forest Service management direction is insufficient, but rather that Forest Service management is not addressing all factors that contribute to species ecological viability. Much of the other management issues not addressed may be off National Forest lands such as roads managed by other entities and hydroelectric dams. A low Forest Service contribution may also be due to presence on non-native fish and isolation due to natural barriers and man-made barriers off the National Forest as well as the current status of the MIS/focal species and habitat conditions as reflected in the AEC. As has been discussed, the viability of the MIS/focal species is currently threatened because: many MIS/focal species are isolated above natural as well as anthropogenic barriers and population status affected by the widespread distribution and abundance of non-native trout; and degraded habitat conditions both on and off the Forest.

The no-action alternative provides a current baseline from which to judge the relative potential change in the Forest Service contribution to MIS/focal species viability between alternatives.

## Effects – No Action

### *Old Forest Management and Timber Production*

Old forest management in the current forest plan occurs in old growth fixed reserves and is also guided by the Eastside Screens. The fixed reserves cover 30,741 acres or about three percent of the Forest. The

Eastside Screens direct that no tree over 21 inches in diameter be harvested. Timber production is allowed in the Recreation, Scenic/Timber, Scenic/Winter Range, Wood/Forage and Winter Range MAs that cover almost 81 percent of the Forest. However, vegetation management in the Caribou, Old Growth Dependent Species, Recreation/Wildlife, Scenic/Winter Range and Winter Range MAs is more likely to be similar to vegetation management in the Focused Restoration or Late Forest Structure MAs of the proposed action and alternatives R and P, and the Restoration Zone in alternatives B and O. The aforementioned No Action MAs include about 25 percent of the Forest, which is similar to the proposed action.

More intense timber production is expected in the Recreation, Scenic/Timber and Wood/Forage MAs totaling about 682,200 acres (62 percent of the Forest). The area with a timber production emphasis is more than the Active Management Area of alternative B and the Responsible Management Area included in alternative O. The watershed condition and AEC for most subwatersheds on the Forest are rated as *functioning at risk* or *not properly functioning* and little improvement may be expected over the current baseline conditions. The risks to watershed processes and aquatic habitat associated with timber production continue to occur over more of the Forest than any other alternative. While past timber harvest may have degraded the riparian vegetation attribute of the AEC, the transportation system needed to support the timber program is a bigger impact on watershed processes. Recent work completed by PIBO shows, that after almost 20 years of implementing INFISH, stream habitat conditions may be improving but the rate of improvement is slow, and habitat conditions on the Forest are in “poor” condition compared to reference streams. Therefore aquatic habitat may continue to show slow improvement but most watersheds would likely continue to *function at risk* or be *not properly functioning*.

### *Motorized Recreation and Access*

Roads are allowed on over 80 percent of the Forest. Currently, there are approximately 4,000 miles of National Forest System roads. There are approximately 2,500 miles of roads owned by other jurisdictions within the boundaries of subwatersheds that include the Forest. Roads not only disrupt watershed processes but their presence can have an impact on fish populations as well. Generally, watersheds that exhibit properly functioning watershed condition and support strong fish populations have road densities less than 1.0 mile per square mile and no valley bottom roads. Watersheds with road densities of 1 to 2.4 miles per square mile are generally considered to be functioning at risk for maintaining watershed processes and strong fish populations, and watersheds with road densities greater the 2.4 miles per square mile are considered to be not properly functioning. The AEC assessment found most subwatersheds on the Forest to be functioning at risk or not properly functioning for the road density and riparian road density attributes. The impaired watershed conditions are expected to continue under the no-action alternative. While some MAs include desired conditions limiting open road densities at least seasonally there are no specific desired conditions for watersheds function or fish habitat. A road that is closed to access, such as for deer winter range, but still existing on the landscape is still has an imprint on watershed processes and therefore such roads are considered “open” in our road density calculations.

The Forest currently decommissions about four miles of road per year and completes three to five fish passage improvement projects annually and it is assumed this rate would continue under the no-action alternative. Road decommissioning should help improve watershed conditions, especially when concentrated in “focus” watersheds and may be expected to reduce fine sediment delivery to streams over the long-term. However with an emphasis on timber production the overall road densities are not expected to be significantly reduced on the Forest as a whole.

Off-road vehicle use would continue to be allowed in designated areas and trails over approximately 698,575 acres (about 65 percent of the Forest); allowed but subject to seasonal closures or other restrictions on approximately 232,646 acres (about 21 percent of the Forest; and discouraged or not allowed on about 168,370 acres (15 percent of the Forest). Off-road use increases the potential for

accelerated sediment delivery to streams and damage to riparian vegetation and stream banks. These risks may increase if recreation use increases as expected and budgets to manage and maintain the system do not keep pace.

### *Recommended Wilderness*

The current forest plan includes no lands recommended as potential wilderness. The no-action alternative is the only alternative that does not include recommended wilderness.

### *Riparian and Aquatic Resource Management*

Watershed, riparian, and aquatic habitat direction is provided by INFISH. The existing forest plan and amendments focus heavily on Goals, Objectives and Standards and Guidelines to implement the watershed, aquatic, and riparian direction (see appendix 1 of the specialist report for INFISH plan direction and comparison to action alternatives). Under the no-action alternative current forest plan direction for watershed, aquatic and riparian resources would remain as defined in INFISH.

INFISH includes eight riparian goals (similar to desired conditions) establishing the expectation for providing the characteristics of healthy, functioning watersheds, riparian areas and fish habitat; Riparian Management Objectives (RMOs) that are numeric descriptors for good fish habitat,[40] Riparian habitat conservation areas (RHCAs) (similar to RMAs) where riparian-dependent resources receive primary emphasis and specific standards and guides for land management activities are to be applied; Priority Watersheds designated to protect and conserve inland native fish habitat and populations; Watershed Analysis, a systematic procedure for determining how a watershed functions in relation to its physical and biological components; watershed restoration to improve the current condition of watersheds to restore degraded habitat and to provide long-term protection to riparian and aquatic resources (although no restoration strategy was originally included); and Monitoring (USDA Forest Service 1995).

The delineation of riparian management areas would continue under the INFISH RHCA definitions (table 71). RHCA widths may be increased or decreased when necessary to attain RMOs when site-specific data supports the change. Standards and guidelines direct management within the RHCAs to meet the numeric RMOs although there is no distinction between a standard and a guideline.

**Table 71. Riparian habitat conservation area width**

| Stream and water body classification | Riparian Habitat Conservation Area (RHCA) width |
|---|---|
| Fish-bearing streams | 300 ft. slope distance on each side (600 ft. total) |
| Permanently flowing non-fish-bearing streams | 150 ft. slope distance on each side (300 ft. total) |
| Ponds, lakes, reservoirs and wetlands greater than 1 acre | 150 ft. slope distance around feature |
| Seasonally flowing or intermittent streams, wetlands less than 1 acre | 100 ft. slope distance in priority watersheds, 50 ft. slope distance in non-priority watersheds. |

INFISH designated what are termed Priority Watersheds. Within Priority Watersheds inland native fish are to receive special attention and treatment (USDA Forest Service 1995). The criteria to designate priority watersheds include:

[40] The specific measurable RMOs are for the following in-stream features; pool frequency; water temperature; large woody debris; bank stability; lower bank angle and width/depth ratio The RMOs are to remain in place unless they are revised through watershed or site-specific analysis

1. Watersheds with excellent habitat of strong assemblages of inland native fish, with a priority on bull trout populations
2. Watersheds that provide for meta-population objectives
3. Degraded watersheds with a high restoration potential

Watersheds in good condition are to serve as anchors for the potential recovery of depressed populations, and provide colonists for adjacent areas where habitat had been degraded by land management or natural events. Those watersheds with lower quality habitat and high potential for restoration would become future sources of good habitat through focused restoration. The RHCA widths for intermittent streams are wider in Priority Watersheds than in non-priority watersheds (100 feet versus 50 feet) however, there are no other specific goals, desired conditions, or other direction specific to the priority watersheds.

The results of stream surveys conducted by the Forest show that many of the reaches surveyed are not meeting the RMOs as defined by INFISH. Deficiencies were noted in pool frequency and the number of large pools, large woody debris, bank conditions and stream widths riparian vegetation and sediment. However, given the natural variability in stream habitat conditions due to weather, disturbance and the physical environment a “one-size-fits-all” approach, such as the use of RMOs may not adequately describe habitat conditions (Al-Chokhachy et al. 2011).

Archer et al. (2009) and Meredith et al. (2012) found that the PACFISH and INFISH strategies appeared to be working although streams within managed watersheds are generally in a more degraded condition than more unmanaged or reference watersheds (Al-Chokhachy et al. 2010). Using an index approach, PIBO data was assessed for sampled streams on the Forest. After almost 20 years implementing INFISH, a number of individual components of aquatic habitat and overall habitat scores on the Forest tended to be (but not universally) less (impaired habitat condition) than would be expected compared to reference streams. However, the results indicate positive trends for a number of the stream habitat indicators, suggesting that habitat may be slowly improving under current management. The bank angle and fine sediment indicators, D50 and percent fines, appear to be most commonly in what might be considered an impaired condition.

There are currently 13 priority watersheds where inland native fish are to receive special emphasis. The priority watersheds cover 214,283 acres or about 19 percent of the Forest. Watersheds in good condition would serve as anchors for the potential recovery of depressed populations, and provide colonists for adjacent areas where habitat had been degraded by land management or natural events. Those watersheds with lower quality habitat and high potential for restoration would become future sources of good habitat through focused restoration. The RHCA widths for intermittent streams are wider in priority watersheds that in non-priority watersheds (100 feet versus 50 feet), however, there are no other specific goals, desired conditions, or other direction specific to the priority watersheds.

The priority watersheds are only located in the Pend Oreille subbasin. Most of the priority watersheds support both bull trout and WSCT populations. The following table displays the priority watersheds including all designated bull trout critical habitat on the Forest.

**Table 72. INFISH priority and alternative B key watersheds**

| Subwatershed Number | Subwatershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | Species/CH |
|---|---|---|---|---|
| 170102160201 | Exposure Creek-Pend Oreille River | 41,224 | 14,463 | BT, WSCT |
| 170102160202 | Skookum Creek | 31,811 | 14,192 | BT, WSCT |

| Subwatershed Number | Subwatershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | Species/CH |
|---|---|---|---|---|
| 170102160301 | Middle Creek-Pend Oreille River | 23,209 | 5,066 | BT |
| 170102160302 | West Branch Le Clerc Creek | 21,672 | 15,099 | WSCT, CH |
| 170102160303 | East Branch Le Clerc Creek | 26,663 | 11,145 | WSCT,CH |
| 170102160401 | Harvey Creek | 32,999 | 27,554 | BT, WSCT |
| 170102160402 | Headwaters Sullivan Creek | 45,516 | 45,417 | WSCT,CH |
| 170102160403 | North Fork Sullivan Creek-Sullivan Creek | 12,709 | 11,259 | WSCT,CH |
| 170102160702 | Headwaters South Salmo River | 20,697 | 12,472 | BT, WSCT |
| 170102160704 | Outlet South Salmo River | 14,013 | 3,460 | BT, WSCT |
| 170102160902 | Sweet Creek-Pend Oreille River | 41,832 | 28,890 | WSCT |
| 170102160903 | Slate Creek | 20,195 | 19,907 | WSCT,CH |
| 170102161003 | Cedar Creek | 17,209 | 5,359 | WSCT,CH |
| | **Total Acres** | **349,747** | **214,283** | |

WSCT=Westslope Cutthroat Trout, IRT=Interior Redband, BT=Bull Trout, CH=Bull Trout Critical Habitat

While native fish are to receive special management emphasis within priority watersheds, there is no additional management direction provided such as specific desired conditions, objectives, or standards and guides specific to the priority watersheds.

There is no INFISH direction specifically addressing the threat of aquatic invasive species. There is one standard and guideline:

- FW-4 Cooperate with Federal, tribal, and State fish management agencies to identify and eliminate adverse effects on native fish associated with habitat manipulation, fish stocking, fish harvest, and poaching.

AIS and preventing their distribution is indirectly addressed in the INFISH riparian goal to maintain or restore the:

- diversity and productivity of native and desired non-native plant communities in riparian zones.
- riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.
- habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Currently, the Forest AIS strategy includes a milfoil weed control project in the Little Pend Oreille Lakes and using preventive measures such as disinfecting field gear to reduce the accidental spread of AIS. These activities are expected to continue.

Active grazing allotments overlap with RHCAs, including those that provide habitat for MIS/focal species. Managing grazing allotments would continue under INFISH riparian goals and the four INFISH grazing standards and guidelines that focus on attainment of riparian management objectives, which may or may not be appropriate to site-specific hydrologic, geomorphic and riparian vegetation conditions. There are no other specific physical or biological indicators specified. Aquatic habitat tends to be of poor quality on the Forest compared to reference streams, but after almost 20 years of implementing INFISH, there is indication that aquatic habitat conditions on the Forest are slowly improving. The bank stability,

percent undercut bank, and bank angle attributes of aquatic habitat, which can be affected by grazing, are showing some improving trends on the Forest. However, the bank angle attribute and the fine sediment indicators, D50 and percent fines, which also can be affected by grazing, are commonly in a "poor condition", although it must be noted the extent to which grazing is or is not contributing to the current habitat conditions is not determined at this time. Allotments with bull trout critical habitat would continue to be governed by biological opinions issued by the USFWS and may include more specific measures to limit impacts on bull trout and bull trout habitat.

### Cumulative Effects

A general discussion of cumulative effects common to all alternatives is included in the section; Past Present and Foreseeable Activities Relevant to the Cumulative Effects Analysis. The watershed condition and status of most of the MIS/focal Species' local populations are functioning at risk or not properly functioning, although there is some indication of slow improvement in aquatic habitat condition. Road densities and riparian road densities which are two major attributes causing the poor watershed condition scores may not significantly improve, despite restoration, due to the amount of land available for timber production, the current Forest road system, and the 2,500 miles of road managed by other entities, which is not expected to change.

The Forest would continue with actions as described in the *Northeast Washington Forest Vision 2020* project. Such actions, especially when they are implemented in a whole watershed restoration approach, should help restore watershed condition to some degree. However, given the road system and the fact that after 20 years of implementing INFISH on the Forest stream habitat is only slowly improving, watershed condition and stream habitat may not be expected to significantly improve forestwide. The magnitude of the improvement within a subwatershed would depend upon the amount of work that is socially acceptable and technically feasible to implement. The MIS/focal species' population status are significantly affected by high numbers and wide distribution of non-native fish, isolation above barriers and low MIS/focal species numbers, and problems in the migratory corridors on the larger rivers. The terms associated with relicensing of hydroelectric dams on mainstem rivers adjacent to the Forest should have beneficial impacts to native fish, especially bull trout and WSCT.

### Climate Change

The overall effects of climate change were presented in the Summary of Effects Common for all Alternatives section. Under the no-action alternative, Colville National Forest aquatic resource management direction for managing for stronghold populations that may contribute to the MIS/focal species persistence under different climate change scenarios is contained in the INFISH direction for priority watersheds. The priority watersheds are Exposure Creek-Pend Oreille River, Skookum Creek, Middle Creek Pend Oreille River, West Branch Le Clerc Creek, East Branch Le Clerc Creek, Harvey Creek, Headwaters Sullivan Creek, North Fork Sullivan Creek-Sullivan Creek, Headwaters South Salmo River, Outlet South Salmo River, Sweet Creek-Pend Oreille River, Slate Creek, and Cedar Creek. The Priority watersheds may provide the potential to rebuild populations and improve habitat, especially in the East Fork and West Fork Le Clerc Creeks, which are focus watersheds. Where implemented, habitat restoration projects, improved aquatic passage, road decommissioning should help protect MIS/focal species populations and improve connectivity for bull trout populations in those streams, especially in the East and West Branch Le Clerc Creek and Ninemile Creek where restoration actions are to be focused in the near-term. The threat to the MIS/focal species due to the high abundance and broad distribution of non-native trout may be exacerbated in a warming climate.

### Monitoring Recommendations

The monitoring program was previously described in the Summary of Effects Common for all Alternatives.

## Proposed Action

The proposed action reflects current management policies of the Forest. The proposed action provides for a mix of wilderness, motorized and non-motorized recreation opportunities to address the increase in visitor uses due to population growth and changing demographics. Similar to the current forest plan, the proposed action allows the existing level of authorized road access with approximately 80 percent of the Forest in a roaded recreation setting. Some key differences between the proposed action and the current plan include; a dynamic approach to managing old forests rather than fixed reserves, more area emphasizing backcountry motorized use, and approximately 101,390 acres identified as recommended wilderness.

In addition to including the Recommended Wilderness MA, two restoration management areas are proposed, Focused Restoration and General restoration. Focused restoration areas are defined by key watersheds, and grizzly bear and caribou recovery areas that are not included in Backcountry and Backcountry Motorized MAs. General Restoration areas spatially include all areas not already included in another MA.

The road density desired conditions for Focused and General Restoration areas vary between the proposed action, and alternatives R and P. Road density is defined as the miles of all National Forest System roads per square mile of National Forest System land. The total National Forest System road density is averaged over the whole MA (Focused or General Restoration) within a watershed (HUC10).

**Table 73. Proposed action management area acres by subbasin pertinent to aquatics discussion**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total* |
|---|---|---|---|---|---|---|
| Focused Restoration | 0 | 31,073 | 46,989 | 179,079 | 0 | 257,143 |
| General Restoration | 101,808 | 96,764 | 166,104 | 106,538 | 62,348 | 533,844 |
| Backcountry | 5,270 | 13,627 | 20,448 | 32,907 | 18,587 | 90,838 |
| Backcountry Motorized | 1,357 | 11,807 | 40,459 | 5,259 | 2,844 | 61,726 |
| Wilderness Recommended | 0 | 30,002 | 24,009 | 38,876 | 8,498 | 101,390 |
| Wilderness-Congressionally Designated | 0 | 0 | 0 | 31,400 | | 31,400 |

*Acres are approximate and vary due to GIS methodology

The proposed action addresses the need for updated, integrated direction for watershed, aquatic and riparian management. Riparian and aquatic resource direction included in the proposed action is based on the ARCS (USDA Forest Service 2008). The ARCS includes designation of riparian management areas (RMAs), designation of a key watershed network, and a core set of desired conditions, goals, objectives, and standards and guidelines designed to provide ecological conditions conducive to maintaining, restoring, and enhancing habitat necessary to sustain aquatic and riparian-dependent species on National Forest System lands.

### Old Forest Management and Timber Production

**Key Indicator** – The number of acres that have Focused Restoration (or Late Forest Structure), General Restoration, and a timber production emphasis.

- Focused Restoration – 257,143 acres.
- General Restoration – 533,844 acres

The proposed action employs a landscape approach to restoring vegetation conditions, including late forest structure forests across the Forest. Approximately 71 percent of the Forest is available for timber harvest in the restoration MAs with the intent to restore forest vegetation conditions. The Focused Restoration MA includes about 23 percent of the Forest and the General Restoration Area about 48 percent of the Forest. The amount of land in these two MAs is almost reversed in alternative R. Alternative P has similar amounts of land in the two MAs; about 28 percent in Focused restoration and almost 45 percent in General Restoration.

The intent of timber harvest and other vegetation management activities is to create vegetation conditions that are more resilient to disturbances such as wildfire, drought and insect infestations. Management to restore vegetation to conditions, including old forests or late forest structure that are more resilient to disturbances such as fire, drought and insects and disease may help improve watershed conditions. The restoration management approach would likely have fewer risks to aquatic habitat and watershed condition than management with a timber production emphasis. It is assumed that there would be more active management within the General Restoration MA and therefore potentially more risk to aquatic resources due to vegetation management activities, as the Focused Restoration MA has a greater emphasis to provide habitat for wildlife and key watersheds. However, the potential increased risks due to vegetation management in the General Restoration MA compared to the Focused Restoration areas is small as the intent in both areas is to improve upslope vegetation conditions. The potential benefits to watershed condition and aquatic habitat due to terrestrial vegetation management may not be fully realized due to the desired road densities (see below).

## Motorized Recreation Trails and Access

**Key Indicators**

- Desired Conditions for road densities – Road density desired conditions are 2.0 miles per square mile in Focused Restoration MA and 3.0 miles per square mile in General Restoration MA.
- Acres allocated to motorized use – Approximately 954,000 acres or 87 percent of the Forest, however, it should be noted that 101,390 of those acres are in recommended wilderness where only existing trails can be used and no new trails developed.

Watershed conditions would continue to be impaired as road densities above 2.4 miles per square mile are generally considered indicative of a *not properly functioning* watershed and are not conducive to supporting strong fish populations. The 2.0 miles per square mile road density desired conditions still falls in the range where watershed conditions and the ability of a watershed to support strong fish populations is *at risk*.

Off-road vehicle use is allowed over most of the Forest including in recommended wilderness where the trails currently exist. The continued off-road use increases the potential for accelerated sediment delivery to streams and damage to riparian vegetation and stream banks. The level or magnitude of the risks would depend in part, whether the Forest can maintain the trail system to keep pace with the expected growing demand.

## Recommended Wilderness Areas

**Key Indicator - Total Area in Recommended Wilderness – 101,390 acres**

The 101,390 acres allocated to recommended wilderness would be protective of streams within those lands. While no roads can be constructed within recommended wilderness, the proposed action would allow existing motorized recreation uses to continue, presenting more risk to watershed processes, riparian and aquatic habitat than alternatives in which motorized recreation is not to be permitted within recommended wilderness.

## Riparian and Aquatic Resource Management

**Key Indicator – ACS Direction, RMA Delineation and RMA Direction**

The proposed action ACS, based upon the Region 6 ARCS (USDA Forest Service 2008) includes desired conditions, standards and guidelines, and a key watershed network designed to provide the ecological conditions conducive to maintaining, restoring, and enhancing habitat necessary to sustain aquatic and riparian-dependent species on National Forest System lands. Watershed, aquatic, and riparian direction address both ecosystem and species diversity at watershed and landscape scales by providing the core set of desired conditions, objectives and standards and guidelines for general water resources, key watersheds and riparian management areas

The proposed action includes riparian management areas (RMAs), similar to the RHCAs in the no-action alternative. Two notable differences between the proposed action RMAs and the existing INFISH RHCA definitions are: (1) a 300-foot RMA for lakes and natural ponds compared to INFISH riparian width of 150 feet; and (2) the proposed riparian width of 100 feet for all seasonally flowing or intermittent streams, wetlands, seeps and springs less than one acre; compared to the existing direction of 100 feet in Priority watersheds, and 50 feet in non-priority watersheds. The increase in RMAs, compared to the INFISH direction contained in the no-action alternative, recognizes the importance of these areas for maintaining watershed function and protecting downstream aquatic habitat as well as associated riparian dependent species (USDA Forest Service 2008).

Direction for managing RMAs to benefit riparian-dependent resources, includes two desired conditions. Direction for managing other resource programs within the RMAs is provided by 13 standards and 28 guidelines. In the current forest plan there is no distinction between standards and guidelines within the INFISH RHCAs. The inclusion of specific standards and guidelines provides clear direction for resource management within RMAs.

The proposed action also includes six key watershed and riparian management objectives for improving riparian and aquatic habitat. The objectives address grazing concerns, restoring riparian processes at dispersed recreation sites and on user-constructed trails, and to restore fish passage in key watersheds.

**Key Indicator – Key Watersheds, Management Direction, MIS/Focal Species and Objectives**

The proposed action carries forward the concept of key watersheds as a primary element to maintain and improve aquatic conditions for the MIS/focal species' populations, other aquatic species, and to provide high water quality. Management in key watersheds emphasizes minimizing risk and maximizing restoration or retention of ecological health.

The proposed action identifies 22 HUC 12 subwatersheds as key watersheds covering 371,943 acres or almost 34 percent of the Forest; compared to the 13 Priority Watersheds in the no-action alternative that include 214,283 acres (about 19 percent of the Forest). In the no-action alternative all the Priority Key Watersheds are located in the Pend Oreille Subbasin. The proposed action includes a broader network that

not only benefits bull trout and includes bull trout critical habitat, but expands the key watershed network for WSCT and includes subwatersheds with interior redband trout populations.

Management direction is provided through three desired conditions that address key watershed contribution to the conservation and recovery of threatened and endangered fish species, watershed integrity, and minimizing the risk due to roads. Unlike INFISH which has no standards specific to key watersheds, the proposed action includes three. There is to be no net increase in roads in a key watershed and there are two standards for hydroelectric development. The proposed action includes six objectives for key watersheds, emphasizing that management within key watersheds is to focus on; the restoration or protection of watershed, aquatic and riparian function; reducing the impacts of roads on watershed function; improving aquatic organism passage at road/stream crossings, range management actions; enhancing late forest structure in upland plant communities within RMAs and improving stream channel and floodplain function. Additional, specific objectives have also been developed to guide restoration activities. The expansion of key watersheds to include more subwatersheds supporting WSCT and interior redband trout is expected to better protect those populations than under the current key watershed network, as experience within the Northwest Forest plan area has shown key watershed designation generally results in improved watershed conditions (Lanigan et al. 2012). The improved conditions observed within key watersheds is due to the overall management direction provided by desired conditions and standards, but also focused restoration.

**Key Indicator - Change in distribution of aquatic invasive species (AIS):**

There is no specific direction within the proposed action that addresses AIS prevention, control, or eradication other than a desired condition; “Native assemblages of riparian dependent plants and animals are free of persistent non-native species.” There is also indirect direction for managing AIS risk in the overall and riparian desired conditions for healthy watersheds and aquatic systems, maintaining and recovering native species.

*Improvement in riparian vegetation conditions within grazing allotments*

Grazing management within RMAs is guided by watershed and RMA desired conditions and RMA standards and guidelines. The proposed action includes one standard addressing livestock handling, management and watering facilities, and four guidelines. One guideline specifically addresses streambank alteration, and utilization of herbaceous and woody vegetation. The guideline provides a starting point for managing grazing within RMAs to protect riparian and aquatic habitat.

## The Forest Service Contribution to MIS/Focal Species Viability

The proposed action is expected to contribute to the viability of the MIS/focal species to a greater degree than the no-action alternative. Compared with the no-action alternative the proposed action includes more lands allocated to MAs that are felt to be “protective“ of watershed processes and aquatic habitat (Wilderness, Recommended Wilderness, Backcountry and Backcountry Motorized), more lands that have a “moderate” level of protection (Focused Restoration); and while timber is expected to be an output from both the Focused and General Restoration areas, there is more emphasis of restoring forest vegetation conditions than timber production in the proposed action than the no-action alternative. There is also a significantly larger key watershed network that expands the key watersheds to include more subwatersheds with bull trout and WSCT in the Pend Oreille subbasin; and subwatersheds with interior redband trout in the Lake Roosevelt and Kettle subbasins. The Forest’s contribution to viability is improved as well by road density desired conditions for the Focused and General Restoration Areas, but the overall contribution compared to alternatives R and P is reduced because the desired road densities, especially for the General Restoration MA, are higher than the road densities generally found in functioning watersheds that provide habitat for strong fish populations. The RMAs in the proposed action

are expanded compared to the no-action alternative to included extra consideration for all intermittent streams, recognizing the importance of these small streams for providing high quality water to downstream aquatic habitat.

Table 70 in the no-action alternative discussion displays the relative Colville National Forest contribution to viability in the subbasins for the MIS/Focal Species by alternative. The proposed action increases the Forest Service contribution to the focal species viability in all subbasins for all the MIS/focal species. If the ratings for the MIS/Focal Species are averaged across the subbasins, the Forest Service contribution to MIS/focal species' viability under the proposed action is greater for all species than in no-action alternative and alternative B but less than in alternatives R and P; and less than, but somewhat similar to alternative O.

## Effects – Proposed Action

### *Old Forest Management and Timber Production*

Approximately 71 percent of the forest is available for timber harvest in the Focused and General Restoration MAs. The intent of timber harvest and other vegetation management activities is to create vegetation conditions that are more resilient to disturbances such as wildfire, drought and insect infestations. Although endemic levels of insects and diseases create snags which in turn provide woody debris to streams, and low-severity fires can deliver wood and nutrients to aquatic system, many of the subwatersheds are functioning at risk for the fire regime indicator and a few are not properly functioning in the AEC assessment. A few subwatersheds are functioning at risk for insects and disease. Epidemic insect population levels and/or high-severity fire can lead to vegetation losses or sediment increases above desired levels for native fish populations.

Management to restore vegetation to conditions, including late forest structure, as may be expected under historical and anticipated environmental conditions is a component of managing for healthy, resilient watersheds and may help improve watershed conditions. There are likely less risks to aquatic resources due to vegetation management in the Focused Restoration MA than in the General Restoration MA, as the Focused Restoration includes a greater emphasis for wildlife habitat and key watersheds. The restoration management approach for both the MAs would likely have fewer risks to aquatic habitat and watershed condition than management with a timber production emphasis; however, the potential benefits of terrestrial vegetation management may not be fully realized due to the desired road densities (see below).

### *Motorized Recreation and Access.*

Motorized trails are not authorized in research natural areas, wilderness, or on national scenic trails. Wilderness designation further precludes mechanized use with minor exceptions. Motorized trails may be authorized in specified locations at recreation or administrative sites.

The proposed action has two Backcountry MAs, motorized and non-motorized. In the proposed action, approximately 6 percent of the Forest is allocated to Backcountry Motorized (BCM) management and approximately eight percent is allocated to Backcountry Non-motorized (BC). Motorized trail use and off-trail over-snow use is allowed in the BCM management areas but not in BC areas. Summer and winter motorized use would be authorized within the Focused and General Restoration MAs.

Roads are currently allowed on about 80 percent of the Forest and the proposed action continues to allow road access in those areas. Road access would not be allowed within recommended or designated wilderness areas, BCM and BC MAs, or research natural areas. Road density desired conditions are identified for the Focused and General RAs. The desired road density in the Focused Restoration Areas is

2.0 miles per square mile averaged over the Focused Restoration areas within watershed and 3.0 miles per square mile in the General Restoration areas.

Most subwatersheds on the Forest are functioning at risk or not properly functioning for the AEC road density and riparian road density attributes. The road attributes are a prime reason for impaired watershed function. Roads are currently allowed on 80 percent and the proposed action would continue to allow access to these areas. Road access is not allowed in wilderness areas, recommended wilderness, backcountry motorized and non-motorized management areas or research natural areas; about 26 percent of the Forest.

The proposed action identifies desired road densities for the Focused Restoration and General Restoration Areas. The Focused Restoration MA, approximately 23 percent of the Forest, has a road density desired condition of 2.0 miles per square mile. The General Restoration MA, about 48 percent of the Forest, has a desired road density of 3.0 miles per square mile. Watersheds with road densities of 1.0 to 2.4 miles per square mile are generally considered functioning at risk for watershed condition and for providing the conditions necessary to support strong fish populations. Road densities greater than 2.4 miles per square mile are generally considered not properly functioning. The Forest's ability to achieve the desired road densities would be depend upon budgets and in some cases public acceptance. Implementation of the proposed action may improve watershed conditions in Focused Restoration areas that currently exceed 2.0 miles per square mile, with the greatest improvements likely to occur as restoration objectives are met in key watersheds. However, approximately 71 percent of the Forest watersheds may be expected to remain functioning at risk or not properly functioning for road densities.

The desired conditions, standards and guides for aquatic resources provide direction for minimizing the effects of roads especially in key watersheds and RMAs

Off-road vehicle use is allowed over most of the Forest including in recommended wilderness where the trails current exist. The continued off-road use increases the potential for accelerated sediment delivery to streams and damage to riparian vegetation and stream banks. The level or magnitude of the risks would depend in part if budgets to manage the system keep pace with the expected growing demand.

Some improvement to impaired watershed condition due to roads and off-road vehicle use may occur due to the Aquatic and Riparian Management plan components, including overall desired conditions, RMA standards and guidelines, and key watershed direction (see Riparian and Aquatic Resource Management). The Forest currently decommissions about 4 miles of road a year and completes 3 to 5 fish passage improvement projects annually, and it is assumed the activities would continue at the present rate. Road decommissioning should improve watershed function, especially in focus and Key watersheds but the overall effectiveness at improving watershed condition may be constrained by the desired road densities. Implementation of the objectives for restoration, Key watersheds and RMAs may help reduce the impacts of roads and trails that are left on the landscape.

### *Recommended Wilderness*

The proposed action identifies 101,390 acres, about 9 percent of the Forest, to be managed as recommended wilderness. The wilderness character of these areas is to be maintained until Congress either designates them as wilderness or releases an area from consideration. Existing motorized trails are allowed. While there may be some impacts to watershed processes and fish habitat associated with use of the existing trails, overall, the recommended wilderness areas, with no roads or management other than recreation, should be protective of aquatic habitat.

### *Riparian and Aquatic Resource Management*

The proposed action ACS is based upon the Region 6 ARCS (USDA Forest Service 2008). The ARCS and subsequently the Forest's ACS includes desired conditions, standards and guidelines, and a key watershed network designed to provide the ecological conditions conducive to maintaining, restoring, and enhancing habitat necessary to sustain aquatic and riparian-dependent species on National Forest System lands. Watershed, aquatic and riparian direction address both ecosystem and species diversity at watershed and landscape scales by providing the core set of desired conditions, objectives and standards and guidelines for general water resources, key watersheds and riparian management areas.

Overall, direction is provided by plan components that include 11 desired conditions that apply to all watersheds, aquatic and riparian systems. These are similar to the riparian goals of INFISH. Desired conditions apply to all watersheds and are intended to provide a comprehensive description of the characteristics of healthy functioning water, fisheries and riparian resources toward which land management should be directed. The 11 desired conditions direct National Forest System Lands to contribute to; the distribution, diversity and resiliency of watershed and landscape-scale features; uninterrupted physical and biological processes within and between watersheds; habitat and ecological conditions that are capable of supporting self-sustaining populations of native and desired non-native aquatic and riparian dependent plant and animal species; the physical integrity of aquatic systems and riparian habitat; water quality necessary to support healthy riparian, aquatic and wetland ecosystems; the sediment regime within the natural range of variation; in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing; the timing, variability and duration of floodplain inundation; the timing, variability and water table elevation in wetlands, seeps and springs; the species composition and structural diversity of plant communities in riparian management areas (including wetlands); and native assemblages of riparian-dependent plants and animals.

The ACS identifies RMAs similar to the INFISH RHCAs except additional consideration is given to the riparian areas adjacent to intermittent streams, wetlands less than 1 acre, seeps and springs and unstable and potential unstable areas in all watersheds. The increase in RMAs provides additional protection to these areas, recognizing their importance for maintaining watershed function and protecting downstream aquatic habitat as well as associated riparian dependent species (USDA Forest Service 2008).

**Table 74. Riparian widths for the proposed action, R, P, and O alternatives**

| Stream and Water body Classification | Riparian Management Area (RMA) Widths |
|---|---|
| Fish-bearing streams | 300 feet each side |
| Permanently flowing non-fish-bearing streams | 150 feet each side |
| Constructed ponds and reservoirs and wetlands greater than 1 acre | 150 feet |
| Lakes and natural ponds | 300 feet |
| Seasonally flowing or intermittent streams, wetlands, seeps and springs less than 1 acre and unstable and potentially unstable areas | 100 feet |

Desired Conditions for RMAs include:

- RMAs within any given watershed reflect a natural composition of native flora and fauna and a distribution of physical, chemical and biological conditions appropriate to natural disturbance regimes.

- Key riparian processes and conditions (slope stability, vegetative root strength, wood delivery, etc.) are operating consistently with local disturbance regimes.

Standards and guidelines provide direction for management activities within RMAs. Standards and guidelines are defined as (2012 planning rule: section 219.7):

*(iii) Standards. 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.*

*(iv) Guidelines. 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. 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.*

Direction for managing RMAs to benefit riparian-dependent resources, including direction for managing other resource programs within the RMAs, is provided by 14 standards and 26 guidelines. In the current forest plan there is no distinction between standards and guidelines within the INFISH RHCAs. The inclusion of specific standards and guidelines provides clear direction for resource management within RMAs.

The direction for RMAs also include four riparian management objectives specifically addressing improving riparian processes and function in grazing programs, restoring dispersed recreation sites and user-constructed trails, and restoring fish passage in the key watersheds. The riparian objectives are different than the RMOs in INFISH and the no-action alternative. The INFISH RMOs were considered to be general descriptors of good fish habitat that could be changed by a Forest with more site-specific information. The RMO “one-size-fits-all” approach is somewhat problematic and may not adequately describe habitat conditions due to the natural variability in stream habitat conditions caused by weather, disturbance and the physical environment (Al-Chokhachy et al. 2011).

Key watersheds are defined as a network of watersheds selected to serve as strongholds for important aquatic resources or having the potential to do so. They are areas crucial to TES and areas that provide high quality water important for downstream aquatic habitat. The protocol for developing key watersheds is provided by Reiss et al. (2008). The proposed action designates an expanded network of key watersheds compared to the no-action alternative by identifying 22 HUC 12 subwatersheds as key watersheds covering 371,943 acres, or almost 34 percent of the Forest; compared to the 13 priority watersheds in the no-action alternative that include 214,283 acres (about 19 percent of the Forest). In the no-action alternative, all the priority key watersheds are located in the Pend Oreille Subbasin. The proposed action includes a broader network that not only benefits bull trout and includes bull trout critical habitat, but expands the key watershed network to other subbasins benefiting additional WSCT populations and includes subwatersheds with interior redband trout populations. Watershed and aquatic habitat condition is expected to improve within Key watersheds as found by Lanigan et al. (2012) over time. The improved watershed conditions are due to the management direction for the key watersheds, the management intent to minimize risks to watershed condition and aquatic habitat within key watersheds, and the emphasis on restoration (discussed below).

**Table 75. Proposed action key watersheds**

| Subwatershed Number | Subwatershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | MIS/ Focal Species CH |
|---|---|---|---|---|
| 170102160102 | Winchester Creek | 10,482 | 5,627 | WSCT, CH |
| 170102160103 | Exposure Creek-Pend Oreille River | 41,223 | 14,462 | BT, WSCT |
| 170102160106 | Smalle Creek | 17,753 | 11,058 | BT, WSCT, CH |
| 170102160109 | Tacoma Creek | 39,519 | 27,182 | BT, WSCT, CH |
| 170102160202 | West Branch Le Clerc Creek | 21,671 | 15,098 | BT, WSCT, CHCH |
| 170102160203 | East Branch Le Clerc Creek | 26,662 | 11,145 | BT, WSCT, CH |
| 170102160204 | Ruby Creek | 19,597 | 18,385 | BT, CH |
| 170102160302 | Sweet Creek-Pend Oreille River | 41,831 | 28,890 | WSCT |
| 170102160303 | Harvey Creek | 32,998 | 27,553 | BT, WSCT |
| 170102160304 | Headwaters Sullivan Creek | 45,516 | 45,417 | BT, WSCT, CH |
| 170102160305 | North Fork Sullivan Creek-Sullivan Creek | 12,708 | 11,258 | BT, WSCT, CH |
| 170102160306 | Slate Creek | 19,911 | 19,907 | BT, WSCT, CH |
| 170102160307 | South Salmo River | 22,271 | 15,932 | BT |
| 170200010104 | North Fork Deep Creek | 49,256 | 26,633 | WSCT |
| 170200010306 | Barnaby Creek | 23,107 | 14,299 | IRT |
| 170200010401 | Upper Hall Creek | 31,648 | 13,785 | IRT |
| 170200010402 | Sitdown Creek | 14,484 | 0 | |
| 170200010403 | Middle Hall Creek | 15,480 | 1,927 | IRT |
| 170200020401 | Trout Creek | 23,434 | 14,121 | IRT |
| 170200020501 | Tonata Creek | 14,453 | 13,780 | IRT |
| 170200020608 | North Fork Deadman Creek | 13,449 | 13,185 | IRT |
| 170200020609 | Deadman Creek | 26,518 | 22,299 | IRT |
| | **Total** | **563,971** | **371,943** | |

WSCT=Westslope Cutthroat Trout, IRT=Interior redband, BT=Bull Trout, CH=Bull Trout Critical Habitat

Management activities in key watersheds are to emphasize minimizing risk and maximizing restoration or retention of ecological health. Three desired conditions are identified for key watersheds:

- Networks of watersheds with good habitat and functionally intact ecosystems that contribute to and enhance conservation and recovery of threatened and endangered fish species
- Roads do not present risk to aquatic resources;
- Key watersheds have high watershed integrity.

The proposed action includes three standards for management within key watersheds:

1. There shall be no net increase at any time in the mileage of Forest roads in any key watershed unless doing so results in a reduction in road-related risk to watershed condition.
2. Hydroelectric and other water development authorizations shall include requirements for in-stream flows and habitat conditions that maintain or restore native fish and other desired aquatic species populations, riparian dependent resources, favorable channel conditions, and aquatic connectivity.

3. New hydroelectric facilities and water developments shall not be located in a key watershed unless it can be demonstrated they have minimal risks and/or no adverse effects to fish and water resources for which the key watershed was established.

The proposed action also includes six objectives for restoration for key watersheds.

- **Key watershed objective 1**: Management in key watersheds focuses on restoration or preservation of watershed, aquatic, and riparian function and recovery of threatened and endangered species. The East Branch LeClerc Creek, West Branch LeClerc Creek, Deadman Creek, Barnaby Creek, Harvey Creek, North Fork Deadman Creek, North Fork Sullivan Creek-Sullivan Creek, Tonata Creek, and Ruby Creek subwatersheds are priorities for active restoration. Additional key watersheds that are priorities for restoration would be identified as priority work is completed.
- **Key watershed objective 2**: Reduce road hydrologic connectivity and sediment delivery through storm damage risk reduction, full hydrologic decommissioning, and other acceptable treatment measures;
- **Key watershed objective 3**: Restore or maintain aquatic organism passage at road/stream crossings for all species, seasons, flows, and life stages within 15 years of plan implementation, through culvert replacement or installation and improvement of hydrologic and aquatic habitat function and resiliency to a range of flows thorough natural channel design and other acceptable treatment measures;
- **Key watershed objective 4**: Improve hydrologic and aquatic function through range infrastructure improvements, including riparian fencing, movement and improvement of watering troughs, and other acceptable treatments;
- **Key watershed objective 5**: Enhance late forest structure in upland vegetation within riparian management areas;
- **Key watersheds objective 6**: Restore hydrologic, geomorphic, and riparian process and function through streambank stabilization, restoration of lateral and vertical hydrologic connectivity and improvement of stream channel and floodplain function.

Additionally, there are objectives for key watersheds that identify restoration activities specific to the individual key watersheds. The objectives identify treating 68 miles of road to reduce impacts on water quality and watershed processes; improving aquatic organism passage at 30 road/stream crossings; improving range infrastructure to reduce the potential for detrimental impacts to riparian and aquatic habitat due to grazing on 240 acres; improving the structure and composition of upland vegetation within RMAs on between 450 and 900 acres; and restoring 70 miles of stream. The combined direction for key watersheds should improve watershed condition as roads are decommissioned and riparian vegetation is improved. The benefits may improve watershed conditions the most where the actions are focused in a watershed.

**Table 76. Proposed action — objectives and projected improvements in key watersheds that are active priorities for restoration**

| Key Watershed Prioritization | Road Treatments Road Improvement (miles) | Road Treatments Aquatic Organism Passage Improvement (# of crossings) | Range Infrastructure Improvement (acres) | Riparian Vegetation Structure Improvement (acres) | Stream Restoration (miles) |
|---|---|---|---|---|---|
| East Branch LeClerc Creek | 3 | 5 | 20 | 0 | 10 |
| West Branch LeClerc Creek | 3 | 1 | 20 | 0 | 10 |
| Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| Barnaby | 5 | 5 | 30 | 75-150 | 4 |
| Harvey Creek | 10 | 2 | 0 | 0 | 4 |
| North Fork Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| North Fork Sullivan-Sullivan Creek | 15 | 1 | 0 | 0 | 20 |
| Tonata Creek | 4 | 4 | 50 | 75-150 | 3 |
| Ruby Creek | 3 | 4 | 30 | 75-150 | 3 |
| Treatments in additional key and/or priority watersheds (estimate addition 3 subwatersheds) | 15 | 6 | 30 | 75-150 | 10 |
| Total for the life of the plan (essential projects completed for 12 key watersheds) | 68 miles | 30 crossings | 240 acres | 450-900 acres | 70 miles |

All key watersheds are in the Focused Restoration MA. The intent to restore terrestrial vegetation should help improve the resiliency of watersheds to disturbance although the actual benefit would depend upon the amount of terrestrial restoration activity that actually occurs in a watershed or subwatershed. key watershed and riparian management objectives to reduce road related sediment should help improve water quality and fish habitat, but changing watershed conditions to full functioning may be limited by the road density desired condition of 2.0 miles per square mile that is considered a risk to watershed processes and strong fish populations.

There is no specific direction within the proposed action that addresses AIS prevention, control, or eradication other than a desired condition; “Native assemblages of riparian dependent plants and animals are free of persistent non-native species. There is also indirect direction for managing AIS risk in the overall and riparian desired conditions for healthy watersheds and aquatic systems, maintaining and recovering native species.

A number of subwatersheds are functioning at risk or not properly functioning for the AEC Riparian Vegetation attribute. Aquatic habitat tends to be of poor quality on the Forest compared to reference streams, but after almost 20 years of implementing INFISH, there is indication that aquatic habitat conditions on the Forest are slowly improving. The bank stability, percent undercut bank and bank angle attributes of aquatic habitat, which can be affected by grazing, are showing some improving trends on the

Forest. However, the bank angle attribute and the fine sediment indicators, D50 and percent fines, which also can be affected by grazing are commonly in a "poor condition." The extent to which grazing is or is not contributing to the current habitat conditions is not determined at this time. Grazing management within RMAs is guided by watershed and RMA desired conditions and RMA standards and guidelines. The proposed action includes one standard addressing livestock handling, management and watering facilities, and four guidelines. One guideline describes utilization within the RMA that states: Within green-line vegetation area adjacent to all watercourses.[41]

- do not exceed 20 percent streambank alteration;
- do not exceed 40 percent utilization of mean annual vegetative production on woody vegetation;
- maintain at least 4 to 6 inches or do not exceed 40 percent utilization of mean annual vegetative production on herbaceous vegetation.[42]

Streambank alteration is an indicator of damage to streambanks that can lead to bank instability, accelerated delivery of sediment to stream channels, loss of undercut banks and increasing bank angles with an associated loss of cover for fish and contributing to channel widening. When discussing standards or guidelines for streambank alteration it is important to identify the protocol to be used as the allowable percent alternation would depend upon the protocol (different protocols may have different results for the same level of bank alteration (Archer 2014)). It is assumed that the Forest would continue to use the Multiple Indicator Monitoring (MIM) protocol (Burton et al. 2011). Bengeyfield (2006) suggest bank alteration of 20 percent or less should be protective of streambanks, however, Bengeyfield (2006) used a different protocol. A standard of 20 percent bank alteration using the MIM protocol is consistent with the recommendations of Archer (2014) based upon the PIBO monitoring information. Not exceeding 40 percent utilization of mean annual vegetative production on woody vegetation should protect riparian shrubs and bushes from excessive grazing (Winward 2000). Maintaining 4 to 6 inches stubble height is designed to protect the health of riparian vegetation. Clary and Leininger (2000) suggest that a 4-inch stubble height is a starting point for improved riparian grazing but raising the stubble height to 6 to 8 inches may be required to protect willows and limit bank trampling. Therefore, depending upon the conditions at a site, a 4-inch residual stubble height may not be sufficient for improving riparian vegetation conditions. Root strength is important for maintaining stable streambanks, preventing bank erosion, and for the development of undercut banks that provide cover for fish. Overall utilization of herbaceous vegetation can result in slow or diminished root growth, thus, potentially affecting the health of riparian vegetation and reducing the root strength. The standard for not exceeding 40 percent utilization of the mean annual vegetative production of herbaceous vegetation is at the upper end of the recommendations of Archer (2014). The guideline establishes the upper limits for bank alteration, utilization and stubble height as the starting point for identifying grazing management strategies within RMAs.

[41] National Forests can modify the numeric values in these guidelines to more effectively achieve desired conditions. Rationale for these changes should be documented

[42] Sampling and assessment of these parameters is intended to portray the general condition of banks and riparian vegetation along an individual stream reach within each pasture. It is assumed that there will be some variability in conditions within the reach, including occasional, limited area of concentrated animal use, such as water gaps or crossings.

*Numeric values in this standard represent minimum levels of what cannot be exceeded and should be more conservatively modified where determined necessary to effectively achieve desired conditions. Rationale for these changes must be documented. Standards can be applied solely or in combination as appropriate to site-specific conditions. Sampling and assessment of these parameters is intended to portray the general condition of banks and riparian vegetation along an individual stream reach within each pasture after the grazing season. It is assumed that there will be some variability in geomorphic, hydrologic and vegetation conditions within designated monitoring areas, including occasional, limited area of concentrated animal use, such as water gaps or crossings.

The other guidelines address considering the removal of existing livestock handling or management facilities form RMAs, avoidance of livestock trailing, bedding, loading and other handling activities, and avoiding trampling threatened or endangered fish species' redds. The specific direction to avoid red trampling is important as redd trampling can cause direct mortality to the eggs or alevins.

The grazing guidelines, when used in total, should help manage livestock grazing to protect riparian and aquatic habitat. The bank alteration and utilization standards may be more protective and actually be reached before the stubble height is grazed down to 4 to 6 inches. The bank alteration standard however needs to be measured very soon after the cattle are removed from an allotment and before the fall rains that may wash away signs of alteration (Archer 2014).

## Cumulative Effects

Information regarding cumulative effects that is common for all alternatives is included in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The activities outside the influence of the proposed action, such as the aquatic habitat improvement work associated with hydroelectric projects are common for all alternatives. The activities associated with the *Northeast Washington Forest Vision 2020* project would continue and be guided by the proposed action direction.

The ACS for the proposed action is based on the Region 6 ARCS which was based upon the lessons learned through implementation of the Northwest Forest Plan, PACFISH and INFISH, as well as science that came to light after those plans were written. The ACS clarifies standards and guidelines for RMAs and key watersheds as well as restoration objectives that should provide more direction for improving watershed, aquatic and riparian habitat conditions that may result in those conditions improving at a faster rate than has occurred under the no-action alternative.

However over the Forest most subwatersheds may remain functioning at risk or not properly functioning due to the road density desired conditions for the Focused Restoration (2.0 miles per square mile) and General Restoration (3.0 miles per square mile) MAs and the transportation system managed by other entities. Actual achievement of the road density desired conditions would be dependent upon budgets for restoration and social acceptance.

Restoration work and attaining the ACS desired conditions may be greatest where Colville National Forest actions and coordinated with the actions of other entities such as those associated with the Boundary Hydroelectric Project.

## Climate Change

The general description of the potential effects of climate change remain the same as discussed in the Effects Common to All Alternatives section. The increased overall direction of the ACS including forestwide desired conditions, riparian and key watershed standards and guides; the key watershed network covering approximately 34 percent of the Forest; desired conditions for and management to improve the vegetative structure and composition of Forests; and objectives for improving riparian and watershed conditions may remove human stressors to the environment and provide a somewhat better opportunity for aquatic species to adjust to climate change. Specific Key watershed objectives to improve aquatic organism passage should help improve the habitat and MIS/focal species population connectivity as the projects are implemented. However, the road density desired conditions may continue to pose a risk to MIS/focal species' persistence in the face of climate change.

A particular risk to the MIS/focal species would remain the presence of non-native fish, low MIS/focal species population numbers, and isolated and fragmented populations. In addition to the Forest actions described above, the non-native fish population suppression or eradication, habitat improvement and

improved passage at the hydroelectric project dams may be key factors in conserving the MIS/focal species.

### Monitoring Recommendations

The monitoring program was previously described in the Summary of Effects Common for all Alternatives.

## Alternative R

Riparian and aquatic resource direction in alternative R is based on the proposed action direction, but incorporates additional desired conditions, objectives, and standards and guidelines that address contemporary issues specific to the Forest raised by the public, regulatory agencies, and internally during scoping.

**Table 77. Alternative R management area acres by subbasin pertinent to aquatics discussion**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Late Forest Structure | 84,792 | 120,823 | 160,038 | 195,906 | 3,990 | 565,549 |
| General Restoration | 17,023 | 13,517 | 59,778 | 93,241 | 61,222 | 244,781 |
| Backcountry | 0 | 0 | 7,570 | 12,214 | 437 | 20,221 |
| Backcountry Motorized | 1,357 | 63 | 0 | 5,279 | 0 | 6,699 |
| Wilderness Recommended | 5,339 | 48,945 | 70,928 | 55,951 | 26,699 | 207,800 |
| Wilderness-Congressionally Designated | 0 | 0 | 0 | 31,400 | | 31,400 |

### Old Forest Management and Timber Production

**Key Indicator – The number of acres that have Focused Restoration (or Late Forest Structure), General Restoration, and a timber production emphasis.**

- Focused Restoration (Late Forest Structure) – 565,550 acres
- General Restoration – 245,063

Alternative R retains the two restoration MAs introduced in the proposed action. The Focused Restoration Area includes about 51 percent of the Forest and the General Restoration area about 22 percent of the Forest. Alternative R includes more land in the Focused Restoration MA and less in the General Restoration MA than either the proposed action or alternative P. In addition, approximately 484,000 acres within the Focused Restoration MA are to be managed with an emphasis on late forest structure.

