Snoquera Landscape Analysis
Draft Environmental Assessment

Snoqualmie Ranger District, Mt Baker-Snoqualmie National Forest, King and Pierce Counties, WA
December 2018
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Format of this Environmental Assessment

CEQ regulations define an environmental assessment as

A concise public document that serves to “briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact (FONSI).”

This environmental assessment focuses on what is relevant and important and concentrates on the issues that are truly significant to the action in question, rather than amassing needless detail (40 CFR 1500.1). Legal requirements only require the EA to provide enough evidence to support our conclusions, address relevant environmental impacts and concentrates on whether the action would “significantly” affect the quality of the human environment.

Therefore this environmental assessment does not include some topics that are not required in an environmental document but have historically been included. Topics that have been eliminated are: project summary, NEPA process language, lengthy list of forest plan standard and guidelines, irreversible and irretrievable commitment section, list of preparers, and appendices.

Contents

Format of this Environmental Assessment .................................................. ii
Contents .......................................................................................................... ii
Introduction .................................................................................................... 1
  Project Location .......................................................................................... 1
Tribal Consultation ......................................................................................... 4
Public Involvement ......................................................................................... 5
Management Direction .................................................................................. 6
  Land Allocations .......................................................................................... 7
  Travel Analysis and the MBS Sustainable Roads Strategy ......................... 9
  Survey and Manage Direction .................................................................. 10
Need for the Proposal ................................................................................... 12
  Landscape Restoration Context for Snoquera Project Area ..................... 13
  2017 Fires Context for Snoquera Project Area .......................................... 18
Proposed Action and Alternatives ................................................................. 20
  Summary of Alternatives ......................................................................... 20
  Alternative 1 – No Action ......................................................................... 22
  Alternative 2 - Proposed Action .............................................................. 22
    Terrestrial Restoration ............................................................................. 23
    Transportation System ........................................................................... 32
    Watershed Restoration .......................................................................... 39
    Recreation Enhancement ....................................................................... 45
  Alternative 3 ............................................................................................ 55
  Project Design Criteria and Mitigation Measures ..................................... 57
  Alternatives Considered but Eliminated from Detailed Study .................. 81
Environmental Impacts of the Proposed Action and Alternatives .................. 83
  Forest Vegetation ..................................................................................... 83
  Methodology ............................................................................................. 83
  Affected Environment ............................................................................. 84
  Environmental Consequences .................................................................. 86
Wildlife ........................................................................................................ 94
Affected Environment .................................................................................. 94
Environmental Consequences ...................................................................... 99
Aquatic Resources ...................................................................................... 162
Botanical Resources .................................................................................. 200
Affected Environment ................................................................................ 200
Environmental Consequences ..................................................................... 205
Alternative 3 ............................................................................................... 209
Invasive Plants ............................................................................................. 209
Alternative 2 ............................................................................................... 211
Alternative 3 ............................................................................................... 211
Compliance with law, regulation, policy, and the Forest Plan ....................... 212
Recreation .................................................................................................... 214
Affected Environment .................................................................................. 214
Environmental Consequences ...................................................................... 215
Cumulative Effects ....................................................................................... 223
Affected Environment .................................................................................. 224
Environmental Consequences ...................................................................... 225
Wild and Scenic Rivers ................................................................................ 226
Affected Environment .................................................................................. 226
Environmental Consequences ...................................................................... 227
Compliance with law, regulation, policy, and the Forest Plan ....................... 228
Transportation ............................................................................................. 228
Travel Analysis and the MBS Sustainable Roads Strategy ......................... 230
Transportation System and Vegetation Management .................................... 231
Methodology ................................................................................................. 236
Spatial and Temporal Bounding of Analysis Area ....................................... 236
Affected Environment .................................................................................. 237
Environmental Consequences ...................................................................... 238
Treaty Rights ................................................................................................ 250
Climate Change ............................................................................................ 251
Inventoried Roadless Areas ........................................................................ 257
Affected Environment .................................................................................. 257
Methodology ................................................................................................. 258
Spatial and Temporal Context for Effects Analysis ...................................... 258
Environmental Consequences ...................................................................... 258
Cumulative Effects ....................................................................................... 260
Other Undeveloped Lands .......................................................................... 260
Affected Environment .................................................................................. 260
Methodology ................................................................................................. 261
Spatial and Temporal Context for Effects Analysis ...................................... 261
Environmental Consequences ...................................................................... 263
Other Required Disclosures ........................................................................ 266
Prime Farmlands, Rangelands, Forestlands, and Parklands ......................... 266
Floodplains and Wetlands ............................................................................ 266
Environmental Justice and Civil Rights