Vegetation management to restore vegetation to conditions, including late forest structure that may be more expected under historic and anticipated disturbance regimes, is a component of managing for healthy watersheds. Vegetation management including timber harvest as outlined for alternative R may be more beneficial toward improving watershed conditions than the proposed action due to more land within the Focused Restoration MA.

## Motorized Recreation Trails and Access

**Key Indicator - Desired Conditions for Road Density**

- Focused Restoration Areas – 1.0 mile per square mile
- General Restoration Areas – 2.0 miles per square mile

Road density desired condition for Focused restoration MA is 1.0 mile per square mile. Road density indicator for General Restoration is 2.0 miles per square mile. Most subwatersheds on the forest are not properly functioning or functioning at risk for the AEC road density and riparian road density attributes. Implementing alternative R would potentially help improve watershed condition more than the proposed action. If the road density desired conditions are attained watershed conditions may be expected to improve. The Focused Restoration MA, with a desired average road density of 1.0 mile per square mile covers about half percent of the Forest. In general road densities of 1.0 mile per square mile are the upper bounds of what are considered properly functioning watersheds, conducive to providing habitat for strong fish populations. The General Restoration MA with a desired average road density of 2.0 miles per square mile includes a little less than one-quarter of the Forest. Watersheds with 2.0 miles per square miles are generally considered to be functioning at risk for watershed condition and supporting strong fish populations. The extent to which the road density desired conditions would be attained will depend upon budgets and social acceptance.

**Key Indicator - Acres allocated to motorized recreation - Approximately 833,630 acres, about 76 percent of the Forest.**

The alternative includes 207,800 acres of recommended wilderness (second most of the alternatives), where not only new roads won't be built, but no motorized recreation is permitted, reducing the risk of accelerated sediment delivery from motorized trails compared to the proposed action. Motorized recreation is allowed on approximately 817,311 acres; 74 percent of the Forest.

## Recommended Wilderness

**Key Indicator - Recommended Wilderness Areas**

Alternative R allocates approximately 19 percent of the Forest to recommended wilderness, second highest amount of all the alternatives. The restrictions on motorized use of all kinds reduces the risk of accelerated sediment delivery to streams from any existing trails.

## Riparian and Aquatic Resource Management

Riparian and aquatic resource direction in alternative R is based on direction in the proposed action, but incorporates additional desired conditions, objectives, and standards and guidelines that address contemporary issues specific to the Forest raised by the public, regulatory agencies, and internally during scoping.

**Key Indicator – ACS Direction, RMA Delineation, and RMA Direction**

Watershed direction within the alternative R incorporates the desired conditions for watersheds, aquatic and riparian systems that were described in the proposed action with clarifying language added to several of the desired conditions. Alternative R also includes the addition of desired conditions for TES species, one for roads, and five additional standards to decrease the spread of AIS and to minimize the disruption of hydrologic processes due to roads and trails.

The alternative R definition of RMAs and the associated widths are the same as in the proposed action. The management direction for RMAs includes 16 standards and 23 guidelines. Several of the RMA guidelines in the proposed action are standards in alternative R, some additional standards have been added, and specificity has been added to the language describing some standards and guidelines. Changing guidelines to standards may add additional clarity and certainty to expectations concerning how management actions are to be implemented within RMAs. An additional desired condition is also added regarding livestock grazing.

**Key Indicator – Key Watershed Acres, Management Direction for Key Watersheds, MIS/Focal Species, Key Watershed and Restoration Objectives**

The alternative R Key watershed network includes 25 subwatersheds covering 452,051 acres, compared to 22 key watersheds covering about 371,943 acres in the proposed action. Three subwatersheds were removed from the proposed action key watershed network because they had less than 25 percent National Forest System ownership. The key watershed network includes the bull trout critical habitat and expands the network to include subwatersheds with interior redband trout and additional subwatersheds with WSCT. The alternative R along with alternatives P and O (discussed later) provide the greatest benefit to the MIS/focal and aquatic species due to the key watershed network.

Alternative R includes the three key watershed desired conditions as in the proposed action with some clarifying language added and the three key watershed standards. The key watershed objectives are similar to those as described for the proposed action (see appendices 1 and 2 of the specialist report) with additional objectives to improve range infrastructure to protect riparian habitat, restore the structure and composition of upland vegetation within RMAs and for stream restoration.

**Key Indicator – Change in the Distribution of Aquatic Invasive Species (AIS)**

Alternative R includes standards developed specifically for prevention, control, and eradication of AIS. Such plan components provide more clear and urgent direction to implement appropriate AIS management actions than the proposed action and no-action alternatives and thus alternative R may be provide more protection from AIS invasion than no action and the proposed action.

**Key Indicator – Improvement in riparian conditions within grazing allotments.**

Alternative R includes three standards and two guidelines for grazing within RMAs. The guideline in the proposed action for that refers to maintaining 4- to 6-inch stubble height and no more than 20 percent bank alteration is changed to maintaining at least 8-inch stubble height and to not exceed 25 percent bank alteration.

## Forest Service Contribution to MIS/Focal Species Viability

Alternative R provides the greatest Colville National Forest contribution to MIS/focal species viability of all alternatives. The Forest contribution for alternative R is the highest for WSCT and interior redband trout of any alternative and equal to alternative P for bull trout. The reason that alternative R exhibits the greatest potential contribution is the expanded key watershed network that includes the bull trout critical habitat and has an increased the key watershed area for WSCT and interior redband trout compared to no action, the proposed action, and alternative B. Alternative R includes the second greatest amount of recommended wilderness of all alternatives and the greatest amount of land within the Focused Restoration MA. The potential benefits of the amount of land within the Focused MA is the 1.0 mile per square mile road density desired condition compared to the 2.0 miles per square mile desired condition included in the proposed action.

Although not included in the "scoring," alternative R maintains the definition for RMAs that is included in the proposed action, extending the amount of lands within RMAs around intermittent streams. Alternative R, compared to the no-action alternative, relies more on standards than guidelines to provide management direction and includes standards for the prevention, control and eradication of AIS. The distinction between standards and guidelines is mentioned standards may add additional clarity and expectations concerning how management actions are to be implemented within RMAs than a guideline may offer.

## Effects – Alternative R

### *Old Forest Management and Timber Production*

Alternative R uses a fixed reserve management approach to maintain old forest habitats and late forest structure. The reserves are called "late forest structure emphasis areas" and overlay other management areas, guiding the vegetation management emphasis for the area. The desired conditions, standards, and guidelines in the old forest emphasis areas are the same as the proposed action's plan direction for old forests and direction for goshawk habitat. The key difference between the proposed action and alternative R for late forest structure that these areas in the proposed action are managed dynamically at the landscape scale, whereas in alternative R they are managed in a static reserve system.

Old forest emphasis areas emphasize habitat for key watersheds and wildlife species including grizzly bear and goshawk. Road density direction is a desired condition of 1.0 mile per square mile on average. Alternative R allocates about 51 percent of the Forest to Focused Restoration and about 22 percent of the Forest to General Restoration.

Timber harvest is permitted in the Focused and General Restoration MAs. On approximately 484,000 of those acres the goal is to provide late forest structure appropriate to the vegetation community. Other than in the approximately 484,000 acres reserved for late forest structure, vegetation management within the Restoration MAS is to emphasize providing the vegetation structure and composition to provide for forest communities that are resilient to disturbances such as wildfire, drought and insect infestations, similar to the proposed action. Many of the subwatersheds on the Forest are functioning at risk for the fire regime indicator in the AEC assessment, and a few are not properly functioning. Vegetation management to restore vegetation to conditions including, late forest structure, that may be more expected under historic and anticipated disturbance regimes may help improve watershed conditions. Vegetation management including timber harvest as outlined for alternative R may be more beneficial toward improving watershed conditions due to the road density desired conditions compared to the proposed action. The potential risks to aquatic resources due to vegetation management projects, especially timber sales would likely be greatest in the General Restoration area due to the higher desired conditions for road density and an expected greater amount of active vegetation management than in the Focused Restoration Area.

### *Motorized Recreation and Access*

Alternative R provides one percent of the Forest for summer motorized trail opportunities in a backcountry, unroaded setting and two percent of the Forest for summer non-motorized trail opportunities in a backcountry, unroaded setting. Summer and winter motorized trails may be authorized in administrative and recreation sites and are not authorized on national scenic trails or in research natural areas, recommended wilderness, or wilderness. Seasonal restrictions and closures may apply to areas such as deer and elk winter range. Summer and winter motorized use would be authorized within the Focused and General Restoration management areas, providing a roaded recreation setting.

The alternative includes 207,800 acres of recommended wilderness (second most of the alternatives). The recommended wilderness allocation combined with the Backcountry Recreation MA and current

Wilderness comprise about 24 percent of the Forest where no motorized recreation is permitted, reducing the risk of accelerated sediment delivery from motorized trails. However, motorized use is still allowed on most of the Forest where some accelerated erosion and potential damage to riparian and aquatic habitat may occur, especially if management is not able to maintain the trail system given the expected increase in use.

Roads are currently allowed on about 80 percent of the Forest and alternative R would continue to allow roads in those areas. Like all other alternatives, new road access would not be allowed in recommended or designated wilderness areas, backcountry motorized and non-motorized management areas, or research natural areas.

Alternative R includes desired condition for road density in the focused and general restoration MAs. Desired road density in the focused restoration MA is no greater than 1.0 mile per square mile averaged over focused restoration areas within the 5th field watershed. The desired road density in the general restoration MA is no greater than 2.0 miles per square mile averaged over general restoration areas within the 5th field watershed.

Most subwatersheds on the forest are not properly functioning or functioning at risk for the AEC road density and riparian road density attributes. Implementing alternative R would potentially help improve watershed condition more than the proposed action. The majority of lands within key watersheds are within the focused restoration MA, which includes a desired average road density of 1.0 mile per square mile, or other MAs that restrict road development including backcountry non-motorized, recommended wilderness, and wilderness. The benefits of the alternative to watershed and aquatic resources is extended to the plan area as a whole, compared to the proposed action and no-action alternatives, as the focused restoration MA includes about one-half of the Forest. In general, road densities of 1.0 mile per square mile are the upper bounds of what are considered properly functioning watersheds, conducive to providing habitat for strong fish populations. The general restoration MA with a desired average road density of 2.0 miles per square mile includes only about one-quarter of the Forest. Watersheds with 2.0 miles per square mile are generally considered to be functioning at risk, however, between the two MAs there should be some improvement in watershed conditions and fish habitat if the desired road densities are attained. As with the proposed action and alternative P, the ability of the Forest to attain the desired road densities would depend upon budgets and social acceptance. Achieving the desired road densities is most likely in the key watersheds due to focused restoration.

#### *Recommended Wilderness*

Alternative R includes approximately 207,800 of recommended wilderness, second highest amount of all the alternatives, where no new roads or motorized use is allowed. The restriction on motorized use of all kinds provides benefit to watershed conditions and aquatic habitat by reducing the risk of sediment delivery to streams and aquatic habitat due to the use of existing motorized trails, and the construction of new roads or trails.

#### *Riparian and Aquatic Resource Management*

Watershed direction in the alternative R contains plan components (desired conditions, objectives and standards and guidelines) for general watershed resources; key watersheds and RMAs. Watershed, aquatic and riparian forest plan direction is designed to maintain and restore the ecological health of watersheds and aquatic and riparian ecosystems on National Forest System lands.

Watershed direction within the alternative R incorporates the desired conditions for watersheds, aquatic and riparian systems that were described in the proposed action; adds clarifying language to several of the desired conditions, and incorporates an additional desired condition regarding TES fish: *National Forest*

*lands contribute to the recovery of Threatened and Endangered fish species and conservation of Regional Foresters sensitive fish species. Aquatic habitat supports spawning, rearing and other key life history requirements*.

Five additional standards were added that apply not only to overall watershed management but to RMAs as well. These standards include direction to decrease the potential spread of AIS when working in water; including during fire suppression activities, utilizing Early Detection and Rapid Response principles to respond to a potential introduction of an AIS, and an overall standard to minimize the disruption of hydrologic processes due to roads and trails.

The alternative R definition of RMAs and the associated widths are the same as in the proposed action. The management direction for RMAs includes 16 standards and 23 guidelines. Standards may add additional clarity and expectations concerning how management actions are to be implemented within RMAs than a guideline.

**Table 78. Alternatives R, P, O - objectives and projected improvements in key watersheds that are active priorities for restoration**

| Key Watershed Objective 6: Key Watershed Prioritization | Key Watershed Objective 7: Road Treatments | | Key Watershed Objective 8: Range Infrastructure Improvements | Key Watershed Objective 9: Riparian Vegetation Structure | Key Watershed Objective 10: Stream Restoration |
|---|---|---|---|---|---|
| Management in key watersheds focuses on restoration or preservation of watershed, aquatic, and riparian function and recovery of threatened and endangered species. Improve watershed condition class in key watersheds that are a priority for restoration. Key watersheds that are a priority for restoration include: | Reduce road-hydrologic connectivity and sediment delivery on roads through storm damage risk reduction treatments, full hydrologic decommissioning, and other accepted treatment measures on hydrologically connected road (miles) | Restore or maintain aquatic organism passage at road/stream crossings for all native species, seasons, flows, and life stages through culvert replacement or installation and improvement of hydrologic and aquatic habitat function and resiliency to a range of flows through natural channel design and other acceptable treatment measures (# of crossings) | Improve hydrologic and aquatic function through range infrastructure improvements, including riparian fencing, movement and improvement of watering troughs, and other acceptable treatments(acres) | Move upland vegetation in riparian management areas toward HRV (acres) | Restore hydrologic, geomorphic, and riparian process and function through activities including streambank stabilization, restoration of lateral and vertical hydrologic connectivity, and improvement of stream channel and floodplain function (miles) |
| East Branch LeClerc Creek | 3 miles | 5 | 20 | 0 | 10 |
| West Branch LeClerc Creek | 3 miles | 1 | 20 | 0 | 10 |
| Deadman Creek | 5 miles | 1 | 30 | 75-150 | 3 |
| Upper Sherman Creek | 5 miles | 5 | 0 | 75-150 | 2 |
| South Fork Sherman Creek | 5 miles | 9 | 0 | 75-150 | 4 |
| Barnaby | 5 miles | 5 | 30 | 75-150 | 4 |
| Harvey Creek | 10 miles | 2 | 0 | 0 | 4 |
| Tonata Creek | 4 miles | 4 | 50 | 75-150 | 3 |
| North Fork Deadman Creek | 5 miles | 1 | 30 | 75-150 | 3 |
| North Fork Sullivan-Sullivan Creek | 15 miles | 1 | 0 | 0 | 20 |
| Ruby Creek | 3 miles | 4 | 30 | 75-150 | 3 |
| Treatments in additional key and/or priority watersheds (estimate addition 3 subwatersheds over 15 years) | 15 miles | 6 | 30 | 75-150 | 10 |
| Total for the life of the plan (essential projects completed for 14 subwatersheds) | 78 miles | 44 crossings | 240 acres | 600-1200 acres | 76 miles |

Alternative R includes additional key watersheds than are included in the proposed action. The key watershed network includes 25 subwatersheds covering 452,051 acres. The key watershed network was expanded in alternative R based on updated fish distribution data and improved data on aquatic habitat function since designation of the proposed action key watershed network. Five subwatersheds were added to the key watershed network included in the proposed action and three subwatersheds were removed from the proposed action key watershed network because they had less than 25 percent National Forest System ownership. The alternative R key watersheds include bull trout critical habitat and expand the key watersheds providing habitat for WSCT and interior redband trout. Alternative R, along with alternatives P and O (discussed in the following sections) provides the greatest potential benefit to the MIS/focal and other aquatic species due to the key watershed network.

**Table 79. Key watersheds for alternatives R, P, and O**

| Subwatershed Number | Subwatershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | MIS/Focal Species/ CH |
|---|---|---|---|---|
| 170102160102 | Winchester Creek | 10,482 | 5,628 | WSCT, CH |
| 170102160103 | Smalle Creek | 17,754 | 11,058 | BT, WSCT, CH |
| 170102160201 | Exposure Creek-Pend Oreille River | 41,224 | 14,463 | BT, WSCT |
| 170102160206 | Tacoma Creek | 39,519 | 27,182 | BT, WSCT,CH |
| 170102160302 | West Branch Le Clerc Creek | 21,672 | 15,099 | BT, WSCT, CHCH |
| 170102160303 | East Branch Le Clerc Creek | 26,663 | 11,145 | BT, WSCT, CH |
| 170102160304 | Ruby Creek | 19,597 | 18,385 | BT, CH |
| 170102160401 | Harvey Creek | 32,999 | 27,554 | BT, WSCT |
| 170102160402 | Headwaters Sullivan Creek | 45,516 | 45,417 | BT, WSCT, CH |
| 170102160403 | North Fork Sullivan Creek-Sullivan Creek | 12,709 | 11,259 | BT, WSCT, CH |
| 170102160702 | Headwaters South Salmo River | 20,697 | 12,472 | BT |
| 170102160902 | Sweet Creek-Pend Oreille River | 41,832 | 28,890 | WSCT |
| 170102160903 | Slate Creek | 20,195 | 19,907 | BT, WSCT, CH |
| 170102161003 | Cedar Creek | 17,209 | 5,359 | BT, WSCT, CH |
| 170200011004 | North Fork Deep Creek | 49,257 | 26,634 | WSCT |
| 170200011301 | South Fork Sherman Creek | 22,004 | 21,899 | IRT |
| 170200011302 | Upper Sherman Creek | 26,381 | 26,260 | IRT |
| 170200011303 | Lower Sherman Creek | 20,987 | 15,98 | IRT |
| 170200011306 | Barnaby Creek | 23,108 | 14,299 | IRT |
| 170200011401 | Upper Hall Creek | 31,648 | 13,786 | IRT |
| 170200021301 | Trout Creek | 23,435 | 14,122 | IRT |
| 170200021701 | Tonata Creek | 14,453 | 13,781 | IRT |
| 170200021907 | East Deer Creek-Kettle River | 23,385 | 15,443 | WSCT |
| 170200022002 | North Fork Deadman Creek | 13,450 | 13,185 | IRT |
| 170200022003 | Deadman Creek | 26,518 | 22,300 | IRT |
| | **Total** | **642,692** | **451,525** | |

The alternative R key watershed direction carries over the key watershed desired conditions in the proposed action with some clarifying language added and includes the proposed action's three key watershed standards. The key watershed objectives are similar to those as described for the proposed action with additional objectives to improve range infrastructure to protect riparian habitat, restore the structure and composition of upland vegetation within RMAs and for stream restoration. Additionally the objectives identify the amount and type of actions expected within the key watersheds to move watershed and stream channels toward the desired conditions. Over the life of the plan the objectives identify:

- Reducing road-hydrologic connectivity and sediment risk on 78 miles of road.
- Restoring or passage at road/stream crossings for all life stages of native aquatic species and improving the hydrologic and aquatic habitat function at 44 crossings.
- Improving range infrastructure over 240 acres.
- Restoring between 600 to 1,200 acres of upland vegetation conditions within RMAs.
- Restoring 76 miles of stream.

Alternative R includes standards developed specifically for prevention, control, and eradication of AIS. Such plan components provide more clear and urgent direction to implement appropriate AIS management actions, and therefore, may be more protective against AIS becoming established than the proposed action and no-action alternatives.

A number of subwatersheds are functioning at risk or not properly functioning for the AEC Riparian Vegetation attribute. As mentioned in the proposed action discussion, aquatic habitat tends to be of poor quality on the Forest compared to reference streams, but there appears to be slow improvement in aquatic habitat after 20 years of implementing INFISH. The extent to which grazing is or is not contributing to the current habitat conditions is not determined at this time. Alternative R includes three standards and two guidelines for grazing within RMAs. The one guideline in the proposed action for streambank alteration and woody vegetation utilization and stubble height is revised to read:

Within green-line vegetation area adjacent to all watercourses:

- Do not exceed a 25 percent streambank alteration;
- Do not exceed a 40 percent utilization of available mean annual vegetative production on woody vegetation;
- Maintain at least 6 to 8 inches residual stubble height and utilize no more than 40 percent of mean annual vegetative production on deep-rooted herbaceous vegetation.

The rationale for the guideline was presented in the discussion of the grazing guideline in the proposed action. The 6- to 8-inch stubble height may be more protective of woody species such as willow (Clary and Leininger 2000) than a guideline for maintaining 4 to 6 inches residual stubble height. The combination of no more than 25 percent bank alteration combined with the 6- to 8-inch stubble height and no more than 40 percent utilization should be allowed for the maintenance and improvement of riparian vegetation conditions, and thus, be protective of streambanks and stream channel conditions. While the allowable 25 percent streambank alteration is greater than the 20 percent allowed in the proposed action, the 8-inch residual stubble height plus the 40 percent utilization limits should be protective of riparian vegetation and thus streambanks. The guideline reflects the recommendations of Archer (2014), based on PIBO results, for improve riparian habitat and stream channel conditions while allowing livestock grazing. The bank alteration stubble height and utilization guidelines set a starting point for designing grazing strategies that are potentially more protective of riparian vegetation and stream habitat than the no-action and proposed action alternatives.

## Cumulative Effects

The information regarding cumulative effects common to all alternatives was discussed in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The activities outside the influence of alternative R, such as the aquatic habitat improvement work associated with hydroelectric projects and the transportation system managed by other entities are common for all alternatives. The activities associated with the *Northeast Washington Forest Vision 2020* project would now be guided by the alternative R key watershed objectives and restoration direction.

The watershed condition of most subwatersheds and the subbasins as a whole on the Forest are not properly functioning or functioning at risk with the road systems appearing to be a primary driver. Alternative R road density desired conditions in Focused Restoration Areas and General Restoration MAs are more within the range considered supportive of good watershed conditions and strong fish populations. The desired conditions for roads, plus vegetation management to improve the composition and structure of forests, should help make watersheds and stream channels more resilient to disturbance. It would be less likely for watersheds within the General Restoration MA to become properly functioning for watershed condition due to the desired road density of 2.0 miles per square mile. The realized benefit however would depend upon the timeframe the road density desired conditions can be met and the amount of terrestrial management occurs in any watershed or subwatershed.

Watershed conditions may improve through the implementation of the ACS. The desired conditions; standards and guides; and objectives are designed to provide for and restore watershed riparian and aquatic habitat conditions. The benefits may be greatest where watershed and riparian restoration, especially in key watersheds, is coordinated with vegetation management and road management to attain the desired conditions. The ACS with an increase in the area covered by RMAs, additional standards and guides and a larger key watershed network with specific restoration actions identified than has occurred under INFISH and may be expected under the other alternatives except alternative P.

The status of many MIS/focal species' local populations are likely to remain at risk due to the presence of non-native fish, isolation above natural and man-made barriers to migration. Coordinating restoration actions on Forest with the work of other entities, such as work tied to hydroelectric project relicensing, provide the most potential for improving the population status of MIS/focal species.

## Climate Change

The general description of the potential effects of climate change remain the same as discussed in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The increased overall direction of the ACS including forestwide desired conditions, riparian and key watershed standards and guides; the key watershed network covering approximately 41 percent of the Forest; desired road densities more in the range of what is considered beneficial to aquatic species and watershed function; desired conditions for and management to improve the vegetative structure and composition of Forests; and objectives for improving riparian and watershed conditions may remove human stressors to the environment to provide a better opportunity for aquatic species to adjust to climate change. A particular risk to the MIS/focal species would remain the presence of non-native fish, low MIS/focal species population numbers and isolated and fragmented populations. In addition to the Colville National Forest actions described above, the actions associated with hydroelectric project re-licensing including, the non-native fish population suppression or eradication, habitat improvement and improved passage at the hydroelectric project dams may be key factors in conserving the MIS/focal species.

### Monitoring Recommendations

The monitoring program was previously described in the Summary of Effects Common for all Alternatives.

## Alternative P

Similar to the proposed action, alternative P includes a whole landscape approach to providing late forest structure, including about 7 percent of the Forest as recommended wilderness, and includes the Focused and General Restoration MAs. Desired road densities for the Focused and General Restoration MAs are the same as for alternative R. Alternative P also proposes to allocate about five percent of the Forest to backcountry non-motorized recreation versus about 8 percent in the proposed action.

**Table 80. Alternative P management area acres by subbasin pertinent to aquatics discussion**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Focused Restoration | 4 | 61,422 | 58,769 | 185,920 | 3 | 306,118 |
| General Restoration | 101,843 | 66,757 | 159,117 | 100,026 | 65,206 | 492,949 |
| Backcountry | 5,338 | 19,481 | 44,426 | 29,110 | 24,690 | 123,045 |
| Backcountry Motorized | 1,357 | 11,893 | 36,072 | 5,255 | 0 | 54,577 |
| Wilderness Recommended | 0 | 23,624 | 0 | 42,353 | 2,356 | 68,300 |
| Wilderness-Congressionally Designated | 0 | 0 | 0 | 31,400 | 0 | 31,400 |

The definition of RMAs, the key watershed network and plan components for watersheds, RMAs and key watersheds are the same as alternative R.

### Old Forest Management and Timber Production

**Key Indicator - The number of acres that have Focused Restoration (or Late Forest Structure), General Restoration, and a timber production emphasis.**

- Focused Restoration – 306,118 acres
- General Restoration – 492,949 acres

As in alternative R, the roaded portion of the Forest is divided into the Focused and General Restoration MAs. The major difference between the two alternatives is alternative P allocates more land to the General Restoration MA (about 492,949 acres; 45 percent of the Forest) than the Focused Restoration MA (about 306,000 acres; 28 percent of the Forest). Timber harvest is allowed in both restoration MAs. The objective for vegetation management, including timber harvest, is to improve the resiliency of forests to disturbance. Many subwatersheds on the Forest are considered to be functioning at risk for the fire regime attribute of the AEC, so vegetation management within the restoration areas may help improve watershed condition. The risks to watershed processes and aquatic habitat associated with vegetation management is probably greater in the General Restoration MA, as the Focused Restoration MA includes more management emphasis for wildlife habitat and key watersheds. The potential benefits of vegetation management improving watershed condition across the Forest is less than alternative R due to the greater amount of land with a 2.0 mile per square mile road density desired condition.

## Motorized Recreation Trails and Access

**Key Indicator- Desired Conditions for Road Densities**

- Focused restoration – 1.0 mile per square mile
- General restoration – 2.0 miles per square mile

Roads are allowed over 80 percent of the forest as in the other alternatives. Most subwatersheds on the Forest are not properly functioning or functioning at risk for the road and riparian road density attributes of the AEC. Alternative P with desired road densities of 1.0 mile per square mile in the Focused Restoration MA and 2.0 miles per square mile in the General Restoration MA may result in improved watershed conditions compared to the no-action alternative, alternative B and alternative O; but the potential improvement is less than alternative R due to more lands within the General Restoration MA. New roads cannot be constructed in Recommended Wilderness, or Backcountry Motorized or Backcountry non-motorized MAs.

**Key indicator – Acres Allocated to Motorized Use**

Motorized recreation is allowed on about 853,926 acres the Restoration MAs and Backcountry Motorized MA. The current levels of motorized recreation are allowed in recommended wilderness, which brings the total amount of land open to motorized recreation to 922,259 acres or about 84 percent of the Forest.

## Recommended Wilderness Areas

**Key Indicator – Total acres in Recommended Wilderness**

Alternative P only proposes to allocate 68,300 acres or about 6 percent of the Forest to recommended wilderness. Therefore, the protection afforded to watershed condition and aquatic habitat is less than the recommended wilderness in the proposed action (9 percent of the Forest) and alternative R (19 percent) and alternative B (about 20 percent of the Forest). Alternative P does recommend more recommended wilderness than the no-action and O alternatives. As in the proposed action, existing motorized and mechanized use is maintained until Congress makes a decision on potential wilderness designation.

## Riparian and Aquatic Resource Management

The alternative P ACS incorporates the ARCS-mod strategy that was described for alternative R. The plan components; desired conditions, the definition of RMAs, the key watershed network, standards and guidelines, and objectives are the same as alternative R as are the anticipated effects.

## Forest Service Contribution to MIS/Focal Species Viability

Only alternative R provides a greater contribution to MIS/focal species viability than alternative P. Alternative P includes the same key watershed network and definitions and management direction for RMAs as alternative R. The alternative P contribution to bull trout viability is the same as alternative R as the watersheds with bull trout critical habitat are included in the key watershed network. The total amount of lands within Recommended Wilderness, Wilderness and the two Backcountry MAs is also similar between the two alternatives, although the actual mix varies. Alternative P contributes slightly less to the viability of WSCT and interior redband trout than alternative R. Although the key watershed network is the same for both alternatives, alternative P includes more lands within the General Restoration MA and the associated desires road density of 2.0 miles per square mile.

## Effects – Alternative P

### *Old Forest Management and Timber Production*

Alternative P uses the whole landscape approach to provide late forest structure. Like the proposed action and alternative R the roaded portion of the Forest is divided into two vegetation restoration areas, the Focused Restoration 306,100 acres (about 28 percent of the Forest) and General Restoration 493,200 acres (about 45 percent of the Forest) MAs. The major difference between the two restoration MAs are the desired road densities and the Focused Restoration MA also emphasizes habitat for Key watersheds, and wildlife species. Timber harvest is allowed in both restoration MAs.

As in the proposed action and alternative R, timber harvest is allowed on about 73 percent of the Forest in the Focused and General Restoration MAs. These areas are to be managed to provide the vegetation structure and composition, including late forest structure, for forest communities that are resilient to disturbances such as wildfire, drought and insect infestations. Many of the subwatersheds on the Forest are functioning at risk for the fire regime indicator in the AEC assessment, and a few are not properly functioning. As with alternative R, vegetation management to restore vegetation to conditions as may be expected under historic and anticipated disturbance regimes, may improve watershed condition especially in the Focused Restoration MAs if the desired road densities are attained.

Watersheds in the General Restoration area may not become fully functioning due to the desired road densities although there may be some improvement from the current conditions as the road densities in not properly functioning watersheds are reduced toward the desired levels The potential risks to aquatic resources due to vegetation management projects, especially timber sales, would likely be greatest in the General Restoration area due to the higher desired conditions for road density and a likely higher level of vegetation management than in the Focused Restoration Area. Management direction for RMAs should minimize the potential adverse impacts to riparian dependent resources due to timber sales. Vegetation management including timber harvest as outlined for alternative P may be more beneficial toward improving watershed conditions due to the road density desired conditions compared to the proposed action but less so than alternative R. As with alternative R and the proposed action, achieving the desired road densities is most likely in the key watersheds due to focused restoration, and would depend upon budgets and social acceptance.

### *Motorized Recreation Trails and Access*

Alternative P would continue to allow roads over 80 percent of the Forest. Similar to all other alternatives, new roads are not allowed in recommended wilderness, backcountry motorized, or backcountry non-motorized MAs, or research natural areas. The desired road density in Focused Restoration MA is no greater than 1.0 mile per square mile and in the General Restoration Area no greater than 2.0 miles per square mile. About 5 percent of the Forest is allocated for backcountry motorized recreation.

Similar to alternative R, watershed conditions and the AEC for the MIS/focal species may improve as the desired road densities are attained, but watersheds in the General Restoration MA would likely remain functioning at risk even if the desired road densities are attained. Alternative P allocates the second most amount of area to backcountry recreation. The recommended wilderness, current wilderness and backcountry recreation areas combine to comprise 20 percent of the Forest where roads are not allowed. However, motorized use is still allowed over 80 percent of the Forest where some accelerated erosion and potential damage to riparian and aquatic habitat may occur, especially if management is not able to maintain the trail system given the expected increase in use.

### *Recommended Wilderness*

Alternative P proposes to add 68,300 acres or about 6 percent of the Forest. Therefore, the protection afforded to watershed condition and aquatic habitat is less than the recommended wilderness in the proposed action (9 percent of the Forest), alternative R (19 percent), and alternative B (about 20 percent of the Forest). Alternative P does recommend more recommended wilderness than the no-action and O alternatives. Motorized and mechanized use is allowed pending a Congressional decision on wilderness designation. Sediment may continue to be delivered to streams and aquatic habitat due to the use of the existing motorized trail system. The level of effect on aquatic habitat would likely depend upon the ability of the Forest to maintain the trails, given the expected increased recreation use.

### *Riparian and Aquatic Resource Management*

The alternative P ACS incorporates the strategy that was described for alternative R. The Plan Components: desired conditions, the definition of RMAs, the key watershed network, standards and guidelines, and objectives are the same as alternative R as are the anticipated effects.

## Cumulative Effects

The information regarding cumulative effects common to all alternatives was discussed in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The activities outside the influence of alternative P such as the aquatic habitat improvement work associated with hydroelectric projects and the transportation system managed by other entities are common for all alternatives. The activities associated with the *Northeast Washington Forest Vision 2020* project would now be guided by the alternative P restoration direction.

The watershed condition of most subwatersheds and the subbasins as a whole on the Forest are not properly functioning or functioning at risk with the road systems appearing to be a primary driver. A number of subwatersheds are also functioning at risk or not properly functioning for the fire regime and insect indicators of the AEC. The alternative P road density desired conditions in Focused Restoration Areas covering about 28 percent of the Forest are more within the range considered supportive of good watershed conditions and strong fish populations. The desired conditions for roads plus vegetation management to improve the composition and structure of forests in the Focus Restoration MAs may help make watersheds more resilient to disturbance and reduce the adverse impacts to aquatic habitat. The realized benefit however would depend upon the timeframe the road density desired conditions can be met and the amount of terrestrial management that occurs in any watershed or subwatershed. It would be less likely for watersheds within the General Restoration MA to become properly functioning for watershed condition due to the desired road density of 2.0 miles per square mile.

Watershed conditions may improve through implementation of the ACS. The desired conditions; standards and guides; and objectives are designed to provide for and restore watershed riparian and aquatic habitat conditions. The benefits may be greatest where watershed and riparian restoration, especially in key watersheds, is coordinated with vegetation management and road management to attain the desired conditions. The ACS with an increase in the area covered by RMAs, additional standards and guides and a larger key watershed network, with restoration objectives, than the no-action or proposed action alternatives may be expected to improve aquatic habitat at a faster rate than has occurred under INFISH.

Many populations of the MIS/focal species are likely to remain at risk due to the presence of non-native fish, isolation above barriers and other barriers to migration. Coordinating restoration actions on Forest with the work of other entities, such as work tied to hydroelectric project relicensing, provide the most potential for improving the population status of MIS/focal species.

### Climate Change

The general description of the potential effects of climate change remain the same as discussed for the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis. The increased overall direction of the ACS including forestwide desired conditions, riparian and key watershed standards and guides; the key watershed network covering approximately 41 percent of the Forest; the Focus Restoration MA with desired road densities more in the range of what is considered beneficial to aquatic species and watershed function; desired conditions for and management to improve the vegetative structure and composition of Forests; and objectives for improving riparian and watershed conditions; may remove some human stressors to the environment to provide a better opportunity for aquatic species to adjust to climate change, especially if actions are concentrated in key watersheds. A particular risk to the MIS/focal species would remain the presence of non-native fish, low MIS/focal species population numbers and isolated and fragmented populations. In addition to the Colville National Forest actions described above, the non-native fish population suppression or eradication, habitat improvement and improved passage at the hydroelectric project dams may be key factors in conserving the MIS/focal species.

### Monitoring Recommendations

The monitoring requirements are the common for all alternatives.

## Alternative B

Two MAs focus on forest vegetation: the Restoration Zone MA, which emphasizes old forests or late forest structure on 31 percent of the landscape, and the Active Management area, which emphasizes timber production on 43 percent of the Forest. The Restoration Zone and the Active Management Area are similar to Focused or General Restoration areas in the proposed action and other alternatives. Active management to restore late forest structure is limited to only dry plant association groups. Also, unlike the proposed action, in alternative R and alternative P, the Active Management MA emphasizes even-aged management for timber production.

**Table 81. Alternative B management area acres by subbasin pertinent to aquatics discussion**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Restoration | 17,301 | 59,902 | 103,416 | 140,786 | 17,123 | 392,262 |
| Active Management Area | 84,491 | 74,515 | 116,645 | 152,616 | 48,200 | 476,467 |
| Backcountry | 0 | 0 | 0 | 4,835 | 0 | 4,835 |
| Backcountry Motorized | 1,357 | 0 | 0 | 5,249 | 0 | 6,606 |
| Wilderness Recommended | 5,356 | 49,640 | 78,278 | 59,275 | 27,761 | 220,330 |
| Wilderness-Congressionally Designated | 0 | 0 | 0 | 31,400 | 0 | 31,400 |

### Old Forest Management and Timber Production

**Key Indicator – The number of acres that have a focused restoration (or late forest structure), general restoration, timber production emphasis.**

- Focused restoration – The Restoration MA includes 338,538 acres

- General Restoration – The Active Management Area includes 476,752 acres. Even-aged management for timber production is allowed.

Timber harvest is allowed in both the Restoration and Active Management MAs.

Vegetation management within the Restoration MA emphasizes enhancing the ecological integrity and ecosystem function by restoring late forest structure, natural processes and the resiliency of forests. Within the Active Management MA, the focus is to provide a stable flow of forests products to the local economy, maintain the infrastructure necessary to provide forest products while increasing the Forest's resilience to insects, disease and uncharacteristic fire. Alternative B allocates less land to a focused restoration type of management than alternative R, but more than is allocated in the proposed action; and similar amount as in alternatives P and O. Unlike the proposed action, alternatives R and P, the emphasis on timber production in the Active Management MA increases the risk to watershed processes and aquatic habitat compared to vegetation management in the proposed action, alternatives R and P and the Restoration MA of this alternative. Any potential benefit to watershed conditions that may be accrued by managing for more resilient forests is likely to be diminished as the current level of 4,000 road miles is to be retained across the Forest.

## Motorized Recreation Trails and Access

**Key Indicator – Desired conditions for road densities.**

There are no road density desired conditions that would potentially improve watershed conditions. There may be some reduction in road densities within the Restoration MA but access would be maintained within the Active Management Area to facilitate the flow of forest products. Overall the current level of 4,000 road miles on the Forest is to be maintained and therefore watershed conditions are not expected to be greatly improved.

**Key Indicator – Acres allocated to motorized access.**

Alternative B allocates the least amount of lands to Backcountry Motorized and Backcountry MAs. Motorized access including motorized trails is allowed on 821,886 acres in the Active Management Area, Restoration and Backcountry Motorized MAs, approximately 75 percent of the landscape.

## Recommended Wilderness Areas

**Key Indicator – Total acres in Recommended Wilderness.**

Alternative B recommends 220,330 acres as proposed wilderness, slightly less than alternative R and more than any other alternative. As in alternative R, motorized use is not allowed in recommended wilderness, enhancing the benefits of the allocation for watershed and aquatic resources compared to the proposed action, alternative P and alternative O.

## Riparian Aquatic and Resource Management

Alternative B continues current riparian and aquatic management under INFISH. The RMA widths to not provide extra consideration to intermittent streams as in the other alternatives. As in the proposed action, the Priority Watersheds are only located in the Pend Oreille subbasin benefiting bull trout, a few WSCT populations and no interior redband trout populations. Stream habitat on the Forest may be slowly improving in the 20 years INFISH has been implemented, but most subwatersheds and aquatic habitat condition is still considered impaired. The trends in watershed condition and stream habitat are expected to be similar as would be expected under the no-action alternative

## Forest Service Contribution to MIS/Focal Species Viability

Implementation of alternative B is expected to contribute the least to MIS/focal species viability compared to all alternatives except the no-action alternative (table 70 in the no-action alternative). The relatively low contribution is due to maintaining the current amount of road mileage on the Forest, a significant amount of the Forest in the Active Management MA and the relatively small number of key watersheds. Alternative B also maintains the INFISH ACS, which after 20 years is showing some slow improvement in stream habitat, but most subwatersheds and stream habitat is, and may be expected to continue to be, in a functioning at risk or not properly functioning state with watershed conditions not generally considered conducive for strong fish populations.

## Effects – Alternative B

### *Old Forest Management and Timber Production*

Alternative B includes two MAs that emphasize vegetation management, the Restoration Zone and the Active Management Zone. Both the Active Management Area and the Restoration Zone allow use of timber harvest, prescribed fire, and thinning of stands to meet vegetation management objectives. Vegetation management in the 338,528-acre Restoration Zone emphasizes enhancing the ecological integrity of forests by restoring late forest structure and natural processes and resiliency of the terrestrial vegetation landscape. Standards limit management for late forest structure objectives to dry plant associations only, as forests in these plant associations are likely to be highly departed from historic conditions due to past management and fire suppression, although moist mixed conifer forests may require some restoration as well.

The Active Management Area includes 43 percent of the Forest. The emphasis in the Active Management Zone is to provide a stable flow of forest products to the local economy and sustain forest products infrastructure while increasing the Forest's resilience to insects, disease, and uncharacteristic fire. Even-aged management is allowed subject to guidelines for timber production. The risks to watershed, riparian and aquatic resources due to vegetation management are expected to be greater in the Active Management MA compared to the Restoration MA due to the greater emphasis on timber production.

The fire regime and insect indicators of the AEC are functioning at risk or not properly functioning in most subwatersheds on the Forest. Vegetation management to improve the resiliency of forests to disturbance, such as uncharacteristically severe wildfire, may help improve the fire regime and insect and disease attributes of watershed condition especially in the Restoration MA. However, overall watershed conditions are unlikely to improve in the either the Restoration or Responsible MAs as any benefit accrued by improving the Forest's resiliency to disturbance would be off-set by maintaining the transportation system at current levels.

### *Motorized Trails and Access*

Alternative B provides the least amount of summer and winter motorized and non-motorized recreation opportunities in a backcountry, unroaded setting, with less than one percent of the forest allocated to backcountry motorized trail recreation.

Motorized recreation is allowed on about 75 percent of the Forest. Like all other alternatives, new road access would not be allowed in recommended or designated wilderness areas, backcountry motorized (trail access only) and non-motorized management areas, or research natural areas. Motorized recreation increases the risk for accelerated sediment delivery to streams from the trails and use of the trails as well as the potential for degrading riparian areas and stream habitat by off-trail use. The level to which the potential adverse impacts occur would depend upon the Forest's ability to management the trail system given the expected increase in recreation use.

Alternative B does not include desired road densities as in the proposed action, and alternatives R and P. Alternative B caps the total miles of National Forest System roads at the current level, about 4,000 miles, and uses a standard that would require at least one mile of road to be decommissioned when adding a mile to the system. Most subwatersheds are already functioning at risk or not properly functioning for road and riparian road densities with road densities above those generally supporting strong fish populations. While there may be some reduction in road density within the Restoration MA due to watershed improvement activities the overall forestwide watershed condition is not expected to improve.

### *Recommended Wilderness*

Alternative B allocates 220,330 acres to recommended wilderness, the most of any alternative. Motorized and mechanized uses are not permitted in the recommended wilderness prior to their potential designation by Congress. The restriction on motorized use of all kinds reduces the risk of sediment delivery to aquatic habitat in the recommended wilderness due to the use of existing motorized trails and the construction of new roads or trails.

### *Riparian Aquatic and Resource Management*

Alternative B continues current riparian and aquatic management under INFISH and effects of the ACS are the same as described for the no-action alternative. The RHCA widths, the Priority Watershed Network, and riparian and aquatic resource goals objectives, standards, and guidelines are the same as no action. The RHCAs do not extend the same consideration to intermittent streams as the other alternatives so may not be as protective of watershed processes. The potential benefits of key watershed designation only occurs in the Pend Oreille subbasin. The key watersheds include bull trout critical habitat and some WSCT populations but fewer WSCT populations than the other alternatives, except No Action, and no interior redband trout populations are included in the key watersheds. Stream habitat on the Forest may be slowly improving in the 20 years INFISH has been implemented, but most subwatersheds and aquatic habitat is considered impaired. The trends in watershed condition and stream habitat are expected to be similar as would be expected under the no-action alternative.

## Cumulative Effects

The information regarding cumulative effects common to all alternatives was discussed in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The activities outside the influence of the Forest, such as the aquatic habitat improvement work associated with hydroelectric projects and the transportation system managed by other entities are common for all alternatives. The activities associated with the *Northeast Washington Forest Vision 2020* project would now be guided by the alternative B restoration direction.

The watershed condition and status of most of the MIS/Focal Species' populations are functioning at risk or not properly functioning although there is some indication of slow improvement in aquatic habitat condition. Road densities and riparian road densities which are two major attributes causing the poor watershed condition scores may not significantly improve despite restoration due to the amount of land available for timber production, maintaining the current miles of National Forest System roads and the 2,500 miles of road managed by other entities, which is not expected to change.

The Forest would continue with actions as described in the Northeast Washington Forest Vision 2020 project. Such actions, especially when they are implemented in a whole watershed restoration approach, should help restore watershed condition to some degree. The magnitude of the improvement within a subwatershed would depend upon the amount of work that is socially acceptable and technically feasible to implement. However, given the current road system and the fact that after 20 years of implementing INFISH on the Forest stream habitat is only slowly improving, watershed condition and stream habitat

may not be expected to significantly improve forestwide. The MIS/focal species' population status is significantly affected by the high numbers and wide distribution of non-native fish, isolation above barriers and low MIS/focal species numbers, and problems in the migratory corridors on the larger rivers.

### Climate Change

The overall effects of climate change were presented in the Past, Present and Foreseeable Future Activities Relevant to Cumulative Effects Analysis section. Under alternative B, the Forest aquatic resource management direction for managing for stronghold populations that may contribute to the MIS/focal species persistence under different climate change scenarios is contained in the INFISH direction for Priority Watersheds. The Priority watersheds may provide the potential to rebuild populations and improve habitat to allow bull trout and WSCT the opportunity to adapt to climate change, especially in the East Fork and West Fork Le Clerc Creeks and Ninemile Creek, which are Focus watersheds. As mentioned in the cumulative effects section, the actual benefits to fish habitat and populations from such work is likely to be limited due to maintaining the current number of roads on the Forest. The potential effects of climate change may be greatest for this alternative and the no-action alternative as the amount of subwatersheds and populations expected to be functioning at risk or not properly functioning is expected to remain as is. The threats to MIS/focal species viability due to population isolation and fragmentation, combined with the wide distribution of non-native fish and poor habitat conditions may be exacerbated in a warming climate.

### Monitoring Recommendations

Monitoring recommendations are common to all alternatives.

## Alternative O

Alternative O emphasizes summer and winter non-motorized opportunities in a backcountry, unroaded setting and minimizes recommended wilderness. Late forest structure is managed with a fixed reserve system. Alternative O includes two management areas to address vegetation management: the Restoration Zone MA to restore the historic range of variation, and the Responsible Management Area that emphasizes timber production. The management zones are very similar to those proposed in alternative B. The total percentage of the Forest allocated to vegetation management is similar to alternative B though alternative O has a greater percentage in the Restoration Zone MA than alternative B.

**Table 82. Alternative O management area acres by subbasin pertinent to aquatics discussion**

| Management Area | Colville | Franklin D. Roosevelt Lake | Kettle | Pend Oreille | Sanpoil | Total |
|---|---|---|---|---|---|---|
| Restoration | 23,993 | 62,766 | 110,389 | 140,463 | 31,419 | 369,030 |
| Responsible | 77,805 | 65,358 | 108,242 | 146,071 | 33,763 | 431,239 |
| Backcountry | 5,354 | 42,856 | 44,448 | 54,576 | 27,068 | 174,302 |
| Backcountry Motorized | 1,356 | 11,878 | 35,241 | 5,259 | 0 | 53,734 |
| Wilderness Recommended | 0 | 0 | 0 | 15,950 | 0 | 15,950 |
| Wilderness-Congressionally Designated | 0 | 0 | 0 | 31,400 | 0 | 31,400 |

The plan components for watershed, riparian and aquatic management; desired conditions, standards and guides, and the definition of RMAs is the same as the proposed action. Alternative O however incorporates the same key watershed network as in alternatives R and P.

### Old Forest Management and Timber Production

**Key Indicator – The number of acres that have a focused restoration (or late forest structure), general restoration, timber production emphasis.**

- Focused restoration – The Restoration MA includes 369,030 acres
- General Restoration – The Responsible Management Area includes 431,525 acres. Even-aged management for timber production is allowed.

Timber harvest is allowed in both the Restoration and Responsible Management MAs.

Vegetation management and timber production as described for alternative O is very similar to alternative B. Vegetation management within the Restoration MA emphasizes enhancing the ecological integrity and ecosystem function by restoring late forest structure, natural processes and the resiliency of forests. The emphasis for vegetation management in the Responsible Management MA is for sustainable active management to provide a steady flow of forest products to the local economy and maintain the infrastructure necessary to provide forest products, while increasing the Forest's resilience to insects, disease and uncharacteristic fire.

Alternative O allocates approximately 39 percent to a focused restoration type of management in the Restoration MA. The amount of land in the Restoration MA is less than the Focused Restoration MA in alternative R, more than the Focused Restoration MA in the proposed action and alternatives P and the Restoration MA in alternative B. Similar to alternative B, the emphasis on timber production in the Active Management MA increases the risk to watershed processes and aquatic habitat compared to vegetation management within the General Restoration MAs in the proposed action, alternatives R and P. Any potential benefit to watershed conditions that may be accrued by managing for more resilient forests is likely to be diminished as the current level of 4,000 road miles is to be retained across the Forest.

### Motorized Recreation Trails and Access

**Key Indicator – Desired conditions for road densities.**

As in alternative B, there are no road density desired conditions that would potentially improve watershed conditions. There may be some reduction in road densities within the Restoration MA but access would be maintained within the Responsible MA to facilitate the flow of forest products. Overall, the current level of 4,000 road miles on the Forest is to be maintained, and therefore, watershed conditions are not expected to be greatly improved.

**Key Indicator – Acres allocated to motorized access.**

Alternative O allocates the most amount of lands to the Backcountry MA and approximately 5 percent of the Forest is allocated to motorized recreation in a backcountry setting. Motorized recreation is allowed in the Backcountry motorized, Restoration and the Responsible MAs as well as recommended wilderness resulting in approximately 79 percent of the landscape being available to motorized recreation.

## Recommended Wilderness Areas

**Key Indicator – Total acres in Recommended Wilderness.**

Alternative O recommends 15,950 acres as proposed wilderness, the least amount of any action alternative. Motorized and mechanized uses would be maintained at current levels in these areas until Congress makes a decision on wilderness designation for the recommended wilderness management areas.

## Riparian and Aquatic Resource Management

The alternative O plan components for watershed, riparian and aquatic resource management; desired conditions, the definition of RMAs, standards and guidelines, and objectives are the same as the proposed action. The primary difference between both alternative O and the proposed action compared to alternatives R and P is a greater reliance on guidelines than standards; there is not an additional desired condition for TES fish there is no specific direction for managing AIS species, or a standard for minimizing the disruption of hydrologic processes due to roads and trails. Alternative O incorporates the same key watershed network and key watershed objectives as alternatives R and P which encompasses more land than the proposed action.

## Forest Service Contribution to MIS/Focal Species Viability

Implementation of alternative O contributes to the MIS/Focal Species Viability to a greater degree than the no-action alternative and alternative B. The alternative O contribution to viability for the three MIS/focal species is less than alternatives R and P and similar to the proposed action (table 70 in the no-action alternative).

A positive aspect of alternative O is the same key watershed network as in alternatives R and P. Alternative O is not expected to contribute to MIS/focal species viability to the same degree as alternative R due to no road density desired conditions and little land allocated to recommended wilderness. Most subwatersheds on the Forest are functioning at risk or not properly functioning for watershed condition. Little overall improvement would be expected under alternative O by maintaining the transportation system at the current levels resulting in watershed conditions that generally do not support strong fish populations.

## Effects – Alternative O

### *Old Forest Management and Timber Production*

Alternative O includes two MAs that emphasize vegetation management, the Restoration Zone and the Responsible Management Zone. The two MAs are very similar to the Restoration and Active Management MAs in alternative B as are the anticipated affects to watershed, aquatic and riparian resources. Both the Responsible MA and the Restoration MA allow use of timber harvest, prescribed fire, and thinning of stands to meet vegetation management objectives. Vegetation management in the Restoration Zone emphasizes enhancing the ecological integrity of forests by restoring late forest structure and natural processes and resiliency of the terrestrial vegetation landscape

The emphasis in the Responsible Management MA is to provide a stable flow of forest products to the local economy and sustain forest products infrastructure while increasing the Forest's resilience to insects, disease, and uncharacteristic fire. Even-aged management is allowed subject to guidelines for timber production. The road system would be retained in the active management areas to facilitate the flow of forest products. The risks to watershed, riparian and aquatic resources due to vegetation management are

expected to be greater in the Responsible Management MA compared to the Restoration MA due to the greater emphasis on timber production.

The fire regime and insect indicators of the AEC are functioning at risk or not properly functioning in many subwatersheds on the Forest. Vegetation management to improve the resiliency of forests to disturbance, such as uncharacteristically severe wildfire, may help improve watershed condition especially in the Restoration MA. The potential risks of adverse impacts on watershed and aquatic habitat are greater in the Responsible MA than the Restoration MA and the Focused and General Restoration MAs in the proposed action, alternative R, and alternative P, due to the emphasis on timber production. Also, unlike the proposed action, alternative R, and alternative P, overall watershed conditions are unlikely to improve in the either the Restoration or Responsible MA s as any benefit accrued by improving the Forest's resiliency to disturbance may be offset by maintaining the transportation system at current levels.

### *Motorized Trails and Access*

Alternative O allocates the greatest amount of land to backcountry recreation where motorized use is not allowed and there are to be no new roads. While some minor disruption of watershed processes may occur on hiking trails here would be no potential for accelerated sediment delivery or damage to riparian and aquatic due motorized recreation in the 174,300-acre Backcountry MA.

Like all other alternatives, new road access would not be allowed in recommended or designated wilderness areas, backcountry motorized (trail access only) and non-motorized management areas, or research natural areas. Motorized recreation would be allowed on approximately 79 percent of the Forest, including within recommended wilderness with the associated risk for accelerated sediment delivery to streams from the trails and use of the trails, as well as the potential for degrading riparian areas and stream habitat by off-trail use. The level to which the potential adverse impacts occur would depend upon the Forest's ability to management the trail system given the expected increase in recreation use.

Alternative O includes no road density desired conditions that would potentially improve watershed conditions. There may be some reduction in road densities within the Restoration MA but access would be maintained within the Active Management Area to facilitate the flow of forest products. Most subwatersheds are functioning at risk or not properly functioning for the road and riparian road density attributes of the AEC. Overall, the current level of 4,000 road miles on the Forest is to be maintained and therefore little improvement in watershed conditions are expected.

### *Recommended Wilderness*

Alternative O recommends just under 16,000 acres as potential new wilderness. recommended wilderness is considered to protect watershed processes, aquatic, and riparian habitat as no roads are to be built or other management activities occur other than recreation. Under alternative O, however, existing motorized use would be allowed to continue until Congress decides on wilderness designation. Therefore the risks to watershed, riparian and aquatic resources due to sediment from the trail system would remain.

### *Riparian and Aquatic Resource Management*

Alternative O incorporates the same ACS as the proposed action with a greater reliance on guidelines than standards than in alternatives R and P. Like the proposed action, alternative O does not include the desired conditions for TES fish or the standards for managing AIS that are included in alternatives R and P. Unlike the proposed action, alternative O does include the same key watershed network as alternatives R and P that includes 25 subwatersheds compared to 22 in the proposed action, primarily providing extra protection for interior redband trout. The riparian and aquatic resource effects are the same as described in the proposed action, other than the effects of the key watershed network. While there may be some

reduction in road density and the effects to watershed and aquatic habitat from the existing roads may be reduced due to focused watershed restoration efforts, the benefits of key watershed designation are expected to be less than either alternative R or P as there are no desired conditions for road densities.

### Cumulative Effects

The information regarding cumulative effects common to all alternatives was discussed in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. The alternative O cumulative effects are similar as alternative B. The activities outside the influence of the Forest, such as the aquatic habitat improvement work associated with hydroelectric projects and the transportation system managed by other entities are common for all alternatives. The activities associated with the *Northeast Washington Forest Vision 2020* project would now be guided by the alternative B restoration direction.

The watershed condition and status of most of the MIS/focal species' populations are functioning at risk or not properly functioning although there is some indication of slow improvement in aquatic habitat condition. Even with the same key watershed network as alternatives R and P the ACS that is felt to be more complete than INFISH in alternative B, and the continued implementation of the Northeast Washington Forest Vision 2020 Project watershed conditions and fish population status are not expected to significantly improve. Maintaining the current miles of road on the Forest combined with the 2,500 miles of road managed by other entities would result in road densities that would keep most subwatersheds in a functioning at risk or not properly functioning status. Such road densities generally do not provide the conditions for strong fish populations.

### Climate Change

The overall effects of climate change applicable to all alternatives were presented in the Past, Present and Foreseeable Activities Relevant to Cumulative Effects Analysis section. Under alternative O, the Forest aquatic resource management direction for managing for stronghold populations that may contribute to the focal species persistence under different climate change scenarios is contained in the ACS direction including key watersheds. Although alternative O includes a more comprehensive ACS, including a broader key watershed network than alternative B, the effects of climate change are expected to be similar to those described for alternative B. The key watershed network may provide some potential to rebuild populations and improve habitat to allow the MIS/focal species the opportunity to adapt to climate change, especially in the East Fork and West Fork Le Clerc Creeks and Ninemile Creek which are Focus watersheds.

The viability of the MIS/focal species on the Forest is threatened by low population numbers, population isolation and fragmentation. The high road densities that would result in subwatersheds to continue to be functioning at risk or not properly functioning and would probably not provide the habitat conditions necessary to recover for strong fish populations. The status of the fish populations, combined with degraded watershed and habitat conditions and the wide distribution of non-native fish may exacerbate the effects of a warming climate.

### Monitoring Recommendations

The monitoring program is common to all alternatives.

## Summary of the Effects of the Alternatives on Aquatic Resources

The current viability of the three MIS/focal species, WSCT, interior redband trout and bull trout is at risk within all subbasins on the Forest. The viability of the MIS/focal species on the Forest is generally threatened by poor watershed conditions, low abundance of the species and a lack of connectivity between habitats and populations both on and off the Forest. The MIS/focal species are also threatened by

the widespread distribution of non-native fish including brook trout, coastal rainbow trout and past introductions of non-native subspecies of cutthroat trout. The no-action alternative would continue current management programs, including the INFISH aquatic strategy. There are indications that aquatic habitat conditions may be slowly improving under current management the overall AEC for most subwatersheds on the Forest would likely continue to be functioning at risk or not properly functioning as little change in overall road densities on the Forest is expected, there is no additional protection afforded to aquatic resources through recommended wilderness, and more of the land base is open to relatively intense timber harvest than under the action alternatives. Of all alternatives, the no-action alternative provides the least Forest Service contribution to the viability of the MIS/focal species.

The proposed action is expected to contribute to the viability of the MIS/focal species to a greater extent than continued management under the no-action alternative. Compared to the no-action alternative, the proposed action includes more lands in recommended wilderness, backcountry and backcountry motorized allocations that are generally considered to be “protective” of watershed processes and aquatic habitat. The proposed action includes more lands that are considered to have a “moderate” level protection in the Focused and General Restoration MAs. While timber harvest is allowed as a tool in the two MAs, the emphasis for vegetation management is to restore terrestrial vegetation structure and composition. The proposed action also includes a significantly larger network of key watersheds than the no-action alternative providing greater potential benefits to not only bull trout but also WSCT and interior redband. RMAs are also expanded to give extra consideration to intermittent streams than in the no-action alternative. The contribution to MIS/focal species viability though is less than alternatives R and P, however, primarily due to desired road densities in the General Restoration MA that are higher than the road densities generally associated with properly functioning watersheds capable of supporting strong fish populations.

Alternative R provides the greatest contribution to MIS/focal species viability of all alternatives. Alternative R is expected to provide the greatest Forest Service contribution to the viability of WSCT and interior redband of any alternative and the expected contribution to bull trout viability is similar to alternative P. Both alternatives R and P include more key watershed acres than the proposed action providing additional benefits to WSCT and interior redband trout. Alternative R also includes the second most amount of land allocated to recommended wilderness of all alternatives. Both alternative R and P include the Focused and General Restoration MAs where the desired road densities of 1.0 mile per square mile and 2.0 miles per square mile are more within the range of road densities generally associated with strong fish populations and properly functioning watersheds. The major difference between alternative R and P is that alternative P includes more land within the General Restoration MA. Both alternatives R and P include aquatic conservation direction similar to the proposed action but include more standards and guidelines to direct management within RMAs.

Alternative B is expected to contribute the least toward the MIS/focal species viability than any action alternative as the alternative includes the same key watershed network as the no-action alternative, hence significantly less than the other action alternatives. Alternative B also maintains the current road network. The watershed and stream channel conditions within most subwatersheds on the Forest are currently considered to be functioning at risk or not properly functioning and would likely remain so under alternative B.

Similar to the proposed action, alternative O may be expected to contribute toward the viability of MIS/focal species to a greater degree than alternative B and the no-action alternative but less so than alternatives R and P. While alternative O includes the same key watershed network as alternatives R and P, alternative O does not include the alternative R and P road density desired conditions.

## Cumulative Effects (Common to all Alternatives)

### Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The future status of fish populations, aquatic and riparian habitats on the Forest would be influenced not only by management on the Forest but also by the management of surrounding lands and actions implemented by other entities within the subbasins. The potential effects to aquatic habitat due to timber harvest, roads and recreation management would continue on the Forest. The potential risks to aquatic habitat would vary depending upon the timber production emphasis, road desired conditions and recreation emphasis; motorized versus non-motorized recreation. The grazing program remains the same through all alternatives. The magnitude and severity of cumulative effects would depend upon; the management direction for the land allocations, the amount of land within the different land allocations, the ACS for an alternative, and the location and timing of management activities. The ACS plan components including; the desired conditions, key watersheds, RMAs, the number of key watersheds, and management direction provided by standards and guidelines would be important to mitigating potential cumulative effects. The future design of land management projects including the location, design criteria and incorporation of best management practices (BMPs) at the project level would be important factors in determining the potential cumulative effects, either positive or negative, to fish populations, aquatic and riparian habitat. Fish habitat quality on the Forest appears to be slowly improving. The improvement in habitat conditions is expected to continue. The potential rate and magnitude of improvement would depend upon the alternative.

Projected human population growth would continue to put demands to forest resources, especially recreation. Recreational use of the Forest is projected to increase due to population growth as more people seek outdoor activities. The anticipated increase in recreation may put demands on infrastructure such as roads and trails. The degree to which the Forest can attain the desired conditions for road densities and OHV use, and maintain the infrastructure to improve watershed conditions may be challenging. Increased recreation use may also increase impacts on riparian habitat. As development of private land continues, the Forest Service anticipates a greater dependence on the Forest for nature-based activities and experiences that are becoming less accessible elsewhere. In many locations, resource impacts and crowding associated with recreation use are growing, with damage to riparian areas and unauthorized trail development being of particular concern. The Forest has been and would continue to aggressively manage OHV use through monitoring and restoration of user-built trails similar to what is described in Appendix 3 of the specialist report. The extent to which recreation and especially OHV use would contribute to cumulative effects that are adverse to fish populations and habitat would depend on the Forest having the resources to manage the program.

The road system on both the Forest and adjacent lands is an important watershed condition attribute resulting in the current, impaired watershed condition in most subwatersheds. The transportation system managed by other jurisdictions is not expected to change in the future, resulting in approximately 2,500 miles of road within the subwatersheds over which the Forest has no management authority. Roads would continue to contribute to the cumulative effects that have resulted in the impaired watershed and stream channel conditions on the Forest. The degree to which the road system contribution to cumulative effects may be reduced would depend upon achieving restoration objectives and the Forest's ability to maintain the desired road system.

The AEC analysis found that few subwatersheds on the Forest have watershed conditions or MIS/focal species populations that are considered to be properly functioning. The ability of the Forest to improve watershed conditions would depend on the Forest's ability to manage the expected increased demands for use of the Forest and continue to implement the current watershed restoration programs, in addition to the restoration objectives described for the alternatives. The Forest, in the Northeast Washington Forest

Vision 2020 project, is planning to accomplish the following by the year 2020 in order to improve upslope and watershed conditions:

- Establish forest vegetation on 35,000 acres
- Improve forest vegetation on 13,600 acres,
- Treat 2,000 acres to manage noxious weeds and invasive plants
- Protect maintain or improve 100 acres of water or soil resources.
- Restore or enhance 20 miles of stream habitat.
- Restore or enhance 45,600 acres of terrestrial habitat.
- Improve maintenance on 1,840 miles of high clearance system roads and 165 miles of passenger car system roads receiving maintenance.
- Decommission 52 miles of road
- Improve aquatic organism passage at 31 stream crossings.
- Improve to standard 785 miles of trail.
- Utilize timber sales to treat 42,500 acres of forestlands and treat hazardous fuels on 136,000 acres to reduce the risk of stand-replacing wildfire.

The activities identified in Forest Vision 2020 are expected to contribute to achieving both desired conditions and objectives. A whole watershed restoration strategy where restoration is focused on meeting the objectives for specific watersheds should help restore watershed condition to some degree and potentially improve the resiliency of watersheds and aquatic habitat to disturbance.

The ability to restore healthy native fish populations on the Forest would be challenged by the past introduction, and resulting established populations, of non-native trout. Restoring the populations of the MIS/focal species on the Forest would be greatly influenced by actions implemented by other entities both on and off the Forest. The hydroelectric projects on the mainstem rivers would continue to impact migratory fish populations including WSCT and bull trout. Riverine habitats have been converted to reservoir habitat and the dams impede fish passage. The mitigation measures included in the re-licensing for the hydroelectric dams on mainstem rivers adjacent to the Forest should provide some beneficial impacts to MIS/focal species populations and aquatic habitat on the Forest. Some actions to be implemented include (USFWS 2012):

- Removing Mill Pond Dam on Sullivan Creek and installing a cold water pipe in Sullivan Lake.
- Providing upstream fish passage at Boundary Dam
- Eradicating non-native fish and supplementing the native WSCT and bull trout populations.
- Habitat improvement projects both on and off the Forest.

Additionally, Pend Oreille PUD under actions associated with the Box Canyon license would be providing upstream and downstream fish passage at Box Canyon Dam, restoring 164 miles of tributary habitat, eradicating non-native fish and supplementing with natives, controlling aquatic invasive weed species and controlling erosion on Forest lands along Box Canyon Reservoir.[43]

[43] Email Brian Peck, CNF to Ken MacDonald (FW: Project Operations Compliance Report submitted in FERC P-2144-000 by Seattle City Light, et al.) (March 21, 2014). Terms of Seattle City Light's license are available at: http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20140318-5216 (March 25, 2014)

Uncharacteristic fire may affect both watershed conditions and MIS/focal species populations. While disturbances such as fire and subsequent erosion events can be beneficial for long-term productive habitat, significant fish mortality can also occur. The MIS/focal species' populations can often recover quickly from such disturbances if the populations are connected to other populations, or have a migratory life history where some individuals are not present at the time of the disturbance. On the Forest, however, a number of the MIS/focal species' local populations are isolated and no longer appear to express the historic migratory life history type. Severe fires in subwatersheds with the isolated populations could result in the extirpation of a local population. The degree to which these populations become more resilient to such disturbances would depend upon improvement in the different attributes of the AEC and restoration actions to be implemented off the Forest by other entities.

### Climate Change

Climate change is the largest unknown factor that would influence long-term cumulative effects. There is a wide range of climate change models that give an equally wide range of future trajectories. There is general agreement that climate will warm, but no certainty on rate. Major shifts in several tree species are expected by the end of the century as is a doubling of fire acres by 2040, and a tripling of fire acres by 2080 (see Vegetation section).

In addition to the potential changes to terrestrial vegetation and the resulting potential for increased wildfires, climate change may also produce profound impacts to fish and aquatic habitat. As summarized by Staab et al. (2014), climate change across the Pacific Northwest is expected to result in:

- declines in snowpacks;
- increased streamflow and associated flooding in the winter and early spring;
- decreased streamflow in the late spring, summer and fall;
- increased stress on scarce summer water supplies;
- increased stress on salmon and other cold-water species due to declining summer streamflows and rising stream temperatures.

Streamflow patterns are expected to change in northeastern Washington with decreasing snowpacks in mid-elevation and wetter locations. Most subbasins on the Forest have a mixed rain and snow winter precipitation pattern, with only the Pend Oreille considered to be a snow dominated subbasin as a whole; however it may transition to a more mixed pattern by 2040 (Snover et al. 2013). In the mountains of northeastern Washington, snowpacks are expected to persist at higher elevations but at diminished levels, with large portions of the mountains of northeastern Washington possibly losing their April 1 snow-water equivalent (see Staab et al. 2014),[44] which may result in lower summer flows and potentially an increase in stream temperatures that are stressful for native salmonids (Mantua et al. 2010). Additional changes in streamflow regimes that may be expected include peak streamflows occurring earlier in the spring, a slight increase in the 20-year recurrence interval flood, and some reduction in low flows (Mantua et al. 2010).

Although many biotic and abiotic factors interact to determine suitable habitats for different fish species at a specific location, warming streams, declining summer flows, and increasing flood risk are, in general, all expected to negatively affect coldwater fish populations such as trout. Bull trout are especially

[44] Snow Water Equivalent (SWE) is a common snowpack measurement. It is the amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously (USDA Natural resources Conservation Service, March 22, 2014) http://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/snow/?cid=nrcs142p2_046155. (March 2

vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the species' requirement for cold water temperatures. Warming water temperatures may reduce the miles of stream suitable for bull trout spawning and rearing (Rieman et al. 2007; Wenger et al. 2011). Increased water temperatures may also put bull trout at a competitive disadvantage with brook trout where the two species overlap (Rodtka and Volpe 2007, McMahon et al. 2007). Williams et al. (2009), hypothesize that westslope cutthroat trout populations in northeastern Washington are at high risk due to warming temperatures, however Wenger et al. (2011) felt westslope cutthroat trout distribution may not be strongly influenced by climate change where brook trout are not present. The potential for WSCT populations to hybridize with the non-native rainbow trout is greater in streams with higher mean summer water temperatures (Muhlfield et al. 2009).

While climate change may give brook trout a competitive advantage over bull trout, climate change would also influence brook trout distribution. Like bull trout, Wenger et al. (2011) feel brook trout populations would be negatively affected by climate change, which may be an advantage to westslope cutthroat trout whose distribution appears to be negatively influenced by the presence of brook trout. Rainbow and redband trout may not be as susceptible to warmer water temperatures as they generally are more tolerant of higher water temperatures (Bjornn and Reiser 1991). Issak et al. (2010) found that over a 13-year period increased stream temperatures, primarily driven by climate and to a lesser degree wildfires, minimally affected the thermal habitat for rainbow trout but reduced bull trout habitat.

Climate change would influence the distribution of non-native fishes as well. Warming water temperatures may increase the range of non-native predators such as smallmouth bass and northern pike (*Esox lucius*) from large rivers into tributaries.

The USFWS (2012) in their biological opinion for the Boundary Hydroelectric Project felt that if the current climate change models and predictions for Pacific Northwest aquatic habitats are relatively accurate, bull trout in the Pend Oreille River basin are likely to be impacted through at least one or more of the following pathways:

- Changes in distribution of bull trout within the core area, such as reduced spawning habitat, and/or seasonal thermal blockage in the migratory corridors associated with increased stream temperatures
- Disturbance or displacement of eggs, alevins, juveniles, and adults of resident and/or migratory adults during winter flooding events
- Short- or long-term changes in habitat and prey species due to stochastic events during winter floods
- Changes in flow/out-migration timing in the spring for bull trout and their prey species
- Increased migration stressors from lower stream flows and high stream temperatures during spawning migrations

The USFWS (2012) also judged some specific habitat effects may include:

- Changes in flows in Sullivan Creek due to altered snowpack and snowmelt, which may change the timing of higher flows in lower Sullivan Creek, resulting in a barrier to bull trout migration in July and August.
- Changes in temperature and flows within Sullivan and Slate Creeks may alter the species composition and abundance of the macroinvertebrate and fish populations with adverse consequences to bull trout food base.

- Increased temperatures in Boundary Reservoir would decrease the amount of time that the reservoir is suitable for bull trout migration. Increased temperatures could alter the migratory pattern of bull trout for times entering tributary streams to spawn as well as migration times to and from the Lake Pend Oreille system. Warmer temperatures within Boundary Reservoir would improve conditions for non-native predators.

Few MIS/focal species fish populations on the Forest are judged to be properly functioning as described in the AEC. The negative effects caused by the widespread distribution of the non-native fish may be exacerbated by climate change. In the face of climate change efforts to conserve native fish species should focus on restoring degraded habitat, improving riparian vegetation, providing habitat and population connectivity, providing flows in stream for ecosystem purposes, and providing for a network of intact habitats to support large populations (ISAB 2007; Haak and Williams 2012).

# Hydrology

This section summarizes effects related to hydrology from the specialist report, with special emphasis on the publicly identified issues of “riparian and aquatic resource management,” “access,” and “old forest management and timber production” (Day 2015). While other issues, including recommended wilderness, and motorized recreation trails are tangentially applicable to water resources, public concerns on these issues are not specific to the hydrologic resource. Analysis of the riparian and aquatic resource management, access, and old forest management and timber production issues would indirectly address the potential effects of recommended wilderness and motorized recreation trails to water resources, and how these effects vary across alternatives.

## Affected Environment

### Setting

#### *Physiography*

The Forest is located in the foothills of the Rocky Mountains and is bisected from west to east by Lake Roosevelt on the Columbia River, impounded by the Grand Coulee Dam, and the Kettle and Selkirk mountain ranges in the western and northeastern sections of the forest, respectively. Average elevation is 3,800 ft. and ranges between 1,394 feet near Lake Roosevelt to 7,200 feet in the high ridges of the Selkirk Range. The Selkirk Range includes the Salmo-Priest Wilderness—the only designated wilderness on the Forest.

#### *Climate*

Climate is consistent with both maritime and continental regimes, with air masses from both the Pacific Ocean and interior North America crossing the region. Climate is influenced primarily by latitude, topography, proximity to the Pacific Ocean, prevailing westerly winds, and development and movement of weather systems over the North Pacific (Phillips and Durkee 1972). The majority of precipitation falls between October and April as snow. Summers are usually dry, with most precipitation associated with thunderstorms. Humidity is low throughout the year.

Annual precipitation varies between 10 to 55 inches per year and increases with elevation. The western-most section of the forest is in the rain shadow of the North Cascades and has annual precipitation levels of 10 to 15 inches per year. The eastern portion of the Forest has a moist near-maritime climate caused by the forcing of westerly air flow over the 5,000- to 7,000-foot peaks of the Kettle River and Selkirk ranges. Throughout the year, maritime air from the Pacific exerts a moderating influence on temperatures with more extreme summer and winter temperatures caused by drier air from the interior. The greatest

precipitation levels occur in the Selkirk Mountains, where uplifting of prevailing winds results in increased precipitation (Baldwin 2006).

### *Geomorphology*

The Forest is located in the Okanogan Highlands Section of the northern Rocky Mountain forest-steppe-coniferous forest-alpine meadow province, delineated through the national hierarchical framework of ecological units (ECOMAP 1993). This framework provides a nationally standardized method for the classification, mapping, and description of ecological units at multiple scales based on similarity in potential vegetation, climate, and geomorphology. The Okanogan Highlands are characterized by moderate slopes with broad, rounded summits weathered from repeated continental glaciation. Ice sheets covered the areas during the Pleistocene, and their retreat formed the Columbia and Pend Oreille valleys (WA DNR 2015). Glacial scour has exposed rock outcrops on many slopes. Most of the area is covered with glacial till, outwash, and debris. Glacial lakes, rivers and streams are common as well as mountains with both narrow and broad valleys (McNab and Avers 1994). The history and effects of continental glaciation on the Forest is discussed in greater detail in the soils specialist report (Farr and Craigg 2015).

### *Geology*

The Okanogan Highlands is divided into two geographic regions divided by the Columbia River; the Selkirk, Chewelah, and Huckleberry Mountains to the east, and the Kettle, and Sanpoil Mountains to the west. The eastern Okanogan Highlands contains the oldest sedimentary and metamorphic rocks in Washington formed from the deposition of sediments  with metasedimentary rocks overlain by layers of marine rocks including sandstone (metamorphosed into quartzite), shales, and limestones. The western Okanogan Highlands is less complex geologically than the eastern section, and contains metasedimentary rocks formed from the deposition of volcanic sediments (Lasmanis 1991). The western Okanogan Highlands is an important mineral-producing area with gold, silver, magnetite, pyrite, molybdenum, and cobalt mineral deposits (WA DNR 2015).

## Land Use History

Historical disturbances and management practices affect water quantity and quality and the physical processes within a stream system, including erosion and sedimentation and the distribution of organic material (ICBEMP). The combined impacts of past land uses and disturbance patterns as well as current management and development have shaped and continue to affect hydrologic function and physical stream characteristics.

Abundant salmon runs attracted the first humans to northeastern Washington, and evidence exists that people existed in the region as early as 9,000 to 12,000 years ago (Holstine 1987). Based on the availability of salmon, the area became one of the most important prehistoric trading sites in the Pacific Northwest; however, effects to the physical environment from early inhabitants were minor and diffuse (Holstine 1987). Early uses affecting hydrologic systems increased as European settlers moved into the area. The remnants of these activities including mining, logging, homesteads, livestock grazing, and road building can be found across the landscape.

Beginning in the mid-1800s, fur trapping was one of the most widespread uses resulting in significant declines in beaver populations. Beaver dams in small streams alter hydrology, geomorphology, and habitat, increasing water and sediment storage (Pollack et al. 2003). Beaver dams also dissipate stream energy, provide channel stability, and create diverse aquatic habitat (Gurnell 1998). Loss of beaver populations has affected hydrology and sediment dynamics and has contributed to channel incision and lowering of groundwater levels (Pollack et al. 2003) across the Forest.

Fires burned across 160,000 acres of the Forest in 1910. Historical accounts suggest that as late as 1916 areas that had burned to the ground were still bare. In 1917, fires again swept through the area, burning 23,000 acres in the western portion of the Forest. Fires in the 1920s burned over half of the timber land on the Forest (Holstine 1987). The effects to stream channels of increased erosion, sedimentation, and peak flows from these fires can still be observed. Channel incision common in streams across the Forest was likely accelerated following the fires of the early 1900s.

Placer mining of gold began in 1855 and ended by the 1870s when prospectors began upland “hard rock” mining for gold, silver, and lead which continues in the present (Holstine 1987).

Changes in hydrologic and erosional and depositional processes from land uses including homesteading, logging agriculture, grazing, mining, road construction, and hydro-developments (dams, irrigation, and flood control) have altered flow and sediment regimes, floodplain and riparian function and resulted in loss and fragmentation of aquatic habitat (Wissmar 2004). Current land uses including maintenance and construction of roads, fire exclusion, silvicultural practices, planned and unplanned wildland fire, mining, livestock grazing, and alteration of hydrologic regime and stream morphology through dams and diversions, and stream and watershed restoration are discussed in greater detail throughout this section.

## Surface Water Characteristics

Climate, geology, and physiography are large-scale drivers of hydrologic processes, and control hydrologic regime and stream channel characteristics. Most streams across the Forest flow through glacial outwash within narrow valleys. Present-day glacial lakes and wet valleys are associated with the last retreat of glaciers across the region (McNab and Avers 1994).

### *Streamflow Regime*

Most streams have a snowmelt flow regime with a peak in flow from April-June during spring snowmelt and no discernable peaks in discharge from fall/winter rains. The annual hydrograph from 84 years of gage data on the Kettle River near Laurier shows the typical seasonal discharge pattern for unregulated streams across the Forest.

There are approximately 20 stream gages on or near the Forest, however many of these gages are on regulated systems and have variable years of data available. Therefore, streamflow data from these gages does not necessarily represent all streamflow regime types on the Forest. Reidy Lierman et al. (2012) classified flow regimes for ungaged streams and rivers across Washington using gage data and climactic and physical drainage basin characteristics. Across the Forest, 97 percent of streams are categorized as either snowmelt, ultra-snowmelt, or snow-rain systems. Only 3 percent of streams are hydrologically classified as groundwater systems. Characteristics of these different systems are described in the following table (Reidy Lierman et al. 2012).

**Table 83. Hydrologic stream classification for the Colville National Forest (Reidy Lierman et al. 2012)**

| Stream Hydrologic Classification | Description | Percent of Streams on the Colville National Forest |
|---|---|---|
| Snowmelt | Peak in flow during spring snowmelt, with little discernable winter rain influence | 84% |
| Ultra Snowmelt | Higher-elevation streams that exhibit a peak at spring slightly later in spring than snowmelt-regime streams | 12% |
| Snow-Rain | Mixture of spring snowmelt and winter rain | 1% |
| Groundwater | Predictable annual minimum and base flow values, exhibit a slight increase at snowmelt, but no increase from winter rains | 3% |

### *Water Yield*

Water yield refers to the runoff from a drainage basin and is calculated as precipitation minus evapotranspiration. Physiography, geology, and spatial variation in the magnitude and timing of precipitation are controls of water yields for streams and rivers across the Forest. Water yield at low-flow was calculated for select gages across the Forest based on average streamflow (cubic feet/second (cfs)) in July and August divided by the drainage area upstream of the stream gage ($mi^2$) for the development of the Total Maximum Daily Load (TMDL) for the Forest (discussed later in this section). In the drier, western section of the Forest water yields are less than in the wetter, eastern portion of the Forest.

## Colville National Forest Contribution to Water Supply

Brown and Froemke (2009) estimated the annual contribution of water supply for all National Forests in the contiguous United States based on data from 1953 to 1994. Water supply estimates were calculated as "precipitation minus natural evapotranspiration," with the assumption that water that infiltrates into the soil is not evaporated or transpired is eventually available as surface water (Brown and Froemke 2009). Estimated annual contribution to water supply from lands within the Forest administrative boundary is 65,121 million cubic feet per year. Estimated annual contribution from lands within the Forest ownership boundary is 51,525 cubic feet per year.

## Watershed Hierarchy and Spatial Bounds of Analysis

### *Major Drainage Basins*

The Forest is located entirely in the Columbia River basin, which originates in Canada and flows southwest through Washington forming the border between Washington and Oregon to its mouth at the Pacific Ocean. Major river basins include the Pend Oreille, Sanpoil, Kettle, and Colville. The Pend Oreille River originates in Montana, flows through Idaho into Washington where it flows north into Canada to its mouth at the Columbia River. The Pend Oreille River is the fourth largest contributor of streamflow to the Columbia River. The Forest east of the Selkirk Mountain Crest drains into the Pend Oreille River. The Sanpoil River drains the southwest portion of the Forest west of the Kettle Crest and flows directly into Lake Roosevelt downstream of the Forest administrative boundary. The Kettle River receives most of the runoff from the northwestern portion on the Forest. It flows north into Canada, and south to its confluence with Lake Roosevelt (Columbia River) west of the community of Kettle Falls. The Colville River drains the central portion of the Forest east of the Selkirk Range, and west of Lake Roosevelt. The Colville River drains into the eastern side of Lake Roosevelt near Kettle Falls.

### *Watershed Hierarchy*

A watershed is an area of land where all the water drains into a particular water body. Watersheds occur at various scales and are appropriate boundaries for hydrologic analysis because physical processes including rainfall, precipitation, runoff, erosion, and sedimentation interact within watershed boundaries to shape the landscape (MacDonald 2015), affecting hydrologic function, stream condition, water quality, and water uses.

Watershed boundaries are delineated for this analysis using the hydrologic unit (HU) system. Hydrologic units are delineated and classified by the USGS based on size using a standard nested-hierarchical system with six levels of classification of successively smaller watersheds (FGDC 2005). Individual hydrologic units are denoted both numerically by a unique hydrologic unit code, and name. Classification and general size of hydrologic units within the system are shown in table 84. The table also includes an example of both the name and number of the hydrologic hierarchy of the Ninemile subwatershed.

**Table 84. Classification, naming conventions, and average size of hydrologic units in the hydrologic unit code system**

| HU name | # of digits in HUC | HU Level | Average Size ($mi^2$) | Example Name | Example Number |
|---|---|---|---|---|---|
| Region | 2 | 1st | 180,000 | Pacific Northwest Region | 17 |
| Subregion | 4 | 2nd | 17,000 | Upper Columbia Subregion | 1702 |
| Basin | 6 | 3rd | 10,000 | Upper Columbia Basin | 170200 |
| Subbasin | 8 | 4th | 700 | Sanpoil Subbasin | 17020004 |
| Watershed | 10 | 5th | 227 (40,000-250,000 acres) | Upper Sanpoil Watershed | 1702000401 |
| Subwatershed (SWS) | 12 | 6th | 4 (10,000-40,000 acres) | Ninemile Subwatershed | 170200040107 |

The Forest is located in the Pacific Northwest region, two subregions, and the Pend Oreille, Upper Columbia, and Spokane basins.

**Table 85. Region, subregions, and basins on the Colville National Forest**

| Region | Region Number | Subregion | Subregion Number | Basin | Basin Number |
|---|---|---|---|---|---|
| Pacific Northwest Region | 17 | Kooteney, Pend Oreille, and Spokane River Basins Subregion | 1701 | Pend Oreille Basin<br>Spokane Basin | 170102<br>170103 |
| | | Upper Columbia; Columbia River above the confluence with the Snake River, excluding the Yakima River Subregion | 1702 | Upper Columbia | 170200 |

The administrative forest boundary of the Forest is located within six subbasins, all within the Columbia River drainage. A small portion of the administrative forest (15,826 acres) falls within the Upper Spokane subbasin. Although a portion of the Forest administrative boundary falls within the Upper Spokane subbasin, there is no Forest Service ownership within the subbasin. Therefore, RHCAs, roads, and other features affecting hydrologic function are generally not analyzed in the Upper Spokane subbasin. Subbasins on the Forest and the percentage of each subbasin within the Forest administrative boundary are shown in the following table.

**Table 86. Subbasins within the Colville National Forest administrative boundary**

| HUC 8 Number | Subbasin Name | Colville National Forest Administrative Acres | Total Acres (in U.S. only) | % subbasin within Colville National Forest Administrative Forest |
|---|---|---|---|---|
| 17020001 | Upper Columbia River (FDR Lake) | 212,863 | 1,327,733 | 16 |
| 17020002 | Kettle River | 321,743 | 659,201 | 49 |
| 17020003 | Colville River | 145,579 | 650,712 | 22 |
| 17020004 | Sanpoil River | 105,291 | 627,732 | 17 |
| 17010216 | Pend Oreille River | 557,449 | 698,349 | 80 |
| 17010308 | Little Spokane | 15,826 | 453,912 | 3 |

There are 27 5th field watersheds within greater than 1 percent of land area within the Forest administrative boundary. The hierarchy of these watersheds within their respective subbasins and percent acres of the Forest administrative boundary within each watershed are shown in the following table.

**Table 87. Watersheds within the Colville National Forest administrative boundary**

| Subbasin | Watershed Name | HUC 10 | Total Acres (in U.S. and Canada) | Colville National Forest Administrative Acres | % Watershed within Colville National Forest Administrative Forest |
|---|---|---|---|---|---|
| Upper Columbia River (FDR Lake) | Deep Creek | 1702000110 | 122,290 | 66,529 | 54 |
| | Big Sheep Creek | 1702000111 | 143,633 | 15,060 | 10 |
| | Onion Creek-Franklin D Roosevelt Lake | 1702000112 | 186,401 | 19,895 | 11 |
| | Sherman Creek-Franklin D Roosevelt Lake | 1702000113 | 211,509 | 94,641 | 45 |
| | Hall Creek-Franklin D Roosevelt Lake | 1702000114 | 110,157 | 16,741 | 15 |
| Kettle River | Boundary Creek | 1702000210 | 147,279 | 1,844 | 1 |
| | Rock Creek-Kettle River | 1702000211 | 152,801 | 1,829 | 1 |
| | Toroda Creek | 1702000212 | 104,125 | 7,698 | 7 |
| | Curlew Creek | 1702000213 | 98,976 | 43,232 | 44 |
| | Vulcan Mountain-Kettle River | 1702000217 | 154,221 | 71,280 | 46 |
| | Boulder Creek-Kettle River | 1702000219 | 180,245 | 131,405 | 73 |
| | Deadman Creek-Kettle River | 1702000220 | 102,133 | 64,423 | 63 |
| Colville River | Chewelah Creek-Colville River | 1702000301 | 273,840 | 72,981 | 27 |
| | Little Pend Oreille River | 1702000302 | 117,703 | 19,537 | 17 |
| | Mill Creek | 1702000303 | 90,809 | 45,556 | 50 |
| | Stensgar Creek-Colville River | 1702000304 | 168,840 | 7,508 | 4 |
| Sanpoil River | Upper Sanpoil River | 1702000401 | 181,184 | 99,663 | 55 |
| | West Fork Sanpoil River | 1702000402 | 198,987 | 4,828 | 2 |
| | Middle Sanpoil River | 1702000403 | 120,607 | 802 | 1 |
| Pend Oreille River | Calispell Creek | 1701021601 | 91,577 | 64,144 | 70 |
| | Tacoma Creek-Pend Oreille River | 1701021602 | 195,073 | 125,202 | 64 |
| | Le Clerc Creek-Pend Oreille River | 1701021603 | 159,801 | 145,116 | 91 |
| | Sullivan Creek | 1701021604 | 91,224 | 91,203 | 100 |
| | South Salmo River | 1701021607 | 62,989 | 15,944 | 25 |
| | Slate Creek-Pend Oreille River | 1701021609 | 127,186 | 105,844 | 93 |
| | Cedar Creek-Pend Oreille River | 1701021610 | 59,488 | 10,007 | 17 |
| Little Spokane | Upper Little Spokane River | 1701030801 | 178,244 | 15,826 | 9 |

There are 109 subwatersheds with acreage in the Forest administrative boundary. There are 104 subwatersheds with greater than 5 percent of total area in the Forest administrative boundary, and 75 subwatersheds with greater than 25 percent of total area in the Forest boundary. There have been several changes to subwatershed names and numbers since the forest plan revision process began. Subwatersheds and 5th field watersheds used in this analysis reflect the most current acreages, names, and numbers at the time this analysis was completed in 2014.

The terms subbasin, watershed, subwatershed, priority watershed, focus watershed, and key watershed are used throughout this section. While the term watershed can refer specifically to a 5th field watershed designated in the hydrologic unit system, the term also refers to the drainage area that contributes runoff to a specific stream. Throughout this section priority and key watersheds are delineated at the subwatershed scale, and focus watersheds are delineated at the 5th field watershed scale.

Existing condition is analyzed at different watershed scales depending on the type of analysis, quality and extent of data, and the scale that best fits the intent of the analysis. Existing condition is primarily analyzed at the scale of the Forest administrative boundary. Where appropriate, existing condition is analyzed at the smaller subwatershed scale. The Watershed Condition Framework (WCF) described in detail later in this document analyzed data for subwatersheds with greater than 25 percent Forest administrative ownership. The spatial and temporal bounds for effects analysis are described under Environmental Consequences in this section.

## Existing Condition—Watershed Function, Water Quality, Quantity, and Water Uses

### *Watershed Function*

Watershed hydrologic function includes the processes that convert precipitation to streamflow, including canopy interception, snowmelt, surface runoff, infiltration, subsurface flow, and groundwater flow. Hydrologic function is influenced by upland physical and vegetation condition, ground cover, soil properties and function, stream channel condition, and riparian vegetation condition, all of which affect the rate and timing of water, nutrients, and sediment into streams. Watershed function is a component of ecosystem function where ecosystems are dynamic and resilient to perturbations to structure, composition, and processes of their biological and physical components (USDA 1998), and includes hydrologic, vegetative, aquatic, and riparian biological characteristics, physical structure, and water quality.

### *Watershed Condition*

A fundamental goal of the Forest Service is “To protect NFS watersheds by implementing practices designed to maintain and improve watershed condition, which is the foundation for sustaining ecosystems and the production of renewable natural resources, values, and benefits” (FSM 2521). Watershed condition is defined as “The state of the physical and biological characteristics and processes within a watershed that affect the hydrologic and soil functions supporting aquatic ecosystems” (Potyondy and Geier 2010). Properly functioning watersheds have five characteristics (Williams et al. 1997, and Potyondy and Geier 2010):

- Provide for high biotic integrity, and support adaptive animal and plant communities that reflect natural processes;
- Resilient and recover rapidly from natural and human disturbances;
- Exhibit a high degree of connectivity along the stream both laterally across the floodplain and valley bottom, and vertically between surface and subsurface flows;

- Important ecosystem services including high water quality, recharge of streams and aquifers, maintenance of riparian communities, and resiliency to climate variability and change;
- Maintain long-term soil function.

The Watershed Condition Framework (WCF) was conceptualized at the National scale to change the Forest Service's approach to landscape and watershed restoration. The WCF established a nationally consistent approach to classify watersheds based on underlying ecological, hydrological, and geomorphic functions and targets implementation of focused restoration activities in priority subwatersheds. The WCF provides outcome-based performance measures for documentation of improvement in watershed condition at Forest, Regional, and National scales (Potyondy and Geier 2010).

National Forests throughout the U.S. implemented the WCF process in 2010. Subwatersheds on the Forest were classified into three categories through the WCF based on classes described in FSM 2521.1 and Potyondy and Geier (2010):

- Class 1: Functioning Properly—SWSs that exhibit high geomorphic hydrologic, and biotic integrity relative to natural potential conditions. The watershed is functioning similar to natural wildland conditions (Karr and Chu 1999, Lackey 2001). There are minimal adverse human impacts on natural physical or biological processes, and the watershed is able to naturally recover to previous condition in response to natural and human disturbance (Yount and Neimi 1990);
- Class 2: Functioning at Risk—SWSs exhibit moderate integrity as described above;
- Class 3: Impaired Function—SWSs exhibit low integrity as described above. Adverse human impacts have caused a threshold to be exceeded where the watershed is no longer as resilient to physical and biological processes.

Subwatersheds are classified by watershed condition framework based on geomorphic, hydrologic, and biotic integrity relative to potential natural condition, which relates to geomorphic, hydrologic, and biological watershed function. Integrity is evaluated in the context of the natural disturbance regime and geoclimatic setting and includes aquatic and terrestrial components because water quality and aquatic habitat are related to the integrity and functionality of the upland and riparian areas across the watershed (Potyondy and Geier 2010).

The watershed condition framework classification process includes four process categories including "aquatic physical," "aquatic biological," "terrestrial physical," and "terrestrial biological." These process categories are represented by 12 indicators comprised of attributes that represent underlying ecological function and processes that affect soil and hydrologic function (Potyondy and Geier 2010). Each indicator attribute receives a rating that is summed and averaged to produce an indicator score. The indicator scores within each process category are averaged, and the final watershed condition score is computed as a weighted average of the four process category scores.

The results of the watershed condition framework for the Forest with data compiled in 2010 are used throughout this analysis to describe the existing condition of attributes and indicators that affect watershed function for SWSs across the Forest. Certain parameters have been updated with greater detail to reflect newer data analyzed for the Forest Plan Revision process. This process is discussed in greater detail elsewhere in this document. Additional analysis is discussed in the following sections where applicable. Results of the watershed condition framework by subwatershed are shown in table 88.

**Table 88. Results of the watershed condition framework summarized by number of subwatersheds within each condition class**

| Process Category | Indicator | Attribute | Class 1 Functioning Properly (# of Subwatersheds) | Class 2 Functioning at Risk (# of Subwatersheds) | Class 3 Impaired Function (# of Subwatersheds) |
|---|---|---|---|---|---|
| Aquatic Physical | | | 64 | 24 | 1 |
| | Water Quality | | 67 | 13 | 9 |
| | | Impaired Waters | 61 | 19 | 9 |
| | | Water Quality Problems | 58 | 22 | 9 |
| | Water Quantity | Flow Characteristics | 86 | 3 | 0 |
| | Aquatic Habitat | | 11 | 47 | 31 |
| | | Habitat Fragmentation | 48 | 16 | 25 |
| | | Large Woody Debris | 15 | 44 | 30 |
| | | Channel Shape and Function | 4 | 80 | 5 |
| Aquatic Biological | | | 13 | 37 | 39 |
| | Aquatic Biota | | 12 | 26 | 51 |
| | | Life Form Presence | 12 | 26 | 51 |
| | | Native Species | 12 | 26 | 51 |
| | | Exotic and/or Invasive Species | 12 | 26 | 51 |
| | Riparian Wetland Vegetation | Vegetation Condition | 34 | 21 | 34 |
| Terrestrial Physical | | | 15 | 74 | 0 |
| | Roads and Trails | | 5 | 11 | 73 |
| | | Open Road Density | 6 | 9 | 74 |
| | | Road Maintenance | 5 | 9 | 75 |
| | | Proximity to Water | 6 | 10 | 73 |
| | | +Mass Wasting | n/a | n/a | n/a |
| | Soils | | | | |
| | | Soil Productivity | 89 | 0 | 0 |
| | | Soil Erosion | 89 | 0 | 0 |
| | | Soil Contamination | 79 | 10 | 0 |

| Process Category | Indicator | Attribute | Class 1 Functioning Properly (# of Subwatersheds) | Class 2 Functioning at Risk (# of Subwatersheds) | Class 3 Impaired Function (# of Subwatersheds) |
|---|---|---|---|---|---|
| Terrestrial Biological | | | 89 | 0 | 0 |
| | Fire Regime | Fire Condition Class | 32 | 57 | 0 |
| | Forest Cover | Loss of Forest Cover | 89 | 0 | 0 |
| | *Rangeland Vegetation | *Vegetation Condition | 83 | 2 | 0 |
| | Terrestrial Invasive Species | Extent and Rate of Spread | 85 | 4 | 0 |
| | Forest Health | | 87 | 2 | 0 |
| | | Insect and Disease | 64 | 23 | 2 |
| | | Ozone | 89 | 0 | 0 |
| Final Score | | | 15 | 73 | 1 |

+Mass wasting was not assessed in this analysis, but is addressed elsewhere in this document.
*Attribute and indicator assessed only in subwatersheds with range allotments

Composite results of the WCF for the Forest indicate that 82 percent of SWSs are “functioning at risk.” Only 1 SWS was rated as “not functional,” and 15 SWSs are “functioning properly.” Scores in the aquatic physical process category are generally good, with 72 percent of SWSs functioning properly. Both water quality and water quantity attributes show the majority of SWSs “functioning properly.” Aquatic habitat conditions are the primary driver of reduced function within the aquatic physical process category; 88 percent of SWS were rated as either functioning at risk or not functional for the aquatic habitat indicator.

Scores are low across the aquatic biological process category, with scores of functioning at risk and not functional for most indicators and attributes. Riparian wetland condition scores are higher than other indicators and attributes in this process category. Aquatic habitat is discussed in greater detail in the aquatics BA/BE (MacDonald 2015).

Within the Terrestrial Physical process category, roads attributes and indicators are the primary driver of low scores. Eighty-three percent of SWSs received not functional scores in all road attributes and indicators. Roads are discussed in greater detail in the roads section of this analysis. Soil attributes and indicators were rated functioning properly across most SWSs.

Most indicators and attributes within the Terrestrial Biological process category are rated functional, with a greater percentage of SWSs falling within the functional at risk category in the fire condition class and insect and disease attributes.

Select indicators and attributes from the WCF were used in the aquatic ecological condition (AEC) model to assess the function of aquatic ecological conditions and its ability to support viable populations of aquatic focal species. The AEC model was used to determine key watersheds in the forest planning process and to assess aquatic species viability. The AEC process and results are discussed in the fisheries report (MacDonald 2015).

### *Streams*

There are approximately 2,483 miles of perennial streams that flow throughout the year within the Forest administrative boundary. There are approximately 4,191 miles of intermittent streams across the Forest that flow either seasonally or spatially (flow subsurface in some reaches). The intermittent stream category for purposes of this analysis also includes ephemeral channels, which flow for a short period following precipitation or snowmelt. Ephemeral streams generally do not have the surface groundwater interaction to support riparian or wetland vegetation and do not show evidence of yearly scour. Other water features on the Forest include lakes, ponds, reservoir, and seeps and springs.

#### Stream Channel Condition and Function

Stream channel condition and function is affected by processes occurring throughout a watershed. Stream channel condition is often discussed in terms of the habitat it provides for fish; however channel conditions also affect how stream system responds to changes in inputs of water, nutrients and sediment from natural or anthropogenic disturbance. Although stream systems are variable, functional streams are generally more resilient to disturbance and recover from faster than non-functional systems.

The “channel shape and function” attribute was assessed for WCF using stream channel condition data collected using the level II Region 6 stream inventory protocol (USDA 2012(b)) for most named streams across the Forest. Streams in most SWSs are functioning at risk (80) with four SWSs functioning properly, and five SWSs with impaired function.

Data collected on stream channel variables that are indicators of channel shape and function under the PACFISH INFISH Effectiveness Monitoring Program (PIBO EMP) collected on selected reaches across the Forest since 2001 indicate that channel conditions in reaches in managed watersheds are poorer than in reference reaches located in watersheds with minimal disturbance. See MacDonald 2015 for further discussion of the PIBO EMP and results of monitoring.

### *Riparian and Wetland Function*

Although riparian and wetland ecosystems comprise a small portion of lands on the Forest, they provide important ecological function and habitat for plants and aquatic and terrestrial wildlife (Wissmar 2004). Riparian areas and wetlands provide ecological, economic, and social benefits and are valued for recreation, livestock grazing, mining, transportation corridors, and water supply for cropland and irrigation (Kovalchik and Clausnitzer 2004). They provide a linkage between upland and stream habitats and are important habitat for aquatic and terrestrial wildlife and a variety of plants. Vegetation production is generally higher in wetland and riparian ecosystems than in the uplands, and riparian structure and function influence the rate, amount, and timing of discharge of water, sediment, nutrients, and other potential pollutants (Kovalchik and Clausnitzer 2004).

Historical and current uses in riparian areas have influenced structure, composition, and function of these ecosystems, and conservation, rehabilitation, and restoration of function is a high priority on the Forest. Riparian, aquatic, and wetland ecosystems are diverse in eastern Washington, with 163 recognized aquatic, wetland, and riparian plant associations or community types (Kovalchik and Clausnitzer 2004).

#### Riparian Areas

Riparian areas act as a filtration system for overland water and sediment runoff before it enters the stream system. This function is especially important where watersheds have experienced disturbance or management that alters the routing of water and sediment upslope of the riparian area. Trees and shrubs in riparian areas create shade, regulate air, soil, and water temperature, and provide inputs of downed trees and woody debris to the stream system (Wissmar 2004).

Roots of riparian vegetation provide bank stability and slow the rate of erosion and potential channel migration (Gregory et al. 1991). Riparian vegetation also slows flowing water during high flow events, trapping sediment within the floodplain (Platts et al. 1985), resulting in a reduction in the sediment load in flood water (Wondzell 2001).

INFISH (USDA Forest Service 1995) designates riparian habitat conservation areas (RHCAs) to be managed for the benefit of aquatic and riparian-dependent species. Since RHCAs are designated by width rather than riparian function or existence of riparian vegetation, there is often upland vegetation on the outer width of RHCAs. RHCA widths designated by INFISH vary based on stream/wetland type and are wider in priority watersheds (designated by INFISH). Acres of RHCA across the Forest by stream type are shown in table 89. Since RHCA width only apply to management on lands owned by the Forest, RHCA acreage is calculated for lands owned by the Forest rather than lands within the Colville National Forest administrative boundary.

**Table 89. Existing riparian habitat conservation areas (RHCA) acreage on the Colville National Forest within the administrative boundary**

| RHCA Designation/Description | RHCA Width (ft.) | RHCA Acres across the Colville National Forest |
|---|---|---|
| Fish Bearing Perennial | 300 | 35,427 |
| Non-fish Bearing Perennial | 150 | 49,075 |
| INFISH Natural Waterbody; ponds, lakes, reservoirs | 150 | 6,091 |
| INFISH Non-fish Bearing Intermittent | 50 | 25,987 |
| INFISH Wetland less than 1 acre | 50 | 805 |
| INFISH Wetland >1 acre | 150 | 14,736 |
| Priority Watershed No Fish Intermittent | 100 | 15,904 |
| Priority Watershed Wetlands less than 1 acre | 100 | 233 |
| Priority Watershed Wetlands > 1 acre | 150 | 2,434 |
| Total | | 150,692 |

### Riparian Wetland Vegetation Condition

Conditions across riparian areas on the Forest vary across subwatersheds. Thirty-four subwatersheds are rated as properly functioning; these riparian areas have native mid to late seral vegetation in dynamic equilibrium with the stream or wetland system in greater than 80 percent of riparian areas. Twenty-one subwatersheds are rated as functioning at risk with native vegetation showing a moderate loss of vigor, with a lesser component of mid to late seral vegetation occupying 25 to 80 percent of riparian areas. Thirty-four subwatersheds are rated as “not functional,” with native vegetation displaying a loss in vigor and cover and composition are mostly early seral. Riparian areas in SWSs rated not functional are generally disconnected from surface water and shallow groundwater, and reflect the loss of available soil water (Potyondy and Geier 2010).

Degraded riparian conditions are influenced by livestock grazing, mining, timber harvest and associated infrastructure, fire suppression, and road construction and use. Riparian conditions are also affected by stream channel function and the ability of the stream system to provide water to support persistence of riparian vegetation. Channel incision can lower the water table, making the water table too low to support riparian vegetation (Wondzell and Swanson 1999).

### Wetlands

Wetlands are critical for water storage and slowing the release of flood water and snow melt, recharge groundwater, and recycle nutrients (Keddy 2010). The National Wetlands Inventory (NWI) is a detailed spatial inventory of wetland data mapped across the lower 48 states competed by the U.S. Fish and Wildlife Service. Wetland type and acreage across the Forest are shown in table 90.

**Table 90. Riparian and wetland acreage for the Colville National Forest (National Wetlands Inventory)**

| Wetland Type | General Description | Total Acres |
|---|---|---|
| Freshwater Emergent Wetland | Herbaceous marsh, fen, swale, or wet meadow, palustrine emergent | 5,001 |
| Freshwater Forested/Shrub Wetland | Forested swamp or shrub bog wetland, palustrine forested/shrub | 6,767 |
| **Total** | | **11,768** |

### Groundwater-dependent Ecosystems

Groundwater is the portion of precipitation that infiltrates into soil and bedrock and flows subsurface until it reaches the surface in streams, lakes, springs, seeps, and wetlands (USDA Forest Service 2014(b)). Ground and surface water are interconnected, with groundwater contributing to flow, chemistry, and temperature of streams, lakes, springs, and wetlands, providing the water to support terrestrial and aquatic plants and animals. Groundwater is also critical to water supply and provides drinking water to communities across the country (USDA Forest Service 2007).

Groundwater-dependent ecosystems (GDEs) are areas that require access to groundwater to maintain the community of plants, animals, and physical processes. Examples of GDEs include, springs, seeps, fens, and wetlands. Proper hydrologic function is critical to maintaining conditions in GDEs that support wetland plants and animals. Management activities with the potential to impact GDEs include grazing, road building and maintenance, recreation, vegetation management, large wildfires, and climate change. Impacts to GDEs from these activities are mitigated through standards, guidelines, and BMPs, which are discussed in the effects analysis of this section.

Inventories of GDEs on the Forest have primarily been completed at the project level. The national hydrography dataset (NHD) shows mapped springs and seeps and provides a basis for quantifying springs and seeps across the Forest, however this dataset underrepresents the actual number of springs, seeps, and other groundwater dependent ecosystems. A summary of the number of springs and seeps across the Forest from NHD data is shown in table 91. Location of GDEs can also be approximated using the National Wetland Inventory's categorization of palustrine emergent wetlands which occupy only 12 acres on the Forest. Data from the NWI also underrepresents GDEs and underscores the need for project-level analysis of location and condition of GDEs during planning.

The Forest Service released a draft groundwater management directive on May 7, 2014, to amend its internal direction to establish comprehensive direction for management of groundwater resources on NFS lands. The intent of the proposed directive was to clarify roles and establish new processes and procedures for special uses involving withdrawal of groundwater resources (FSM 2560(draft)). The proposed directive was withdrawn on June 19, 2015, because concerns were raised through collaboration with tribes, conservation organizations, States and other organizations that the proposed directive may exceed the Agency's authorities and infringe on State authorities to allocate water (Federal Register 2015). The intent of any new groundwater directive would be to establish a clear and consistent approach for evaluation and monitoring of the effects of different actions on groundwater resources on NFS lands through a collaborative process (Federal Register 2015).

### Groundwater Aquifers

The Forest is underlain by aquifers that occur in pre-Miocene rocks including igneous, metamorphic, volcanic, and marine and non-marine sedimentary rocks that vary in permeability and water yield. Higher water-yielding aquifers in unconsolidated-deposits consisting of primarily of sand and gravel with lesser components of clay and silt occupy less than 25 percent of the Forest land base (Whitehead 1994). Aquifers occurring in unconsolidated deposits occur primarily in the eastern portion of the Forest.

### Surface and Groundwater Interaction

The interaction between surface and groundwater is a function of climate, geology and aquifers, and soils. Soil affects how water moves across the landscape, and the quantity and timing of stream discharge. Soil water movement was modeled across the Forest using soil erodibility, soil runoff potential, and soil available water storage (Farr et al. 2015). Soil water flow categorization and description, and springs and seeps (from NHD) are shown in table 91.

**Table 91. Soil water flow category acreage across the Colville National Forest administrative forest and number of springs and seeps within each soil water flow category**

| Soil Water Flow Category | Description | Total Acres | Number of Seeps and Springs |
|---|---|---|---|
| Runoff | Primary water movement is on the surface of the soil | 393,297 | 61 |
| Storage | Water primarily infiltrates and is stored in the soil | 693,438 | 116 |
| Lateral Flow | Water infiltrates and water movement is primarily subsurface | 180,149 | 29 |
| No Category | n/a | 0 | 5 |
| **Total** | | **1,266,884** | **211** |

Over half (54 percent) of the area of the Forest have soils that support infiltration and storage. Thirty-one percent of the soils support runoff of water across the soil surface; however, runoff potential is also affected by vegetation and litter cover, and precipitation intensity. Lateral flow is the primary soil water flow mechanism on 14 percent of soils across the Forest. Springs and seeps are most prevalent in areas where storage is the primary soil water flow mechanism.

## *Land Uses and Disturbances Affecting Watershed Function*

Climate, topography, geology/soils and topography interact to affect runoff, erosion, and ultimately water quality and quantity, and stream channel function (Elliot 2010). The primary land uses that affect watershed function addressed in this section include vegetation management, wildland fire, insect and disease outbreaks, grazing, roads, and watershed restoration.

### The Role of Upland Vegetation Condition in Hydrologic Processes

Forest vegetation plays a significant role in hydrologic processes (Hubbart 2007). In an intact forest ecosystem when precipitation falls as rain, vegetation intercepts a percentage of water that evaporates back into the atmosphere. Un-intercepted precipitation falls to the forest floor, where uncompacted soils and the vegetative litter layer allow water to slowly infiltrate into the soil. Infiltrated water enters the groundwater system where it is used by plants and other organisms, and transpired back into the atmosphere through plant photosynthesis. Infiltrated groundwater eventually flows back onto the surface, feeding streams, lakes, rivers, springs, and other surface waters. A small percentage of precipitation may not be intercepted or infiltrated and may travel overland in a process known as overland flow. Overland

flow is limited on forested lands with little disturbance to locations where precipitation intensity exceeds infiltration capacity (Horton overland flow), when soils are saturated and precipitation continues to fall (saturation excess overland flow), or disturbance results in soil compaction or loss of ground cover.

Precipitation falling as snow is associated with climatic processes, but is also dependent on forest cover. In winter, trees intercept significant amounts of snow that often sublimates (changes directly from solid to gas state) and never reaches the ground, reducing the amount of precipitation available to infiltrate or run off the landscape (Elliot 2010). Creation of canopy openings can alter rates of snow accumulation and alter the timing of snowmelt (Troendle and King 1985). Troendle et al. (2001) report that in coniferous forests in cold snow zones, 25 to 35 percent of snow would be intercepted and sublimated or evaporated. Studies have shown that snow water equivalent and snow melt rates are higher in open areas than in forested areas (McCaughey and Farnes 2001, Skidmore et al. 1994). In a study in northern Idaho, measured snow water equivalent was 200mm less under a canopy than in an open area (Hubbart 2007).

The effect of changes in upland vegetation on hydrologic function is dependent on the processes through which changes in vegetation cover affect water cycle components, including evapotranspiration, snow accumulation and melt rates, infiltration, and overland flow (Chamberlin et al. 1991). Removal of canopy cover through timber harvest, insect and disease outbreaks, or wildland fire alters the hydrologic cycle by reducing interception by vegetation, altering evaporation and transpiration. Removal of vegetation and organic matter from the forest floor can also increase watershed runoff, erosion, and sedimentation. Removal of leaf litter and other vegetation material from the forest floor also increase runoff and erosion and sedimentation processes (Robichaud et al. 1993). Removal of forested vegetation can also affect water yield and peak flows. Reduction in canopy cover interception and evapotranspiration can increase the amount of precipitation available and the timing of runoff and recharge to surface water systems (Goodell 1965, Woods 1966). Effects to hydrologic process and function for timber harvest, die-off from insect and disease, and wildland fire are shown in table 92.

**Table 92. Affects to hydrologic processes from timber harvest, die-off from insect and disease outbreaks, and wildland fire (Adams et al. 2012)**

| Associated Change | Die-off | Harvest | Fire |
|---|---|---|---|
| Canopy Cover Loss | X | X | X |
| Soil Compaction from Vegetation Removal Activities | X (if salvaged) | X | X (if salvaged) |
| Heat-induced soil water repellency | | | X |
| Litter layer/understory burning | | | X |
| Water yield | X | X | X |
| Increased peak flows | X | X | X |

### Timber Harvest

Direct removal of vegetation through timber harvest can affect watershed processes including runoff, erosion, and sedimentation, water yield, and peak flows; however, the infrastructure to support vegetation removal has the greatest impact to hydrologic processes and function. Furniss et al. (1991) concluded that forest roads contribute more sediment than all other forest activities combined on a per-unit area basis (Meehan 1991). The majority of sediment from timber harvest activities is related to road construction and increased use of existing roads (Lee et al. 1997, Chamberlain et al. 1991, Dunne and Leopold 1978).

Removal of trees through timber harvest can also affect water yield. Studies on the effects of vegetation removal on water yield show highly variable effects, and generally have not been undertaken on a scale greater than small watersheds (Ziemer 1987). At small scales, changes in water yield are easier to

measure, while changes in runoff per unit area are hard to measure directly for larger areas because changes are too small for direct measurement (Huff et al. 2000). In conifer forests a reduction in forest cover less than 20 percent, resulted in no detectable increase in water yield (Bosch and Hewlett 1982; Stednick 1996). Megahan et al. (1995) found no significant increase in either annual or monthly streamflow in a paired catchment study in Idaho, where 23 percent of one watershed was clearcut through helicopter-logging and burned. A study on a clear-cut in 25 percent of the study basin in the Uinta Mountains of Utah found up to a 147mm (52 percent) increase in annual water yield with the largest increases in May to August. Increases in water yield persisted for the 20 years data was collected after harvest (Burton 1997). A 30-year study of watershed response to timber practices at the High Ridge evaluation area in the Northern Blue Mountain showed low-magnitude, short-term increases in water yield after clear cutting (Helvey et al. 1995).

The greatest relative increases in water yield and streamflow from vegetation removal in the Pacific Northwest are observed in the summer low-flow season, however larger overall increases occur during snowmelt (Harr 1979; Troendle et al. 2001; Brown et al. 2005). In a study in northwestern California, Keppeler and Ziemer (1990) found that relative water yields were greater during summer low-flow, than annual flows, with increases diminishing 5 years post-harvest.

Generally, water yield increases in proportion to forest vegetation removed, with lower magnitude in response in dry regions (Stednick 1996; Brown et al. 2005). Water yield typically increases in the first year following fire or logging, but slowly decreases to pre-disturbance levels as vegetation reestablishes (Hibbert 1967; Peterson et al. 2009). The magnitude of increases in water yield is dependent on precipitation patterns 2 to 3 years after disturbance as vegetation begins to recover. The duration of water yield and peak flow increases following vegetation removal or mortality is dependent on timing and intensity of precipitation and snowmelt rates (MacDonald 2000), and rate of vegetation recovery. Areas with high precipitation generally have vegetation regenerate resulting in the rapid return of streamflow to pre-disturbance state. However, these same higher-precipitation watersheds also have the most pronounced, yet short-lived increase in water yield (Stanley and Arp 2002). Therefore, short-term increases in water yield may be more pronounced on the eastern side of the Forest. Smaller magnitude increases in water yield would be expected in the drier western section of the Forest, however these effects may be longer in duration, as vegetation may take longer to reestablish.

While small-scale studies show that water yield can be increased through focused forest management, the scale of treatment needed to increase water yield on NFS lands is constrained by a variety of factors. Only portions of areas on NFS lands can be economically treated based on physical, environmental, and political constraints (Ziemer 1987). Although it has not been studied locally, a 1983 study for NFS lands in the Sierra Nevada Mountains of California found that if multiple use/sustained yield guidelines were followed, water yield could be increased by 1 percent above current levels (Kattelman et al. 1983). This increase would likely be undetectable from a water use perspective; U.S. Geological Society stream gages usually have up to a 5 percent error (Rothacher 1970). In addition, most of the projected increases would occur during snowmelt in wetter years, rather than during summer low-flow and in drought years.

Vegetation removal also affects peak flows. In a compilation of paired and modeled watershed studies in western North America, the largest increases in peak flows were reported for small storms (less than 1 year recurrence interval), with increases in peak flows diminishing with higher magnitude storms (Grant et al. 2008). The largest peak flow increases were in watersheds that had been 100 percent clearcut, but there was no pattern between treatment type and magnitude of peak flow increase (Grant et al. 2008). While vegetation treatment type affects peak flow, other management treatment considerations including road density, hydrologic connectivity, and drainage efficiency (Wemple et al. 1996), and riparian buffer

widths also influence peak flows (Grant et al. 2008). Increased erosion and runoff from forest roads generally have a greater influence on peak flows than vegetation removal (Wemple et al. 2001).

Potential effects of timber harvest and vegetation removal are mitigated through BMPs and implementation of forest plan standards and guidelines, including limiting the temporal and spatial scale of treatments, limiting vegetation treatment in riparian areas and other unstable areas, and properly locating skid trails, landings, and temporary roads to limit erosion. While implementation of BMPs is included in all alternatives, standards and guidelines for timber harvest and other vegetation management activities vary by alternative, and are discussed in the effects analysis section.

Differences in land available for timber harvest, and the primary types of vegetation management activities and their potential effects are discussed in the Environmental Consequences section. In addition, timber harvest and other vegetation treatments generally require additional access through roads (either temporary or system), therefore potential effects of increased creation and use of roads for vegetation management activities are also discussed in the effects analysis section of this section.

**Wildland Fire**

Wildland fire includes both unplanned and planned initiations (prescribed fire). Prescribed fire is initiated to achieve resource management objectives, primarily to reduce the risk of high severity fires. Wildland fire was once a common occurrence in forest lands across the Forest, however fire exclusion since the early 1900s has resulted in changes in forest structure and species composition resulting in increased risk of higher severity and intensity wildfires when they do occur (Hessberg and Smith 1999). Fire severity describes the effects of a fire to soil structure, infiltration capacity and biotic components and affects runoff and soil erosion potential from fire effects. Fire intensity describes fire effects to vegetative characteristics including tree mortality and consumption of understory vegetation and down wood (Debano et al. 1998) and affects runoff rates, peak flows, water yield, and riparian canopy cover.

Fire kills trees and decreases canopy cover, partially or completely burns ground cover, and may form water-repellant soils (hydrophobic) depending on burn intensity. Soil water storage, interception, and evapotranspiration are reduced when vegetation is removed or killed by fire and when organic matter on the soil surface is consumed by fire (DeBano et al. 1998; Neary et al. 2005). Fire consumption of ground vegetation and hydrophobic soils increase overland flow and erosion and sedimentation risk. Burned areas are vulnerable to accelerated soil erosion which can increased post-fire sediment yield (Neary et al. 2005). Increases in surface erosion following wildfire have been well documented (Helvey 1980, Robichaud and Hungerford 2000; Wondzell and King 2003; and Neary et al. 2005); however, effects are spatially variable based on soil condition, burn severity, and timing and magnitude of precipitation (Robichaud and Hungerford 2000). Helvey et al. (1985) found that annual sediment yield increased as much as 180 times above pre-fire levels following a high-mortality wildfire in the Entiat experimental forest in the eastern Cascades of Washington. Water yields and peak flows can also increase from large fires due to loss of canopy cover and reduction in evapotranspiration (Helvey 1980). Effects of vegetation removal through timber harvest on water yield discussed in the previous section are similar to the effects of wildland fire.

Prescribed fire is used as a management tool to by itself or in conjunction with thinning to reduce fuel loading and the risk of uncharacteristically large fires (Mitchell et al. 2009). The most effective way to reduce fire severity is forest thinning in conjunction with prescribed burning (Covington et al. 1997, Graham et al. 1999). Most prescribed fires are ignited under conditions that limit the potential for high-severity fires (Wondzell 2001), they have less of an effect on vegetative litter and soil organic structure, and result in a lower risk of erosion and changes in water yield and peak flows (DeBano et al. 1998).

Climate change is expected to alter fire return intervals as well as potential effects from increasingly large, severe fires. There is a close correlation with climate conditions and severity and extent of wildfires in the western U.S., and projected changes in temperatures and precipitation in the interior Pacific Northwest are expected to increase the risk of larger, more severe fires (Littell et al. 2010, Westerling et al. 2003).

Potential effects to hydrologic processes from prescribed fire are mitigated through BMPs and standards and guidelines that limit fire intensity and severity, ground-disturbing activities (including firelines), and retain adequate groundcover. While more difficult to mitigate, effects from unplanned ignitions are mitigated through burned area emergency response (BAER) activities, and post-fire rehabilitation of firelines and other infrastructure. In addition, forest vegetation management in all alternatives focuses on increasing landscape resiliency to large-scale wildland fire.

### *Insects and Disease*

Large-scale insect and disease outbreaks can have similar effects to hydrologic function as large scale wildland fire in the scale of disturbance and mortality of overstory vegetation (Wondzell 2001). Increase in dead trees may increase fuel loading and increase susceptibility to large fires (Hessberg et al. 1994). There are limited studies on the effects of die-off from insect and disease outbreaks on erosion and sedimentation, but indirect effects include increased inputs of litter to the forest floor, and increased large woody debris to the stream system and upland environment (Wondzell 2001). Die-off from insects and disease can also alter water yield and peak flows through the same processes discussed in the Timber Harvest and Wildland Fire sections. Adams et al. (2012) hypothesize that in snowmelt-dominated watersheds, there would be decreases in evapotranspiration and increased flows if canopy cover from die-off exceeds 20 percent.

### *Vegetation Condition*

The structure and composition of forest vegetation on the Forest has changed since Euro-American settlement (Wondzell 2001). Historic range of variability (HRV) analysis was used to evaluate existing forest structure condition for 5 vegetation types across the Forest and is discussed in detail in the Forest Vegetation Report (Day 2015). HRV describes the dynamic behavior and functioning of ecosystems before European settlement and provides a framework to determine changes between historic and current conditions (Aplet and Keeton 1999). When forest conditions move beyond the limits of HRV, they move into a state of disequilibrium making them more susceptible to disturbances, including insect and disease outbreaks and stand-replacing fires (Kaufmann et al. 1994). As discussed above, these large-scale episodic disturbances affect hydrologic and watershed function and processes and water quality.

**Table 93. Historical range of variability percentage by vegetation type for five structure classes compared to current conditions. Values below HRV are shaded in black, values above HRV are shaded in gray (Day 2015).**

| | % CNF | | Early % | Mid Open % | Mid Closed % | Late Open % | Late Closed % |
|---|---|---|---|---|---|---|---|
| Douglas-fir dry | 39% | Current % | 12 | 7 | 57 | 5 | 19 |
| | | Historical % | 6-16 | 2-8 | 4-13 | 38-78 | 1-32 |
| Northern Rocky Mountain mixed conifer | 30% | Current % | 19 | 4 | 65 | 1 | 11 |
| | | Historical % | 9-25 | 1-3 | 18-30 | 4-6 | 44-60 |
| Spruce / subalpine fir | 2% | Current % | 21 | 0 | 60 | 0 | 19 |
| | | Historical % | 4-24 | 0 | 7-27 | 0 | 55-83 |

| | % CNF | | Early % | Mid Open % | Mid Closed % | Late Open % | Late Closed % |
|---|---|---|---|---|---|---|---|
| Subalpine fir / lodgepole pine | 19% | Current % | 33 | 4 | 49 | 2 | 13 |
| | | Historical % | 45-65 | 0 | 33-53 | 0 | 3 |
| Western hemlock / western redcedar | 10% | Current % | 35 | 0 | 52 | 0 | |
| | | Historical % | 14-46 | 0 | 13-41 | 0 | 29-57 |

There is an abundance of mid-structural and a lack of late-stage structure across 4 of 5 vegetation types on the Forest. These stands have smaller tree sizes and greater canopy cover than would be expected historically, which is consistent with fire suppression and other changing land use patterns (Day 2015). The overabundance of stands in the mid-closed structural class makes them more susceptible to large-scale disturbance and increases the risk of effects to hydrologic and watershed function.

### *Livestock Grazing*

Livestock grazing is one of the most widespread uses in the interior northwest, however, grazing on the Forest is less widespread and intensive than on other forests east of the Cascades in Oregon and Washington. Livestock effects include trampling of vegetation, soil compaction, and loss of vegetative cover (Platts 1991), which can increase stream and channel instability and result in unstable banks and incised and widened stream channels (Marston 1994). However, the impact of grazing depends on timing, intensity and frequency as well as type of animals. (Heitschmidt and Stuth 1991). Although grazing can affect upland conditions, effects to hydrologic and aquatic function are most pronounced in riparian areas and areas with active water because these areas are most sensitive to livestock disturbance, and they are often where use is concentrated.

Livestock concentrate in riparian areas and trampling and overutilization of riparian vegetation by livestock has contributed to the decline of riparian ecosystem structure and composition across the interior Pacific Northwest (Lee et al. 1997; Johnson 1992). Riparian areas in the western United States comprise approximately 1 to 2 percent of summer range, but provide 20 percent of forage available for livestock (Clary and Webster 1990).

The effects of grazing can be minimized with proper management of grazing, and implementation of practices that keep livestock out of streams and other aquatic features as well as riparian areas. Additional grazing protections were implemented following the establishment of INFISH guidelines in 1995. These guidelines were intended to provide protection for riparian areas to protect resident fish and water quality and move conditions toward attainment of Riparian Management Objectives (RMOs). Analysis of status and trend of stream channel variables is discussed in detail in MacDonald et al. 2015.

PIBO monitoring trend data indicate that since implementation of INFISH, several stream habitat attributes have improved, with macroinvertebrate communities, bank stability, bank angle, pool tail fines, and percent pools showing positive, but not statistically significant trends. Substrate size (D50) has shown a negative though not statistically significant trend. Increases in large woody debris, pool depth, and percent undercut banks show a statistically significant improving trend in most subbasins (Archer 2015). At most sites, PIBO trend data was calculated for two years of sampled data over a 10-year period (each site sampled once every 5 years). Two data points generally do not provide enough data to make conclusions regarding long-term trends.

The timeframe for measureable changes in stream channels may be decades or centuries and is often related to larger scale disturbance, such as floods and fires, making it difficult to isolate the effects of

management on stream channel adjustments. With a longer record of data, trends may be detected. Other studies on changes in channel morphology following livestock exclusion support this conclusion. These studies have shown mixed improvement in stream channel condition and function because morphological change is often on a timescale longer than conducted studies, and is sensitive to processes at the watershed rather than reach scale (McDowell and Magilligan 1997; Medina and Martin1988; and Kondolf 1993).

Approximately 363,845 acres (33 percent) of the Forest are classified as capable for cattle grazing, and 448,160 acres (41 percent) are suitable for sheep grazing. There are a total of 58 allotments on the Forest; 42 are active, and 16 are not currently grazed. Of the 16 vacant allotments, 7 are likely to be used again in the foreseeable future. An animal unit month (AUM) is the amount of forage used by a cow and a calf pair, one horse, or five sheep or goats for one month. AUMs have fluctuated between approximately 28,000 and 33,000 over the past 10 years (Fletcher 2015), and forest plan alternatives do not propose changes to allotment boundaries, use, or AUMs. However, standards and guidelines pertaining to range management differ by alternative and are analyzed in the Environmental Consequences section.

### *Roads*

Roads have wide-ranging effects on hydrologic processes and watershed function. The compacted surface of roads lowers infiltration capacity, which alters and concentrates overland flow and increases erosion and delivery of sediment to the stream system, which can degrade water and habitat quality (Furniss 1991). Roads can also intercept subsurface flow and convert it to rapid surface runoff, extending channel networks and increasing watershed efficiency (Wemple et al. 1996). Roads reduce vegetative cover in streamside areas and accelerate delivery of water and increase erosion and sedimentation into streams (Megahan, 1983). Accelerated erosion, runoff, and sediment delivery from roads increases streambed fine sediment, which affects aquatic habitat and macroinvertebrates, and makes streambeds and banks more susceptible to erosion during high flow events (Cover et al. 2006). At crossings, excessive flow velocities and undersized culverts can alter stream channel function and increase the risk of channel and crossing instability at high flows (Furniss et al. 1998). Other road-related impacts include reduced potential large wood available for in-channel wood and shade from riparian areas. Meredith et al. (2014) found the presence of roads adjacent to streams reduced adjacent in-channel wood.

Slope position of roads is a critical factor in the interaction between roads and streams. Ridge-top roads can influence watershed hydrology by channeling flow into small headwater swales, accelerating channel development. Mid-slope roads can intercept subsurface flow, extend channel networks, and accelerate erosion (Gucinski et al. 2001). Roads adjacent to and crossing streams, or hydrologically connected to streams have the greatest influence on streamflow, streamside shade, and accelerated sediment delivery to the stream system (Croke et al. 2005). Hydrologically connected roads (portions of roads that route water and/or sediment directly to the stream system) increase flow routing efficiency and can increase peak flows and sedimentation (Wemple et al. 1996). Roads also simplify adjacent channels and riparian and in-stream habitat, and prevent natural channel adjustments (Spence et al. 1996).

Several road metrics provide a means to assess the potential effects and risk of roads. Road density is often used as a measure of risk particularly in areas of active timber harvest (Lee et al. 1997, Sharma and Hilborn 2001). However, road density does not adequately assess the varying effects of roads across the landscape that are dependent on geology, precipitation, and location of roads in relation to the stream system (Lee et al. 1997). McCafferty et al. (2007) found a significant positive correlation between total road density, open road density, number of stream crossings, and fine sediment in streams. Traffic density on open roads can also present a larger erosion and sedimentation risk than closed roads. Reid and Dunne (1984) found that a heavily used road segment contributes 130 times as much sediment as a closed road.

The road indicator in watershed condition framework was calculated using open road density (road maintenance levels 2 to 5), proximity of roads to water, and the degree of road maintenance (Potyondy and Geier 2010). Results of the watershed condition framework for the roads and trails indicator show that roads are affecting hydrologic function across most of the Forest, with most subwatersheds rated as impaired for road indicators. In these subwatersheds the density and distribution of roads and trails indicate that there is a high probability that the timing, magnitude, duration, and spatial distribution of flows is altered by the road system.

Additional metrics to assess the existing condition of the road system on the Forest are presented here. Total miles of road on the Forest, road density, riparian road density by subwatersheds, estimates of hydrologic connectivity, and number and relative risk of stream crossings are presented in this analysis. Calculations in this analysis were performed using all open and closed roads (ML 1-5) roads regardless of jurisdiction within the Forest administrative boundary. Decommissioned roads were also included in this analysis because spatial data does not include detail on the level of hydrologic decommissioning completed on decommissioned roads. Therefore, decommissioned roads are assumed to have a continued effect on the hydrologic system. Since they are used for one-time access as needed in a single timber sale or associated project, temporary roads were not included in this analysis. However, temporary roads can have an impact on hydrologic and aquatic function if they are not properly removed and stabilized following use.

Road density and mileage numbers presented here use the metrics that best represent the effects of roads and relative risk to the hydrologic system, and provide a more focused analysis of road condition and relative risk than the road and trails indicator ratings from the watershed condition framework. Road mileage and densities presented here may be different from those contained in other forest plan revision documents. Additional calculations of road density using different criteria are presented by management area and watershed in the effects analysis section. Calculation methodology for this road density metric is described when the data are presented.

Total miles of road on the Forest are shown in table 94. There are total of 5,221 miles of roads under all jurisdictions within the Forest administrative boundary. Fifty-seven percent of roads are open, and 19 percent are non-forest system roads. Approximately 15 percent of the roads are located in RHCAs and two-thirds of the roads in RHCAs are open.

**Table 94. Miles of road on the Colville National Forest**

| Road Type | Miles | % of Total Road Miles | Miles in RHCAs | % of Total Road Miles |
|---|---|---|---|---|
| Total Existing Roads | 5,221 | 100% | 797 | 15% |
| Open | 2,957 | 57% | 547 | 10% |
| Closed | 2,263 | 43% | 250 | 5% |

Road density of open and closed roads was computed at the subwatershed scale for all subwatersheds with greater than 25 percent of land within the Forest administrative boundary. Road density and riparian road density in each subwatershed was categorized based on relative risk, where less than 1 mile per square mile is good, 1 to 2.4 miles per square mile is fair, and greater than 2.4 miles per square mile is poor condition (Potyondy and Geier 2010). Road density and road density in riparian areas is shown in table 95. Road densities across subwatersheds on the Forest are generally in the fair to poor categories; only 5 subwatersheds have road density of less than 1 mile per square mile, and 57 percent of subwatersheds have road densities greater than 2.4 miles per square mile. Road densities in riparian areas are higher than general road densities; 73 percent of subwatersheds have riparian road densities greater

than 2.4 miles per square mile, and only 4 subwatersheds have riparian road densities less than 1 mile per square mile.

**Table 95. Subwatersheds categorized by road density and riparian road density**

| Road Density Category | | Number of subwatersheds in each road density category | |
|---|---|---|---|
| Road Density | Road Density Condition Rating | Total Road Density | Riparian Road Density |
| less than 1 mi/mi$^2$ | Good | 5 | 4 |
| 1-2.4 mi/mi$^2$ | Fair | 27 | 16 |
| >2.4 mi/mi$^2$ | Poor | 43 | 55 |
| Total | | 75 | 75 |

Hydrologically connected roads and crossings are a higher risk to the stream system than mid-slope and ridgetop roads because they deliver water and sediment directly to the stream system. Several tools and models can be used to assess the relative hydrologic risk of the road system, and determine the location of roads were risk could be minimized through focused restoration and road improvements. One tool is the field and model based Geomorphic Road Analysis and Inventory Package (GRAIP). Road sediment delivery data collected across four watersheds in the Pacific Northwest using GRAIP, including the NF Suislaw and North Fork John Day watersheds in Oregon and the Bear Valley and the MF Payette watersheds in Idaho, found that 2 to 10 percent of road drain points (depending on watershed) deliver 90 percent of sediment from the road to the stream system (GRAIP 2014). Results of this analysis suggest that when the location and relative sediment production and delivery of high-risk roads is known, treatments can focus on a relatively small percentage of the road system to reduce hydrologic impacts.

There are an estimated 2,285 road/stream crossings across the Forest. Relative risk of sediment delivery to the stream system from the crossings was assessed using length and gradient of road on each side of the crossing approach. Number of crossings and relative risk are shown in table 96. Fifty-four percent of crossings on the Forest are at high risk for sediment delivery.

**Table 96. Number of crossings and relative risk of sediment delivery**

| # of Crossings | Crossing Risk |
|---|---|
| 350 | Low |
| 694 | Medium |
| 1,241 | High |
| **2,285** | **Total** |

Crossings and roads within RHCAs were used to estimate hydrologic connectivity of the road system. There are an estimated 862 miles of hydrologically connected road across the Forest (17 percent of the road system). These roads have the highest risk of sediment delivery and other impacts to the stream system and are the primary focus of road treatments to improve hydrologic function and aquatic habitat across the Forest.

Some of the effects of roads to watershed function can be mitigated through road design and location (Furniss et al. 1991), implementation of BMPs, and treatments to reduce erosion and hydrologic connection of roads to the stream system. Treatments including road surfacing, improvement of road drainage through construction of waterbars or drainage dips, and seasonal closures to prevent road

damage during wet weather can reduce erosion and sedimentation (Burroughs and King 1989, and Bilby et al. 1989). Hydrologic road decommissioning is also an effective method to restore hydrologic function on roads that are no longer needed for access or forest management. While road decommissioning treatments have been found to reduce erosion and sedimentation, the technique does not eliminate all road related sediment delivery to streams (Madej 2001), and erosion and sedimentation may increase in the first two-three years after treatment (Luce et al. 2001). Other road maintenance activities can increase short-term sediment routing to streams through the exposure of additional soil, alteration of slope stability in cut and fill areas, removal of vegetation, and alteration of drainage patterns (Reid and Dunne 1984, Luce and Black 2001).

Effectiveness of road treatments is dependent on type of treatment, erosion rates, and timing and amount of precipitation. While road decommissioning is usually the most effective method to reduce road hydrologic risk, simply closing the entrance to a road does not reduce hydrologic risk. Full hydrologic decommissioning, including removal of culverts, de-compaction of road surface, and return to natural land contour (if needed) are the most effective treatments to reduce road hydrologic risk.

Effectiveness of hydrologic road decommissioning and storm damage risk reduction (SDRR) treatments was evaluated across the Pacific Northwest using GRAIP (Nelson et al. 2012; Cissel et al. 2014). Road decommission was monitored on 68 km of road and hydrologic connectivity was reduced by 58 percent, and sediment delivery was reduced by 64 percent. SDRR treatments were monitored on 86 km of road and hydrologic connectivity was reduced by 9 percent, and sediment delivery was reduced by 51 percent. Post-storm inventories of decommissioned and control roads found that connectivity was reduced by 44 percent and fine sediment delivery was reduced by 80 percent. Roads treated through SDRR showed a 67 percent reduction in fine sediment delivery, but an 11 percent increase in hydrologic connectivity post storm.

While there are numerous treatments to mitigate the hydrologic effects of roads, not all effects of roads are preventable. A 1983 study in northwestern California showed that 24 percent of road-related erosion could have been prevented from conventional engineering techniques, with the remaining 76 percent of erosion caused by site condition and road location (McCushion and Rice 1983). Although this study was only on 344 miles of road, it illustrates the concept that the mere existence of roads increases erosion and sedimentation and supports the practice of full decommissioning of the road prism to minimize risk. GRAIP effectiveness monitoring shows that decommissioning treatments were more effective in reducing sediment delivery and road hydrologic connectivity than SDRR treatments (Nelson et al. 2012).

## Watershed Restoration and Monitoring

Over the last two decades, watershed restoration and has become a larger focus of land management across the National Forest System. New direction on watershed restoration since the 1988 Land Management Plan is a primary need for change addressed in this forest plan revision.

### *INFISH*

The 1988 Colville Forest Plan was amended by the Inland Native Fish Strategy (INFISH; USDA 1995) which provides additional direction intended to restore and maintain the ecological health of watersheds and aquatic ecosystems on National Forest lands for native resident fisheries. INFISH was implemented in response to the potential listing of resident fish species under the Endangered Species Act (ESA). INFISH prescribed riparian management objectives (RMOs) and designated priority watersheds. RMOSs are discussed in greater detail in the fisheries analysis section. INFISH designated priority watersheds as those “Watersheds having excellent habitat or strong assemblages of inland native fish, particularly bull trout, or watersheds that provide for population distribution goals, or watersheds having a high restoration potential” (USDA FS, INFISH EA). Priority watersheds are a long-term, strategic network of watersheds

that serve as strongholds for native fishes and provide high-quality water. Priority watersheds under INFISH were originally designated in 1995 and were amended in 2001. INFISH-designated priority subwatersheds for the Colville National Forest are shown in the following table.

**Table 97. INFISH priority watersheds on the Colville National Forest designated at the subwatershed scale**

| Subwatershed Name | Subwatershed Number |
|---|---|
| Cedar Creek | 170102161003 |
| East Branch Le Clerc Creek | 170102160203 |
| Exposure Creek-Pend Oreille River | 170102160103 |
| Harvey Creek | 170102160303 |
| Headwaters Sullivan Creek | 170102160304 |
| Headwaters South Salmo River* | 170102160702 |
| Middle Creek-Pend Oreille River | 170102160301 |
| North Fork Sullivan Creek-Sullivan Creek | 170102160305 |
| Outlet South Salmo River* | 170102160704 |
| Skookum Creek | 170102160202 |
| Slate Creek | 170102160306 |
| Sweet Creek-Pend Oreille River | 170102160302 |
| West Branch Le Clerc Creek | 170102160202 |

Riparian habitat conservation areas (RHCA) widths in priority watersheds under INFISH are wider than RHCA widths in non-priority watersheds for non-fish-bearing intermittent streams and wetlands less than 1 acre (table 98). INFISH did not specify additional more-restrictive standards or guidelines for priority watersheds.

**Table 98. Differences in RHCA widths for INFISH priority and non-priority watersheds**

| | INFISH RHCA Designation for non-priority watersheds | INFISH Priority Watershed RHCA designation |
|---|---|---|
| Non-fish-bearing intermittent | 50 | 100 |
| Wetland less than 1 acre | 50 | 100 |

## Aquatic Restoration Strategy

The Region 6 Aquatic Restoration Strategy (ARS) was originally developed in 2005 to provide guidance for watershed and aquatic and riparian condition improvement at a regional scale through both passive and active restoration techniques (USDA Forest Service 2005). Passive restoration is the broad-scale natural recovery of the aquatic ecosystem and includes coordination, analysis, planning, and design activities to maintain or improve habitat conditions while implementing projects across multiple resource areas (USDA Forest Service 2005). Examples include implementation of best management practices, designation of riparian habitat conservation areas (or riparian management areas), compliance with laws, regulations, permits, and plans, interagency coordination, monitoring, and adaptive management. Active restoration includes management actions with the specific goal of restoring the processes that improve aquatic and riparian habitat function. Active restoration is focused on a more limited scale than passive restoration.

ARS prioritized basins for aquatic restoration based on modeling of aquatic resource condition, watershed sensitivity, and sensitivity to management (USDA Forest Service 2005). Through the basin prioritization process, the Upper Columbia basin was designated as high priority and the Pend Oreille and Spokane basins were designated as low priority basins. Since the prioritization of these basins, there is recognition that the basin scale is meaningful for planning at the regional scale, but it may not reflect restoration goals at the scale of individual forests (MacDonald, personal com).

Through the ARS, the Forest identified 3 focus watersheds to focus active restoration (table 101). Focus watersheds were identified in 2008 based on the need for watershed restoration to improve aquatic habitat condition, function, and water quality, the presence or potential presence of native fish populations, partnership potential and planned or completed NEPA documentation for restoration.

**Table 99. Focus 5th field watersheds on the Colville National Forest**

| Watershed Name | Watershed Number |
|---|---|
| Le Clerc Creek-Pend Oreille River | 1701021602 |
| Upper Sanpoil River | 1702000401 |
| Chewelah Creek-Colville River | 1702000301 |

In partnership with the Okanagan National Forest and the Colville Confederated Tribes, the Forest completed a watershed action plan (WAP) for the Upper and West Forks of the Sanpoil River in 2012 (SWAP 2012). The LeClerc Creek Watershed Action Plan (Hickenbottom et al. 2009) was completed in 2009. These watershed action plans describe limiting factors to structural and biological aquatic function and prioritize aquatic restoration projects for the improvement of water quality, watershed function, aquatic habitat, riparian function and structure (Hickenbottom et al. 2009, SWAP 2012). A WAP for the Chewelah Creek-Colville River watershed has not yet been completed.

## Watershed Condition Framework

In 2010, national forests throughout the U.S. were mandated to implement the Watershed Condition Framework process, with the goal of identification of current conditions of subwatersheds on NFS lands. The results of the assessment were used to identify priority subwatersheds where focused management over a 5- to 10-year period could improve constituent elements that impair watershed function. The watershed condition framework process and results are discussed in greater detail in the Existing Condition section. The Forest identified 3 priority watersheds through this process (table 101), and completed watershed action plans outlining essential project to improve watershed condition for 3 priority watersheds, in 2011 and 2012, including West Branch LeClerc Creek, East Branch LeClerc Creek, and Ninemile Creek (CNF 2011 2012(a and b)). Completion of essential projects within these subwatersheds is currently in progress. Essential projects in the East Branch LeClerc subwatershed are scheduled for completion in 2016. Once essential projects in existing subwatersheds are completed, additional priority subwatersheds would be identified.

**Table 100. Priority watersheds on the Colville National Forest**

| Subwatershed Name | Subwatershed Number |
|---|---|
| West Branch LeClerc Creek | 170102160202 |
| East Branch LeClerc Creek | 170102160203 |
| Ninemile Creek | 170200040107 |

## Summary of Existing Priority Watersheds

The watershed hierarchy of existing focus and priority watersheds for restoration is shown in the following table.

**Table 101. Summary of existing priority and focus watersheds**

| Focus Watershed Name (Designated through ARS) | Priority Subwatershed Name (Designated by INFISH and watershed condition framework) | INFISH Priority Subwatershed | Watershed Condition Framework Priority Subwatershed |
|---|---|---|---|
| Chewelah Creek-Colville River | N/A | | |
| Upper Sanpoil River | Ninemile Creek | | X |
| Le Clerc Creek-Pend Oreille River | West Branch LeClerc Creek | X | X |
| | East Branch LeClerc Creek | X | X |
| | Cedar Creek | X | |
| | Exposure Creek-Pend Oreille River | X | |
| | Harvey Creek | X | |
| | Headwaters Sullivan Creek | X | |
| | Headwaters South Salmo River | X | |
| | Middle Creek-Pend Oreille River | X | |
| | North Fork Sullivan Creek-Sullivan Creek | X | |
| | Outlet South Salmo River | X | |
| | Skookum Creek | X | |
| | Slate Creek | X | |
| | Sweet Creek-Pend Oreille River | X | |

## Aquatic and Riparian Conservation Strategy

The Aquatic and Riparian Conservation Strategy (ARCS) was developed by Forest Service Region 6 in 2008 to consolidate management direction from the Northwest Forest Plan, PACFISH, INFISH, and ARS into a framework document to be used in forest plan revision. ARCS includes five elements including; designation of riparian management areas (RMAs), designation of a key watershed network, mid-scale analysis of watersheds, watershed restoration, and monitoring. The interaction of these five elements forms the basis for watershed, aquatic, and riparian ecosystem management and restoration (USDA Forest Service 2008).

Scientific studies completed after the initiation of the Northwest Forest Plan, PACFISH, and INFISH support their assumptions and general framework, however, there was a need for a unified aquatic conservation strategy that incorporated new science and addressed and clarified issues identified through more than a decade of field-level implementation (Naiman and Bilby 2000, Spence et al. 1996, Reeves 2006, Heller and McCammon 2004). Providing refinement to earlier strategies is the primary basis for the development of ARCS. ARCS includes better recognition of the role of disturbance in building ecosystem resiliency, consideration of scale effects on ecosystem processes, confirmation of the value of watershed-scale analysis, the need for better monitoring, and better establishment of the linkage between management intent and aquatic strategy.

Most alternatives in this forest plan revision use ARCS as the framework for management of hydrologic and aquatic resources, however ARCS-modified plan components are included in alternatives R and P.

### *ARCS-Modified*

The ARCS supports forests adding specificity and local detail to tailor management of watersheds and riparian resources to local systems and conditions. As forests work through a public and internal collaborative process, plan components may be added to those provided in ARCS that are forest-specific and science-based (USDA Forest Service 2008).

Based on public and internal comments, best available science, and new policies on Forest Service management of aquatic and riparian resources, including the Watershed Condition Framework, plan components in ARCS were updated in alternatives P and R. The updated plan components are referred to as "ARCS-modified." ARCS-modified plan components were updated based on discussions with the Forest Plan interdisciplinary team, resource specialists in the Pacific Northwest regional office, and other reviewers of the draft forest plan.

Most of the updates made to ARCS plan components ARCS-modified add clarity to individual plan components (i.e., guidelines worded properly as guidelines, standards worded as standards). The interdisciplinary team also considered operational constraints in the evaluation of each standard and guideline within ARCS. Specific differences between ARCS and ARCS-modified are discussed in the environmental consequences section.

During the forest plan revision process, the terms "ARCS" and "ARCS-modified" are used to distinguish differences in aquatic and riparian direction between alternatives. Once a revised forest plan decision is signed, the terms ARCS and ARCS-modified will no longer be used. The plan components and aquatic direction within ARCS will become part of the revised forest plan.

## Water Quality, Quantity, and Uses

Water quality and water uses on the Forest are managed cooperatively with other State and Federal agencies responsible for preservation and management of water quality, and quantification and management of water rights and uses. In Washington, Water Resources Inventory Areas (WRIAs) are the administrative and planning boundaries used by State agencies as the basis and scale for management of water quality, water uses and rights, and management of fish and wildlife. WRIAs were formalized under WAC 173-500-040 and authorized under the Water Resources Act of 1971, RCW 90.54. The Washington Department of Ecology (Ecology) has the responsibility for development and management of designation and management of WRIA administrative and planning boundaries (WADoE 2014(d)). There are seven WRIAs that contain the Forest administrative boundary. Generally WRIAs follow subbasin boundaries, however, the Franklin D. Roosevelt subbasin is divided into the Upper Lake Roosevelt and Middle Lake Roosevelt WRIAs.

**Table 102. Crosswalk between subbasins and WRIAs on the Colville National Forest administrative forest**

| Subbasin | WRIA Name | WRIA Number |
|---|---|---|
| Pend Oreille River | Pend Oreille | 62 |
| Upper Columbia River—FDR Lake | Upper Lake Roosevelt | 61 |
| | Middle Lake Roosevelt | 58 |
| Colville River | Colville | 59 |
| Kettle River | Kettle | 60 |
| Sanpoil River | Sanpoil | 52 |
| Upper Spokane | *Little Spokane | 55 |

*There is no Colville National Forest ownership within the Little Spokane WRIA.

## Water Quality

Water produced on the Forest is generally of high quality; research on the effects of land management has shown that water quality in undisturbed forests is usually good. In managed watersheds, water quality is affected by land-use practices (USDA FS 2000). The most widespread pollutants of concern on the Forest are fecal coliform bacteria and temperature. High summer air temperatures during summer low-flows and reduction in stream shading can increase summer stream temperature. Fecal coliform levels are elevated from both native mammals and livestock grazing both on and off NFS lands. Dissolved oxygen and pH are also pollutants of concern but are not as widespread as fecal coliform and temperature.

Sediment is also considered a pollutant if high levels of fine sediment accumulation are affecting aquatic habitat and channel function. Fine sediment accumulation is a natural channel function and varies based on geology, streamflow, and channel gradient (Montgomery and Buffington 1997). Accumulation of fine sediment is evident in some streams on the Forest from localized bank erosion and roads.

## Best Management Practices

Preventing water quality impacts is more effective than restoring damage from management activities. Implementation and monitoring of Best Management Practices (BMPs) is the fundamental basis of the Forest Service water quality management program to protect, restore, or mitigate water quality impacts from activities on NFS lands (USDA Forest Service 2012). BMPs are methods, measures, or practices to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19). Site-specific BMPs are implemented at the project level using WA forest practices rules (222 WAC), regional guidance (USDA FS 1988), forest plan direction, and national BMP guidance.

Implementation and effectiveness monitoring of BMPs has been completed across project activities on the Forest since the development of regional BMPs, however monitoring completed at the project scale was not integrated into a larger program of consistent BMP monitoring and reporting. The Forest Service's national BMP program was established in 2012 to establish consistent direction for BMP implementation to control non-point source pollution on NFS lands to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources and meet the intent of State and Federal water quality laws and regulations, executive orders, and USDA and Forest Service directives. The national BMP program also establishes a consistent process to monitor, evaluate, and report implementation and effectiveness of BMPs in the protection of water quality at multiple scales (USDA Forest Service 2012).

BMP implementation and effectiveness has been systematically monitored across National Forest Lands in California since 1992, using protocols similar to the more recent national BMP protocols. From 2008 to 2010, randomized monitoring showed 91 percent of BMPs were implemented, and 80 percent of implemented BMPs were rated effective. BMPs for timber harvests, fuels treatments, and vegetation management were consistently highly effective, while BMPs for other activities, including roads, range management, recreation, and mining, were less effective (USDA Forest Service 2013). At sites where BMPs were not implemented or effective the monitoring program includes a strong feedback loop to take corrective action on non-compliance scenarios.

BMP monitoring completed on the Forest since 2012, using the national BMP protocol indicate that most projects monitored were implemented correctly, and that BMPs were generally effective in protecting water quality. When BMPs were not implemented correctly, monitoring provided the feedback to implement corrective actions where needed to improve future BMP implementation and effectiveness (Colville National Forest 2013).

Water quality across streams in the Forest has improved in recent years as a result of changes in management from INFISH direction, implementation of best management practices (BMPs), direction

from the Regional Aquatic Restoration Strategy, fish recovery plans, and increased emphasis on watershed restoration and partnerships. The Forest has been working on grazing allotments to implement BMPs including off-stream watering, and riparian exclusion fencing. In addition, the Forest has worked to restore riparian areas, stabilize stream banks, and implemented measures to prevent off-highway vehicle use near streams and wetlands (CNF 2013).

## Beneficial Uses and the Clean Water Act

The principal law governing pollution in the Nation's streams, lakes, and estuaries is the Federal Water Pollution Control Act (P.L. 92-500, enacted in 1972), commonly known as the Clean Water Act (CWA). The CWA is the primary Federal law that protects the Nation’s waters, including lakes, rivers, aquifers and coastal areas from point and non-point source pollution. The primary objective of the CWA is to restore and maintain the integrity of the nation's waters through regulation of point and non-point source water pollution.

Through the CWA, each state is required to provide guidance and direction for the protection and restoration of water bodies (40 CFR 131.12). In Washington, the United States Environmental Protection Agency (EPA) has designated authority for compliance with the CWA to The Washington Department of Ecology (WADoE). As required under the CWA, Ecology identified beneficial uses and developed water quality standards to protect beneficial uses. Water quality standards for the primary pollutants on streams and rivers across the Forest are shown in table 103. Designated beneficial uses established for national forests, wilderness areas, and national parks in Washington include (WAC 173-201A-200; Baldwin 2006):

- Salmon and trout spawning, core rearing and migration
- Extraordinary primary contact recreation
- Domestic, industrial, and agricultural water supply
- Stock watering
- Wildlife habitat
- Harvesting (fish, etc.)
- Commerce and navigation
- Boating
- Aesthetic values

**Table 103. Water quality standards for waters of the Colville National Forest (WAC 173-201A-200)**

| Parameter | Standard |
|---|---|
| Temperature | 16°C (60.8$^0$F) (7 day average of daily maximum temperature) |
| pH | 6.5-9.0* |
| Fecal Coliform | geometric mean above 50 colonies per 100 milliliters with the 90$^{th}$ percentile of the samples not exceeding 100 colonies per 100 milliliters |
| Dissolved Oxygen | 9.5 mg/L (lowest 1-day minimum) |
| Total Dissolved Gas | Shall not exceed 110% of saturation at any point of sample collection |
| +Turbidity | 5 NTU over background when background is 50 NTU or less. A 10% increase in turbidity when background turbidity is more than 50 NTU. |

*Based on naturally occurring dissolved calcite from regional limestone geology, the upper range of the standard for pH was raised from 8.5 to 9.0 (Whiley and Baldwin 2005).

+ Sediment in water bodies fits into two categories; suspended sediments (measured and regulated by the turbidity standard), and bedded sediments. There is no approved water quality standard for sediment in Washington. Bedded sediments are difficult to regulate and implement without site specificity on background erosion rates (Seeds and Foster 2010).

Section 303(d) of the Clean Water Act and EPA regulation (40 CFR 130.2(J), and 130.7), delegates the authority to list waters that do not meet water quality standards or beneficial uses to individual states. Washington determines its 303(d) list through the water quality assessment (WQA) process. Once a water body is listed as impaired on the 303(d) list, it is Ecology's responsibility to develop a Total Maximum Daily Load (TMDL) for each pollutant of concern. A TMDL is a quantitative plan and analysis procedure for attaining and maintaining water quality standards and specifies the total load of pollutant a waterbody can carry and still meet beneficial uses. The TMDL and associated Water Quality Implementation Plan (WQIP) outline the process through which beneficial uses can be met through the identification of sources of pollutants, and actions that lead to improved water quality (40 CFR 130.2(H)).

A 2000 Memorandum of Agreement (MOA) between Ecology and Region 6 of the U.S. Forest Service designates the Forest Service as the management agency for meeting CWA requirements on NFS lands. Through this MOA, the Forest Service is responsible for ensuring that all waters on NFS lands meet or exceed water quality laws and regulations and that activities on NFS lands are consistent with protections provided in Washington Administrative Code and relevant state and water quality requirements (USDA FS and WADoE 2000). The MOA recognizes the contribution of existing Forest Service direction, including the Interior Columbia Basin Ecosystem Management Project (ICBEMP), INFISH, and BMPs in meeting water quality laws and regulations, and states that the Forest Service and Ecology will collaborate to address 303(d) listings through the development of TMDLs and WQIPs (USDA Forest Service and WADoE 2000). While the 2000 MOA has not been updated, the Forest Service and Ecology continue to manage CWA compliance under MOA.

The 2008 Water Quality Assessment (WQA) and 303(d) list was approved by EPA Dec. 21, 2012 (U.S. EPA 2012). The 2008 WQA and 303(d) list is considered the '2012 Water Quality Assessment' to reflect when the assessment was approved rather than when the assessment was scheduled for completion (WADoE 2014(b)). The 2012 WQA 305(b) list and 303(d) list contains 42 stream reaches on the Forest that do not meet water quality standards and includes all impaired stream segments added to the 303(d) list since 2004 that are not under an approved TMDL (WADoE 2014(a, b, and f)). Impairment pollutants include fecal coliform bacteria, dissolved oxygen, pH and temperature. Portions of Big Muddy Creek, Brown's Creek, Buck Creek, Middle and North Fork Calispell Creek, Cedar Creek, Cee Ah Creek, Cottonwood Creek, East Deer Creek, Exposure Creek, Fisher Creek, Halfmoon Creek, Harvey Creek, Lambert Creek and an unnamed tributary, East, West, Middle, and main stem LeClerc Creek, North Fork and main stem Lone Ranch Creek, Lost Creek, McAhee Creek, Meadow Creek, Mill Creek, Pend Oreille River, Ruby Creek, Sandwich Creek, North Fork, South Fork, and main stem Sherman Creek, South Fork and main stem Skookum Creek, Slate Creek, Smackout Creek, North Fork St. Peter Creek, North Fork and main stem Sullivan Creek, Tacoma Creek, and Wilson Creek are on the 2008 303(d) list. Bead Lake is the only lake on the Forest on the 303(d) list and is listed for PCBs and dioxins found in fish tissue samples.

To meet the goals outlined in the MOA and comply with the CWA, Ecology began working with the Forest in 2002 on a TMDL for temperature, bacteria, pH, and dissolved oxygen and Water Quality Implementation Plan (WQIP) (WADoE 2006) for waters across the Forest on the 1998 303(d) list. EPA approved the TMDL and WQIP for fecal coliform on 8 waterbody segments and temperature on 4 segments from the 1998 303(d) list as well as 41 temperature-impaired waterbody segments added to the 303(d) list during the TMDL development process in 2005 (EPA 2005, Whiley and Baldwin 2005). The TMDL for pH and dissolved oxygen was not approved at this time because the submittal report lacked some of the required components in the dissolved oxygen and pH analysis (Baldwin 2006). EPA also approved a TMDL for the Colville River and its tributaries for fecal coliform in 2003 (Coots 2002, Murray and Coots 2003, Baldwin 2005). There are several stream segments on the Forest included in the Colville River TMDL.

Although water bodies added to the 303(d) list since TMDLs and WQIPs were finalized are not included in the TMDLs, they are included in monitoring plans on the Forest (discussed below). Miles of stream by pollutant by subbasin covered under TMDLs and WQIPs, and not covered under TMDLs and WQIPs are shown in table 104.

**Table 104. Miles of stream by pollutant by subbasin on the Colville National Forest under an approved TMDL and WQIP, and miles of stream on the current 303d list not specifically covered under at TMDL and WQIP (WADoE 2014(a))**

| | Pollutant by Miles of Streams Covered under a TMDL and WQIP (*Category 4a) | | Pollutant by Miles of Streams not Specifically Covered under a TMDL or WQIP (*Category 5) | | | |
|---|---|---|---|---|---|---|
| **Subbasin** | **Bacteria** | **Temperature** | **Bacteria** | **Temperature** | **pH** | **DO** |
| Colville | 8.5 | 2 | 0.2 | 1.4 | 0 | 0 |
| Franklin D Roosevelt Lake | 2.0 | 0 | 0 | 7.5 | 2.4 | 0.6 |
| Kettle | 2.0 | 0.8 | 0.8 | 2.8 | 1.4 | 1.3 |
| Pend Oreille | 0 | 2.2 | 2.2 | 3.3 | 11.0 | 20.1 |
| Sanpoil | 0 | 0 | 0 | 0 | 0 | 0 |
| Little Spokane | 0 | 0 | 0 | 0 | 0 | 0 |

* Category 4a waters have known pollution problems that have an approved TMDL being actively implemented. Category 5 waters are classified as polluted waters that require a TMDL or WQI plan and are traditionally known as the 303(d) list.

The Forest is working to reduce fecal coliform bacteria from varied sources, including recreation and livestock grazing. Outhouses in developed campgrounds have been replaced and sealed vault toilets have been installed at select dispersed recreation sites further from surface waters (Baldwin 2005). Work also continues to improve BMPs on active grazing allotments, including installation of off-stream watering and fencing (WADoE 2013(a)). In compliance with the WQIP, the Forest has monitored 13 streams annually for fecal coliform bacteria following procedures described in the Quality Assurance Project Plan in the TMDL (Baldwin 2006). A 2013 assessment of 10 years of fecal coliform monitoring results determined that six streams continually met the fecal coliform standard, and one stream met standards most years. These seven streams were removed from the monitoring program, and a 2014 request was made to remove these streams from the TMDL. Nine additional monitoring sites were added across the Forest in 2013 (WADoE 2013(a)).

In 2013, Ecology concluded that the Forest has made significant progress in the last eight years toward meeting the requirements of the bacteria TMDL and improving water quality on the Colville National Forest. Based on monitoring and restoration progress toward meeting fecal coliform standards, the final target date to reduce bacteria concentrations to meet water quality standards has been extended from October 2013 to October 2018 (Colville National Forest 2014). Monitoring and restoration activities will continue with the goal of meeting the fecal coliform standard by 2018.

The Forest is also working to monitor and improve temperature in impaired stream reaches. The WQIP and TMDL requires temperature monitoring and compliance at 37 sites by 2056. The Forest has temperature data for 78 streams with varying years of data. A subset of these 78 temperature monitoring sites are on temperature-impaired streams. Progress continues to increase temperature monitoring sites and to improve the processes that impair stream temperature.

The majority of waterbodies across the Forest meet water quality standards and support designated beneficial uses, however the current 303(d) list and TMDLs do not necessarily include all the streams

across the Forest where water quality may be impaired. Many streams do not have the monitoring data to determine if water quality is impaired. Protection measures for activities with the potential to impact water quality, including BMPs and forest plan standards and guidelines that focus on riparian areas and other vulnerable areas ensure that waters of the Forest will continue to be of high quality. Focused restoration activities to improve hydrologic processes will continue to preserve and improve water quality where needed. Those waterbodies that do not meet these goals are monitored, and WQIPs and TMDLs are in place to improve conditions.

## Water Quantity and Uses

In the Columbia River basin, an estimated 38 percent of water yield originates from National Forest lands (Sedell et al. 2000). This water is valued from ecological, economic, social, and cultural purposes. Water from National Forests is used for both consumptive and non-consumptive uses for defined purposes recognized by Federal and state agencies. This section describes both consumptive and non-consumptive water uses across the Forest.

## Instream Flows

The Washington Department of Fish and Wildlife (WDFW) is responsible for recommending instream flows for watershed planning, administration of water rights, and protection of fish and wildlife (WAC 75), and Ecology is required to maintain instream flows sufficient to protect and preserve beneficial uses (RCW, 90.54 and 90.22). Instream flows are defined by Ecology as a specific streamflow level (cfs) at a specific location on a given stream. Instream flows change from month to month and protect a quantity of streamflow for instream resources (WADoE 2013(b)). WDFW more narrowly describes instream flow as flows needed to protect stream habitat (Wald 2009). Generally, in-stream flow requirements are set only when a potential or existing project affects flow in a river system, the impacts of altered flow on instream resources is evaluated using accepted instream flow study guidelines (WDFW and WDoE 2004). WDFW recommends, requests, or requires, as applicable minimum instream flows that:

A. Protect full fish and wildlife potential;

B. Maintain riparian and instream wildlife habitat;

C. Manage water use and allocation to provide channel forming and maintaining flows;

D. Protect hyporheic flows;

E. Maintain fish passage and safe downstream fish migration;

F. Provide mitigation for, or enhancement of adversely affected fish and wildlife habitat to ensure “no net loss” of function and value;

G. Provide habitat for desirable aquatic non-game wildlife species, even in streams without populations of fish;

H. Preserve future enhancement and/or compensation options where potential fish habitat is unused because of barriers to immigration;

I. Avoid adverse impacts on estuarine and marine habitats; and

J. Provide connectivity of channel processes such as movement of sediment and debris.

WDFW also recognizes the importance of high flows for providing geomorphic conditions for fish migration and spawning, including transport of sediment and organic matter, maintenance of channel geometry, formation of new channels, and creation of meanders, and side channels (Wald 2009).

## Source Water Protection Areas

Source water is untreated water from streams, rivers, lakes, or underground aquifers that is used to provide public drinking water, and to supply private wells used for human consumption (U.S. EPA 2012). A source water protection area is the land area contributing to a public water system where potential contamination could affect drinking water supply.

Many communities in northeastern Washington rely on water from the Forest for drinking. The Safe Drinking Water Act is the 1974 Federal law that sets standards for drinking water quality. The law requires actions to protect drinking water and its sources, and sets national standards for drinking water to protect against naturally occurring and man-made contaminants (U.S. EPA 2012). A 1996 amendment to the Safe Drinking Water Act requires each state to implement Source Water Assessment Programs (SWAP). The SWAP program in Washington is administered by the state Department of Health Office of Drinking Water (ODW). There are four requirements under the SWAP program: (1) Delineation of source water protection areas that serve greater the 25 individuals for each source, (2) Inventory each source water protection area for potential contaminant sources, (3) Conduct a susceptibility assessment for each drinking water source, and (4) Make the findings available to interested parties (WA Dept of Health).

The SWAP program designates both surface and groundwater source water protection areas and classifies water systems as Group A and B. Group A is a designation specific to Washington and includes public use water systems large enough to be regulated by the Safe Drinking Water Act (those serving over 25 individuals). Group B public water systems serve fewer than 25 individuals (WA Dept of Health).

### *Surface sourcewater protection areas*

Surface source water protection areas are delineated by the upstream watershed that contributes to the point of use (WA Dept of Health). Waters of the Forest are upstream of surface water systems that service Cusick, Grand Coulee, Kettle Falls, Metaline, Metaline Falls, Orient, and Riverbend. Designated surface source water protection areas have also been delineated for water systems for Grand Coulee Dam, Forty Nine Degrees North Ski resort, and Columbia Cedar (Surface Water Protection spatial data). All surface water protection areas on the Forest provide water to Group A water systems.

### *Groundwater sourcewater protection areas*

There are 31 Group A and 51 Group B water systems that are groundwater-sourced within the Forest administrative boundary. One, 5, and 10-year time of travel wellhead protection areas are delineated by WA Dept of Health for all group A groundwater systems, and a 600-foot fixed radius is used as the wellhead protection boundary for group B systems.

## Forest Service Drinking Water Systems

The Forest manages 15 drinking water systems across the Forest at campgrounds and administrative sites. These include Noisy Creek, Lake Leo, Mill Pond, Swan Lake, Pierre Lake, Gillette, Panhandle, Sullivan Lake, Edgewater, Long Lake, South Skookum Lake, Pioneer Park, and Sherman Overlook campgrounds, Batey-Bould trailhead, and the Bead Lake boat launch..

## Water Rights

A water right is a legal authorization to use a certain amount of water for a specific purpose of use. Water rights in Washington are managed by Ecology. There are three types of water rights documents:

1) A “claim” is a claim to use water that predates the state’s water permitting system, the validity of which must be confirmed through judicial processes;

2) A “permit” is permission by the state to develop a water right and gives the permit-holder permission to proceed with construction of a water system to put water use;

3) A “certificate” is issued when all conditions of the permit have been met—and is a legal record of the water right. Certificates are appurtenant to the land on which the water is used (WADoE 2013(c)).

Data on water rights was summarized from spatial data obtained from Ecology. Figures presented in this analysis are estimates only. There are approximately 115 certificated water rights and 356 points of diversion in the name of the USDA Forest Service on the Forest. The Forest does not have any current claims, applications, or permits for which a certificate has not been issued. The primary purpose of use for consumptive rights on the Forest is livestock (table 105), with only 8 certificates for other uses. Total certificated storage volume is 477 acre-feet per year; certificated diversion volume is 4.55 cfs. A total of 17 irrigated acres also have certificated water rights. Water rights are concentrated in the drier western portion of the Forest.

**Table 105. Certificated water rights and points of diversion in the name of the Colville National Forest* by purpose of use and volume**

| Purpose of Use | # of Certificates | # of points of diversion | Certificated storage volume (acre-feet) | Certificated diversion (cfs) | Irrigated Acres |
|---|---|---|---|---|---|
| Livestock | 107 | 348 | 447 | 3.7 | |
| Domestic single/Irrigation | 1 | 1 | | 0.01 | 1 |
| Domestic multiple | 1 | 1 | | 0.05 | |
| Domestic multiple/irrigation | 2 | 2 | 19 | 0.54 | 15 |
| Domestic multiple/recreation beautification | 1 | 1 | 1 | 0.01 | |
| Domestic multiple/fire protection/recreation beautification | 1 | 1 | | 0.1 | |
| Domestic multiple/fire protection/irrigation | 1 | 1 | 4 | 0.1 | 1 |
| Domestic multiple/fire protection | 1 | 1 | 6 | 0.035 | |
| Total | 115 | 356 | 477 | 4.55 | 17 |

*Several certificates are in the name of the Kaniksu National Forest, but are located within and managed by the Colville National Forest.

There are approximately 536 certificated water rights in the name of others within the Forest administrative boundary. The largest consumptive uses within the Forest administrative boundary by volume are for domestic use, municipal use, irrigation, and power generation. Storage rights in the name of others within the Forest administrative boundary total 111,193 acre-feet. A total of 6,114 irrigated acres also have certificated water rights.

**Table 106. Certificated water rights within the Colville National Forest administrative boundary in the name of others**

| | Applications | Claims | Permits | Certificates |
|---|---|---|---|---|
| Total Number | 11 | 712 | 61 | 536 |
| Storage Volume (acre-feet) unless otherwise noted | 1700 gpm | 316,314 | 33,802 | 111,193 |
| Irrigated Acres | 480 | 36,327 | 98 | 6,114 |

Certificated water rights for consumptive uses in the name of the Forest Service within the Forest administrative boundary constitute less than 1 percent of both storage volume and irrigated acres of total certificated rights. The majority of water volume certificated for consumptive uses within the Forest boundary are in the name of others. Certificated water rights within the Forest administrative boundary are small in comparison to water yield from the Forest and consumptive uses downstream of the Forest. Water availability on lands off-forest are discussed in the Cumulative Effects section.

## Dams

The Forest currently administers four dams including the West Branch LeClerc Creek Dam, Little Twin Lakes Dam, and Big Meadow Lake Dam, Bayley Lake Dam. There are an additional five dams within the administrative boundary of the Forest that are owned by public utilities or local governments. Additional details on dams on the Forest are shown in table 107. Management of these dams does not vary by forest plan alternative, and management and mitigation of effects of these dams is expected to continue under all alternatives.

**Table 107. Dams on the Colville National Forest**

| Dam Name | Owner | Subbasin | Stream/River Name | Notes |
|---|---|---|---|---|
| Little Twin Lakes Dam | Colville National Forest (CNF) | Colville | Camp Creek | 70-acre reservoir maintained for recreation and fish and wildlife |
| Big Meadow Lake Dam | CNF | Franklin D Roosevelt Lake | Meadow Creek | 83-acre reservoir maintained for recreation and fish and wildlife |
| Bayley Lake Dam | CNF | Colville | Bayley Creek | Impounds Bayley Lake, a 17-acre reservoir, located on the Little Pend Oreille Wildlife Refuge. Lake is maintained for recreation, fish, and wildlife. Dam is on the Colville National Forest. |
| West Branch LeClerc Creek Dam | CNF | Pend Oreille | West Branch LeClerc Creek | Log crib dam that does not create impoundment; filled with fine sediment. Removal is an essential project in the WB LeClerc Watershed Action Plan |
| Metaline Falls Municipal Water Dam | Metaline Falls | Pend Oreille | Tributary to Sullivan Creek | Diversion dam supplying water to the Community of Metaline Falls |
| Boundary Dam | Seattle City Light | Pend Oreille | Pend Oreille | See text |
| Mill Pond Dam | Pend Oreille PUD | Pend Oreille | Sullivan Creek | Scheduled for removal in 2019 |

| Dam Name | Owner | Subbasin | Stream/River Name | Notes |
|---|---|---|---|---|
| Sullivan Lake Dam | Pend Oreille PUD | Pend Oreille | Harvey Creek/ Outlet Creek | Dam enhances the natural lake. Managed by Pend Oreille PUD for recreation, and water supply for interbasin transfers. |
| Box Canyon Dam | Pend Oreille PUD | Pend Oreille | Pend Oreille | See text |

### *Hydroelectric Dams*

There are three hydropower projects on the Forest, including Boundary Dam, the Sullivan Creek Water Supply Project, and Boundary Dam. In addition, though not within the Forest administrative boundary, all of the waters of the Forest eventually drain into Lake Roosevelt, on the Columbia River. Lake Roosevelt is impounded by the Grand Coulee dam—the largest power supplying dam in the United States. The Grand Coulee Dam generates 21 billion kilowatt-hours of electricity per year, supplying power to Washington, Oregon, Idaho, Montana, Wyoming, Colorado, California, Nevada, New Mexico, Utah, Arizona, and Canada (USBR 2014).

The Federal Energy Regulatory Commission (FERC) regulates all operating non-Federal dams that generate electrical energy. FERC licenses these projects and permits the dam owner to use public waters for energy generation. The license specifies the conditions for construction, operation, and maintenance of the project, is enforceable by FERC through fines or injunctions, and may be revoked for non-compliance (FERC Licensing 2014). Settlement agreements signed in conjunction with issuance of FERC licenses for Box Canyon Dam, Boundary Dam, and the surrender of the hydropower license for the Sullivan Creek Water Supply project, provide funds and comprehensive plans for restoration of hydrologic and aquatic resources on the Forest to mitigate effects from hydropower production

### *Box Canyon Dam*

Opened in 1956, the Box Canyon Dam is a gravity-type hydroelectric dam on the Pend Oreille River operated by the Pend Oreille PUD. The dam is 62 feet high, 160 feet long, and creates the Box Canyon Reservoir which stretches 55 miles to Albeni Falls Dam near the Idaho border. The dam impounds water draining an area of 24,900 $mi^2$ and has a surface area between 7,000 and 9,000 acres depending on pool elevation. The dam is capable of producing 62 MW of power. The Box Canyon Dam operates “run of river”—flows released from the project approximate the flows released upstream from the Albeni Falls Dam (Public Utility District No. 1 of Pend Oreille County). The Box Canyon Dam project occupies 190 acres on the Forest (Public Utility District No. 1 of Pend Oreille County).

The Box Canyon Dam was relicensed in 2005. Under the settlement agreement signed in 2010, the Pend Oreille PUD committed to a variety of treatments to improve hydrologic and aquatic function, and fisheries in tributaries of the Box Canyon reservoir. Most of these tributaries are on the Forest, and projects under this settlement agreement on Forest lands will be completed in collaboration with the PUD and other state and Federal partners (Public Utility District No. 1 of Pend Oreille County).

### *Boundary Dam*

The Boundary Dam on the Pend Oreille River is a concrete arch gravity-type hydroelectric dam that supplies more than one third of Seattle City Light’s Power and began operations in 1967. The dam is 340 feet high from its bedrock foot and is 740 feet long. The reservoir created by the dam is 17.5 miles long and extends to the base of the Box Canyon Dam. The reservoir created by the dam is 1,794 acres and drains an area of 25,200 $mi^2$ (FERC 2011). The dam has the capacity to produce 1040MW at peak

output—40 percent of the Seattle's electricity demands (Seattle City Light 2014(1)). The Boundary Dam project occupies 609 acres on the Forest (City of Seattle).

#### *Sullivan Creek Water Supply Project*

The Sullivan Creek Water Supply Project includes the Sullivan Dam, and Mill Pond Dam. The Sullivan Dam enhances the existing Sullivan Lake to a surface area of 1,240 acres. The area impounded by Mill Pond Dam covers a 63-acre area. The project occupies 522 acres on the Forest and will be operated under a special use permit with the Forest once mitigations in the settlement agreement for the surrender of the license of the project are complete. The Pend Oreille PUD purchased the project in 1959, including water rights, and obtained a FERC license (FERC 2011).

The application to relicense the Boundary Project was filed in 2009. In 2010, a joint offer of settlement for the Boundary Dam and Sullivan Creek water supply project was filed that proposed consolidation of the relicensing of the Boundary project and Pend Oreille PUD's surrender of license for the Sullivan Creek Project. The joint settlement agreement was signed by the City of Seattle, Pend Oreille PUD, the Kalispel Tribe, several state and Federal Agencies (including the Colville National Forest ), and two non-governmental organizations. FERC issued a 42-year license in 2013. As part of the settlement agreement, Seattle City Light committed $60 million to a 42-year program of watershed improvements including evaluation and improvement of passage for resident salmonids, improvement of aquatic habitat, fish stocking, groundwater well decommissioning, acquiring and managing land for wildlife, recreation enhancement, and enhancement and protection of cultural resources (FERC 2011; Seattle City Light 2014(b)). The FERC license for the Sullivan Creek project was surrendered and a settlement for the project was reached in 2010. The settlement agreement included changes in the timing of flow release of Sullivan Lake, an increase in lake elevation, installation of a cool water release pipe to allow colder water from the bottom of the lake to discharge into Sullivan Creek and the removal of Mill Pond Dam in partnership with Seattle City Light (WADoE 2014(d)).

### Need for Change

This analysis addresses the following needs to revise the 1988 forest plan:

- Accelerate improvement in watershed condition across the Forest. The current forest plan and amendments do not adequately provide integrated management direction to maintain and restore properly functioning watersheds that provide a range of benefits on and off the Colville National Forest within a meaningful timeframe. This is supported by best available science, the listing of bull trout (*Salvelinus confluentus*) under the Endangered Species Act (1988), designation of critical habitat for bull trout (2010), information provided by the bull trout recovery plan (2014), and the results of new assessment tools such as the national Watershed Condition Framework. Properly functioning watersheds provide stable and productive ecological systems and allow for conditions that support aquatic species viability and self-sustaining populations, contribute to the recovery and de-listing of threatened and endangered species, and restore stream systems that do not meet Washington State water quality standards (WADoE 2014(f)).
- Integrate watershed and aquatic strategies across the Forest. The existing Colville Forest Plan was completed in 1988, and was amended by the Inland Native Fish Strategy (INFISH; USDA 1995) in 1995. Since 1988, the Aquatic Restoration Strategy (ARS; USDA 2005), the Aquatic and Riparian Conservation Strategy (ARCS; USDA 2008) and the Watershed Condition Framework (WCF; Potyondy and Geier 2010) have been developed to reflect management direction recommended by current research and supported by regional and national policy. The ARS is a Forest Service Pacific Northwest Regional operational strategy that reinforces the foundation of existing forest plan strategies, including broad-scale passive restoration, and strategically-focused active restoration and

guides implementation through establishment of specific goals and objectives and a formal process for near-term active restoration. The 2010 National Watershed Condition Framework process evaluated current conditions at the subwatershed scale and identified priority subwatersheds where focused restoration could improve watershed condition on NFS lands. ARCS is a refinement of previous forest plan strategies (including the Northwest Forest Plan, PACFISH, and INFISH) incorporating key concepts from the ARS and WCF, and is intended to provide the core set of desired conditions, suitability, objectives, standards and guidelines for aquatic and riparian management. ARCS provides additional watershed direction intended to restore and maintain watershed conditions and processes that sustain a full range of ecosystem services and support beneficial uses of water, with a focus on protection and restoration of native anadromous and non-anadromous fisheries. Consistency and integration of new research and regional and national direction on restoration and protection of watershed and aquatic habitat and function will contribute to the restoration and maintenance of riparian and aquatic habitats and beneficial uses of water and increase resilience to disturbance.

- Address climate change implications and vulnerabilities. The existing forest plan does not address the potential effect of climate change. Recent scientific findings on climate change (Intergovernmental Panel on Climate Change [IPCC] 2014) have dramatically improved our understanding of how ecosystems have changed and are likely to change in the future. Changing climate conditions have affected ecosystem composition, structure, process, and spatial pattern, altering the character and distribution of habitats for key surrogate plant and animal species. In addition, climate change has altered, and will continue to alter disturbance regimes, including forest insects and diseases, fire, and hydrologic regimes. Future conditions may be more favorable to some undesired non-native plant, wildlife, and aquatic species (IPCC 2014). The full impact of climate change on ecosystems is uncertain, but an integrated management direction that provides flexibility to respond to a changing environment is needed to maintain or restore the resilience of the national forests in the face of these changes.

## Environmental Consequences

### *Methodology*

This section describes the analysis process to determine the environmental consequences to watershed function, water quality, and water uses from implementation of six forest plan alternatives. Environmental consequences are not site-specific at the broad-scale of forest planning, therefore several indicators will be discussed in qualitative terms based on best available science, and professional judgment. Quantitative analysis of potential effects is presented where appropriate and applicable. This section discusses the broad-scale environmental consequences and relative trends and provides a means to compare the potential effects of alternatives.

### *Assumptions*

- In estimation of effects of alternatives at the forest plan level, it is assumed that the kinds of management activities allowed under the prescriptions will occur to achieve the goals and objectives of each alternative. The actual location and design of treatments is not known, and will be determined through project-level, site-specific NEPA decisions. Therefore, this analysis refers to potential effects that could occur, but cannot be applied to specific locations. Effects analysis at the forest plan scale is useful for comparing alternatives, but cannot be applied to specific locations other than at the broad scale of management areas and ecological regions.

- Data representing forestwide conditions many not represent site-specific water quality, quantity, or watershed function. Additional site-specific analysis is needed at the project scale during implementation of this forest plan.
- Measurable objectives for water resources, key and priority watersheds, and RMAs identify priority treatment activities, extent (i.e., miles, acres, number of crossings improved), and timing of completion were developed in the forest plan revision process. Effects of meeting these objectives through the life of this forest plan are based on the assumption that forest budgets will remain relatively constant, but will vary from year to year. The actual rate of improvement of watershed condition is dependent on internal and partner financial contributions, and staffing levels.
- Forest plan guidelines provide guidance for carrying out projects and activities to achieve desired conditions and objectives. Guidelines do not force action, but provide design criteria that should apply when an action is being taken. Standards are mandatory constraints on project activities and are established to achieve desired conditions, mitigate or avoid undesirable effects, and meet applicable legal requirements. Standards provide strict design criteria, allowing no variation, whereas guidelines allow variation if the result would be equally effective to move toward achievement of desired conditions. Therefore, standards provide a greater assurance of specific protections than guidelines.
- Issues addressed in this analysis are those identified through the scoping process for the forest plan revision, and issues specific to hydrologic resources.
- Previously decommissioned roads were included in road calculations because full hydrologic closure of these roads is not certain. At the scale of the Forest, total mileage of previously decommissioned road makes up less than 1 percent of NFS roads.
- Estimates of primary vegetation management tools used in all alternatives are based on modeling of treatment by vegetation type (described in Day 2015). For each alternative, an estimated acres of treatment type per year by vegetation type is presented based on modeling. These figures are used as means to compare alternatives, and are not assumed to represent actual acres that will be treated. Vegetation management is not authorized under this document, and treatments will be evaluated in subsequent project-specific treatment. Differences in primary vegetation management tools used in each vegetation type vary by alternative and potential effects are broadly discussed by alternative. Since there is little variation in treatment type by alternative, potential indirect effects of vegetation treatments by alternative are discussed in terms of estimated (modeled) acres of treatment, and the acreage within each management area where vegetation treatment is authorized.

### *Spatial and Temporal Context for Effects Analysis*

The spatial bound for analysis of indirect effects is all lands within the Forest ownership boundary, and within the five subbasins with Forest ownership for cumulative effects. The temporal boundary of indirect and cumulative effects is 15 years, the estimate amount of time management would continue under the revised forest plan. Vegetation condition was modeled for 100 years. Climate change analysis to inform cumulative effects analysis uses projections for the 2040s and 2080s

## Summary of Effects

### *Restoration Priority and Focus Watersheds*

Priority and focus watersheds are the same across alternatives. Essential projects outlined in watershed action plans in priority and focus watershed would continue in all alternatives, however, restoration activities would be prioritized based on key watershed objectives in the proposed action and alternatives R, P, and O.

#### *Water Quality*

The Forest will continue to comply with the Clean Water Act in all alternatives. The Forest will continue to work with Ecology to implement the Colville National Forest TMDL and the TMDL for the Colville River through monitoring of fecal coliform and water temperature. As new streams on the Forest are added to the 303(d) list, they will be included, as funding and strategic project planning allows in the Forest's fecal coliform and temperature monitoring program. The memorandum of agreement (MOA) between Ecology and the Forest recognizes the contribution of existing Forest Service direction, including ICBEMP, INFISH, and BMPs in meeting water quality laws and regulations, and states that the Forest Service and Ecology will collaborate to address 303(d) listings through the development of TMDLs and WQMPs (USDA Forest Service and WADoE 2000).

Potential indirect effects of implementation of this forest plan on water quality vary by alternative, based on differences in goals, objectives, standards, and guidelines and are discussed in effects analysis by alternative.

#### *Grazing*

There are no proposed changes in the location or boundaries of permitted range allotments or type of livestock across alternatives. Boundaries, AUMs, and management of allotments are expected to change over time, based on site-specific analysis through the NEPA and allotment management planning process, however this does not vary by alternative. Grazing standards and guidelines differ by alternative and grazing practices may vary based on differences in standards and guidelines in each alternative. Potential differences are discussed in the effects analysis section.

### Best Management Practices

Implementation of best management practices (BMPs) would continue to be one of the primary mechanisms to ensure that aquatic and hydrologic function are preserved in all alternatives. Project-level monitoring of implementation and effectiveness of BMPs using nationally consistent protocols would continue under all alternatives. BMP monitoring would be used to identify and implement corrective actions to address site-scale problems with BMP implementation and effectiveness. Adaptive management would be used to correct systematic, programmatic-level issues (i.e., lack of transfer of BMPs from planning to project implementation, project design criteria specified in NEPA not included into contract provisions, etc.). Accountability for addressing lack of effectiveness and implementation of BMPs is a critical component of water resource protection and compliance with the CWA.

### Water Uses

Water uses across the Forest are expected to be the same across all alternatives. Standards protecting key watersheds from certain uses differ by alternative and are discussed in effects analysis.

## No-action Alternative

### Riparian and Aquatic Resource Management

#### *Acres of RHCAs and management and protection of RHCAs*

Present management of riparian areas under INFISH (USDA Forest Service 1995) includes designation of riparian habitat conservation areas (RHCAs) where riparian-dependent resources receive primary emphasis and additional standards and guidelines apply to management. RHCAs overlay approximately 150,692 (13 percent) of the Forest. RHCAs are mapped, but actual locations of RHCAs may be changed and updated based on project level planning and reconnaissance. RHCA widths vary by water body type and intermittent streams and wetlands less than 1 acre receive a wider buffer in INFISH priority

watersheds than these features in non-INFISH priority watersheds. RHCA widths and acreages are shown in the following table.

**Table 108. Riparian habitat conservation areas width and acreages on the Colville National Forest in no-action and alternative B**

| Stream and water body classification | Riparian habitat conservation area width | Total Acres |
|---|---|---|
| Fish-bearing streams | 300 ft. slope distance on each side (600 ft. total) | 35,427 |
| Permanently flowing non-fish-bearing streams | 150 ft. slope distance on each side (300 ft. total) | 49,075 |
| Ponds, lakes, reservoirs and wetlands greater than 1 acre | 150 feet slope distance around feature | 23,261 |
| Seasonally flowing or intermittent streams, wetlands less than 1 acre | 100 ft. slope distance in priority watersheds, 50 ft. slope distance in non-priority watersheds. | 42,929 |
| Total | | 150,692 |

RHCAs are intended to protect desired riparian functions, including sediment filtration, stream temperature moderation, production of fine organic matter and large woody material, and stream bank stability. Research on the effectiveness of riparian protection measures suggests that a width of one site-potential tree is sufficient to protect riparian function in most systems (Wenger 1999). Pollock and Kennard (1998) found that buffer widths of 50 to 250 feet were sufficient to preserve riparian function in eastern Washington, with differences in effective widths dependent on soils, slope, and vegetation.

## Riparian and Aquatic Plan Components

Riparian and aquatic plan components including objectives, standards, and guidelines in the no-action alternative are from INFISH (see appendix B of the specialist report for comparison of plan components across all alternatives). INFISH includes riparian goals rather than desired conditions, and riparian management objectives (RMOs) that define numeric stream habitat objectives for width to depth ratio, bank stability, bank angle, large woody debris, stream temperature, percent fine sediment , dominant substrate, and pool frequency, that describe high quality habitat. RMOs were developed from existing stream habitat data and were designed to provide benchmarks for evaluation of current stream conditions. Although RMOs have been widely applied, analysis of their usefulness or applicability across ecoregions has not been widely researched. Criticisms of numeric stream habitat objectives including the failure to account for variability and recognition of the difficulty of separation of land use effects from natural disturbance. (Kershner and Roper 2010). RMOs are discussed in greater detail in the fisheries section of this DEIS (MacDonald et al. 2015).

INFISH includes standards and guidelines (with no differentiation between standards and guidelines) for RHCAs that constrain management within RHCAs to achieve RMOs. Standards and guidelines address activities including timber management, livestock grazing management, recreation management, mineral management, fire and fuels management, lands, general riparian area management, watershed and habitat restoration, and fisheries and wildlife restoration. RHCA widths may be increased or decreased when necessary to attain RMOs when site-specific data and watershed analysis supports the change.

## Acres in INFISH Priority Watersheds

INFISH priority watersheds on the Forest were originally designated in 1998 and updated in 2001. INFISH designated as “priority” watersheds “having excellent habitat or strong assemblages of inland native fish, particularly bull trout, or watersheds that provide for population distribution goals, or watersheds having a high restoration potential” (USDA Forest Service 1995a). There are 214,283 acres

(19 percent total National Forest System ownership) in INFISH priority watersheds under National Forest System ownership in the no-action alternative (table 109).

**Table 109. INFISH priority watersheds (designated at the subwatershed scale)**

| Subwatershed Number | Subwatershed Name | Total Subwatershed Acres | Administrative Forest Acres | Colville National Forest Ownership Acres |
|---|---|---|---|---|
| 170102160201 | *Exposure Creek-Pend Oreille River | 41,224 | 23,376 | 14,463 |
| 170102160202 | Skookum Creek | 31,811 | 31,728 | 14,192 |
| 170102160301 | *Middle Creek-Pend Oreille River | 23,209 | 21,760 | 5,066 |
| 170102160302 | West Branch Le Clerc Creek | 21,672 | 21,672 | 15,099 |
| 170102160303 | *East Branch Le Clerc Creek | 26,663 | 26,651 | 11,145 |
| 170102160401 | *Harvey Creek | 32,999 | 32,991 | 27,554 |
| 170102160402 | *Headwaters Sullivan Creek | 45,516 | 45,510 | 45,417 |
| 170102160403 | *North Fork Sullivan Creek-Sullivan Creek | 12,709 | 12,703 | 11,259 |
| 170102160702 | *Headwaters South Salmo River | 20,697 | 12,475 | 12,472 |
| 170102160704 | Outlet South Salmo River | 14,013 | 3,469 | 3,460 |
| 170102160902 | Sweet Creek-Pend Oreille River | 41,832 | 33,477 | 28,890 |
| 170102160903 | Slate Creek | 20,195 | 19,911 | 19,907 |
| 170102161003 | *Cedar Creek | 17,209 | 7,074 | 5,359 |
| **Total Acres** | | 349,747 | 29,2795 | **214,283** |

There are no standards, guidelines, goals, or measurable objectives specific to INFISH priority watersheds in the no-action alternative. However, the intent of INFISH is for priority watersheds in good condition to serve as anchors for the potential recovery of depressed aquatic populations, and provide colonists for adjacent watersheds with degraded habitat. Priority watersheds with lower habitat are the focus of restoration activities to improve habitat quality and function.

## Watershed and Aquatic Restoration

Based on the original intent of the short time period for implementing INFISH, a restoration strategy was not included in this amendment. The intent of INFISH was for forests to use watershed analysis to determine restoration strategies and projects, with INFISH priority watersheds being the highest priority for restoration. Historically, aquatic restoration across the INFISH priority network has not accelerated since this watershed network was designated in 1995 (and expanded in 2001) on the Forest, except in a select number of subwatersheds. Instead, the pace of restoration was increased through designation of focus watersheds identified through ARS and priority subwatersheds identified through WCF. Investment in watershed restoration to improve aquatic habitat and hydrologic function has and would continue to occur in several subwatersheds within the INFISH priority network, including the East and West Branches of LeClerc Creek, and the Headwaters and North Fork of Sullivan Creek, but there are no specific plans to accelerate the pace of restoration in other subwatersheds in the INFISH priority network under the no-

action alternative. Therefore, restoration in INFISH priority watersheds would continue at the current pace under the no-action alternative.

Watershed and aquatic restoration would focus on completion of essential projects outlined in watershed action plans in focus (Sanpoil, LeClerc, and Chewelah Creek watersheds) and national priority watersheds (East and West Branch LeClerc Creek, and Ninemile Creek subwatersheds). In addition, opportunistic restoration would continue across the Forest based on partnerships, funding from FERC relicensing, Vision 20/20 (see MacDonald (2015) for specific projects), and completed NEPA for vegetation management, grazing, and recreation projects.

Based on current restoration plans in place under the no-action alternative for the next 15 years, treatment is expected on 51 miles of road, 15 crossings to improve aquatic organism passage, 54 miles of stream channel, 70 acres of rangeland infrastructure, and 75 to 150 acres in RHCAs to move toward HRV. Improvement in watershed condition class is estimated in seven subwatersheds.

## Roads/Access

### *Acres of management areas where road-building activities are permitted*

Approximately 218,266 acres (20 percent of Colville National Forest ) in the no-action alternative are in management areas where construction of new roads is prohibited.

### *Road density desired conditions*

Road density desired conditions range from 0.4 to 2 miles per square mile of open road (ML 2-5) and are dependent on species or resource in need of protection. Since road density desired conditions do not consider closed ML 1 roads, they do not adequately address the potential impacts of the road system on hydrologic and aquatic function and habitat.

### *Road management plan components*

Standards and guidelines, and BMPs specific to road construction focus on minimizing erosion and sediment risk from the road system to attain RMOs and minimize adverse effects to inland native fish. In INFISH priority watersheds, watershed analysis is required before certain road activities and construction of new recreation facilities are permitted in RHCAs, and there are specific protections against increased sedimentation through prioritization of road treatments in priority watersheds.

## Old Forest Management, Timber Production, and Upland Vegetation Condition

### *Active Vegetation Management*

Existing management areas (MAs) and authorization of road building and timber production by MA are shown in table 110. Timber production is allowed in MA-3A (Recreation), MA-5 (Scenic/Timber), MA-6 (Scenic/ Winter Range), MA-7 (Wood/ Forage), and MA-8 (Winter Range). These management areas cover 80.7 percent of the Forest, the largest land base available for active vegetation management of all alternatives. Actual acres treated per year are constrained by forest budgets and additional constraints at the project level.

**Table 110. Existing management areas and authorization of road building and timber production by management area**

| Management Area | Acres | New roadbuilding authorized? | Timber Production Authorized? |
|---|---|---|---|
| Caribou Habitat | 30,306 | N | N |
| Downhill Skiing | 2,026 | N | N |
| No Management Area Assigned | 19 | N | N |
| Old Growth Dependent Species Habitat | 32,859 | N | N |
| Private Lands Originally | 1,262 | N | N |
| Recreation | 43,153 | Y | Y |
| Recreation/Wildlife | 12,474 | N | N |
| Research Natural Area | 4,707 | N | N |
| Scenic Timber | 216,525 | Y | Y |
| Scenic/Winter Range | 76,128 | Y | Y |
| Semi-Primitive, Motorized Recreation | 13,571 | N | N |
| Semi-Primitive, Non-Motorized Recreation | 86,880 | N | N |
| Water | 2,365 | N | N |
| Wilderness Management | 31,400 | N | N |
| Winter Range | 126,207 | Y | Y |
| Wood/Forage | 423,305 | Y | Y |
| *RHCAs | 150,692 | Y, within standards and guidelines | N, except where needed to maintain or meet RMOs |

## Primary Vegetation Management Tools

Partial harvest would be the primary vegetation management tool in the Douglas-fir dry MAs where harvest is authorized with 500 acres of treatment estimated per year. Thinning, regeneration harvest, and mechanical fuels treatments are used in the northern Rocky Mountain mixed conifer vegetation type. Regeneration harvest would be the primary tool in the subalpine fir/lodgepole pine vegetation type with 388 acres of treatment per year estimated. Mechanical fuels treatments would also be used in this vegetation type. Prescribed fire would be used in Douglas-fir dry, northern Rocky Mountain conifer, and subalpine fir/lodgepole pine vegetation types and is estimated on 4,879 acres. A total of 1,096 acres of mechanical fuels treatments per year are estimated under the no action alternative.

## Historic Range of Variability

Six out of 19 structure classes are within HRV after 100 years of land management under the no-action alternative, which has the least number of structure classes within HRV (table 111). Eight structure classes are below HRV, and five are above. Late open and closed structure conditions show the greatest departure from HRV. Levels of disturbance and management do not occur across enough acres over 100 years under the no-action alternative to create open structure conditions that existed historically. Areas that would historically have contained large trees with open canopy conditions, and greater resistant to wildfire and insect and disease outbreaks would be in a closed canopy condition with greater susceptibility to disturbance (Day 2015). Greater susceptibility of forest stands to disturbances including large fires and insect and disease outbreak increases the risk to hydrologic function from disturbance.

**Table 111. Vegetation and structure type within HRV modeled after 100 years of management under the no-action alternative**

| Vegetation Type | Early Structure | Mid-open Structure | Mid-closed Structure | Late Open Structure | Late Closed Structure |
|---|---|---|---|---|---|
| Douglas-fir dry | @ | - | + | - | + |
| Northern Rocky Mountain mixed conifer | - | - | + | - | @ |
| Western hemlock/ Western redcedar | - | n/a | - | n/a | + |
| Subalpine fir / Lodgepole pine | @ | n/a | @ | n/a | @ |
| Spruce/ Subalpine fir | - | n/a | @ | n/a | + |

@=within HRV; -=below HRV; +=above HRV; and n/a=structure class does not exist within this vegetation type

## Vegetation Management Plan Components

INFISH provides stricter standards and guidelines for vegetation management activities than the Forest Plan it amended. Timber harvest and fuelwood cutting in RHCAs is prohibited under INFISH except in the event of safety, catastrophic events, or if watershed analysis indicates that vegetation treatment is needed to move toward attainment of RMOs. In addition, INFISH includes standards and guidelines that minimize roads and landings in RHCAs. Standards and guidelines and BMPs are the primary mechanisms to protect water quality and riparian function from vegetation management activities under the no-action alternative.

## Grazing Plan Components

Current allotment boundaries and AUMs would continue under the no-action alternative. INFISH provides stricter standards and guidelines than the Forest Plan it amended on grazing to move toward attainment of RMOs. These standards and guidelines apply primarily in RHCAs and would continue to be implemented under the proposed action. It is assumed that allotment management under the proposed action would meet guidelines for grazing in RHCAs, and that changes in grazing management to attain RMOs would be implemented through project-level NEPA, and allotment management plans. There are no specific numeric guidelines for grazing in RHCAs in INFISH and the no-action alternative. Standards and guidelines and BMPs are the primary mechanisms to protect water quality and riparian function from grazing under the no-action alternative. PIBO monitoring indicates that stream conditions across the Forest are improving (see MacDonald 2015 and discussion of PIBO data discussed previously in this section) under INFISH standards and guidelines, however most stream channel parameters are outside of reference conditions.

## Summary of Effects and Comparison to Other Alternatives

The no-action alternative provides less protection to the processes that improve or preserve hydrologic function than the proposed action and alternatives R, P, and O. The no-action alternative would provide a slower pace of recovery of hydrologic function through passive and active restoration than the proposed action and alternatives R, P, and O. Effects of the no-action alternative in relation to other alternatives include:

- The no-action alternative does not address the need for change in this forest plan revision; the pace of watershed restoration is not increased from current levels, watershed and riparian direction is not integrated. Specific watershed and riparian objectives in the proposed action, and alternatives R, P, and O should increase the pace and scale of watershed restoration, and improve resiliency to the

potential hydrologic effects of climate change more effectively than the plan components in the no-action alternative and alternative B.

- Narrower RHCA widths along intermittent streams, lakes, and ponds are less restrictive than RMA widths in the proposed action, and alternatives R, P, and O and may not improve or preserve hydrologic and riparian function as well as wider RMA widths.
- There are fewer acres of priority watersheds in the no-action alterative than in the key watershed network in the proposed action and alternatives R, P, and O. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network in the proposed action and alternatives R, P, and O and specific restoration objectives in key watersheds would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network.
- The no-action alternative does not accelerate improvement in watershed condition as much as the proposed action and alternatives R, P, and O. The INFISH priority network would remain and there are not specific plans to accelerate the pace of restoration across the INFISH priority watershed network. There are no measureable objectives for the INFISH priority watershed network other than essential projects outlined in watershed action plans for focus watersheds designated through ARS, and priority watersheds designated through WCF.
- RMOs would continue to be used as benchmarks for evaluation of current stream conditions, even though they may not adequately account for natural variability or separate land use effects from natural disturbance.
- The no-action alternative manages toward eight riparian goals, the proposed action and alternatives R, P, and O focus on the attainment of desired conditions for aquatic and riparian function and watershed condition.
- Approximately 20 percent of Colville National Forest land base is in management areas where construction of new roads is prohibited. Construction of new roads is prohibited in a higher percentage of the Forest in all other alternatives including the proposed action. Road density desired conditions range from 0.4 to 2 miles per square mile of open road (ML 2-5) and depend on species or resource in need of protection. Unlike the prosed action and alternatives R, P, and O, road density desired conditions include ML 1-5 roads. Inclusion of ML 1 (closed) roads in road density calculations provides a better metric for improvement in aquatic and riparian function because closed roads have an effect on hydrologic processes.
- Approximately 80 percent of the Colville National Forest land base is available for timber production; all other alternatives have less land open to these activities.
- Standards and guidelines in the no-action alternative do not effectively address contemporary issues of watershed function, including protection of streambank and floodplain integrity from livestock grazing, and reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Standards and guidelines in the no-action alternative may not protect watershed function and water quality as effectively as the proposed action, and alternatives R, P, and O.
- Standards for development of hydroelectric and other water use developments are less stringent in the no-action alternative than the proposed action and alternatives R, P, and O.
- Six out of 19 vegetation structure classes are within HRV after 100 years of land management under no action. Forests that are departed from HRV generally are at greater risk for large fires and insect and disease outbreaks, which can impact hydrologic function and aquatic ecosystems.

- The no-action alternative does not increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change; infrastructure upgrades would continue at the current pace.

## Proposed Action Alternative

The proposed action was released to the public in June 2011. It reflects current management policies of the Forest and meets the intent of recovery plans for terrestrial and aquatic threatened and endangered species, based on science that has evolved since the existing Colville Forest Plan was published in 1988. An emphasis on management that applies landscape ecology concepts to provide for ecological resilience to disturbances, including the effects of climate change, has also been added based on current scientific knowledge. Management areas (MAs) in the proposed action are designated where management intent is similar.

Direction for management of aquatic resources is based on the Region 6 Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008) and provides a comprehensive core set of plan components (desired conditions, objectives, standards, and guidelines) to maintain and restore the ecological health of watersheds and aquatic ecosystems across the Forest. ARCS also designates riparian management areas (RMAs) and a key watershed network.

### Riparian and Aquatic Resource Management

#### *Riparian Management Areas*

Riparian and aquatic resource direction included in the proposed action is based on the Region 6 Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008), which is a refinement of earlier strategies including the Northwest Forest Plan (USDA Forest Service and USDI BLM, 1994), PACFISH (USDA and USDI 1995), INFISH (USDA Forest Service 1994c and 1995), and the R6 Aquatic Restoration Strategy (ARS) (USDA Forest Service 2005). The proposed action includes designation of riparian management areas (RMAs), which include portions of watersheds where aquatic and riparian-dependent resources receive special management. RMAs overlay approximately 179,236 acres (16 percent) of the Forest, compared to 13 percent under the no-action and B alternatives. RMAs are mapped, but actual locations of RMAs may be changed and updated based on project level planning and reconnaissance.

**Table 112. RMA widths and total acreage for the proposed action and alternatives R, P, and O**

| Stream and water body classification | Riparian Management Area (RMA) width | Acres |
|---|---|---|
| Fish-bearing streams | 300 ft. slope distance on each side (600 ft. total) | 34,840 |
| Permanently flowing non-fish-bearing streams | 150 ft. slope distance on each side (300 ft. total) | 48,791 |
| Lakes and natural ponds | 300 ft. slope distance around feature | 10,138 |
| Constructed ponds and reservoirs, and wetlands greater than 1 acre | 150 ft. slope distance around feature | 15,844 |
| Seasonally flowing or intermittent streams; wetlands, seeps, and springs less than 1 acre, and unstable or potentially unstable areas | 100 ft. slope distance from stream (200 ft. total), 100 ft. slope distance around wetland, seep, spring, or unstable or potentially unstable area | 69,623 |
| Total | | 179,236 |

An increase in total acres of RMAs from the no-action alternative gives greater protection to riparian function and structure than the no-action alternative and the B alternative at lakes and natural ponds

(where riparian distance is increased from 150 to 300 feet), and intermittent streams and wetlands, seeps, and springs less than 1 acre (where riparian distance is increased from 50 feet in non-INFISH priority watersheds to 100 feet across the Forest). There is no research to indicate that riparian reserve widths under the Northwest Forest Plan provide more protection than necessary to meet riparian desired conditions and objectives (Everest and Reeves 2007). This finding supports the expansion of RMA widths from INFISH RHCA widths to be more consistent with Riparian Reserve widths from the Northwest Forest Plan.

### *Riparian and Aquatic Resource Plan Components*

The proposed action includes objectives, standards, and guidelines specific to RMAs. Objectives for RMAs include:

- Modification of grazing practices in RMAs to move toward desired conditions
- Restoration of riparian processes at dispersed recreation sites
- Consolidation of  user-created access routes in RMAs
- Provide upstream fish passage at road stream crossings

Standards address activities including chemical application, fuel containment, fuel wood cutting, road and stream crossing construction and reconstruction, location of livestock handling and watering facilities, location of mine waste, pump screening, fire suppression, fuel chipping, new and existing special uses, and development of new hydroelectric facilities. Guidelines address activities including, RMA function, water drafting, hazard tree retention, harvest and thinning, road and stream crossing construction and re-construction, livestock grazing, recreation facilities, mineral development, fire suppression, and watershed restoration project design. There are 28 guidelines and 17 standards for RMAs in the proposed action. These standards and guidelines and BMPs form the primary mechanisms of protection of riparian and aquatic function under the proposed action.

### *Key Watersheds*

Key watersheds are one of the primary elements within the proposed action that maintain and improve hydrologic and aquatic function. Key watersheds are a network of watersheds that serve as strongholds for important aquatic resources or have the potential to do so through focused restoration (USDA Forest Service 2008). Key watersheds are designated at the subwatershed scale and were selected based on population condition of focal aquatic species (interior redband trout, westslope cutthroat trout, and bull trout), and aquatic habitat condition and function (see fisheries report for description of this methodology). Management in key watersheds minimizes risk and maximizes restoration of preservation of ecological health. The key watershed network in the proposed action was identified in 2011, and expands the INFISH priority network in the proposed action with the addition of 13 additional subwatersheds. Four subwatersheds in the INFISH priority network were not included in the key watershed network for the proposed action because they did not have the aquatic habitat conditions or focal species population necessary for designation as a key watershed under Reiss et al. (2008).

There are 371,943 acres of key watersheds under National Forest System ownership (34 percent of total Colville National Forest ownership) in the proposed action (table 113). Existing miles and road density of NFS roads in RHCAs within the Forest ownership boundary in key watersheds are shown in table 113. Key watersheds are included in the focused restoration, backcountry, backcountry motorized, research natural area, recommended wilderness, and wilderness management areas. The Winchester Creek SWS is the only key watershed located in the general restoration MA in the proposed action. Subwatershed names, numbers, and boundaries have changed since the creation of management areas in the proposed action, and inclusion of Winchester Creek in the general restoration MA is a legacy of these changes.

**Table 113. Key watersheds in the proposed action**

| Key Watershed Number | Key Watershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | Riparian Road Miles | Riparian Road Density |
|---|---|---|---|---|---|
| 170102160102 | Winchester Creek | 10,482 | 5,627 | 10.7 | 4.2 |
| 170102160103 | Exposure Creek-Pend Oreille River | 41,223 | 14,462 | 9.7 | 1.7 |
| 170102160106 | Smalle Creek | 17,753 | 11,058 | 9.9 | 1.9 |
| 170102160109 | Tacoma Creek | 39,519 | 27,182 | 25.1 | 2.7 |
| 170102160202 | West Branch Le Clerc Creek | 21,671 | 15,098 | 5.6 | 0.9 |
| 170102160203 | East Branch Le Clerc Creek | 26,662 | 11,145 | 11.0 | 2.7 |
| 170102160204 | Ruby Creek | 19,597 | 18,385 | 13.1 | 2.2 |
| 170102160302 | Sweet Creek-Pend Oreille River | 41,831 | 28,890 | 16.5 | 2.1 |
| 170102160303 | Harvey Creek | 32,998 | 27,553 | 17.6 | 1.9 |
| 170102160304 | Headwaters Sullivan Creek | 45,516 | 45,417 | 45.1 | 3.9 |
| 170102160305 | North Fork Sullivan Creek-Sullivan Creek | 12,708 | 11,258 | 1.8 | 0.6 |
| 170102160306 | Slate Creek | 19,911 | 19,907 | 10.5 | 2.3 |
| 170102160307 | South Salmo River | 22,271 | 15,932 | 0.1 | 0 |
| 170200010104 | North Fork Deep Creek | 49,256 | 26,633 | 15.7 | 2.2 |
| 170200010306 | Barnaby Creek | 23,107 | 14,299 | 9.1 | 2.4 |
| 170200010401 | Upper Hall Creek | 31,648 | 13,785 | 3.7 | 1.0 |
| 170200010402 | Sitdown Creek | 14,484 | 0 | 0 | 0 |
| 170200010403 | Middle Hall Creek | 15,480 | 1,927 | 0.9 | 0.8 |
| 170200020401 | Trout Creek | 23,434 | 14,121 | 10.7 | 3.6 |
| 170200020501 | Tonata Creek | 14,453 | 13,780 | 16.2 | 5.9 |
| 170200020608 | North Fork Deadman Creek | 13,449 | 13,185 | 8.8 | 1.1 |
| 170200020609 | Deadman Creek | 26,518 | 22,299 | 10.7 | 2.6 |
| **Total** | | 563,971 | **371,943** | | |

### *Watershed and Aquatic Restoration*

The proposed action prioritizes watershed restoration through measureable objectives in key watersheds, and additional RMA objectives to improve aquatic and hydrologic condition and function and move toward desired conditions. Plan components specific to key watersheds, including measureable objectives are discussed in this section.

Key watersheds where restoration would be prioritized were identified based on limiting factors to hydrologic and aquatic function that could be improved through focused restoration projects identified in the WCF and AEC processes (see MacDonald et al. 2015). Measurable objectives for key watersheds that are priorities for active restoration would contribute to the maintenance and restoration of desired conditions in key watersheds. Desired conditions for key watersheds include:

- Key watersheds are networks of watersheds with good habitat and functionally intact ecosystems that contribute to and enhance recovery of threatened and endangered species;
- Roads do not present risk to aquatic resources;
- Key watersheds have high watershed integrity

Future projects in key watersheds would focus on achieving key watershed-specific, RMA, and aquatic and riparian system desired conditions. While watershed improvement treatments are not expected on every acre of key watershed through the life of this forest plan, specific measurable objectives for key watersheds where restoration is focused are expected to accelerate the pace of aquatic restoration across the key watershed network.

Specific objectives for key watersheds were developed that are intended to achieve desired conditions. Objectives for the key watershed network under the proposed action include:

- **Key watershed objective 1 Watershed Restoration Prioritization:** Management in key watersheds focuses on restoration or preservation of watershed, aquatic, and riparian function and recovery of threatened and endangered species. Improve watershed condition class in key watersheds that are a priority for restoration within 15 years of forest plan implementation. Key watersheds that are a priority for restoration include East Branch LeClerc Creek, West Branch LeClerc Creek, Deadman Creek, Barnaby Creek, Harvey Creek, North Fork Deadman Creek, North Fork Sullivan Creek, Sullivan Creek, Ruby Creek, and Tonata Creek subwatersheds. Additional key watersheds that are a priority for restoration would be identified, as appropriate through the life of the plan.
- **Key watershed objective Road Treatments:** Reduce road-hydrologic connectivity and sediment delivery on roads through storm damage risk reduction treatments, full hydrologic decommissioning, and other accepted treatment measures on 78 miles of hydrologically connected road within 15 years of forest plan implementation.
- Restore or maintain aquatic organism passage and improve hydrologic and aquatic habitat function at 36 road/stream crossings for all native aquatic species, seasons, flows, and life stages within 15 years of Forest plan implementation through culvert replacement or crossing improvement and natural channel design or other acceptable treatment measures that provide for natural stream channel function at all flows.
- **Key watershed objective Range Infrastructure Improvements:** Improve hydrologic and aquatic function through range infrastructure improvements, including riparian fencing, movement and improvement of watering troughs, and other acceptable treatments on 250 acres within 15 years of plan implementation.
- **Key watershed objective Riparian Vegetation Structure:** Move upland vegetation within riparian management areas in key watersheds toward HRV on 1,200 acres within 15 years of plan implementation.
- **Key watershed objective Stream Restoration:** Restore hydrologic, geomorphic, and riparian process and function on 76 miles of stream within 15 years of forest plan implementation through activities including streambank stabilization, restoration of lateral and vertical hydrologic connectivity and improvement of stream channel and floodplain function.

Objectives for key watersheds and estimates of restoration work that would be completed through the life of this plan in key watersheds that are priorities for active restoration are shown in the following table.

**Table 114. Objectives for key watersheds that are a priority for restoration**

| Key Watershed Prioritization | Road Treatments Road Improvement (miles)* | Road Treatments Aquatic Organism Passage Improvement (# of crossings) | Range Infrastructure Improvement (acres) | Riparian Vegetation Structure Improvement (acres) | Stream Restoration (miles) |
|---|---|---|---|---|---|
| West Branch LeClerc Creek | 3 | 5 | 20 | 0 | 10 |
| East Branch LeClerc Creek | 3 | 1 | 20 | 0 | 10 |
| Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| Barnaby | 5 | 5 | 30 | 75-150 | 4 |
| Harvey Creek | 10 | 2 | 0 | 0 | 4 |
| North Fork Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| North Fork Sullivan Creek | 3 | 1 | 0 | 0 | 0 |
| Sullivan Creek | 15 | 6 | 0 | 0 | 20 |
| Tonata Creek | 4 | 4 | 50 | 75-150 | 3 |
| Ruby Creek | 3 | 4 | 30 | 75-150 | 3 |
| Treatments in additional key and/or priority watersheds (estimate addition 3 subwatersheds) | 12 | 6 | 30 | 75-150 | 10 |
| **Total for the life of the plan (essential projects completed for 12 key watersheds)** | **68 miles** | **36 crossings** | **240 acres** | **450-900 acres** | **70 miles** |

The following standards were developed for key watersheds in the proposed action:

- There shall be no net increase at any time in the mileage of Forest roads in any key watershed unless doing so results in a reduction in road-related risk to watershed condition;
- Hydroelectric and other water development authorizations shall include requirements for in-stream flows and habitat conditions that maintain or restore native fish and other desired aquatic species populations;
- New hydroelectric facilities and water developments shall not be located in a key watershed.

Through the life of this revised forest plan, completion of essential projects in 12 key watersheds is estimated. Treatments to achieve this goal include; 68 miles of reduction in road hydrologic connectivity through decommissioning and storm damage risk reduction treatments, improvement of aquatic organism passage at 36 crossings, 240 acres of range infrastructure improvements, 450 to 950 acres of riparian vegetation improvements to move upland vegetation in riparian areas toward HRV, and 70 miles of improvement of hydrologic and geomorphic channel function through in-stream channel improvements.

## Roads/Access

### *Acres of Management Area Where Road Building Activities are Permitted*

Approximately 291,096 acres (26 percent of Colville National Forest) in the proposed action are in management areas where construction of new roads is prohibited, including backcountry, backcountry motorized, research natural areas and both designated and recommended wilderness.

### *Road Density Desired Conditions*

Road densities of less than 1 mile per square mile with no valley bottom roads are considered low enough to support proper watershed and aquatic function (Potyondy and Geier 2010). Road densities of 1 to 2.4 miles per square mile are considered functional at risk, and road densities greater than 2.4 miles per square mile are considered not functional. While road density provides a broad-scale metric to assess watershed condition, the location, type, and condition of roads provides a better approximation for potential effect of the road system on hydrologic and aquatic function.

While road densities vary across the management areas, a road density desired condition of no greater than 2 miles per square mile of ML1-5 roads is included in the focused restoration management area (257,157 acres, 23 percent of Colville National Forest ), and no greater than 3 miles per square mile in the general restoration management area (533,891 acres, 48 percent of Colville National Forest ). Existing road densities calculated by management area at the 5th field watershed scale for the focused and general restoration management areas are shown in table 115. There are no watersheds within the focused restoration MA where existing condition meets the road density desired condition of 2 miles per square mile. There are 8 watersheds within the general restoration MA that meet the road density desired condition of 3 miles per square mile, and 9 watersheds that do not meet road density desired conditions.

**Table 115. Existing road density by 5th field watershed for the focused and general restoration management areas under the proposed action**

| 5th field Watershed Name | Road Density (mi/mi$^2$) | Meets Road Density Desired Condition of 2 mi/mi$^2$? |
|---|---|---|
| **Focused Restoration MA** | | |
| Boulder Creek-Kettle River | 3.3 | N |
| Curlew Creek | 2.6 | N |
| Deep Creek | 3.7 | N |
| Hall Creek-Franklin D Roosevelt Lake | 5.3 | N |
| Le Clerc Creek-Pend Oreille River | 2.1 | N |
| Sherman Creek-Franklin D Roosevelt Lake | 2.8 | N |
| Sullivan Creek-Pend Oreille River | 3.7 | N |
| Tacoma Creek-Pend Oreille River | 3.1 | N |
| Vulcan Mountain-Kettle River | 3.9 | N |

| 5th field Watershed Name | Road Density (mi/mi$^2$). | Meets Road Density Desired Condition of 3 mi/mi$^2$? |
|---|---|---|
| **General Restoration MA** | | |
| Boulder Creek-Kettle River | 3.0 | Y |
| Chewelah Creek-Colville River | 4.3 | N |
| Curlew Creek | 3.6 | N |
| Deep Creek | 3.4 | N |
| Hall Creek-Franklin D Roosevelt Lake | 4.3 | N |
| Le Clerc Creek-Pend Oreille River | 2.6 | Y |
| Little Pend Oreille River | 3.3 | N |
| Mill Creek | 2.7 | Y |
| Onion Creek-Franklin D Roosevelt Lake | 2.8 | Y |
| Sherman Creek-Franklin D Roosevelt Lake | 2.8 | Y |
| Stensgar Creek-Colville River | 3.0 | Y |
| Sullivan Creek-Pend Oreille River | 3.0 | Y |
| Tacoma Creek-Pend Oreille River | 4.1 | N |
| Toroda Creek | 2.5 | Y |
| Upper Sanpoil River | 3.2 | N |
| Vulcan Mountain-Kettle River | 4.6 | N |
| West Fork Sanpoil River | 3.7 | N |

### *Road Management Plan Components*

A specific objective for reduction in road hydrologic connectivity and sediment delivery through treatment of an estimated 68 miles of hydrologically connected road through the life of the plan would improve hydrologic and aquatic function and reduce road risk and density. Roads that are hydrologically connected to the stream system are the focus of restoration activities because watershed-scale road analyses across the Pacific Northwest have shown that less than 10 percent of road segments deliver 90 percent of road-generated sediment to the stream system. Therefore, treatment of the highest risk

hydrologically connected road has the greatest potential to reduce the risk of roads to aquatic habitat and hydrologic function (GRAIP 2014).

In addition to specific road density desired conditions for the general and focused restoration management areas, desired conditions for aquatic and riparian systems, RMAs, and key watersheds focused on minimizing hydrologic interruption, erosion, and sedimentation from the road system are included in the proposed action. Projects implemented under the proposed action would be designed with the goal of achieving these desired conditions.

The proposed action includes standards for sidecasting, fill placement, and avoidance of hydrologic flow paths during road construction, maintenance, and reconstruction. Also included in the proposed action is a standard for reconstructing stream crossings to accommodate 100-year flows, avoid diversion of streamflow onto roads in the event of crossing failure, and provide fish passage for all species and life stages. Guidelines in the proposed action include avoidance of road construction in RMAs, wetlands, and unstable areas, construction or reconstruction of stream crossings to allow for riparian-dependent species passage, and retention of fish passage barriers where they restrict access by non-native fish species. Standards, guidelines, BMPs, and restoration objectives to minimize hydrologic impacts from the road system are the primary mechanisms to protect water quality and riparian function from roads under the proposed action.

### *Old Forest Management, Timber Production, and Upland Vegetation Condition*

#### Active Vegetation Management

Timber production is allowed in both focused and general restoration management areas, which cover 790,987 acres (71 percent of the Forest). This is less than the no-action and B alternatives, similar to alternatives P and O, and more than alternative R. Acres treated are constrained by forest budgets, and project-level considerations. BMPs are the primary mechanism to limit the potential effects of vegetation management activities on water quality and hydrologic function.

#### Primary Vegetation Management Tools

Variable density thinning would be the primary tool for active commercial vegetation management in the focused and general restoration MAs in the proposed action in the Douglas-fir dry and northern Rocky Mountain mixed conifer vegetation types in the proposed action with an estimated (modeled) treatment of 4,050 acres per year. Mechanical fuels treatments are estimated on 5,000 acres per year in these vegetation types. Mixed and light severity prescribed fire would be used in open-canopy stands on a 20-year rotation to maintain open conditions in the Douglas-fir dry and northern Rocky Mountain mixed conifer vegetation types with treatment modeled for 3,839 acres per year. Shelterwood harvest with reserves would be the primary commercial vegetation management tool in the subalpine fir and lodgepole pine vegetation type with an estimated (modeled) 950 acres of treatment per year. Stand-replacing prescribed fire would be used in the subalpine fir and lodgepole pine vegetation type with an estimated treatment of 1,040 acres per year. There are no modeled vegetation treatments in the Western redcedar/Western hemlock and spruce/subalpine fir vegetation types.

Acres of Colville National Forest lands by management area and activities authorized in each management area are shown in table 116.

**Table 116. Proposed action management areas and activities authorized in each management area that can affect the hydrologic resource**

| Management areas | Acres | New roadbuilding authorized? | Timber production authorized? |
|---|---|---|---|
| Focused Restoration | 257,157 | Y, 2 mi/mi$^2$ | Y |
| General Restoration | 533,892 | Y, 3 mi/mi$^2$ | Y |
| Backcountry | 90,846 | N | N |
| Backcountry Motorized | 61,726 | N | N |
| Research Natural Area | 5,703 | N | N |
| Scenic byways | 19,564 | Y | N |
| Recommended Wilderness (RW) | 101,390 | N | N |
| Congressionally Designated (CD) Wilderness | 31,400 | N | N |
| *RMAs | 179,236 | Y—within standards and guidelines | N—vegetation management can be used as a tool to meet or maintain desired conditions, goals and objectives |
| Total Acres | 1,101,709 | | |

*MAs overlay other management area and are not included in total acreage calculations.

## Historic Range of Variability

Six out of 19 structure classes are within HRV after 100 years of land management under the proposed action (table 117). The same number of structure classes are within HRV for no action, the proposed action, and alternatives P and B. Six structure classes are below HRV, and seven are above. The late closed forest structure would be above HRV in three of five vegetation types. Levels of disturbance and management do not occur across enough acres over 100 years under the proposed action to create open structure conditions that existed historically. Areas that would historically have contained large trees with open canopy conditions, and greater resistant to wildfire and insect and disease outbreaks would be in a closed canopy condition with greater susceptibility to disturbance (Day 2015).

**Table 117. Vegetation and structure type within HRV modeled after 100 years of management under the proposed action**

| Vegetation Type | Early Structure | Mid-open Structure | Mid-closed Structure | Late Open Structure | Late Closed Structure |
|---|---|---|---|---|---|
| Douglas-fir dry | @ | @ | + | - | + |
| Northern Rocky Mountain mixed conifer | - | + | + | @ | @ |
| Western hemlock/ Western redcedar | - | n/a | - | n/a | + |
| Subalpine fir / Lodgepole pine | + | n/a | - | n/a | @ |
| Spruce/ Subalpine fir | - | n/a | @ | n/a | + |

@=within HRV; -=below HRV; +=above HRV; and n/a=structure class does not exist within this vegetation type

## Vegetation Management Plan Components

Standards for fuel wood cutting, application of herbicides and other pesticides, and fuel chipping are included in the proposed action. Guidelines are included for hazard tree felling, timber harvest and thinning in RMAs, location of landings, skid trails, and staging, decking, and yarding activities in RMAs.

Standards, guidelines, and BMPs are the primary mechanisms to protect water quality and riparian function from vegetation management activities under the proposed action.

**Grazing Plan Components**

Current allotment boundaries and AUMs would continue under the proposed action. Plan components in the proposed action provide stricter guidelines than INFISH to attain goals, objectives, and desired conditions. A guideline with stricter criteria for minimizing streambank alteration, decreasing vegetation utilization, and increasing stubble height should move toward desired conditions in a shorter timeframe than the no-action alternative. Specific guidelines within greenline vegetation area adjacent to all watercourses include:

- Do not exceed 20 percent streambank utilization
- Do not exceed 40 percent utilization of mean annual vegetation production on woody vegetation
- Maintain at least 4 to 6 inches or do not exceed 40 percent utilization of mean annual vegetative production of herbaceous vegetation.

Standards, guidelines, BMPs, and restoration objectives to mitigate the impact of grazing on hydrologic function and water quality are the primary mechanisms to preserve water quality and hydrologic function under the proposed action.

## Summary of Effects and Comparison to Other Alternatives

The proposed action provides more protection for preservation and restoration of hydrologic function, water quality, and water uses than the no-action and B alternatives. The proposed action does not provide as much protection for preservation and restoration of hydrologic function, water quality, and water uses as the R, P, and O alternatives. Effects of the proposed action in relation to other alternatives include:

- The proposed action addresses the need for change more effectively than no action and alternatives B and O. Through plan components and principles from ARCS, and specific objectives for restoration in key watersheds, the pace and scale of watershed restoration and resiliency to potential hydrologic effects of climate change are increased in the proposed action. The proposed action does not address the need for change as effectively as alternatives P and R.
- Wider RMA widths along intermittent streams, lakes, and ponds than the no-action alternative and alternative B would improve and preserve hydrologic and riparian function better than narrower RHCA widths in no action and alternative B.
- There are more acres of key watersheds in the proposed action than in the INFISH priority network in no action and alternative B. There are fewer acres of key watersheds in the proposed action than in the R, P, and O alternatives. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network in the proposed action would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network in no action and alternative B.
- The proposed action would accelerate improvement in watershed condition faster than no action and alternative B. Measurable objectives in key watersheds would accelerate restoration and preservation of hydrologic function. There are fewer subwatersheds in the proposed action key watershed network than in the key watershed network for alternatives R, P, and O.
- Desired conditions are identified for general aquatic riparian and watershed condition; no action and alternative B focus on general riparian goals rather than desired conditions.

- Approximately 26 percent of Colville National Forest land base is in management areas where construction of new roads is prohibited. Twenty-three percent of the Colville National Forest land base is within the focused restoration MA where desired condition for road density is 2 miles per square mile.
- Approximately 71 percent of Colville National Forest land base is in management areas where active vegetation management is authorized. This is less than no action and alternative B, similar to alternatives P and O, and greater than alternative R.
- Six out of 19 vegetation structure classes are within HRV after 100 years of land management under the proposed action. Departure from HRV in the proposed action is the same as no action, and alternatives P and O.
- Standards and guidelines address watershed function, including protection of streambank and floodplain integrity from livestock grazing, reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Standards and guidelines in the proposed action should protect watershed function and water quality more effectively than no action and alternative B. Standards and guidelines in the proposed action are less restrictive than in alternatives R and P.
- There is a greater emphasis on grazing standards and guidelines in the proposed action, A guideline with numeric criteria for streambank alteration, herbaceous and woody utilization, and stubble height should be more effective in moving toward desired conditions in RMAs in grazing allotments than no action and alternative B. Standards and guidelines for grazing in the proposed action are not as restrictive as in alternatives R and P.
- Standards for development of hydroelectric and other water use developments are more stringent in the proposed action and alternatives R, P, and O than in no action and B alternative.
- Measureable objectives and focused restoration activities in key watersheds in the proposed action would increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change. Since the key watershed network is smaller in the proposed action than alternatives R, P, and O, the proposed action would be less effective in increasing resiliency to climate change than alternatives R, P, and O.

## Alternative R

Alternative R responds to public comments that the proposed action does not provide watershed, aquatic, and riparian resource protections that are as effective as current forest plan direction. Aquatic direction and plan components in alternative R are based on a modified version of ARCS (referred to throughout this plan as ARCS-modified), which adds clarification to desired conditions, objectives, standards, and guidelines to address issues specific to the Forest.

Changes from ARCS to ARCS-modified were based on public and internal comments, best available science, and new policies on Forest Service management of aquatic and riparian resources, including the Watershed Condition Framework. ARCS-modified plan components were updated based on discussions with the Forest Plan interdisciplinary team, resource specialists in the Pacific Northwest regional office, and other reviewers of the draft forest plan.

Most of the updates made to ARCS plan components in ARCS-modified add clarity to individual plan components. Operational constraints were also considered in the evaluation of each standard and guideline within ARCS.

Alternative R includes three new guidelines related to aquatic invasive species, one new guideline addressing fuel storage in RMAs, a new standard to limit hydrologic impacts from roads, trails, and

developed recreation sites, and 5 standards that were guidelines in the proposed action. RMAs are the same as the proposed action and alternatives P and O. There are more subwatersheds within the key watershed network than in the proposed action.

## Riparian and Aquatic Resource Management

### *Acres of RMAs*

RMA widths and acreages are the same as the proposed action and alternatives P and O.

### *Riparian and Aquatic Plan Components*

Alternative R includes desired conditions, objectives, standards, and guidelines for general water resources and RMAs. Desired conditions for general water resources, key watersheds, and RMAs have been updated and clarified in alternative R. An additional desired condition addressing roads in RMAs is included in alternative R. A desired condition was also added to alternative R to address the existing condition in focus and priority watersheds. RMA and general water resources objectives address limiting factors to hydrologic, aquatic, and riparian function, and focus on improving watershed condition through the life of the plan and are discussed in detail in the watershed and aquatic restoration section.

Standards in alternative R address activities including chemical application, fuel containment, fuel wood cutting, road and stream crossing construction and reconstruction, location of livestock handling and watering facilities, location of mine waste, pump screening, fire suppression, fuel chipping, new and existing special uses, and development of new hydroelectric facilities. Guidelines under the proposed action that address activities including, RMA function, water drafting, hazard tree retention, harvest and thinning, road and stream crossing construction and re-construction, livestock grazing, recreation facilities, mineral development, fire suppression, and watershed restoration project design are standards in alternative R. Alternative R has a greater emphasis on standards than the proposed action; there are 27 guidelines and 21 standards for general water resources, key watersheds, and RMAs in the proposed action. Standards, guidelines, and BMPs are the primary mechanisms to protect hydrologic, aquatic, and riparian function in alternative R.

### *Key Watersheds*

The key watershed network is expanded in alternative R based on updated fish distribution data, improved data on aquatic habitat function, and changes in boundaries, names, and numbers of subwatersheds since designation of the key watershed network for the proposed action. Five subwatersheds were added to the key watershed network in the proposed action. Additionally, three subwatersheds were removed from the proposed action key watershed network because they contain less than 25 percent National Forest System ownership.

There are 451,525 acres of key watersheds under National Forest System ownership (41 percent of total Colville National Forest ownership) in alternative R. Under alternative R, key watersheds are included in the late forest structure, backcountry, backcountry motorized, research natural area, recommended wilderness, and wilderness management areas. While watershed improvement treatments are not expected on every acre of key watershed through the life of this forest plan, specific measurable objectives for key watersheds are expected to accelerate the pace of aquatic restoration across the key watershed network. Water quality and hydrologic function are expected to improve from restoration projects to meet specific objectives outlined in the forest plan.

**Table 118. Key watersheds (subwatershed scale) for alternatives R, P, and O**

| Key Watershed Number | Key Watershed Name | Total Subwatershed Acres | Colville National Forest Ownership Acres | Riparian Road Miles | Riparian Road Density |
|---|---|---|---|---|---|
| 170102160102 | Winchester Creek | 10,482 | 5,628 | 10.7 | 4.2 |
| 170102160103 | Smalle Creek | 17,754 | 11,058 | 9.9 | 1.9 |
| 170102160201 | Exposure Creek-Pend Oreille River | 41,224 | 14,463 | 9.7 | 1.7 |
| 170102160206 | Tacoma Creek | 39,519 | 27,182 | 25.1 | 2.7 |
| 170102160302 | West Branch Le Clerc Creek | 21,672 | 15,099 | 5.6 | 0.9 |
| 170102160303 | East Branch Le Clerc Creek | 26,663 | 11,145 | 11.0 | 2.7 |
| 170102160304 | Ruby Creek | 19,597 | 18,385 | 13.1 | 2.2 |
| 170102160401 | Harvey Creek | 32,999 | 27,554 | 17.6 | 1.9 |
| 170102160402 | Headwaters Sullivan Creek | 45,516 | 45,417 | 45.1 | 3.9 |
| 170102160403 | North Fork Sullivan Creek-Sullivan Creek | 12,709 | 11,259 | 1.8 | 0.6 |
| 170102160702 | Headwaters South Salmo River | 20,697 | 12,472 | 0.1 | 0 |
| 170102160902 | Sweet Creek-Pend Oreille River | 41,832 | 28,890 | 16.5 | 2.1 |
| 170102160903 | Slate Creek | 20,195 | 19,907 | 10.5 | 2.3 |
| 170102161003 | Cedar Creek | 17,209 | 5,359 | 1.4 | 1.2 |
| 170200011004 | North Fork Deep Creek | 49,257 | 26,634 | 15.7 | 2.2 |
| 170200011301 | South Fork Sherman Creek | 22,004 | 21,899 | 11.6 | 2.3 |
| 170200011302 | Upper Sherman Creek | 26,381 | 26,260 | 15.4 | 2.8 |
| 170200011303 | Lower Sherman Creek | 20,987 | 15,998 | 6.7 | 6.7 |
| 170200011306 | Barnaby Creek | 23,108 | 14,299 | 9.1 | 2.4 |
| 170200011401 | Upper Hall Creek | 31,648 | 13,786 | 3.7 | 1.0 |
| 170200021301 | Trout Creek | 23,435 | 14,122 | 10.7 | 3.6 |
| 170200021701 | Tonata Creek | 14,453 | 13,781 | 16.2 | 5.9 |
| 170200021907 | East Deer Creek-Kettle River | 23,385 | 15,443 | 4.2 | 1.5 |
| 170200022002 | North Fork Deadman Creek | 13,450 | 13,185 | 8.8 | 1.1 |
| 170200022003 | Deadman Creek | 26,518 | 22,300 | 10.7 | 2.6 |
| | **Total** | 642,692 | **451,525** | | |

Three desired conditions for key watersheds in alternative R are similar to the proposed action, but have been updated for clarity. These desired conditions address riparian composition, key riparian processes, and livestock grazing, which are the same in alternative R and the proposed action. Standards for key watersheds are similar to the proposed action with clarification in the description of the “no net increase in road miles” standard.

### *Watershed and Aquatic Restoration*

Identification of key watersheds that are a priority for restoration and objectives for key watersheds are the same as the proposed action, except Upper Sherman Creek and South Fork Sherman Creek were added as restoration priorities in alternative R. Key watersheds that are priorities for restoration and

projected restoration completed through the life of this forest plan are shown in table 119. Key watershed objectives include:

- **FW-OBJ-WR-05. Key Watershed Restoration Prioritization:** Management in key watersheds focuses on restoration or preservation of watershed, aquatic, and riparian function and recovery of threatened and endangered species. Improve watershed condition class in key watersheds that are a priority for restoration within 15 years of forest plan implementation. Key watersheds that are a priority for restoration include:

  East Branch LeClerc Creek, West Branch LeClerc Creek, Deadman Creek, Barnaby Creek, Harvey Creek, North Fork Deadman Creek, North Fork Sullivan Creek, Sullivan Creek, Ruby Creek, Upper Sherman Creek, South Fork Sherman Creek, and Tonata Creek subwatersheds. Additional key watersheds that are a priority for restoration will be identified, as appropriate through the life of the plan.

- **FW-OBJ-WR-06. Key Watershed Road Treatments:** Reduce road-hydrologic connectivity and sediment delivery on roads through storm damage risk reduction treatments, full hydrologic decommissioning, and other accepted treatment measures on 78 miles of hydrologically connected road within 15 years of forest plan implementation.

  Restore or maintain aquatic organism passage and improve hydrologic and aquatic habitat function at 50 road/stream crossings for all native aquatic species, seasons, flows, and life stages within 15 years of Forest plan implementation through culvert replacement or crossing improvement and natural channel design or other acceptable treatment measures that provide for natural stream channel function at all flows.

- **FW-OBJ-WR-07. Key Watershed Range Infrastructure Improvements:** Improve hydrologic and aquatic function through range infrastructure improvements, including riparian fencing, movement and improvement of watering troughs, and other acceptable treatments on 250 acres within 15 years of plan implementation.
- **FW-OBJ-WR-08. Upland Vegetation Structure in RMAs in Key Watersheds:** Move upland vegetation within riparian management areas in key watersheds toward HRV on 1,200 acres within 15 years of plan implementation.
- **FW-OBJ-WR-09. Stream Restoration in Key Watersheds:** Restore hydrologic, geomorphic, and riparian process and function on 76 miles of stream within 15 years of forest plan implementation through activities including streambank stabilization, restoration of lateral and vertical hydrologic connectivity and improvement of stream channel and floodplain function.

**Table 119. Key watersheds that are priorities for restoration and projected restoration activities based on key watershed objectives that will be completed through the life of alternative R**

| Key Watershed Prioritization | Road Treatments Road Improvement (miles)* | Road Treatments Aquatic Organism Passage Improvement (# of crossings) | Range Infrastructure Improvement (acres) | Riparian Vegetation Structure Improvement (acres) | Stream Restoration (miles) |
|---|---|---|---|---|---|
| West Branch LeClerc Creek | 3 | 5 | 20 | 0 | 10 |
| East Branch LeClerc Creek | 3 | 1 | 20 | 0 | 10 |
| Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| Upper Sherman Creek | 5 | 5 | 0 | 75-150 | 2 |
| South Fork Sherman Creek | 5 | 9 | 0 | 75-150 | 4 |
| Barnaby Creek | 5 | 5 | 30 | 75-150 | 4 |
| Harvey Creek | 10 | 2 | 0 | 0 | 4 |
| Tonata Creek | 4 | 4 | 50 | 75-150 | 3 |
| North Fork Deadman Creek | 5 | 1 | 30 | 75-150 | 3 |
| North Fork Sullivan Creek | 3 | 1 | 0 | 0 | 0 |
| Sullivan Creek | 15 | 6 | 0 | 0 | 20 |
| Ruby Creek | 3 | 4 | 30 | 75-150 | 3 |
| Treatments in additional key and/or priority watersheds (estimate addition 3 subwatersheds over 15 years) | 12 | 6 | 30 | 75-150 | 10 |
| **Total for the life of the plan (essential projects completed for 14 subwatersheds)** | **78 miles** | **50 crossings** | **240 acres** | **600-1,200 acres** | **76 miles** |

Objectives for restoration in RMAs are expanded and clarified in alternative R from those included in the proposed action. In addition, alternative R includes an objective for management of upland vegetation in RMAs to move toward HRV. Two RMA objectives apply to subwatersheds outside of key watersheds, since key watershed objectives address the same activities within key watersheds. Objectives for RMAs in alternative R include:

- **MA-OBJ-RMA-01. Improve Riparian Function at Dispersed and Developed Recreation Sites:** Over the next 15 years, restore riparian processes and balance need for occupancy and access to water at 50 dispersed and developed recreation sites, through education, enforcement, and engineering where recreational use results in bank damage, reduction in water quality, and/ or a reduction in stream shade.

- **MA-OBJ-RMA-02. Restoration of Riparian Habitat and Processes on Roads:** Restore hydrologic and riparian habitat function within RMAs in non-key watersheds by reducing road-related impacts on 30 miles of road within 15 years.
- **MA-OBJ-RMA-03. Restoration of Late Forest Structure:** Move upland vegetation within riparian management areas outside of key watersheds toward HRV on 500 acres within 15 years of plan implementation.

Alternative R also includes general water resources objectives, not included in the proposed action:

- **FW-OBJ-WR-01. Aquatic Invasive Species:** Within the next 15 years, implement aquatic invasive species prevention measures at all developed recreation sites providing direct and/or indirect access to water bodies, such as boat ramps and other campgrounds, resorts and day use areas that provide portal zones for hand carried watercraft. Implement aquatic invasive species prevention measures as part of all aquatic survey and inventory procedures and other management activities that pose high potential for invasion vectors to occur.
- **FW-OBJ-WR-02. Aquatic Invasive and Non-Native Species:** Within the next 15 years, implement aquatic invasive species control and eradication at 10 sites where such invasions have become established and prevent attainment of listed fish recovery plan goals and/or effects to social, economic and ecological systems are determined to be unacceptable.
- **FW-OBJ-WR-03. General Watershed Function and Restoration:** Within the next 15 years, decrease sediment delivery from management activities on 1,000 acres including but not limited to roads, livestock, illegal ORV use, vegetation management, and dispersed and developed campsites. Restore hydrologic, aquatic and riparian processes through activities that stabilize stream bank erosion, and other accelerated channel destabilizing processes (i.e., headcutting), improve lateral and vertical hydrologic connectivity, and improve stream channel and floodplain function on 10 miles of streams.
- **FW-OBJ-WR-04. Fish Passage Improvement:** Restore aquatic organism passage at 45 road/stream crossings and man-made instream structures including water diversions and dams outside of key watersheds for all native species, seasons, flows, and life stages within 15 years of forest plan implementation, through culvert replacement or installation and improvement of hydrologic and aquatic habitat function and resiliency to a range of flows through natural channel design and other acceptable treatment measures.
- **FW-OBJ-WR-10. Watershed Restoration in Focus and Priority Watersheds:** Over 15 years, implement the watershed condition framework through completion of essential projects outlined in watershed action plans in existing focus and priority watersheds to improve watershed condition class. Focus watersheds designated at the 5th field watershed scale include, Upper Sanpoil, Chewelah Creek-Colville River, and LeClerc Creek-Pend Oreille River watersheds. Priority watersheds designated at the subwatershed scale include Ninemile Creek, East Branch LeClerc Creek, and West Branch LeClerc Creek subwatersheds.

Appendix C of the specialist report includes details on how water resources and RMA objectives were calculated. The water resources and RMA objectives included in alternative R provide additional direction and a stronger focus on aquatic restoration than the proposed action.

Measurable objectives for key watersheds are similar as the proposed action; however, the specific key watersheds that are priorities for active restoration where these objectives apply are expanded from the proposed action in alternative R. Specific objectives were developed in alternative R for the subwatersheds added to the key watershed network.

Completion of essential projects in 14 key watersheds, and 1 priority watershed is estimated under alternative R. Treatments to achieve this goal include; 78 miles of reduction in road hydrologic connectivity through decommissioning and storm damage risk reduction treatments, improvement of passage at 44 crossings, 240 acres of range infrastructure improvements, 600 to 1,200 acres of riparian vegetation improvements to move upland vegetation in RMAs toward HRV, and 76 miles of improvement of hydrologic and geomorphic channel function through in-stream channel improvements. Completion of projects outside of key and priority watersheds is expected to improve hydrologic, aquatic and riparian function through the treatment of erosion at 50 dispersed recreation sites, 30 miles of road in RMAs, 1,000 acres where erosion problems are identified. In addition, control or eradication of aquatic invasive species at 10 sites, 500 acres of improvement of upland vegetation in RMAs, improvement of aquatic organism passage at 45 crossings and man-made in-stream structures, and 10 miles of stream restoration would also improve hydrologic, aquatic, and riparian function.

### *Roads/Access*

#### Acres of Management Area Where Road Building Activities are Permitted

In alternative R, approximately 271,931 acres (25 percent of Colville National Forest) are in management areas where construction of new roads is prohibited, including backcountry, backcountry motorized, research natural areas and both designated and recommended wilderness.

#### Road Density Desired Conditions

While existing road densities vary across the management areas, road density desired condition of ML1-5 roads is no greater than 1 mile per square mile in the late forest structure management area (565,565 acres, 51 percent of Colville National Forest ), and no greater than 2 miles per square mile in the general restoration management area (245,110 acres, 22 percent of Colville National Forest ). Existing road densities calculated by management area at the 5th field watershed scale for the late forest structure and general restoration management areas are shown in table 120. There are no watersheds within the general restoration MA where existing condition meets the desired condition of 2 miles per square mile. There are no watersheds within the late forest structure MA that meet the desired condition of 1 mile per square mile. Objectives for treatment of roads to decrease sediment delivery should move toward meeting road density desired conditions through the life of this forest plan.

**Table 120. Existing road density by 5th field watershed for the general restoration and late forest structure management areas in alternative R**

| 5th field Watershed Name | Road Density (mi/mi$^2$) | Meets Road Density Desired Condition of 2 mi/mi$^2$? |
|---|---|---|
| **General Restoration MA** | | |
| Boulder Creek-Kettle River | 4.5 | N |
| Chewelah Creek-Colville River | 6.5 | N |
| Curlew Creek | 4.0 | N |
| Deep Creek | 6.4 | N |
| Hall Creek-Franklin D Roosevelt Lake | 9.0 | N |
| Le Clerc Creek-Pend Oreille River | 4.6 | N |
| Little Pend Oreille River | *14.5 | N |
| Mill Creek | 3.8 | N |
| Onion Creek-Franklin D Roosevelt Lake | *36.2 | N |
| Sherman Creek-Franklin D Roosevelt Lake | 4.9 | N |
| Sullivan Creek-Pend Oreille River | 3.9 | N |
| Tacoma Creek-Pend Oreille River | 5.3 | N |
| Toroda Creek | 4.5 | N |
| Upper Sanpoil River | 3.5 | N |
| Vulcan Mountain-Kettle River | 4.0 | N |
| West Fork Sanpoil River | 5.3 | N |

| 5th field Watershed Name | Road Density (mi/sq mi) | Meets Road Density Desired Condition of 1 mi/mi$^2$? |
|---|---|---|
| **Late Forest Structure MA** | | |
| Boulder Creek-Kettle River | 3.6 | N |
| Chewelah Creek-Colville River | 5.1 | N |
| Curlew Creek | 4.2 | N |
| Deep Creek | 4.8 | N |
| Hall Creek-Franklin D Roosevelt Lake | 6.1 | N |
| Le Clerc Creek-Pend Oreille River | 4.4 | N |
| Little Pend Oreille River | 4.6 | N |
| Mill Creek | 3.4 | N |
| Onion Creek-Franklin D Roosevelt Lake | 3.6 | N |
| Sherman Creek-Franklin D Roosevelt Lake | 3.9 | N |
| Stensgar Creek-Colville River | 3.2 | N |
| Sullivan Creek-Pend Oreille River | 5.0 | N |
| Tacoma Creek-Pend Oreille River | 4.5 | N |
| Toroda Creek | 4.8 | N |
| Upper Sanpoil River | 7.2 | N |
| Vulcan Mountain-Kettle River | 4.6 | N |

*Low land area included in road density calculation may make road density calculations appear high.

**Road Management Plan Components**

In addition to road density desired conditions for the general and focused restoration management areas, desired conditions for aquatic and riparian systems, RMAs, and key watersheds focused on minimizing hydrologic interruption, erosion, and sedimentation from the road system are included in alternative R. Road treatment projects through the life of this forest plan under alternative R would move toward desired conditions.

Standards and guidelines to protect aquatic and riparian resources are in the RMA standards and guidelines section of the forest plan. Alternative R includes standards for restriction of sidecasting, placement of fill, or plowed snow in RMAs or other hydrologically connected areas, and avoidance of hydrologic flow paths during road construction, maintenance, and reconstruction. Also included in alternative R is a standard for reconstructing stream crossings to accommodate 100-year flows, avoiding diversion of streamflow onto roads in the event of crossing failure, and providing fish passage for all species and life stages at crossings. Guidelines in alternative R include construction or reconstruction of stream crossings to allow for riparian-dependent species passage, and retention of fish passage barriers where they restrict access by non-native fish species. Two road guidelines in the proposed action were changed to standards in alternative R, including a no net increase in system roads in RMAs (avoidance of road construction in RMAs guideline in the proposed action), and minimizing hydrologic connectivity and sediment delivery from the road system. Standards, guidelines, BMPs, and restoration objectives to minimize hydrologic impacts from the road system are the primary mechanisms to protect water quality and riparian function from roads under alternative R.

## Old Forest Management, Timber Production, and Upland Vegetation Condition

### *Active Vegetation Management*

Timber production would be allowed in General Restoration areas, comprising 245,110 acres (22 percent of the Forest). Alternative R has the least amount of MAs allocated to active vegetation management. Acres treated are constrained by forest budgets, and project-level considerations. BMPs, standards, and guidelines are the primary mechanism to limit the potential effects of vegetation management activities on water quality and hydrologic function.

### *Primary Vegetation Management Tools*

Partial harvest, variable density thinning, and shelterwood with reserves would be the primary tools for active commercial vegetation management with an estimated (modeled) treatment of 975 acres per year under alternative R. Mixed severity prescribed fire would be used in open-canopy stands on a 20-year rotation to maintain open conditions in the Douglas-fir dry and northern Rocky Mountain mixed conifer vegetation types. Stand-replacing prescribed fire would be used in the subalpine fir and lodgepole pine vegetation type.

Acres of Colville National Forest lands by management area and roadbuilding and timber production authorized by management area are shown in the following table.

**Table 121. Alternative R management areas and activities authorized in each management area that can affect the hydrologic resource**

| Management Areas | Acres | New roadbuilding authorized? | Timber Production Authorized? |
|---|---|---|---|
| Late Forest Structure | 565,565 | Y<br>1 mi/mi$^2$ desired condition for road density | Y |
| General Restoration | 245,110 | Y<br>2 mi/mi$^2$ desired condition for road density | Y |
| Backcountry | 20,230 | N | N |
| Backcountry Motorized | 6,698 | N | N |
| Research Natural Area | 5,704 | N | N |
| Scenic Byways | 19,109 | Y | |
| Wilderness – Recommended | 207,800 | N | N |
| Wilderness-Congressionally Designated | 31,400 | N | N |
| *RMAs | 179,236 | Y—within standards and guidelines | N—vegetation management can be used as a tool to meet or maintain desired conditions, goals and objectives |
| Total | 1,101,717 | | |

*MAs overlay other management area and are not included in total acreage calculations.

### *Historic Range of Variability*

Four out of 19 structure classes are within HRV after 100 years of land management under alternative R (table 122). Alternative R has the least number of structure and vegetation types within HRV of all alternatives. Seven structure classes are below HRV, and eight are above. Late open structure conditions show the greatest departure from HRV. The late closed forest structure would be above HRV in four out of five vegetation types. Levels of disturbance and management do not occur across enough acres over 100 years under alternative P to create open structure conditions that existed historically. Areas that would historically have contained large trees with open canopy conditions, and greater resistant to wildfire and insect and disease outbreaks would be in a closed canopy condition with greater susceptibility to disturbance (Day 2015).

**Table 122. Vegetation and structure type within HRV modeled after 100 years of management under alternative R**

| Vegetation Type | Early Structure | Mid-open Structure | Mid-closed Structure | Late Open Structure | Late Closed Structure |
|---|---|---|---|---|---|
| Douglas-fir dry | @ | + | + | - | + |
| Northern Rocky Mountain mixed conifer | - | + | @ | - | @ |
| Western hemlock/ Western redcedar | - | n/a | - | n/a | + |
| Subalpine fir / Lodgepole pine | + | n/a | - | n/a | + |
| Spruce/ Subalpine fir | - | n/a | @ | n/a | + |

@=within HRV; -=below HRV; +=above HRV; and n/a=structure class does not exist within this vegetation type

### *Vegetation Management Plan Components*

Standards for fuel wood cutting, chemical application of herbicides and pesticides, and fuel chipping are included in alternative R. A guideline is included for hazard tree felling. Three guidelines in the proposed action addressing timber harvest and thinning in RMAs to move upland vegetation toward HRV, location of landings, skid trails, and staging and decking areas, and yarding activities in RMAs were changed to standards in alternative R. Standards, guidelines, and BMPs are the primary mechanisms to protect water quality and riparian function from vegetation management activities under alternative R.

### *Grazing Plan Components*

Current allotment boundaries and AUMs would continue under alternative R. Alternative R includes a stricter guideline for stubble height in greenline areas to reflect best available science, and two guidelines in the proposed action are standards in alternative R. These changes provide the framework to better manage grazing in areas critical to aquatic and riparian function toward attainment of desired conditions. Specific objectives for rangeland improvements in key watersheds that are priority for active restoration should also accelerate the pace of improvement of range infrastructure and management in RMAs. Comparison of grazing components between alternative R and other alternatives are shown in table 123.

**Table 123. Comparison of grazing plan components that are different between alternative R and other alternatives (not under INFISH)**

| Proposed Action and Alternative O | Alternatives R and P |
|---|---|
| **RMA Guideline GM**<br>Within green-line vegetation area adjacent to all watercourses:<br>• Do not exceed 20 percent streambank alteration;<br>• Do not exceed 40% utilization of mean annual vegetative production on woody vegetation;<br>• Maintain at least 4-6 inches or do not exceed 40% utilization of mean annual vegetative production on herbaceous vegetation | **MA-GDL-RMA-09**<br>***Recreational and permitted grazing management – green-line vegetation areas***<br>Within green-line vegetation area adjacent to all watercourses:<br>• A 25 percent stream bank alteration shall not be exceeded;<br>• A 40 percent utilization of available mean annual vegetative production on woody vegetation shall not be exceeded;<br>• Maintain at least 6 to 8 inches residual stubble height and utilize no more than 40% of mean annual vegetative production on deep-rooted herbaceous vegetation. |
| **RMA Guideline GM**<br>During allotment management planning consider removal of existing livestock handling or management facilities from RMAs | **MA-STD-RMA-13*Recreational and permitted grazing management – allotment management planning***<br>During allotment management planning, impacts from existing livestock handling or management facilities located within riparian management areas shall be minimized or eliminated. |
| **RMA Guideline GM**<br>Generally avoid trampling of federally listed threatened or endangered fish redds by livestock | **MA-STD-RMA-14**<br>***Recreational and permitted grazing management – fish redds***<br>Prohibit livestock access to federally listed threatened or endangered fish redds. |

Standards, guidelines, BMPs, and restoration objectives to minimize the impact of grazing on hydrologic function and water quality are the primary mechanisms to preserve water quality and hydrologic function under alternative R.

## Summary of Effects and Comparison of Other Alternatives

Alternative R provides the best protection for preservation and restoration of hydrologic function, water quality, and water uses of all alternatives. Effects of alternative R in relation to other alternatives include:

- Alternative R addresses the need for change more effectively than no action, the proposed action, and alternatives B and O. Through plan components and principles from ARCS-modified, and specific objectives for restoration of general watershed function across the forest, and restoration in key watersheds and RMAs, the pace and scale of watershed restoration and resiliency to potential hydrologic effects of climate change are increased in alternative R.
- Wider RMA widths along intermittent streams, lakes, and ponds than no action and alternative B would improve and preserve hydrologic and riparian function better than narrower RHCA widths in no action and alternative B.
- There are more acres of key watersheds in alternative R than in the INFISH priority network in no action and alternative B, and the key watershed network in the proposed action. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network in alternative R would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network in no action and alternative B and the smaller key watershed network in the proposed action.
- Alternative R would accelerate improvement in watershed condition faster than no action, the proposed action, and alternative B. Measurable objectives for water resources, RMAs and the expanded key watershed network would accelerate restoration and preservation of hydrologic function.
- Desired conditions are identified for general aquatic riparian and watershed condition; DCs are not identified in no action and alternative B.
- Approximately 25 percent of Colville National Forest land base is in management areas where construction of new roads is prohibited. Fifty-one percent of the Colville National Forest land base is within the focused restoration MA where desired condition for road density is 1 mile per square mile.
- Approximately 22 percent of the Colville National Forest land base is in areas where active vegetation management is authorized; this is the least amount of acres designated for this use among all alternatives.
- Four out of 19 structure classes are within HRV after 100 years of land management under alternative R. Alternative R has the least number of structure and vegetation types within HRV of all alternatives.
- There is a greater emphasis on grazing standards in alternative R (and alternative P), and stricter numeric criteria for stubble height in MA-GDL-RMA-09 should be more effective in moving toward desired conditions in RMAs in grazing allotments than no action, the proposed action, and alternatives B and O.
- Standards and guidelines address watershed function, including protection of streambank and floodplain integrity from livestock grazing, reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Alternative R has a stronger emphasis on standards than the proposed action, which should protect watershed function and water quality more effectively than no action, proposed action, and alternatives B and O.
- Standards for development of hydroelectric and other water use developments are more stringent in alternatives R, P, O, and the proposed action than in no action and alternative B.

- Measureable objectives and focused restoration activities in alternative R would increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change faster than the proposed action, and alternative B.

## Alternative P

Alternative P addresses public concern that wilderness designation may result in lower revenue to local economies due to reduced recreational opportunities. Alternative P has less recommended wilderness than the proposed action. Forest plan direction for watershed, aquatic, and riparian resources is the same as the R alternative.

### Riparian and Aquatic Resource Management

#### *Acres of RMAs*

RMA widths and acreages are the same as the proposed action and alternatives R, P, and O.

#### *Riparian and Aquatic Plan Components*

Desired conditions, objectives, standards, and guidelines are the same as alternative R.

#### *Key Watersheds*

Acres, management, and objectives in key watersheds are the same as alternative R.

#### *Watershed and Aquatic Restoration*

The pace and scale of watershed and aquatic restoration is the same as alternative R.

### Roads/Access

#### *Acres of Management Area Where Road-building Activities are Permitted*

Approximately 283,119 acres (26 percent of Colville National Forest) in alternative P are in management areas where construction of new roads is prohibited, including backcountry, backcountry motorized, research natural areas and both designated and recommended wilderness.

#### *Road Density Desired Condition*

While existing road densities vary across management areas, desired condition for road density of ML1-5 roads is no greater than 1 mile per square mile in the focused restoration management area (306,092 acres, 28 percent of Colville National Forest ), and no greater than 2 miles per square mile in the general restoration management area (493,267 acres, 45 percent of Colville National Forest ). Existing road densities calculated by management area at the 5th field watershed scale for focused and general restoration management areas are shown in table 124. There are no watersheds within the focused restoration MA where existing condition meets the desired condition of 1 mile per square mile. There are no watersheds in the general restoration MA that meet the desired condition of 2 miles per square mile. Measureable objectives in key watersheds and desired conditions for water resources, key watersheds, and RMAs would contribute toward reduction in road densities within the focused restoration MA, through treatment of hydrologically connected road segments.

**Table 124. Existing road density by 5th field watershed for the focused and general restoration management areas in alternative P**

| 5th field Watershed Name | Road Density mi/mi$^2$ | Meets Road Density Desired Condition of 1 mi/mi$^2$? |
|---|---|---|
| **Focused Restoration MA** | | |
| Boulder Creek-Kettle River | 3.0 | N |
| Curlew Creek | 2.6 | N |
| Deep Creek | 3.7 | N |
| Hall Creek-Franklin D Roosevelt Lake | 5.2 | N |
| Le Clerc Creek-Pend Oreille River | 2.1 | N |
| Sherman Creek-Franklin D Roosevelt Lake | 2.8 | N |
| Sullivan Creek-Pend Oreille River | 3.7 | N |
| Tacoma Creek-Pend Oreille River | 3.2 | N |
| Vulcan Mountain-Kettle River | 3.9 | N |

| 5th field Watershed Name | Road Density mi/mi$^2$ | Meets Road Density Desired Condition of 2 mi/mi$^2$? |
|---|---|---|
| **General Restoration MA** | | |
| Boulder Creek-Kettle River | 3.1 | N |
| Chewelah Creek-Colville River | 4.2 | N |
| Curlew Creek | 3.5 | N |
| Deep Creek | 3.4 | N |
| Hall Creek-Franklin D Roosevelt Lake | 4.3 | N |
| Le Clerc Creek-Pend Oreille River | 2.6 | N |
| Little Pend Oreille River | 3.3 | N |
| Mill Creek | 2.7 | N |
| Onion Creek-Franklin D Roosevelt Lake | 2.8 | N |
| Sherman Creek-Franklin D Roosevelt Lake | 2.8 | N |
| Stensgar Creek-Colville River | 3.0 | N |
| Sullivan Creek-Pend Oreille River | 3.0 | N |
| Tacoma Creek-Pend Oreille River | 3.9 | N |
| Toroda Creek | 2.5 | N |
| Upper Sanpoil River | 3.0 | N |
| Vulcan Mountain-Kettle River | 3.0 | N |
| West Fork Sanpoil River | 3.7 | N |

### *Road Management Plan Components*

Desired conditions, objectives and standards and guidelines for roads are the same as alternative R.

## Old Forest Management, Timber Production, and Upland Vegetation Condition

### *Active Vegetation Management*

Timber production would be allowed in management areas Focused and General Restoration areas, comprising 799,359 acres (72 percent of the Forest). This is less than no action and alternative B, similar

to the proposed action and alternative O and more than alternative R. Acres treated are constrained by forest budgets, and project-level considerations. BMPs, standards, and guidelines are the primary mechanism to limit the potential effects of vegetation management activities on water quality and hydrologic function.

### *Primary Vegetation Management Tools*

Variable density thinning would be the primary tool for active commercial vegetation management in the focused and general restoration MAs in alternative P in the Douglas-fir dry and northern Rocky Mountain mixed conifer vegetation types in the proposed action with an estimated (modeled) treatment of 4,050 acres per year. Mechanical fuels treatments are estimated on 5,000 acres per year in these vegetation types. Mixed and light severity prescribed fire would be used in open-canopy stands on a 20-year rotation to maintain open conditions in the Douglas-fir dry and northern Rocky Mountain mixed conifer vegetation types with treatment modeled for 3,839 acres per year. Shelterwood harvest with reserves would be the primary commercial vegetation management tool in the subalpine fir and lodgepole pine vegetation type with an estimated (modeled) 950 acres of treatment per year. Stand-replacing prescribed fire would be used in the subalpine fir and lodgepole pine vegetation type with an estimated treatment of 1,040 acres per year. There are no modeled vegetation treatments in the Western redcedar/Western hemlock and spruce/subalpine fir vegetation types.

Acres of Colville National Forest lands by management area and roadbuilding and timber production authorized by management area are shown in table 125.

**Table 125. Alternative P management areas and activities authorized in each management area that can affect the hydrologic resource**

| Management Areas | Acres | New roadbuilding authorized? | Timber Production Authorized? |
|---|---|---|---|
| Focused Restoration | 306,134 | Y<br>1 mi/mi$^2$ desired condition for road density | Y |
| General Restoration | 493,282 | Y<br>2 mi/mi$^2$ desired condition for road density | Y |
| Backcountry | 123,055 | N | N |
| Backcountry Motorized | 54,577 | N | N |
| Research Natural Area | 5,707 | N | N |
| Scenic Byways | 19,356 | Y | |
| *Special Interest Area | 82,800 | N | N |
| Wilderness –Recommended | 68,300 | N | N |
| Wilderness-Congressionally Designated | 31,400 | N | N |
| *RMAs | 179,236 | Y—within standards and guidelines | N—vegetation management can be used as a tool to meet or maintain desired conditions, goals and objectives |
| **Total** | **1,101,890** | | |

*MAs overlay other management area and are not included in total acreage calculations.

### *Historic Range of Variability*

Number of structure classes departed from HRV is the same as the proposed action.

### *Vegetation Management Plan Components*

Standards and guidelines for vegetation management are the same as alternative R.

### *Grazing*

Current allotment boundaries and AUMs would continue under alternative P. Standards and guidelines for grazing management and potential indirect effects are the same as alternative R. Specific objectives for rangeland improvements in key watersheds that are priority for active restoration are the same as alternatives R and O.

## Summary of Effects and Comparison of Other Alternatives

Alternative P is similar to alternative R in providing protections for preservation and restoration of hydrologic function, water quality, and water uses. Alternative P would be slightly less effective than alternative R, and more effective than no action, the proposed action, and alternatives O and B.

- Similar to alternative R, alternative P addresses the need for change more effectively than the no-action alternative, the proposed action, and alternatives B and O. Through plan components and principles from ARCS, and specific objectives for restoration of general watershed function across the forest, and restoration in key watersheds and RMAs, the pace and scale of watershed restoration and resiliency to potential hydrologic effects of climate change are increased in alternative P.
- Wider RMA widths along intermittent streams, lakes, and ponds than no action and alternative B would improve and preserve hydrologic and riparian function better than narrower RHCA widths in the no-action alternative and alternative B.
- There are more acres of key watersheds in alternative P than in the INFISH priority network in the no-action alternative and alternative B, and the key watershed network in the proposed action. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network in alternative P would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network in the no-action alternative and alternative B and the smaller key watershed network in the proposed action.
- Alternative P would accelerate improvement in watershed condition faster than the no-action alternative, the proposed action, and alternative B. Measurable objectives in the expanded key watershed network would accelerate restoration and preservation of hydrologic function.
- Desired conditions are identified for general aquatic riparian and watershed condition; DCs are not identified in no action and alternative B.
- Approximately 26 percent of Colville National Forest land base is in management areas where construction of new roads is prohibited. Twenty-eight percent of the Colville National Forest land base is within the focused restoration MA where desired condition for road density is 2 miles per square mile. This is less than in alternative R, and higher than in the proposed action.
- Approximately 72 percent of the Colville National Forest land base is in MAs where timber production is authorized. This is similar to the proposed action and alternative O, less than no action and alternative B, and greater than alternative R.
- Standards and guidelines address watershed function, including protection of streambank and floodplain integrity from livestock grazing, reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Standards and guidelines in alternative P are more restrictive, and should protect watershed function and water quality more effectively than no action, the proposed action, and alternatives B and O.

- Six out of 19 vegetation structure classes are within HRV after 100 years of land management in alternative P. Departure from HRV in alternative P is the same as no action, the proposed action, and alternative B.
- Standards for development of hydroelectric and other water use developments are more stringent in alternatives R, P, O, and the proposed action than in no action and alternative B.
- Measureable objectives and focused restoration activities in key watersheds in alternative P would increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change. Since the key watershed network is expanded from the proposed action in alternative R, this alternative would be more effective in increasing resiliency to climate change than no action, the proposed action, and alternative B.

## Alternative B

Alternative B combines feedback from diverse interest groups and incorporates management strategies supported by the Northeast Washington Forestry Coalition. Alternative B addresses the concerns of multiple constituencies in one alternative by designating restoration and timber management zones, recommending the highest level of wilderness designation and the least amount of area for backcountry management and backcountry motorized use.

Forest plan direction for watershed, aquatic, and riparian resources would remain the same as the no-action alternative.

### Riparian and Aquatic Resource Management

#### *Acres of RHCAs*

Acreage, management, and protection of RHCAs are the same as in the no-action alternative.

#### *Riparian and Aquatic Resource Plan Components*

Riparian goals, riparian management objectives, standards, and guidelines are the same as the no-action alternative.

**INFISH Priority Watersheds**

Acres and management in INFISH priority watersheds are the same as the no-action alternative.

**Watershed and Aquatic Restoration**

The pace and scale of watershed and aquatic restoration is the same as the no-action alternative.

### Roads/Access

#### *Acres of Management Area Where Road Building Activities are Permitted*

Approximately 268,921 acres (24 percent of Colville National Forest ) in alternative B are in management areas where construction of new roads is prohibited, including backcountry, backcountry motorized, research natural areas and both designated and recommended wilderness.

#### *Road Density Desired Conditions*

This alternative caps total miles of National Forest System roads at the current level, about 4,000 miles, and uses a standard that would require at least one mile of road to be decommissioned when adding a mile to the system. There are no specific road density desired conditions in MAs in alternative B.

### *Road Management Plan Components*

Desired conditions, objectives and standards and guidelines for roads are the same as the no-action alternative.

## Old Forest Management, Timber Production, and Upland Vegetation Condition

### *Active Vegetation Management*

Timber production would be allowed in the Active Management and Restoration areas, comprising 815,345 acres (74 percent of the Forest).

### *Primary Vegetation Management Tools*

In alternative B, variable density thinning and shelterwood with reserves would be the primary vegetation management tools in all vegetation types with the exception of the spruce/subalpine fir type, which has no anticipated vegetation management. Prescribed fire of varying intensity is expected in the Douglas-fir dry, northern Rocky Mountain mixed conifer, and subalpine fir/ lodgepole pine (wilderness only) vegetation types. Timber harvest of 2,250 acres per year is estimated (modeled) under alternative B. Mechanical fuels treatments and prescribed fire are estimated (modeled) at 2,501, and 3,839 acres per year, respectively.

Acres of management areas and roadbuilding and timber production authorized by management area are shown in table 126.

**Table 126. Alternative B management areas and activities authorized in each management area that can affect the hydrologic resource**

| Management Areas | Acres | New roadbuilding authorized? | Timber Production Authorized? |
|---|---|---|---|
| Active Management Area | 476,804 | Y | Y |
| Restoration | 338,541 | Y | Y |
| Backcountry | 4,835 | N | N |
| Backcountry Motorized | 6,606 | N | N |
| Research Natural Area | 5,713 | N | N |
| Scenic Byways | 17,614 | Y | N |
| Wilderness –Recommended | 220,330 | N | N |
| Wilderness-Congressionally Designated | 31,400 | N | N |
| *RHCAs | 179,236 | Y, within standards and guidelines | N, except where needed to maintain or meet RMOs |
| Total | 1,101,880 | | |

### *Historical Range of Variability*

Six out of 19 structure classes are within HRV after 100 years of land management under alternative B (table 127). The same number of structure classes is within HRV for no action, the proposed action, and alternative P. Five structure classes are below HRV, and eight are above. The late closed forest structure would be at or above HRV in all vegetation types. Levels of disturbance and management do not occur across enough acres over 100 years under alternative B to create open structure conditions that existed historically. Areas that would historically have contained large trees with open canopy conditions, and greater resistant to wildfire and insect and disease outbreaks would be in a closed canopy condition with greater susceptibility to disturbance (Day 2015).

**Table 127. Vegetation and structure type within HRV modeled after 100 years of management under alternative B**

| Vegetation Type | Early Structure | Mid-open Structure | Mid-closed Structure | Late Open Structure | Late Closed Structure |
|---|---|---|---|---|---|
| Douglas-fir dry | + | + | + | - | + |
| Northern Rocky Mountain mixed conifer | @ | + | @ | - | @ |
| Western hemlock/ Western redcedar | - | n/a | @ | n/a | + |
| Subalpine fir / Lodgepole pine | + | n/a | - | n/a | @ |
| Spruce/ Subalpine fir | - | n/a | @ | n/a | + |

@=within HRV; -=below HRV; +=above HRV; and n/a=structure class does not exist within this vegetation type

### *Vegetation Management Plan Components*

Standards and guidelines for vegetation management are the same as the no-action alternative.

### *Grazing Plan Components*

Current allotment boundaries and AUMs would continue under alternative B. Standards and guidelines for grazing management and potential indirect effects are the same as the no-action alternative.

## Summary of Effects and Comparison of Other Alternatives

Effects to hydrologic function, water quality, and water uses in alternative B is similar to the no-action alternative and provides less protection to the processes that improve or preserve hydrologic function than the proposed action and alternatives R, P, and O. Alternative B would provide a slower pace of recovery of hydrologic function through passive and active restoration than the proposed action and alternatives R, P, and O. Effects of alternative B in relation to other alternatives include:

- Alternative B does not adequately address the need for change in this forest plan revision; the pace of watershed restoration is not increased from current levels, watershed and riparian direction is not integrated. Specific watershed and riparian objectives in the proposed action, and alternatives R, P, and O should increase the pace and scale of watershed restoration, and improve resiliency to the potential hydrologic effects of climate change more than no action and alternative B.
- Narrower RHCA widths along intermittent streams, lakes, and ponds are less restrictive than RMA widths in the proposed action, and alternatives R, P, and O and may not improve or preserve hydrologic and riparian function as well as wider RMA widths.
- There are fewer acres of priority watersheds in alternative B than the proposed action and alternatives R, P, and O. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network in alternative B.
- Alternative B does not accelerate improvement in watershed condition; the INFISH priority network would remain and there are not specific plans to accelerate the pace of restoration in the INFISH priority watershed network. There are no measureable objectives for the INFISH priority watershed network in alternative B.
- RMOs would be used as benchmarks for evaluation of current stream conditions, even though they may not adequately account for natural variability or separate land use effects from natural disturbance.

- Desired conditions are not identified for general aquatic, riparian, and watershed condition.
- Approximately 20 percent of Colville National Forest land base is in management areas where construction of new roads is prohibited. The cap on existing road mileage in alternative B is not as protective as the 2 miles per square mile objective for the focused restoration and late forest structure MAs in the proposed action and alternatives R and P.
- Six out of 19 vegetation structure classes are within HRV after 100 years of land management under alternative B. Departure from HRV in alternative B is the same as no action, the proposed action, and alternative P.
- Standards and guidelines would not address contemporary issues of watershed function, including protection of streambank and floodplain integrity from livestock grazing, reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Standards and guidelines in alternative B may not protect watershed function and water quality as effectively as the proposed action, and alternatives R, P, and O.
- Standards for development of hydroelectric and other water use developments are less stringent in alternative B than the proposed action and alternatives R, P, and O.
- Alternative B does not increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change.

## Alternative O

This alternative comes from a series of public, collaborative meetings run by the Forest Service that focused on motorized recreation, wilderness recommendations, and vegetation management and reflects areas of general agreement among participants in those meetings. The Forest Service fully developed this alternative using the proposed action to fill in the gaps not addressed in the collaborative process.

Forest plan components, including general goals, objectives, and standards and guidelines are the same as the proposed action. RMAs are the same as the proposed action and alternatives R and P. The key watershed network, and objectives specific to key watersheds are the same as the R and P alternatives.

### Riparian and Aquatic Resource Management

#### *Acres of RMAs*

RMA widths and acreages are the same as the proposed action and alternatives R and P.

#### *Riparian and Aquatic Resource Plan Components*

Desired conditions, objectives, standards, and guidelines are the same as the proposed action.

#### *Key Watersheds*

Acres in key watersheds are the same as alternative R. The priority key watershed network and measureable objectives for key watersheds are the same as alternatives R and P. Standards and guidelines for key watersheds are the same as the proposed action.

#### *Watershed and Aquatic Restoration*

The pace and scale of watershed and aquatic restoration in key watersheds is the same as the proposed action. However, like the proposed action, there are no measureable objectives for general water resources, and RMA objectives are the same as the proposed action.

## Roads/Access

### *Acres of Management Areas Where Road Building Activities are Permitted*

Approximately 268,921 acres (24 percent of Colville National Forest) in alternative B are in management areas where construction of new roads is prohibited, including backcountry, backcountry motorized, research natural areas and both designated and recommended wilderness.

### *Road Density Desired Conditions*

There are no specific road density desired conditions in MAs in alternative O. Road direction is the same as alternative B; road miles are capped at their current level (approximately 4,000 miles).

### *Road Management Plan Components*

Desired conditions, objectives, and standards and guidelines for roads are the same as the proposed action; however, there are no specific road density desired conditions in MAs in alternative O. Similar to the proposed action, and alternatives R and P, alternative O includes FW-STD-WR-03, which states that there would be no net increase in mileage of NFS roads in key watersheds at any time, unless doing so improves watershed condition.

## Old Forest Management, Timber Production, and Upland Vegetation Condition

### *Active Vegetation Management*

Timber production could occur in both the Responsible Management Area and the Restoration Zone, comprising 801,124 acres (72 percent of the Forest).

### *Primary Vegetation Management Tools*

Anticipated vegetation management tools and estimated (modeled) acres of treatment per year in alternative O are the same as alternative B.

Acres of Colville National Forest by management area and roadbuilding and timber production authorized by management area in alternative O are shown in table 128.

**Table 128. Alternative O management areas and activities authorized in each management area that can affect the hydrologic resource**

| Management Areas | Acres | New roadbuilding authorized? | Timber Production Authorized? |
|---|---|---|---|
| Backcountry | 174,311 | N | N |
| Backcountry Motorized | 53,734 | N | N |
| Research Natural Area | 5,713 | N | N |
| Restoration | 369,053 | Y | Y |
| Responsible | 431,562 | Y | Y |
| Scenic Byways | 19,607 | Y | N |
| *Special Interest Area | 99,000 | N | N |
| Wilderness –Recommended | 15,950 | N | N |
| Wilderness-Congressionally Designated | 31,400 | N | N |
| *RMAs | 179,236 | Y, within standards and guidelines | N—vegetation management can be used as a tool to meet or maintain desired conditions, goals and objectives |
| Total | 1,101,370 | | |

*MA overlays other management area and is not included in total acreage calculations.

### *Historic Range of Variability*

Eight out of 19 structure classes are within HRV after 100 years of land management under alternative O; this is the most structure classes within HRV of all alternatives (table 129). Four structure classes are below HRV, and seven are above. Late and mid-open structure conditions show the greatest departure from HRV. The late closed forest structure would be at or above HRV in all vegetation types. Levels of disturbance and management do not occur across enough acres over 100 years under alternative O to create open structure conditions that existed historically. Areas that would historically have contained large trees with open canopy conditions, and greater resistance to wildfire and insect and disease outbreaks would be in a closed canopy condition with greater susceptibility to disturbance (Day 2015).

**Table 129. Vegetation and structure type within HRV modeled after 100 years of management under alternative O**

| Vegetation Type | Early Structure | Mid-open Structure | Mid-closed Structure | Late Open Structure | Late Closed Structure |
|---|---|---|---|---|---|
| Douglas-fir dry | + | + | + | - | + |
| Northern Rocky Mountain mixed conifer | @ | + | @ | - | @ |
| Western hemlock/ Western redcedar | - | n/a | @ | n/a | + |
| Subalpine fir / Lodgepole pine | @ | n/a | @ | n/a | @ |
| Spruce/ Subalpine fir | - | n/a | @ | n/a | + |

@=within HRV; -=below HRV; +=above HRV; and n/a=structure class does not exist within this vegetation type

### *Vegetation Management Plan Components*

Standards and guidelines for vegetation management are the same as the proposed action.

### *Grazing Plan Components*

Current allotment boundaries and AUMs would continue under alternative O. Standards and guidelines to move streams and RHCAs toward attainment of RMOs and indirect effects are the same as the proposed action. Specific objectives for rangeland improvements in key watersheds that are priority for active restoration are the same as alternatives R and P.

## Summary of Effects and Comparison of Other Alternatives

Alternative O is similar to the proposed action in providing protections for preservation and restoration of hydrologic function, water quality, and water uses. Alternative O would be less effective than alternatives R and P, and more effective than no action and alternative B. Effects of alternative O in relation to other alternatives include:

- Similar to the proposed action, alternative O addresses the need for change more effectively than no action and alternative B. Through plan components and principles from ARCS, and specific objectives for restoration in key watersheds, the pace and scale of watershed restoration and resiliency to potential hydrologic effects of climate change are increased in alternative O. Alternative O does not address the need for change as effectively as alternatives P and R.
- Wider RMA widths along intermittent streams, lakes, and ponds than no action and alternative B would improve and preserve hydrologic and riparian function better than narrower RHCA widths in no action and alternative B.
- There are more acres of key watersheds in alternative O than in the INFISH priority network in no action and alternative B, and the key watershed network in the proposed action. While restoration activities are not expected on every acre within key watersheds, the larger key watershed network in alternative O would accelerate the pace of restoration of hydrologic function than in the smaller INFISH priority network in no action and alternative B and the smaller key watershed network in the proposed action.
- Alternative O would accelerate improvement in watershed condition faster than no action, the proposed action, and alternative B. Measurable objectives in the expanded key watershed network would accelerate restoration and preservation of hydrologic function.
- Desired conditions are identified for general aquatic riparian and watershed condition; DCs are not identified in no action and alternative B.
- Approximately 26 percent of the Forest land base is in management areas where construction of new roads is prohibited. The cap on existing road mileage in alternative O is not as protective as the 2 miles per square mile objective for the focused restoration and late forest structure MAs in the proposed action and alternatives R and P.
- Eight out of 19 vegetation structure classes are within HRV after 100 years of land management under alternative O. Alternative O has the most structure classes within HRV of all alternatives.
- Standards and guidelines address watershed function, including protection of streambank and floodplain integrity from livestock grazing, reduction of erosion and sedimentation and disruption of hydrologic processes from roads and trails. Standards and guidelines in alternative O should protect watershed function and water quality more effectively than no action and alternative B. Standards and guidelines in alternative O are less restrictive than in alternatives R, and P.
- Standards for development of hydroelectric and other water use developments are more stringent in alternatives R, P, O, and the proposed action than in no action and B alternative.

- Measureable objectives and focused restoration activities in key watersheds in alternative O would increase the pace of increasing resiliency of infrastructure and water uses to potential effects of climate change. Since the key watershed network is expanded from the proposed action in alternative O, this alternative would be more effective in increasing resiliency to climate change than no action, the proposed action, and alternative B.

## Comparison of Key Indicators between Alternatives

The six indicators related to riparian and aquatic resource management and predicted effects by alternative are summarized in the following table.

**Table 130. Comparison of key indicators between alternatives**

| Element | No Action | Proposed Action | Alternative R | Alternative P | Alternative B | Alternative O |
|---|---|---|---|---|---|---|
| RHCA/RMA acreage | 150,692 acres | 179,236 acres | 179,236 acres | 179,236 acres | 150,692 acres | 179,236 acres |
| Acres CNF ownership of Priority/Key watersheds | 214,283 acres; 19% CNF ownership | 371,943 acres; 34% CNF ownership | 451,525 acres; 41% CNF ownership | 451,525 acres; 41% CNF ownership | 214,283 acres; 19% CNF ownership | 451,525 acres; 41% CNF ownership |
| Estimated miles of road treated | 51 miles | 68 miles | 108 miles | 108 miles | 51 miles | 68 miles |
| Estimated number of crossings where passage is improved | 15 crossings | 36 crossings | 95 crossings* | 95 crossings* | 15 crossings | 36 crossings |
| Estimated miles of in-stream channel improvements | 54 miles | 70 miles | 86 miles* | 86 miles* | 54 miles | 70 miles |
| Estimated acres of range infrastructure improvement | 70 | 240 | 240* | 240* | 70 | 240 |
| Estimated acres of treatment of upland vegetation in RMAs to move toward HRV | 75-150 | 450-950 | 600-1,200* | 600-1,200* | 75-150 | 450-950 |
| Number of subwatersheds where conditions are improved | 7 | 12 | 15* | 15* | 7 | 12 |
| Acres where road building is prohibited | 218,266 acres 20% CNF ownership | 291,096 acres; 26% CNF ownership | 271,931 acres; 25% CNF ownership | 283,199 acres; 26% CNF ownership | 268,921 acres; 24% CNF ownership | 268,921 acres; 24% CNF ownership |
| Acres with 1 mi/mi$^2$ road density objective | n/a | n/a | 565,565 acres; 51% CNF ownership | 306,092 acres; 28% CNF ownership | n/a | n/a |
| Acres with 2 mi/mi$^2$ road density objective | n/a | 257,157 acres; 23% CNF ownership | 245,110 acres; 22% CNF ownership | 493,267; 45% CNF ownership | n/a | n/a |
| Acres with 3 mi/mi$^2$ road density objective | n/a | 533,892 acres; 48% CNF ownership | n/a | n/a | n/a | n/a |

| Element | No Action | Proposed Action | Alternative R | Alternative P | Alternative B | Alternative O |
|---|---|---|---|---|---|---|
| Other road restrictions | Road density desired conditions for ML 2-5 range from 0.4-2 mi/mi$^2$. No desired conditions for ML 1 roads | No net increase in NFS road mileage in key watersheds | No net increase in NFS road mileage in key watersheds<br><br>No net increase in NFS road miles in RMAs in a subwatershed | No net increase in NFS road mileage in key watersheds<br><br>No net increase in NFS road miles in RMAs in a subwatershed | Cap on existing road miles | No net increase in NFS road mileage in key watersheds;<br>Cap on existing road mileage |
| Acres where active mechanical vegetation management is authorized | 885,318 acres;<br>80% CNF ownership | 790,987 acres;<br>71% CNF ownership | 245,110 acres;<br>22% CNF ownership | 799,359 acres;<br>72% CNF ownership | 815,345 acres;<br>74% CNF ownership | 801,124 acres;<br>72% CNF ownership |
| Number of vegetation structure classes within HRV after 100 years | 6 | 6 | 4 | 6 | 6 | 8 |

*Total includes estimates from water resource objectives for both key watersheds, and non-key watersheds.

## Cumulative Effects

### Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The five subbasins with Forest ownership also have private, Federal, tribal, state, or county ownership outside of the Forest boundary. Many of the impacts to hydrologic function and water quality on the Forest are from activities occurring on lands under other ownership. Impacts include roads, grazing, mining, development, timber management, dams and diversions, hydropower production and development. All alternatives would maintain or improve hydrologic function, water quality, and water uses, which helps mitigate the effects of off-forest activities.

Past management activities and disturbance on National Forest System lands including timber harvest, grazing, road building and wildland fire can have cumulative effects on the hydrologic system. Impacts to hydrologic function and water quality from past management includes soil compaction, erosion and sedimentation in stream banks and channels, alteration of riparian vegetation, channel widening and incision, and loss of stream channel complexity and function. Upland and stream channel recovery from disturbance takes decades, and sometimes centuries to recover to a properly functioning condition, however changes in aquatic management across Region 6 have improved conditions (Archer 2014). Aquatic direction in INFISH was intended to reverse aquatic and riparian degradation from management activities, and significantly changed the management of aquatic resources on NFS lands in the Pacific Northwest (Heller and McCammon 2004).

Active partnerships with State, county, Federal, tribal and non-profit organizations would continue, and restoration of hydrologic and aquatic function on off-forest lands would continue.

### Water Availability

Water availability is discussed at the subbasin scale in this analysis because the water provided by the Forest is an important component of water availability for more intensive downstream uses, and downstream water uses can cumulatively impact water uses and availability on the Colville National Forest. While consumptive uses in the name of the Forest are a small percentage (less than 1 percent) of uses at the subbasin scale, water uses as well as the water supplied from the Forest is upstream of more intensive consumptive uses. Ecology released analyses on the availability of water for the five major subbasins (six WRIAs) on the Forest in 2012 that provide general information on the availability of water for new consumptive uses.

Below is a general discussion of water availability in each subbasin, including adjudications, surface water source limitations (SWSLs), other factors affecting water availability and the issuance of new water rights. Adjudication is a legal process to determine who has a valid water right, how much water can be used, and who has priority during shortages. The adjudication process accounts for water needed for resource use, protection and planning, and transfer of water rights (WADoE 2014(e)). SWSLs are recommended by Department of Fish and Wildlife to protect flows to maintain fish populations and can either specify that the limitations apply at low-flow or that waters are closed to new uses (RCW 77.57.020).

**Table 131. Adjudications and surface water limitations for WRIAs on the Colville National Forest**

| WRIA Name and Number | Adjudications* | Low Flow Surface Water Source Limitations | Surface Water Source Limitations Closure |
|---|---|---|---|
| Colville 59 | Bulldog Creek, Chewelah Creek, Deer Creek, Hoffman Creek, Jumpoff Joe Creek/Lake, Narcisse Creek, Sherwood Creek, Spring Creek, and Thomason Creek | | |
| Kettle 60 | Twin Creek and Myers Creek | All of the WRIA not closed by SWSL | Curlew Creek, Goosmus Creek, Lambert Creek, Little Goosmus Creek, Sand Creek; portions of Tonasket Creek, Toroda Creek, and Toulou Creek |
| Middle Lake Roosevelt 58 | Alder Creek, Corus Creek, Chewelah Creek, Jennings Creek, Harvey Creek, Magee Creek, O-Ra-Pak-En Creek, Quillisascut Creek, Stranger Creek | All of the WRIA not closed by SWSL | Ninemile Creek, North Fork of Hall Creek |
| Pend Oreille 62 | Renshaw Creek, Little Calispel Creek, Marshall Creek/Lake | All of the WRIA not closed by SWSL | Davis Creek, Harvey Creek, Indian Creek, Maitlen Creek, and Skookum Creek and portions of Bracket Creek and East Fork of Smalle Creek |
| Sanpoil 52 | | All of the WRIA | |
| Upper Lake Roosevelt 61 | Pingston Creek | All of the WRIA not closed by SWSL | Deep Creek, Onion Creek, and Williams Lake |

*Generally, most of the water has been appropriated in adjudicated basins, and new appropriations are not available (WADoE 2012(d)).

Across subbasins on the Forest, the majority of precipitation occurs during the winter months, when demand is lowest. In summer, rain is infrequent and streams are dependent on groundwater to maintain low or baseflows. Groundwater availability and yield is limited by both climate and geology—only 3 percent of streams across the Forest are considered groundwater systems (Reidy-Liermann et al. 2012), and groundwater-dependent ecosystems including seeps and springs make up considerably less than 1 percent of Forest lands (NHD spatial data). Therefore, surface water is least available when demand for water is highest (WADoE 2012(a-f)).

Within the Pend Oreille WRIA, Ecology is in the process of considering the establishment of streamflow requirements in areas of the WRIA that are restricted or closed to new uses or are expected to experience increased pressure based on population growth and climate change. Flow studies have been initiated on the South Fork of Kalispell and Indian Creek (WADoE 2012(d)). The Kalispel Indian Reservation is located in this WRIA, and there are tribal concerns about maintaining flows for fish habitat. Federally Reserved Rights have not been quantified in this WRIA, therefore the legal availability of this water has not been determined (WADoE 2012(d)).

The Colville WRIA has an instream flow regulation establishing base flows to protect beneficial uses and protect senior water rights (WAC 173-559-030). Tributaries of the Colville River are closed to further consumptive appropriation except for reservoir storage, from November 1 through May 31 and in-house single domestic supply if an alternative source is not available (WADoE 2012(a)). The Upper and Lower Colville River is closed to further consumptive appropriation from July 16 to September 30.

The WRIA 59 (Colville River) Water Resource Management Board, which consists of local citizens, local, state, and Federal agencies (including the Forest) has been working on watershed planning activities in the Colville River Watershed over the past 15 years. Key activities of the Water Resource Management Board include development of a watershed implementation plan, an instream flow study, and research on water storage projects to meet future water needs.

While the Middle Lake Roosevelt is not closed to new water uses, the majority of water is appropriated, and new uses are subject to SWSLs. Adjudicated basins within this WRIA have annual water shortages (WADoE 2012(c)).

The Sanpoil WRIA is not closed to new water uses, however, the majority of water is appropriated, and new uses are subject to SWSLs. There are no adjudicated watersheds in the Sanpoil WRIA (WADoE 2012(e)). Federally Reserved Rights are not quantified in the Sanpoil WRIA, however, it is likely new appropriations in the lower Sanpoil River would impact Federal Reserved Water Rights of the Colville Indian Tribe (which owns the majority of the lower subbasin). Future surface water applications for single domestic or stock watering may be approved if there is no alternative source of water supply, and the use would not affect existing Federal reserved rights (WADoE 2012(e)).

The doctrine of reserved water rights has evolved to ensure that Indian reservations and other Federal lands would have sufficient water to fulfil the purpose for which they were established. Federal reserved rights have a priority date of when the lands were set aside, in contrast to state-based appropriative rights which have a priority date of when the water was first put to beneficial use.

The revised Forest Plan addresses water availability primarily through increasing ecological function and resiliency. Forest practices that increase and preserve watershed and riparian function, including best management practices, forest plan components (desired conditions, objectives, standards, and guidelines), and vegetation management activities that increase resiliency to disturbance are expected to improve landscape resiliency to low flows.

The revised Forest Plan includes components to improve and restore hydrologic function, which allows the landscape to hold water longer and release water slower in the summer months when streamflow is low. Desired conditions for water resources provide the framework for hydrologic function, and implementation of the revised forest plan would move the Forest toward these desired conditions. Watershed restoration objectives outline specific activities that would improve landscape function and resiliency. In addition, the revised forest plan includes a robust set of standards and guidelines for protection of water resources and riparian management areas.

### Water Rights

Applications, claims, certificates, and permits for WRIAs with Forest administrative forest ownership are shown in table 132. Within the six WRIAs, the majority of consumptive certificated water rights are located off the Forest.

**Table 132. Number of applications, claims, certificates, and permits for WRIAs within the Colville National Forest**

| WRIA Name and Number | Applications | Claims | Permits | Certificates |
|---|---|---|---|---|
| Colville 59 | 56 | 2,728 | 50 | 1,495 |
| Kettle 60 | 13 | 1,067 | 21 | 656 |
| Middle Lake Roosevelt 58 | 9 | 742 | 16 | 657 |
| Pend Oreille 62 | 11 | 1,049 | 72 | 691 |
| Sanpoil 52 | 16 | 529 | 5 | 221 |
| Upper Lake Roosevelt 61 | 18 | 548 | 5 | 305 |

## Climate Change

The existing forest plan does not address the potential effect of climate change. Integrated management direction that provides flexibility and increased resiliency to respond to a changing environment is one of the primary needs for change driving this forest plan revision process.

Climate change is expected to affect physical hydrologic processes including the amount, timing, and type of precipitation. Changes in snowpack, (Hamlet et al. 2005) and timing of snowmelt are also expected, which can affect streamflow (Mantua et al. 2010) and temperature (Isaak et al. 2011, Luce et al. 2014). Changes in climate would also affect forest vegetation which may have additional impacts on hydrologic processes and water available for consumptive uses and ecological and biological values (Adams et al. 2012).

A climate change vulnerability assessment of hydrologic resources on the Forest is presented here. This analysis identifies key water resource values on the Forest that may be altered through climate change. This analysis focuses on vulnerable infrastructure and water resource values for consumptive uses and analyzes how potential change in hydrologic variables from climate change may impact these resources.

### *Water Uses*

Water uses are key resource to focus climate change vulnerability assessment for the Forest because changes in timing and quantity of flows could affect multiple uses of water. Consumptive water uses on the Forest are a small proportion of consumptive uses at the subbasin scale. The primary climate change mechanisms with the potential to affect water uses both on and off the Forest are changes in the timing and amount of precipitation falling as snow, and the timing of snowmelt.

### *Snowpack*

Loss of snowpack in the Pacific Northwest is one of the most certain aspects of climate change (Kapnick and Hall 2012, Mote et al. 2005). Increasing temperatures across the PNW over the last 50 years have caused more precipitation to fall as rain, reduced spring snowpack and earlier snowmelt. The sensitivity of snowpack across the Forest was assessed using data from Kramer and Snook (2014) that analyzed snowpack data from the Snow Data Assimilation System (SNODAS) (NOHRSC 2004). SNODAS integrates ground, airborne, and satellite snow observations with weather prediction models to produce 1-km resolution daily snow data. Snow water equivalent (SWE) on April 1 (when snowpack is at its peak) SNODAS data from 2003-2012 was used to spatially classify and characterize snowpack sensitivity (USDA Forest Service 2014(a)). April 1 SWE was classified based in differences in snowpack between warmer, drier El Niño and cooler, wetter La Niña years to spatially project potential changes in snowpack under a warmer climate scenario.

Classification of snowpack vulnerability and acres of National Forest System land in each category are shown in table 133.

**Table 133. SWE classification and acres of Colville National Forest within each category (Kramer and Snook 2014)**

| SWE Category | Description | Acres of CNF Administrative Forest | Percent CNF Administrative Forest Acres |
|---|---|---|---|
| No Snow | No snow on April 1 | 141,917 | 10% |
| Ephemeral Snow | April 1 SWE was less than 1.5 inches during warm dry years, and greater than 1.5 inches in cold wet years. | 819,575 | 60% |
| Persistent-Most Sensitive | The timing of peak snowmelt in the warmest, driest years occurred more than 30 days earlier that the coldest, wettest years. | 249,422 | 19% |
| Persistent-Least Sensitive | Timing of peak snowmelt occurred less than 30 days earlier in warm, dry years than cold, wet years. | 147,837 | 11% |

Snowpacks classified as persistent least-sensitive to warmer temperatures are located along the crests of the Kettle and Selkirk mountains. Mountain snowpacks are most sensitive to warmer temperatures in the mid-elevation bands in the Kettle and Selkirk Mountains. The majority of the Forest is in the ephemeral snow zone where April 1 snowpack is generally not large enough to have high inter-annual variability. Snow in this zone is not as critical for sustained runoff during spring snowmelt, because snow generally melts before peak snowmelt. The ephemeral snow zone would likely see the greatest transition from snow to rain in warmer conditions.

Changes in snow accumulation and the timing of snowmelt have potential implications for decreases in summer low flows when flows are critical to satisfy consumptive water uses as well as in-stream flow and habitat requirements.

*Low Flow Analysis*

Summer low flows are influenced by the timing of snowmelt as well as physical landscape properties including geology, vegetation, and degree of watershed alteration from roads and other disturbances. These factors influence the process of converting precipitation into discharge (Safeeq et al. 2013).

The western U.S. streamflow metric dataset was developed by Wenger et al. (2010) using daily simulations of the variable infiltration capacity (VIC) macro-scale hydrologic model Projections of future low flow using the VIC hydrologic model (Wenger et al. 2010) were used to assess potential change in summer low flow on perennial streams across the Forest using the NHD plus stream layer.

Percent change in mean summer flow (cfs) from historic data was calculated for the 2040 and 2080 warming scenarios. The magnitude of change in summer low flow is projected to be less than in other regions across the Pacific Northwest east of the Cascade Mountain Range. Miles of stream within each percent change category are summarized in table 134

**Table 134. Percent change in mean summer flow (cfs) from historic data and perennial stream mileage within each category under the 2040 and 2080 warming scenarios**

| Percent change | Change Category | Vulnerability | Year 2040 Miles | Year 2080 Miles |
|---|---|---|---|---|
| >(-10) | 1 | Low | 1,879 | 241 |
| -10-(-20) | 2 | Moderate | 2,220 | 2,815 |
| >(-20) | 3 | High | 26 | 1,069 |

Potential decreases in summer low flows are relatively minor under 2040 projections with increases in low flow vulnerability in 2080. In 2040, the greatest vulnerability is in the Salmo-Priest Wilderness—where elevations are the highest, however, only 26 miles of stream are within this category. Most streams are at moderate risk for reduction in low flows, with lower risk in the western portion of the Forest. In 2080, 1,069 miles of stream are projected to have a high risk decreased summer flow (greater than 20 percent change in low flow) compared to 26 miles in 2040. Low flow vulnerability in 2080 is highest in the Selkirk Range and on the Kettle Crest.

### *Infrastructure Risk*

Hydrologic changes as a result of climate change may impact the infrastructure system on the Forest through reduced and earlier runoff of snowpack resulting in earlier use of roads, higher peak flows and flood risk, and reduced low-flows in summer.

Projected change in bankfull flow magnitude (cfs) was used in this analysis to assess potential risks to roads located near perennial streams. Stream reaches within 300 feet of roads administered by the Forest were used to determine miles of road at risk under the 2040 and 2080 warming scenarios using VIC data (table 135). While there are several factors that affect the vulnerability of infrastructure to high flows, roads near perennial streams were selected for this analysis because roads in valley-bottoms adjacent to the stream network increases infrastructure sensitivity to flooding, channel migration, and bank erosion. Most existing stream crossings are aging culverts that are vulnerable to flood peaks and associated sediment and debris. Bankfull flows are projected to increase in 2040, with greater magnitude changes projected for 2080.

**Table 135. Projected vulnerability of roads within 300 feet of perennial streams for 2040 and 2080 categorized by percent increase in bankfull flows from VIC data**

| Percent change | Change Category | Vulnerability | Year 2040 Miles of Vulnerable Road | Year 2080 Miles of Vulnerable Road |
|---|---|---|---|---|
| less than 0-10 | 1 | Low | 1,081 | 785 |
| 10-20 | 2 | Moderate | 372 | 346 |
| >(-20) | 3 | High | 142 | 464 |
| **Total** | | | **1,595** | **1,597** |

### *Adaption to Climate Change*

All alternatives in this analysis have components to adaptively manage hydrologic resources to respond to hydrologic changes in climate. The proposed action and alternatives R, P, and O address climate change through inclusion of desired conditions that address hydrologic and aquatic processes to improve resiliency to climate change. No action and alternative B include riparian goals and RMOs included in INFISH that do not address the need for change based on climate change as effectively as the proposed action and alternatives R, P, and O. While riparian goals in INFISH address the function and processes that improve climate change resiliency, the narrow RMOs do not provide the same flexibility for adaptive management as the aquatic and riparian plan components in the proposed action and alternatives R, P, and O. In addition, most aquatic and riparian objectives in alternatives R and P (ARCS-modified), and to a lesser extent in the proposed action and alternative O (ARCS) have prioritized potential restoration treatments of roads, culverts, and recreation sites based on spatial analysis of vulnerability of these resources to changes in peak and low flows. Several other aquatic and riparian objectives respond to climate change vulnerability through increasing resiliency of the landscape through in-stream restoration, improvement of range infrastructure, and treatment of upland vegetation in RMAs. Standards and guidelines under alternatives R and P, and to a lesser extent, the proposed action and alternative O provide the framework to respond to changes in climate, including MA-STD-RMA-10, in which new or replaced

culverts would accommodate a 100-year flow with associated bedload and debris. As the magnitude of 100-year flows change over time, calculation of this figure may also change, however this standard would still remain applicable.

## No-action Alternative Cumulative Effects

The no-action alternative would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in focus and priority watersheds (designated through the WCF process), and to a lesser degree in INFISH priority watersheds as funding and partnership opportunities are available. The no-action alternative would help mitigate potential effects from off-forest activities with the potential to affect hydrologic function, water quality, and water uses. Focused restoration activities would improve resiliency of infrastructure to climate change. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, the no-action alternative would improve hydrologic function and be responsive to climate change, but may not be as effective as the proposed action, and alternatives R, P, and O.

## Proposed Action Cumulative Effects

The proposed action would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in 11 key watersheds designated as priorities for restoration. The proposed action expands the key watershed network from the INFISH priority network. The proposed action includes wider RMA widths than RHCA widths in the no-action alternative, and includes RMA-specific standards and guidelines. Additional desired conditions, goals, objectives, standards, and guidelines in the proposed action would improve and preserve aquatic function and water quality. The proposed action also includes standards for development of hydroelectric and other water use developments that would limit new consumptive water uses. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, the proposed action would improve hydrologic function and be responsive to climate change, but may not be as effective as alternatives R and P.

## Alternative R Cumulative Effects

Alternative R would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in 13 key watersheds designated as priorities for restoration. Alternative R expands the key watershed network from the INFISH priority network and the key watershed network in the proposed action. Alternative R proposes wider RMA widths than RHCA widths in the no-action alternative, and includes RMA-specific standards and guidelines. Desired conditions, goals, objectives, standards, and guidelines in alternative R were updated to better preserve and improve aquatic function and water quality. Alternative R includes standards for development of hydroelectric and other water use developments that would limit new consumptive water uses. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, alternative R is the most effective alternative for improvement of hydrologic function and responsiveness to climate change.

## Alternative P Cumulative Effects

Similar to alternative R, alternative P would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in 13 key watersheds designated as priorities for restoration. Alternative P expands the key watershed network from the INFISH priority network and the key watershed network in the proposed action. Alternative P proposes wider RMA widths than RHCA widths in the no-action alternative, and includes RMA-specific standards and guidelines. Desired conditions, goals, objectives, standards, and guidelines in alternative P were updated

to better preserve and improve aquatic function and water quality. Alternative P includes standards for development of hydroelectric and other water use developments that would limit new consumptive water uses. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, alternative P would improve hydrologic function and be responsive to climate change, but may not be as effective as alternative R.

## Alternative B Cumulative Effects

Alternative B would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in focus and priority watersheds (designated through the WCF process), and to a lesser degree in INFISH priority watersheds as funding and partnership opportunities are available. Alternative B would help mitigate potential effects from off-forest activities with the potential to affect hydrologic function, water quality, and water uses. Focused restoration activities would improve resiliency of infrastructure to climate change. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, alternative B would improve hydrologic function and be responsive to climate change, but may not be as effective as the proposed action, and alternatives R, P, and O.

## Alternative O Cumulative Effects

Alternative O would continue to improve hydrologic function and water quality and improve watershed and hydrologic function through restoration activities in 13 key watersheds designated as priorities for restoration. Alternative O expands the key watershed network from the INFISH priority network. Alternative O includes wider RMA widths than RHCA widths in the no-action alternative, and includes RMA-specific standards and guidelines. Additional desired conditions, goals, objectives, standards, and guidelines in the proposed action would improve and preserve aquatic function and water quality. Alternative O also includes standards for development of hydroelectric and other water use developments that would limit new consumptive water uses. When analyzed with past, present, and reasonably foreseeable future activities both on and off the Forest, alternative O would improve hydrologic function and be responsive to climate change, but may not be as effective as alternatives R and P.

## Summary

Overall, the proposed action provides more protection for preservation and restoration of hydrologic function, water quality, and water uses than the no-action and B alternatives. The proposed action does not provide as much protection for preservation and restoration of hydrologic function, water quality, and water uses as the R, P, and O alternatives.

# Soil

Soil resource information is a core component of national forest planning. Information about the soil resource provides planning teams with an understanding of the inherent capability of different portions of the landscape to meet a variety of land management objectives. Understanding the inherent soil capabilities and limitations of the landscape also assures that planned activities are both obtainable and sustainable over time. This analysis focuses on the “motorized recreation trails” and “late forest structure” issues, since they are the most relevant to soil resources.

## Affected Environment

The Colville National Forest has a wide diversity of soil types from the minimally developed, nutrient poor soil and rock outcrop complexes of the steep mountain slopes and ridges to the deep, fertile soils of the lower valleys. Cooler temperatures, shorter growing seasons and steep topography are the prime factors behind the lack of soil development in the upper elevations of the Forest. Conversely, warmer temperatures, a longer growing season, and gentle topography found within the lower forest elevations provide more favorable conditions for soil development.

## Soil Development

Soil development is dominated by five major soil formation factors: time, parent material, topography, climate, and biology. The two greatest influences on the development of the soils on the Colville National Forest are continental glaciation and distant volcanic activity.

During the Pleistocene Epoch (approximately 2.4 million to 18 thousand years ago), a continental glacier called the Cordilleran Ice Sheet built up, advanced and retreated several times covering much of western Canada as well as northern Washington and Idaho and northwestern Montana in the United States including the area covered by the Colville National Forest. The ice sheets advanced and then retreated several times, according to the sequence of sediments that the ice sheets left behind. However, the most completely understood ice sheet advance is the one that occurred most recently, between 200,000 and 18,000 years ago. This most recent advance obscured much of the evidence of the earlier advances.

In places where the ice sheet flowed across bedrock, such as in eastern Washington, it smoothed the mountains and hills into more streamlined and rounded shapes. The highest peaks on the Colville National Forest remained unglaciated as the ice sheet moved around and not over them. The ice sheet valley fill and terraces of glacial outwash around its margins in the northern part of eastern Washington. Katabatic winds, driven by the temperature contrasts between the ice and the land, picked up and moved the finer-grained sediments from the outwash both out of and onto the area of the Colville National Forest.

Glacial soils fall into three, general categories: lacustrine, outwash and till. Lacustrine soils are derived from ancient glacial lakebeds. These soils are higher in silt or clay content than other glacial soils, resulting in higher water-holding capacities and higher fertility. Lacustrine soils are more susceptible to hillslope and wind erosion than till or outwash because of their fine texture. Streams flowing from glaciers deposited outwash soils. Water of varying speeds deposits particles of different sizes, sometimes resulting in distinct layers of gravel, sand, and rock in the soil profile. Usually, glacial outwash soils drain rapidly and have low organic matter content. Some glacial outwash soils contain a layer of wind deposited silt (loess) that increases their moisture-retaining capacity and fertility. Glacial till was deposited directly, mixed, deformed or compressed by glaciers and often results in a mixed particle size soil that is variably drained. Glacial till that was laid down beneath glaciers is known as basal till and has a dense, compacted layer, or densic layer, at a depth of about 18 to 36 inches that can extend more than 10 feet. This densic layer is often impenetrable to both plant roots and infiltrating water, forming a

perched water table. Because of this, sites with basal till soils often drain poorly. If the densic layer is very shallow the soils may not be able to support trees or more deeply rooted plant species by virtue of wetland conditions.

Although lacking volcanoes, younger than 40 million years old within the Forest boundaries, many soils in the forest owe their productivity to volcanic activity. Volcanic ash from the eruption of Mount Mazama (now Crater Lake) 7,900 years ago has significantly influenced forested soils of the area. Additional volcanic ash and loess influenced by volcanic ash were deposited by eruptions of Mount Rainier, Mount St. Helens, and Glacier Peak. These ash-influenced soils can be found throughout the western United States. Locally, these soils are characterized by a bright brown “cap” of volcanic ash 6 inches or more in thickness. These ash-cap soils, in contrast to other soils, are important to forest management due to their low bulk density, high porosity, and high infiltration and water and nutrient retention capabilities. These soil properties reduce drought stress on plants during extended summer dry periods found in the forest. Given the distance from the volcanoes, the ash cap is much more stable, resistant to erosion, and greater bearing strength than the pumice based soils, closer to the sources.

## Landtypes

Soils of the Colville National Forest can be divided into five landform groups based on similar geomorphic processes (Davis et al. 2004):

- Soils on glaciated and scoured mountain slopes (673,990 acres)

Soils on glaciated and scoured mountain slopes are formed from metasedimentary, igneous, and pyroclastic geologies that have been shaped by continental glaciation. Scoured areas tend to have thin rocky soils. Lesser areas of deeper soil can be found in glacial till in draws and north facing slopes.

- Soils on glacial moraines (397,794 acres)

Glacial deposition is the most common land forming process in glacial moraines. The most common rock types are metamorphic, intrusive, and volcanic. Springs, seeps, and pothole lakes are common.

- Soils on unglaciated mountains (120,144 acres)

This landform group consists of dissected and structure controlled mountain slopes and rounded ridge tops. These are the only landforms on the forest that are not glacially influenced. Moderately deep residual soils can be found on the ridge tops. Erosion and mass wasting are the primary landform drivers on the mountain slopes. These soils are formed from igneous intrusive and metasedimentary geologies.

- Soils on valley bottoms (120,036 acres)

These landforms are located in valley bottoms of varied size. Glacial meltwater, fluvial flooding, and glacial lake sedimentation are the major land forming factors. These soils are formed from relatively young surficial deposits of glacial till, alluvium, landslide debris, and glacial outwash. Rock types are mixed and varied in these landforms.

- Soils on glacial troughs and cirques (16,403 acres)

These landtypes are glacial valleys formed from alpine and continental glaciation. Ridges were scoured and slopes steepened by glacial erosion. Alluvial fans and glacial moraine deposits are found at the lower slopes. The most common rock type is metasedimentary.

## Soil Taxonomy

The system of soil classification used by the National Cooperative Soil Survey has six levels. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. Each level of taxonomy gives more detailed information about the soils. The dominant soil orders found in the Forest are Inceptisols and Andisols followed by Mollisols and Alfisols (table 136).

Inceptisols are soils with poorly developed characteristics. Most Inceptisols occur under forested landscapes in a variety of climatic conditions. They tend to occur on steep slopes where erosion is continuously removing topsoil or convex toeslopes where colluvium is being deposited. Time tends to be the limiting factor of soil development in these soils.

**Table 136. Soil orders on the Colville National Forest**

| Soil Order | Acres | % of Administrative Forest |
|---|---|---|
| Inceptisols | 666,134 | 49% |
| Andisols | 477,507 | 35% |
| Mollisols | 64,416 | 5% |
| Alfisols | 39,630 | 3% |
| Others (including Entisols, Histosols, and Spodosols) | 110,462 | 8% |

Andisols are soils that have formed from volcanic ash or other volcanic material. These soils have characteristic chemical and physical properties that include high water holding capacity and the ability to keep large quantities of phosphorus unavailable to plants. While volcanic ash plays an important role in the soils of the Forest, not all the soils have ash depths that would classify to Andisols. Many soils are within Andic and Vitrandic suborder, great group, or subgroups.

Mollisols are grassland soils with thick dark surface horizons. These dark surface horizons are the result of long-term additions of organic matter primarily through grass roots. These soils were formed in areas with a short fire return interval that prevented the growth of woody vegetation and stimulated the growth of native grasses. Some Mollisols may be relics of periglacial tundra.

Alfisols are soils that have clay-enriched subsoils and high base saturation. These soils have typically formed in forested ecosystems and tend to have high soil fertility.

## Current Conditions and Trends

### Soil Quality

Soil is the foundation of the ecosystem. Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation and ecosystem health. Soil productivity is the inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which include the growth of desirable plant species, plant communities, or a sequence of plant communities, all to support multiple land uses.

Forest Service Manual (FSM) Chapter 2550 Soil Management directs soil resource management on National Forest System lands. The objectives of the national direction are (1) to maintain or restore soil quality on National Forest System lands, and (2) to manage resource uses and soil resources on National Forest System lands to sustain ecological processes and function so that desired ecosystem services are provided in perpetuity. Soil function is any ecological service, role, or task that soil performs.

The FSM identifies six soil functions: soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and filtering and buffering. In order to provide multiple uses and ecosystem services in perpetuity, these six soil functions need to be active and effectively working. Each of these six soil functions are discussed in the following sections. Interpretive maps have been developed to assist in understanding how these functions are operating within different ecosystems. These soil functions and the interpretive maps are also referenced in the discussion of Environmental Consequences.

## Soil Biology

Soil biology is the ability to provide habitat for a wide variety of organisms including plants, fungi, microorganisms and macro-organisms in the upper sections of the soil. Diversity of soil biology is beneficial for several reasons:

The complex process of decomposition and nutrient cycling requires a varied set of organisms.

- An intricate group of soil organisms can compete with disease-causing organisms and prevent a problem-causing species from becoming dominant.
- Several organisms are involved in creating and maintaining the soil structure important to water dynamics in soil.
- Many antibiotics and other drugs and compounds used by humans come from soil organisms.
- Most soil organisms cannot grow outside of soil, so it is necessary to preserve healthy and diverse soil ecosystems to preserve beneficial microorganisms.

The major drivers of soil biological function are presence of organisms and thermodynamics. The organism influences on the soil include plant and animal actions from root growth and distribution to macro pore creation by small mammals. The thermodynamics of the site control moisture and temperature of the soil profile. Vegetation canopy and soil cover (forest floor, fine and coarse woody debris) provide macro and microhabitat and climate conditions on-site in order to support the soil organisms. Important characteristic soils are formed on unglaciated areas with remnant plant communities; these are typically older, well-developed soils.

## Soil Hydrology

Soil hydrology is the ability of the soil to absorb, store, and transmit water, both vertically and horizontally. Soil hydrology is extremely important on the Forest, because the ecosystem productivity is typically limited by water. Soil can regulate the drainage, flow, and storage of water and solutes, including nitrogen, phosphorus, pesticides, and other nutrients and compounds dissolved in the water. With proper functioning, soil partitions water for groundwater recharge and use by plants and animals. Sensitive soils for the hydrologic function are soils with volcanic ash deposits, soils susceptible to drought, and hydric soils (wetlands).

### *Volcanic Ash Soils*

The surficial volcanic ash deposits, or ash cap, of the soils on the Forest are instrumental to the high productivity of the Forest. The ash-cap on the Forest is characterized by a low bulk density, high water holding capacity, and a high cation exchange capacity that can lead to a concentration of nutrients. The ash-caps found on the Forest are in varying forms from thick mantles of pure ash to layers of ash mixed with weathered mineral soil.

The ash deposited on the Forest tends to be fine particles forming loam and silt loam textured soils. The high water holding capacity of the ash-cap is arguably the most important feature of the ash-cap locally. The ash was deposited over rocky and sandy coarse textured soils with relatively low water holding

capacities in northeastern Washington and therefore the majority of the plant-available water in this landscape is held in the ash cap.

Ash-caps are extremely susceptible to decreased soil quality due to compaction, erosion, and soil mixing. Ashy soils have low soil bearing capacity and therefore compact very easily within a large range of soil moisture levels. Compaction causes a restriction to plant rooting, lowered water-holding capacity, and lowered infiltration rates. Ashy soils also do not recover from compaction as quickly as other soil types. Several hypotheses exist regarding the slower recovery times; including the low amounts of clay and therefore limited natural shrink and swell cycles or the possible physical locking of jagged edge ash particles during compaction.

Ash-cap layers tend to be resistant to erosive forces when fully vegetated due to high infiltration rates and strong soil structure. When vegetation and litter layers are removed, the ashy surface is highly susceptible to severe erosion. Loss of the ash-cap layer would reduce the water-holding capacity and increase the overall soil bulk density. These effects would decrease available soil moisture and tree root penetrability. The effects of mixing the ash-cap with subsoil are similar and would result in comparable productivity decreases. Since volcanic ash is not replaced, the effects of erosional losses of the ash-cap would be long term. Areas with ground disturbance may become more favorable for weed invasion, which could reduce overall soil productivity.

A map of areas and types of ash-cap soils on the Colville Forest was created using the Natural Resources Conservation Service SSUGRO soil data layer. The purpose of this interpretive map is to show where ash-cap soils occur and the relative thickness and makeup of the different volcanic ash soils. Four categories were identified based on whether or not an ash-cap was present and soil taxonomic classification of the ash-caps (Soil Survey Staff 2014). Andisols include soils in the Andisols soil order that have an ash-cap at least 24 inches thick. Ash-cap soils in the Andic subgroup have at least 8 inches of ash-cap and contain minerals weathered from volcanic ash. Ash-cap soils in the Vitrandic subgroup also have at least eight inches of ash-cap and have higher volcanic glass content compared to Andic subgroups.

### *Droughty Soils*

Drought affects trees directly by slowing or arresting growth, and causing injury or death. It also affects them indirectly, by increasing their susceptibility to wildfire, insect pests and disease. A drought may be short-lived, perhaps lasting one growth season, but its impact on a tree's health—and, ultimately, a forest's—can last much longer. Trees have evolved protective mechanisms to deal with water stress, but there are many external factors that determine the effects of drought, including soil composition and topography, as well as the species mix, age and density of trees. These soils that are susceptible to drought can inform management as to desired tree density and areas at risk to insect and disease outbreaks.

Oregon State University has created a soil drought index layer for the Pacific Northwest Region of the Forest Service (table 137). This layer represents an initial approximation of the potential for droughty soil conditions in forested landscapes in Washington and Oregon. The index is based upon best-available soils data and satellite-derived estimates of actual and potential evaporation. Potential evapotranspiration (PET) is an estimate of the evaporation and transpiration that would occur if an adequate supply of moisture were available. Actual evapotranspiration (AET) measures the actual loss of moisture from soil and plant surfaces, and so the degree to which AET falls below PET may be interpreted an indicator of moisture limitation. Some studies have found that prolonged periods of low AET to PET ratio (AET/PET) during a growing season are highly correlated with reduced dryland crop yields. AET/PET has been used as a broad-scale indicator of potential drought stress.

**Table 137. Droughty soil index for the Colville National Forest**

| Droughty Soil Index | Acres | Percent of Administrative Forest |
|---|---|---|
| **April, May, June** | | |
| Low | 5,915 | 0% |
| Low to Moderate | 546,751 | 41% |
| Moderate | 643,988 | 48% |
| Moderate to High | 147,427 | 11% |
| High | 840 | 0% |
| **July, August, September** | | |
| Low | 7,374 | 1% |
| Low to Moderate | 464,796 | 35% |
| Moderate | 644,360 | 48% |
| Moderate to High | 182,961 | 14% |
| High | 45,432 | 3% |

### *Hydric Soils*

Hydric soils and wetlands are areas on the landscape that tend to retain moisture on the landscape and are sensitive to human activities. There are very limited amounts of hydric soils on the Colville National Forest. The NRCS classifies map units in the Soil Survey program as to the amount of the map unit that is hydric. There are 2,989 acres of soils mapped as 100 percent hydric on the forest and 2,247 acres of soils mapped as predominately hydric (66 to 99 percent hydric) (table 138). This combines to less than 1 percent of the Forest land base. Map units that are made up of hydric soils may have small areas, or inclusions, of non-hydric soils in the higher positions on the landform, and map units made up of non-hydric soils may have inclusions of hydric soils in the lower positions on the landform. Map units that are not listed do not meet the definition of hydric soils because the dominant soil component does not have one of the hydric soil indicators. A portion of these map units, however, may include hydric soils. There are inclusions in most map units that can be hydric, therefore the total land base on the forest that have hydric soils is likely underestimated due to the level of mapping and classification. In all soil surveys, every map unit includes areas of soil components or miscellaneous areas that are not identified in the name of the map unit. Many areas of these components are too small to be delineated separately. Generally in these soil surveys, inclusions can make up to 20 percent of a map unit.

**Table 138. Map unit hydric ratings on the Colville National Forest**

| Hydric Class | Acres | Percent of Administrative Forest |
|---|---|---|
| Non Hydric (0%) | 1,181,432 | 87% |
| Predominately Non Hydric (1-32%) | 171,480 | 13% |
| Predominately Hydric (66-99%) | 2,247 | 0.17% |
| Hydric (100%) | 2,989 | 0.22% |

Hydric soils are defined as soils formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions within the upper part. A soil is defined as saturated when all pores are filled with water, excluding all air. The saturated soil closest to the soil surface indicates the level of the water table. Anaerobic conditions exist when biologically available oxygen is absent from the soil.

Positions in the landscape that have high water tables are more likely to have wet and potentially hydric soils. The same is true for soils that are prone to flooding or ponding. The following landscape positions are locations that may contain hydric soils, based on the timing and duration of saturation and anaerobic soil conditions.

- Depressional areas collect and store runoff water from the surrounding landscape after rain events. Saturation is not sustained for long periods after rain events. Mineral soils are likely to be present and may or may not be hydric. Vegetation can consist of trees, shrubs and herbs.
- Flood plains that are seasonally flooded may contain hydric soils. Hydric soils usually form in the backwater area, where water is retained for extended periods. Soils are typically mineral with trees and shrubs being the dominant vegetation.
- Seeps occur at the bases of slopes where the groundwater table intersects the soil surface. They are often found where a slope grades into flat land. The high water table in seeps is sustained by groundwater discharge. There can be mineral or organic soils, and the vegetation in and around the seep can consist of trees, shrubs and herbs.

In hydric soils, soil organic matter accumulates because the microorganisms decompose plant and animal material more slowly than in anaerobic soils. This decrease in decomposition causes organic matter to build up at the surface. As a result, anaerobic soils usually have a dark or almost black surface. Common rates of organic accumulation may average 2 inches every 100 years. A dark surface horizon, underlain by a gray horizon is one common indicator. Another indicator of a hydric soil is a horizon that is predominantly gray with accumulations of iron along root channels or in masses. In the horizons with accumulated iron, there are also areas that are depleted, making them lighter than the main horizon color (Hurt et al. 1996).

The presence of hydric soils is one-third of the requirements needed to meet a jurisdictional wetland. The two other requirements include wetland hydrology and hydrophytic vegetation. Hydrology refers to the movement of water in the environment. However, wetland hydrology specifically implies the soil is saturated to the surface for approximately 5 percent of the growing season, or is frequently flooded or ponded. Hydrophytic vegetation is adapted to survive in saturated and anaerobic soils. Wetlands are universally sensitive to machine traffic due to saturation throughout the growing season and high organic matter content of the soils.

### *Nutrient Cycling*

Nutrient cycling is the movement and exchange of organic and inorganic matter back into the production of living matter. Soil stores, moderates the release of, and cycles nutrients and other elements. In contrast to the annual harvests associated with agriculture, forest harvest—and hence nutrient removal—typically occurs only once per rotation or every 40 to 120 years. This not only reduces the rate of removal, but the long-time interval makes natural additions of nutrients by atmospheric deposition and by weathering of soil minerals very important in maintaining nutrient status. Sensitive soil attributes for nutrient cycling include the forest floor vegetation quantity composition, and coarse soil texture subject to leaching. Soils formed on quartzite are problematic, in that they are very low in nutrients from parent material and have little capacity for retaining deposited nutrients.

During these biogeochemical processes, analogous to the water cycle, nutrients can be transformed into plant available forms, held in the soil, or even lost to atmosphere or water. Carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled through soil. Decomposition by soil organisms is at the center of the transformation and cycling of nutrients through the environment. Decomposition liberates carbon and nutrients from the complex material making up life forms and puts them back into biological circulation so they are available to plants and other organisms. Decomposition

also degrades compounds in soil that would be pollutants if they entered ground or surface water. Nutrient cycling can be assessed by considering organic matter composition on a site (forest and rangeland floor, fine and coarse woody material) and the nutrient availability (topsoil horizons and nutrient deficiencies).

Nearly all the nitrogen in forest systems is bound to organic matter. Very little of the total pool of nitrogen is available to plants; only about 2.5 percent of total organic nitrogen is released annually (Grigal and Vance 2000). The rate of nitrogen release from organic matter (mineralization) is controlled by microbial decomposition, which in turn is controlled by environmental factors as well as the amount and chemical composition of organic matter (Grigal and Vance 2000). Rates of nitrogen mineralization are highly spatially variable within stands (Johnson and Curtis 2001). The availability of nitrogen from organic matter has been said to “most often limit the productivity of temperate forests” (Hassett and Zak 2005). Logging residues are a source of nitrogen during early periods of stand growth after harvest (Hyvönen et al. 2000)(Mälkönen 1976). Dead woody material left after logging provides carbon-rich material for microbes to feed upon; and typically microbial populations increase after forest harvests due to the input of logging residues. Microbes immobilize nitrogen in their tissues and limit losses that could otherwise occur through leaching or volatilization. As dead woody material gradually decomposes during the 15–20 years following harvest, microbial populations decline and slowly release the nitrogen to growing vegetation. One research study found that nearly all the nitrogen and much of the phosphorous that moved down through the litter layer into mineral soil was in organic forms as a result of microbial transformations of organic matter in the forest floor (Qualls et al. 1991). This indicates that some nitrogen and phosphorous can be moved from the litter layer into mineral soil where it may be stable for a longer period. Phosphorus is another essential nutrient that is mainly supplied, in forms available to plants, by the microbial breakdown of organic materials. A deficiency of available phosphorus can limit plant metabolism of nitrogen, and some forests may be limited by phosphorus availability (Trettin et al. 2003). Inorganic phosphorus is often present in soil minerals, but under low-pH conditions often found in forest soils; soluble aluminum and iron react with inorganic phosphorus to form insoluble compounds that are unavailable to most plants (Pritchett 1979). Sulfur, like nitrogen, occurs in soil primarily as organic compounds and is made available for plant growth through oxidation by microbes to sulfate forms (Fisher and Binkley 2000). Carbonic acid weathering of the feldspathinc, ferro-magnesian igneous rocks, very common on the Forest yields aluminum, iron, calcium, and magnesium ions in low soil pH.

### *Soil Organic Matter*

The soil organic layer is extremely important to all soils on the Forest, especially those formed from low-nutrient geology like granite and quartzite which weathers slowly. Soil organic matter is fundamentally important to sustaining soil productivity. Soil organic matter is influenced by fire, silviculture activities, and decomposition/accumulation rates. The organic component of soil is a large reserve of nutrients and carbon and is the primary site for microbial activity. Forest soil organic matter influences many critical ecosystem processes, including the formation of soil structure. Soil structure influences soil gas exchange, water infiltration rates, root penetration, and water-holding capacity. Soil organic matter is also the primary location for nutrient recycling and humus formation, which enhances soil cation exchange capacity and overall fertility. Soil organic matter depends on inputs of biomass (e.g., vegetative litter, fine and coarse woody debris) to build and maintain the surface soil horizons, support soil biota, enhance moisture-holding capacity, and prevent surface erosion. Nevertheless, in natural systems organic matter fluctuates with forest growth, mortality, fire, and decay.

### *Low-nutrient Soils*

A rating on soil nutrient availability based on geology types has been developed by the Intermountain Tree Nutrient Cooperative at the University of Idaho (table 139). Tree nutrition value is an interpretation of rock geochemistry and its nutritive status. Soils formed from quartzite geologies tend to be very

nutrient poor. This is especially true when the volcanic ash layer is no longer on site. Soil wood loss may alter processes of forest regeneration and growth, favoring species requiring lower soil moisture and lower nutrient levels, and provide for a greater potential for soil erosion. Potential loss or reduction of organic matter can lead to a decline in several key soil and foliar nutrients (Powers et al. 2005). Further effects also include a reduction of habitat for species requiring soil wood as dens or as substrate for invertebrates, bacteria and fungi, which affect food availability for small rodents and their predators.

**Table 139. Geologic tree nutrition values for the Colville National Forest**

| Geology Tree Nutrition Value | Acres | % Administrative Forest |
|---|---|---|
| High | 50,075 | 4% |
| Moderate | 922,817 | 68% |
| Low | 278,203 | 20% |
| Very Low | 104,050 | 8% |

### *Carbon Storage*

The carbon storage function is defined as the ability of the soil to store carbon. The carbon cycle illustrates the role of soil in cycling nutrients through the environment. Globally, more carbon is stored in soil than in the atmosphere and above-ground biomass combined. Limiting factors of soil carbon storage are depth and rockiness. Carbon compounds are inherently unstable and owe their abundance in soil to biological and physical environmental influences that protect carbon and limit the rate of decomposition (Schmidt et al. 2011). Soil organic matter is formed by the biological, chemical, and physical decay of organic materials that enter the soil system from sources aboveground (e.g., leaf fall, crop residues, animal wastes and remains) or belowground (e.g., roots, soil biota). The organic compounds enter the soil system when plants and animals die and leave their residue in or on the soil. Immediately, soil organisms begin consuming the organic matter; extracting energy and nutrients; and releasing water, heat, and carbon dioxide back to the atmosphere. Thus, if no new plant residue is added to the soil, soil organic matter would gradually disappear. If plant residue is added to the soil at a faster rate than soil organisms convert it to carbon dioxide, carbon would gradually be removed from the atmosphere and stored (sequestered) in the soil. Large quantities of soil organic matter accumulate in environments such as wetlands, where the rate of decomposition is limited by a lack of oxygen, and high-altitude sites where temperatures are limiting to decomposition. Most carbon in mineral soil comes from root turnover (Schmidt et al. 2011), although some is moved from the forest floor into upper mineral soil layers (Qualls et al. 1991).

A soil carbon stock was determined for the forest using local data from the soil surveys of the area and local research. The soil carbon stock includes carbon compounds in the forest floor litter layer and the mineral soil to a depth of 1 meter (or depth to bedrock if the soil is shallower than 1 meter). Forest floor carbon numbers were generated using data from the National Cooperative Soil Survey, research data as analyzed by (Smith et al. 2006), and regional data collected by (Page-Dumroese et al. 2006). Soil organic carbon (SOC) was estimated for the Colville National Forest using data from the National Cooperative Soil Survey. A modified equation following the methods of (Batjes 1996) was used to calculate the total SOC to a depth of one meter for the mineral soil. This results in a forest floor carbon stock of 103 Tg (113.5 million tons) with and average density of 103 Mg C/ha (46.0 tons/acre) and a mineral soil carbon stock of 172 Tg (189.6 million tons) SOC in the top one meter of soil with an average carbon density of 127 Mg C/ha (56.7 tons/acre). The total soil carbon stock, organic and mineral layers, for the Colville National Forest is approximately 275 Tg (303.1 million tons) C with a density of 203 Mg C/ha

(90.6 tons/acre). This carbon density is within the ranges found in several research projects, as displayed in the table below.

The carbon storage potential was determined for the forest. The factors used to develop this map include the inherent soil productivity, soil depth, and percent rock fragments in the soil profile.

**Table 140. Soil carbon densities from research**

| Environment | SOC (Mg C/ha) | Source |
|---|---|---|
| Cool, conifer forests of U.S. | 403-494 | (Kern, 1994) |
| Cool, temperate forests of Maine | 130 | (Davidson and Lefebvre, 1993) |
| Global temperate forests | 118 | (Schlesinger, 1977) |
| Cool, temperate forest of north central U.S. | 84-152 | (Franzmeier et al., 1985) |

### *Support and Stability*

Soil stability and support is necessary to anchor plants and structures. Inherent soil properties, like soil texture and particle size distribution, play a major role in physical stability. Soil has a porous structure to allow passage of air and water, withstand erosive forces, and provide a medium for plant roots. Soils also provide anchoring support for human structures and protect archeological artifacts. The need for structural support can conflict with other soil uses. For example, soil compaction may be desirable under roads and houses, but it can be detrimental for the plants growing nearby. The conflict of stability and support with plant growth capabilities is constant when dealing with roads, skid trails, recreation trails, and forest productivity. Sensitive soils for the support and stability function are soils with high erosion hazards and soils with high mass wasting hazards. Support and stability can be assessed by evaluating risk of erosion and mass wasting and observing soil deposition.

### *Highly Erosive Soils*

The susceptibility of soil to erosion, or the relative loss of exposed soil to erosional forces, is expressed by soil erosion ratings. Surface erosion risk was developed for the Landtype Associations of north central Washington (Davis et al. 2004). This rating represents the susceptibility of the bare, un-vegetated surface to erosion by wind and water. Approximately 37 percent of the forest has a high risk for surface erosion (table 141). Basically, if practices or conditions occur that remove vegetative cover and expose the surface soil layer to erosional forces, then the erosion susceptibility rating applies. Skid trails, fire lines, machine piles areas, and severely burned areas are examples of practices and conditions that expose soils to erosional forces such as wind and rain.

**Table 141. Surface erosion risk**

| Surface Erosion Risk | Acres | Percent within Forest Administrative Boundary |
|---|---|---|
| Low | 220,237 | 16% |
| Moderate | 629,664 | 46% |
| High | 507,295 | 37% |

### *Landslide-prone Soils*

Forest soils that have high mass wasting hazards are considered landslide prone. Landslide or mass wasting are terms used to describe the downslope movement of material under the influence of gravity. Water is usually only a minor part of the moving material. A slide is a rapid, planar movement of a large

mass of earth and other debris down a hill or a mountainside. Slumps involve a mass of soil or other coherent material sliding along a curved surface (shaped like a spoon). Slumps and planar slides form crescent-shaped cliffs, or abrupt scarps at the top of the slide slope. More than one scarp can exist down the slope. Slumps form a depression or back slope, between the scarp and the mass that moved. Soil creep is a long-term process. The combination of small movements of soil or rock in different directions over time are directed by gravity gradually downslope. The slumps and soil creep make trees and shrubs curve to maintain their perpendicularity. The surface soil can migrate under the influence of cycles of freezing and thawing, or hot and cold temperatures, inching its way toward the bottom of the slope forming terracettes. Flows are movement of earth materials and vegetative debris that more resemble fluid behavior. Water, air, and ice are often involved in enabling fluid-like motion of the material. Falls, including rockfalls and topples are where rock cascades down a slope, but without fluid or sufficient volume to behave as a flow. The accumulation of fallen rock material residing at the base of the slope is known as talus.

Landslides are likely to occur in areas near where they have occurred in the past or as reactivation of older mass wasting. In many cases, the landscape features provide evidence of past and ongoing landslide activity. Mass wasting is part of the evolution of the landscape, delivering material to be carried away by streams. Landslides are triggered by earthquakes, major storms, volcanic activity, or human activities that may cause slopes to become unstable. The additional weight of rains or snow melt can cause slopes to fail or reactivate older landslides. The most significant factors were steepness of the original slope angle, undercutting of the toe of the slope by erosion or excavation, and height of saturation of the slope (Jones et al. 1961).

Landslide hazards ratings for the Colville National Forest were developed for the Landtype Associations of North Central Washington (Davis et al. 2004). (Landslide hazard ratings are currently being developed for Forest Service Region 6, including adjustments for smaller subsets. These ratings would not be available until after this Plan is finalized.) There are ratings for both deep-seated and shallow rapid landslides. Deep-seated landslides include rotational slumps and other mass movement that is sporadic or slow and involves thick masses of material over a relatively large area. Factors used to assess deep-seated landslide risk were:

- Easily weathered bedrock high in clays
- Geologic structural features such as folding and faulting
- Geomorphic shape features such as escarpments and concave topography
- Fine-textured surficial deposits
- Slope gradients greater than 20 percent
- Indications of concentrated groundwater
- Indications of surface and subsurface water

Approximately 3 percent of the forest has a high risk for deep seated landslides, as shown in table 142. The only area on the forest that was determined to have a high risk at the landtype classification scale is the Pend Oreille River Valley.

**Table 142. Deep-seated landslide risk**

| Deep-seated Landslide Risk | Acres | Percent within Forest Administrative Boundary |
|---|---|---|
| Low | 837,452 | 62% |
| Moderate | 483,928 | 36% |
| High | 35,817 | 3% |

Shallow rapid landslides include debris slides such as debris avalanches, flows and torrents. These slides are relatively small and shallow. Seven factors were used to develop this risk rating:

- Slope gradients greater than 40 percent
- Convergent drainages and/or catchment basins
- Unconsolidated coarse textured soils
- Interface of materials with discontinuous hydrologic properties
- Sparse vegetation patterns
- Geomorphic features such as debris chutes or alluvial fans
- High low order drainage density especially with parallel patterns

Approximately 1 percent of the forest has a high risk for shallow rapid landslides (table 143). The only area of the forest with a high risk of deep-seated landslides at the landtype scale occurs in the Salmo-Priest area of the Selkirk Mountains. For information on the impacts of these landslides on water quality and fisheries, see the sediment delivery risk analysis discussed in the fisheries and the hydrology sections.

**Table 143. Shallow rapid landslide risk**

| Shallow Rapid Landslide Risk | Acres | Percent within Forest Administrative Boundary |
|---|---|---|
| Low | 581,955 | 56% |
| Moderate | 759,961 | 43% |
| High | 15,280 | 1% |

### *Filtering and Buffering*

Soil acts as a filter to protect the quality of water, air, and other resources. Toxic compounds or excess nutrients can be degraded or otherwise made unavailable to plants and animals. The minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits. Soil absorbs contaminants from both water and air. Microorganisms in the soil degrade some of these compounds; others are held safely in place in the soil, preventing contamination of air and water. Wetlands soils especially function as nature's filters. Filtering and buffering on the Forest is impacted by chemical pollutants and industrial contamination at a very small scale. Wetlands are also discussed in the hydrology section.

## Inherent Soil Productivity

Inherent soil productivity can be described as a summation of the six ecological soil functions. The main function drivers of inherent soil productivity on the Colville are soil hydrology and nutrient cycling. Inherent soil productivity influences what plant communities can grow on the forest and how well they grow. Maintaining soil productivity is an important consideration in determining the level of natural

resource extraction, like timber harvest, the forest can sustain, as well as other forest values, such as wildlife habitat and biodiversity.

### Past Management Impacts on Soil Quality and Productivity

Historically (pre-European settlement) and without anthropogenic (man-caused) disturbances, soil loss, soil compaction and nutrient cycling would probably have been within functional limits to sustain soil function and maintain soil productivity for most soils. The exception to this could be relatively short term effects of wildfire during times of drought. Since there were no political boundaries historically, soil condition would have been similar on similar soils throughout the range of the vegetation types.

Much of the current soil condition on the Colville National Forest is related to past management. Soil condition is affected by activities that occur or re-occur at the same place over time. Permanent loss of soil productivity has and could affect the level of goods and beneficial use of the forests in the future. Management activities that have affected soil condition include timber harvesting, site preparation, mechanical fuels treatments, prescribed fires, wildfires, road construction and use, recreation facility maintenance and use, grazing, and special uses. Some examples of impacts that have affected current soil condition include:

- Heavily compacted soils from forest vegetation treatments, grazing and recreation activities have caused or may cause reduced productivity for decades (Burger and Kelting 1999).
- Land-disturbing activities caused erosion of topsoil at rates greater than the soils natural ability to replace it, referred to as soil loss tolerance rate. This has resulted in permanent loss of soil productivity, as soils are considered a non-renewable resource.
- During the 19th and 20th centuries, as more livestock numbers and acres were grazed over long seasons, range condition (and soil condition) declined. The effects of this early, heavy livestock use can still be seen on the ground.
- Road corridors that make up the forests' road system resulted in loss of soil productivity.
- Mineral extraction pits and mines resulted in permanent loss or reduction in soil productivity.
- Uncharacteristic wildfire resulted in erosion rates well beyond tolerance erosion rates.
- Footprints of administration and recreation sites, such as developed campgrounds, have reduced soil productivity.
- Permanent special use sites, such as communication towers and buildings eliminated soil productivity.

There are activities that have improved soil condition, as well as removing risk to soil productivity such as:

- Prescribed fire has removed fuels and undesirable plant material which impede vegetation growth and condition
- Thinning dense forest, woodland and invaded grassland have increased light and reduced water competition for desired understory grasses and shrubs.
- Channel restoration projects have restored bank and vertical streambed stability to and have re-established water table levels on floodplains and terraces that result in increased vegetation/soil productivity.
- Decommissioning of unneeded roads has returned old roadbeds back to producing vegetation.

- Implementation of INFISH, Washington State Forest Practice Rules, Washington State Surface Mining Act, and USDA Forest Service Best Management Practices has resulted in decreased erosion and sedimentation from roads and timber harvests.

## Need for Change

### *Old Forest Management and Timber Production*

In the revision of the Forest Plan, three broad-scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- The recent history of uncharacteristic levels of disturbances resulting from fire and insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Uncertainty about the recovery and viability of old forest-dependent species given the increased risk of uncharacteristically severe disturbances that is likely to be exacerbated by climate change impacts.

### *Motorized Recreation Trails*

The current land management plans provide direction for summer and winter motorized uses, including identifying areas where such use may not be authorized or is limited, mainly for protection of aquatic, plant, and wildlife habitats.

The goal for recreation settings and experiences would include providing a spectrum of high quality, nature-based outdoor recreational settings where visitors access the Forest, including access to the biological, geological, scenic, cultural, and experiential resources of the Forest. Where the visitor's outdoor recreational experience involves few conflicts with other users, access is available for a broad range of dispersed recreation activities such as dispersed camping, rock climbing, boating, mushroom and berry picking, hunting, and fishing and these experiences are offered in an environmentally sound manner, are within budget limits, and contribute to the local economy.

### *Access*

Three broad concerns drove the need to address road density:

1. the Forest can no longer afford to properly maintain the road system at current operational maintenance levels,
2. the current road system is not aligned with current and future resource management objectives, and
3. the existing road management direction is confusing and difficult to follow because it is scattered throughout current Forest Plan (Colville National Forest Land and Resource Management Plan), Forest Plan amendments (Eastside Screens, Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions), national-level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Agreement, the Interior Columbia Basin Strategy).

### *Recommended Wilderness Areas*

By law, all National Forest System lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the National Wilderness Preservation System.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need.

### *Wildlife*

The current Forest Plan provides limited protection for habitat connectivity, providing wildlife and aquatic crossing structures, and managing activities adjacent to the structures so they are used by wildlife.

### *Riparian and Aquatic Resource Management*

The current Forest Plan includes riparian management direction from the Inland Native Fish Strategy. This approach appears to have either maintained or improved riparian and aquatic habitat conditions at the watershed and larger scales.

Objectives for riparian management areas would give emphasis to maintaining or restoring the riparian and aquatic structure and function of intermittent and perennial streams, confer benefits to riparian-dependent plant and animal species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, contribute to improved water quality and flows, and contribute to a greater connectivity of the watershed for both riparian and upland species.

Desired conditions for riparian management areas within any given watershed are to have compositions of native flora and fauna and a distribution of physical, chemical, and biological conditions commensurate with natural processes

## Environmental Consequences

### *Methodology*

#### Old Forest Management

Plant water availability is the resource most limiting productivity within different plant associations groups on the Forest. Information about the soil resource combined with climate can be used to identify different soil drought stress levels and their ability to support dense old forest vegetation structure into the future.

#### Assumptions

Plant water availability is the resource most limiting productivity within different plant associations groups on the Forest. Information about the soil resource combined with climate can be used to identify different soil drought stress levels and their ability to support dense old forest vegetation structure into the future.

#### Methods of Analysis

Four classes of suitability for old growth management areas (not suited, low, medium, and high suitability) was developed to assist in analyzing placement of old growth management areas.

- Step 1: For each alternative, the analysis unit was identified. For example, no action is the fixed old growth management areas while the proposed action is all actively managed portions of the forest = management areas 3A, 5, 6, 7, and 8.
- Step 2: The droughty soils layer was overlaid to provide an estimate of potential productivity and the percentage of each management area in each productivity class was determined based on the droughty soil index map.

**Table 144. Area extent of site productivity ratings for Old Forest Management areas by alternative (acres)**

| Alternative | Management Areas | Acres/ % Area | High | Moderate | Low | Unsuited | Total |
|---|---|---|---|---|---|---|---|
| No Action | Focused and General Restoration | Acres<br>Area | 5,735<br>19% | 15,533<br>51% | 4,165<br>14% | 4,717<br>16% | 30,150<br>-- |
| Proposed Action | Focused and General Restoration | Acres<br>Area | 189,998<br>25% | 390,736<br>53% | 77,417<br>10% | 90,602<br>12% | 748,753<br>-- |
| Alternative R | Focused and General Restoration Late Forest | Acres<br>Area | 191,708<br>25% | 397,065<br>52% | 80,121<br>11% | 94,909<br>12% | 763,803<br>-- |
| Alternative P | Focused and General Restoration | Acres<br>Area | 189,998<br>25% | 390,736<br>53% | 77,417<br>10% | 90,602<br>12% | 748,753<br>-- |
| Alternative B | Restoration area Active Management | Acres<br>Area | 193,154<br>25% | 399,338<br>52% | 80,446<br>11% | 95,105<br>12% | 768,043<br>-- |
| Alternative O | Restoration area Responsible Management | Acres<br>Area | 190,759<br>25% | 394,059<br>52% | 78,872<br>11% | 93,692<br>12% | 757,382<br>-- |

### *Timber Production*

**Assumptions**

- Timber suitability and rangeland capability
    - Lands suitable for timber production are the land base used to calculate timber production harvest levels. Lands are removed from the timber production base for six reasons.
        - Statute, executive order, or regulation has withdrawn the land from timber production.
        - The Secretary of Agriculture or the Chief has withdrawn the land from timber production.
        - Timber production would not be compatible with the achievement of the desires conditions and objectives established by the plan for those lands.
        - The technology is not currently available for conducting timber harvest without causing irreversible damage to soil, slope, or other watershed conditions.
        - There is no reasonable assurance that such lands can be adequately restocked within 5 years after final regeneration harvest.
        - The land is not forest land.

**Methods of Analysis**

- Timber suitability and rangeland capability
    - Areas on the Colville that are considered unsuitable for timber production from a soils perspective fall into these three groupings:

- Areas that are generally not forested because the site is too hot and dry (Mollisols). This condition is more common on the western part of the forest and generally corresponds to low elevation sites on south and west facing slopes.
- Areas that are generally not forested and areas that are generally forested but would be difficult to regenerate artificially because the soil is extremely shallow and/or rocky.
- Areas where the water table is at or near the surface either permanently or seasonally. These conditions typically occur near streams and many of these mapping units would probably be excluded in RHCAs.

### *Motorized Recreation Trails*

**Assumptions**

Motorized access in areas of sensitive soils has the potential to effect soil erosion and soil productivity potentials. Some soil types have low bearing strength when wet and would not support motorized access during periods of high soil moisture. Thin ash-cap soils are easily displaced by motorized equipment negatively affecting the functioning of these soils. The hydrologic functioning of soils that store large quantities of water within the landscape can be disrupted by trails that cause excessive drainage of water in these areas.

**Methods of Analysis**

Each alternative, which varies in where it allows motorized access, has a different potential to negatively affect key soil functions.

- Step 1: The analysis unit for each alternative was determined based on areas of allowable motorized recreation trails.
- Step 2: Was repeated three times, once for each bullet below:
    - Soils having ash-caps with silt and silt loam soil textures and those in the medial soil taxonomic particle size classes are considered to have low bearing strength when moist.
    - Soil taxonomy was used to identify different soil sensitivities to displacement. Andic and vitrandic subgroups are sensitive due to their thin (less than 13 inches depth) ash-caps, Andisols soil orders with thicker ash-caps were identified as moderately sensitive and soil with no ash-cap were considered not sensitive.
    - Soil that store large quantities of water include soils having a hydric soil rating, soils having aquic soil moisture regimes, and flooded/occasionally flooded, poorly and somewhat poorly drained soils.
- Step 3: The percentage of each Back County Management allocation that has sensitive soils was then determined (i.e., low bearing strength, sensitive ash-caps, or water storing soils).

### *Riparian and Aquatic Resource Management*

**Assumptions**

Soil drought index can be used to identify riparian and aquatic resource management areas that may be overstocked and a higher priority for restoration treatments. Areas of high water storage capacity on the landscape can hold large quantities of water to moderate peak flows and supply water for stream flows later in the summer months.

**Methods of Analysis**

Identifying high priority areas for restoration treatments based on soil drought stress.

- Step 1: Riparian and Aquatic Resource Management areas were identified.
- Step 2: These polygons were overlaid with the soil drought index map.
- Step 3: The percentages of five soil drought stress classes (Low, Low to Moderate, Moderate, Moderate to High, and High) were identified.

Identifying where areas of high water storage capacity are on the landscape.

- Step 1: Riparian and Aquatic Resource Management areas were identified.
- Step 2: These polygons were overlaid with the water storage and transmission layer map.
- Step 3: The percentage area of soils having high water storage capacity were identified.

## Summary of Effects

### *Timber suitability and rangeland capability*

Lands suitable for timber harvest includes lands suitable for timber production as well as lands where timber harvest can be used as a tool for reasons other than timber production, such as wildlife habitat improvement or thinning to reduce wildfire risk. Areas of the Colville National Forest that have been identified as suitable for timber harvest but not timber production from a soils perspective are soils classified as Mollisols and mollic subgrades. These soils were developed in a grassland or savannah type ecosystem and would provide opportunity to restore these ecosystems with the use of timber harvest.

An assessment of range capability has been completed for the forest as well. As defined in 36 CFR 219.3, capability refers to 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. Capability depends upon current resource conditions and site conditions, such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture or protection from fire, insects, and disease. Capable range on the Colville National Forest does not include lands considered rock outcrops, very wet and rubble-land. This category includes lands classified as rock outcrop, rubble-land, lithic, serpentinitic, river-wash, very wet or badlands in the soil resource coverages for the National Forest. Lands classified as shallow soils were removed from capable range as well because of inherent productivity limitations. Because slope limits the accessibility of livestock to potential forage, steep slopes need to be withdrawn from the capable land base. A 40 percent slope was determined to be a reasonable threshold for cattle and a 70 percent slope threshold was considered appropriate for sheep on the Forest. Lands steeper than these thresholds were removed from the land base.

### *Motorized Recreation Trails*

The following table shows the percentage area identified for motorized recreation trails having silty ash-cap soils by alternative. When soil moistures are high these silty ash-cap soils would have low equipment bearing strengths. Off road vehicle use in these areas under moist soil conditions are expected to result in excessive rutting and soil puddling that can both reduce water infiltration into the soil and result in channeled runoff and accelerated soil erosion.

**Table 145. Area extent of silty ash-cap soils that are sensitive to motorized recreation trails due to bearing strength under higher soil moisture conditions by alternative**

| Alternative | Management Area | Acres/ % Area | Silty Ash-cap soils (sensitive) | Totals |
|---|---|---|---|---|
| No Action | Semi-primitive Motorized | Acres<br>Area | 10,979<br>42% | 26,399<br>-- |
| Proposed Action | Backcountry Motorized | Acres<br>Area | 11,203<br>30% | 37,802<br>-- |
| Alternative R | Backcountry Motorized | Acres<br>Area | 1,891<br>31% | 6,060<br>-- |
| Alternative P | Backcountry Motorized | Acres<br>Area | 10,671<br>29% | 36,308<br>-- |
| Alternative B | Backcountry Motorized | Acres<br>Area | 1,873<br>31% | 6,031<br>-- |
| Alternative O | Backcountry Motorized | Acres<br>Area | 10,485<br>29% | 35,553<br>-- |

Table 146 shows the percentage of the area identified for motorized recreation trails having different sensitivities to soil displacement of ash-caps by alternative. Displacement of these highly productive ash-cap soil layers would have negative effects to inherent site productivity.

**Table 146. Area extent of soils having different sensitivities to soil displacement by equipment operations due to presence or absence of ash-cap and ash-cap depth by alternative**

| Alternative | Management Area | Acres/ % Area | No Ash-cap (low sensitivity) | Thick Ash-cap (moderate sensitivity) | Thin Ash-cap (high sensitivity) | Totals |
|---|---|---|---|---|---|---|
| No Action | Semi-primitive Motorized | Acres<br>Area | 231<br>1% | 8,510<br>32% | 17,658<br>67% | 26,399<br>-- |
| Proposed Action | Backcountry Motorized | Acres<br>Area | 38<br>>1% | 16,575<br>44% | 21,189<br>56% | 37,802<br>-- |
| Alternative R | Backcountry Motorized | Acres<br>Area | 35<br>>1% | 177<br>3% | 5,848<br>97% | 60,60<br>-- |
| Alternative P | Backcountry Motorized | Acres<br>Area | 38<br>>1% | 15,771<br>43% | 20,499<br>57% | 36,308<br>-- |
| Alternative B | Backcountry Motorized | Acres<br>Area | 35<br>>1% | 159<br>3% | 5,837<br>97% | 6,031<br>-- |
| Alternative O | Backcountry Motorized | Acres<br>Area | 138<br>>1% | 15,539<br>44% | 19,876<br>56% | 35,553<br>-- |

Table 147 shows the percentage of the area identified for motorized recreation trails having water storing soils by alternative. These soils are sensitive to motorized recreation trail use due to soil disturbances that could negatively affect the soil hydrologic function, disrupting water flow in the soil and causing ground water to become surface flow.

**Table 147. Area extent of water-storing soils that are sensitive to motorized recreation trails due to soil disturbances that could negatively affect the soil hydrologic function by alternative**

| Alternative | Management Area | Acres/ % Area | Wet soils (sensitive) | Totals |
|---|---|---|---|---|
| No Action | Semi-primitive Motorized | Acres<br>Area | 3,525<br>13% | 26,399<br>-- |
| Proposed Action | Backcountry Motorized | Acres<br>Area | 1,343<br>4% | 37,802<br>-- |
| Alternative R | Backcountry Motorized | Acres<br>Area | 1,338<br>22% | 6,060<br>-- |
| Alternative P | Backcountry Motorized | Acres<br>Area | 1,343<br>4% | 36,308<br>-- |
| Alternative B | Backcountry Motorized | Acres<br>Area | 1,332<br>22% | 6,031<br>-- |
| Alternative O | Backcountry Motorized | Acres<br>Area | 1,343<br>4% | 35,553<br>-- |

### *Riparian and Aquatic Resource Management*

Table 148 shows acres of riparian and aquatic resource management areas over the whole Forest and discloses the number of acres or percentage of the riparian and aquatic resource management areas that have different soil drought index ratings. Areas having a moderate or high drought index rating should be a higher priority for vegetation management treatments that can help to preserve forest health and promote shading potential in these droughty soil areas.

**Table 148. Area extent of soils having different levels of drought stress within riparian and aquatic resource management areas**

| Management Area | Acres/ % Area | Drought Index | | | | | |
|---|---|---|---|---|---|---|---|
| | | Low | Low to Moderate | Moderate | Moderate to High | High | Total |
| Riparian and Aquatic Resource Management Areas | Acres<br>% Area | 1,664<br>1% | 67,415<br>42% | 74,709<br>47% | 12,716<br>8% | 2,787<br>2% | 159,291<br>-- |

Table 149 indicates acres of riparian and aquatic resource management areas over the whole Forest and discloses the number of acres or percentage of the riparian and aquatic resource management areas that have water storing soils. Recognition of these important water storing areas can help managers highlight and prioritize restoration opportunities in degraded areas. Management opportunities include managing these areas to increase water tables to historic levels, restoration of riparian vegetation in disturbed areas, and identifying mitigation measures and project design criteria to help assure soil disturbances are not affecting soil hydrology.

**Table 149. Area extent of water-storing soils within riparian and aquatic resource management areas**

| Management Area | Acres/ % Area | Water Storage Areas | Total |
|---|---|---|---|
| Riparian and Aquatic Resource Management Areas | Acres<br>% Area | 89,984<br>56% | 159,291<br>-- |

## No-action Alternative

### Old Forest Management

- The current forest plan identifies fixed old growth reserves on about three percent of the total Forest land base and the Eastside Screens provide management direction for their management.
- Approximately 16 percent of the current Old Forest Management areas are unsuited for timber production and another 14 percent of these areas have a low site productivity that is likely marginal for supporting Old Forest Management.

### Motorized Recreation Trails

- Off road vehicle use is allowed in designated areas and trails in Management Areas 3A (Recreation), 3C (Downhill Skiing), 5 (Scenic/Timber), 7 (Wood/Forage), and 10 (Semi-Primitive Motorized Recreation). These Management areas cover 26,399 acres within the Colville National Forest.
- Approximately 42 percent of the motorized off road vehicle use areas have silty ash-cap soils that are expected to have low equipment bearing strength under higher soil moisture conditions. Approximately 67 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. In addition, approximately 13 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

## Proposed Action

### Old Forest Management and Timber Production

- The proposed action uses a “whole landscape” approach for providing late forest structure, allowing late structure forests to shift location in response to ecological process. These types of management enables closer approximation of natural disturbance regimes by allowing closer approximation of natural disturbance regimes that can move around the landscape with disturbance.
- While under the proposed action restoring late forest structure can occur within all management areas across the Forest. This analysis was limited to management areas that allow active management.
- Within managed land allocations approximately 78 percent of the land base consists of high or moderate site productivity, thus allowing a substantial land base for restoring and maintaining Old Forest Management.

### Motorized Recreation Trails

- The proposed action has two Backcountry management areas, motorized and non-motorized. Backcountry (BC) Management Areas (MAs) emphasize non-motorized recreation opportunities while Backcountry Motorized (BCM) management areas support motorized backcountry recreation opportunities. In the proposed Action, approximately 6 percent (37,802 acres) of the Forest is allocated to Backcountry Motorized management and approximately 8 percent is allocated to Backcountry non-motorized.
- Approximately 30 percent of the BCM management areas have silty ash-cap soils that are expected to have low equipment bearing strength under higher soil moisture conditions. Approximately 56 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. In addition, approximately 4 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

## Alternative R

### Old Forest Management and Timber Production

- Alternative R uses a fixed reserve management approach to maintain late forest structure habitats which covers about 44 percent of the Forest. These reserves are called “late forest structure emphasis areas” and overlay other management areas. Although similar to the proposed action, the key difference between the proposed action and alternative R for late forest structure is that late forest structure areas in the proposed action are managed dynamically at the landscape scale whereas alternative R proposes management of static reserves for late forest structure areas.
- Similar to the proposed action approximately 77 percent of the late forest structure emphasis areas land base consists of high or moderate site productivity, thus allowing a substantial land base for identifying Old Forest Management areas.
- An important difference between alternative R and the proposed action is that once late forest structure emphasis areas are identified they would be static and subject to changes in their conditions as a result of management and or disturbance.

### Motorized Recreation Trails

- Alternative R has two Backcountry management areas, motorized and non-motorized. Under alternative R, the 6,060-acre Lost Creek Potential Wilderness Area (PWA) makes up the single BCM management area for this alternative.
- Approximately 31 percent of the Lost Creek Potential Wilderness Area, BCM management area, has silty ash-cap soils that are expected to have low equipment bearing strength under higher soil moisture conditions. Approximately 97 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. And approximately 22 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

## Alternative P

### Old Forest Management and Timber Production

- Alternative P uses the same “whole landscape” approach as the proposed action for providing late forest structure, allowing late structure forests to shift location in response to ecological process. Thus, the effects of Old Forest Management would be the same as the proposed action.

### Motorized Recreation Trails

- Alternative P has two Backcountry management areas, motorized and non-motorized. Under alternative P, approximately 5 percent (36,308 acres) of the Forest is allocated to Backcountry Motorized management and approximately 5 percent is allocated to Backcountry non-motorized.
- Approximately 29 percent of the BCM management areas have silty ash-cap soils that are expected to have low equipment bearing strength under higher soil moisture conditions. Approximately 57 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. In addition, approximately 4 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

## Alternative B

### Old Forest Management and Timber Production

- Alternative B uses a fixed reserve management approach to maintain late forest structure habitats which covers about 31 percent of the Forest. These reserves are called "late forest structure emphasis areas" and overlay other management areas.
- Within managed land allocations approximately 77 percent of the land base consists of high or moderate site productivity, thus allowing a substantial land base for restoring and maintaining Old Forest Management.

### Motorized Recreation Trails

- Alternative B has two Backcountry management areas, motorized and non-motorized. Under alternative B, the 6,031-acre Lost Creek Potential Wilderness Area PWA makes up the single BCM management area in this alternative.
- Approximately 31 percent of the Lost Creek Potential Wilderness Area, BCM management area, has silty ash-cap soils that are expected to have low equipment bearing strength under higher soil moisture conditions. Approximately 97 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. In addition, approximately 22 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

## Alternative O

### Old Forest Management and Timber Production

- Alternative O uses a fixed reserve management approach to maintain late forest structure habitats which cover about 33 percent of the Forest. These reserves are called "late forest structure emphasis areas" and overlay other management areas.
- Within managed land allocations approximately 77 percent of the land base consists of high or moderate site productivity, thus allowing a substantial land base for restoring and maintaining Old Forest Management.

### Motorized Recreation Trails

- Alternative O has two Backcountry management areas, motorized and non-motorized. Under alternative O, approximately 5 percent (36,308 acres) of the Forest is allocated to Backcountry Motorized management and approximately 16 percent is allocated to Backcountry non-motorized.
- Approximately 29 percent of the BCM management areas have silty ash-cap soils that are expected to have low equipment-bearing strength under higher soil moisture conditions. Approximately 56 percent of this area has highly sensitive thin ash-cap soils that are easily displaced by motorized equipment operations. In addition, approximately 4 percent of this area has water-storing soils on which soil disturbance could result in negative effects to soil hydrology.

### Cumulative Effects (Common to All Alternatives)

#### *Bounding of the Cumulative Effects*

Area - Effects on soil productivity are site-specific and not spatially mobile over the analysis area. The analysis area for cumulative effects to soils is the treatment unit or activity area. The activity area as defined in Region 6 Soil Quality Standards as "The total area of ground impacting activity, and is a feasible unit for sampling and evaluating." The effects of past, present, and reasonably foreseeable future

actions to soils typically involve the area of disturbance itself and does not move outside the area disturbed. The development and movement of soils occurs on a geologic time scale and this area bounding reflects cumulative effects to soils.

Time - The time bounding for cumulative effects encompasses previous disturbances from prior wildfire, timber harvest, and grazing as detailed in the existing condition. Disturbance to soil can last for decades and even centuries (Amundson and Jenny 1997, Jenny 1941). For reasonably foreseeable future actions, the bounding is five years in the future.

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Past management activities and disturbance on Colville National Forest lands including timber harvest, silvicultural activities, grazing, road building and wildland fire can have cumulative effects on the soil resource. Limited mining and special uses have also occurred on the Colville National Forest. Impacts to soil productivity and soil quality from past management include soil compaction, soil erosion and topsoil loss, soil puddling, soil displacement, and detrimental soil burning (typically from high severity wildland fires). Grazing, fire suppression, and other activities such as road building have cause detrimental effects to soil moisture regimes including down cutting and dewatering of meadows and wetlands.

There are no foreseeable activities that would vary from present activities. Present activities include timber harvest, fuel reduction (prescribed fire and mechanical), road construction and maintenance, silvicultural treatments, grazing (including llamas), special use permits, and providing recreational opportunities. There is also the potential for wildland fires (suppression and for resource benefit). Foreseeable and present actions also include stream, meadow, and wetland restoration as well as road decommissioning and obliteration.

All alternatives would maintain or improve soil function, soil productivity, and soil quality.

### *No-action Alternative Cumulative Effects*

Within the projected 15- or 20-year life of the Forest Plan, areas of mechanical treatment are possible to be returned to within that time frame, especially fuel break treatments. The no-action alternative includes a 20-percent detrimental soil disturbance threshold to limit the cumulative effects to soils if multiple treatments across multiple timeframes are placed on the landscape.

### *Action Alternatives (Proposed Action, R, P, B, O) Cumulative Effects*

The action alternatives would continue to improve soil conditions on the landscape. Placed within all these alternatives is the restoration of 50 acres of detrimental soil condition per year. This would decrease detrimental soil condition and remediate some of the cumulative effects created from placing multiple treatments across the same activity area. Additional desired conditions, goals, objectives, standards, and guidelines in the action alternatives would improve and preserve soil function and soil quality.

When analyzed with past, present, and reasonably foreseeable future activities, the action alternatives would improve soil reliance and low risk to damage from high-severity wildfire and be responsive to climate change. Due to the funding and staff forecast and the reality that timber harvest, silvicultural treatments, and prescribed fire treatments would be the same extent across action alternatives

## Compliance with Relevant Laws, Regulations, Policies and Plans

The proposed action and the alternatives would meet soil management goals, maintenance of soil quality, and limit of detrimental soil condition. The proposed action and alternatives comply with the standards and guidelines described in the Forest Service Manual and Handbook, Region 6 Soil Quality Standards

and Guidelines (1999), and National Best Management Practice for Water Quality Management on National Forest Systems Lands (2012).

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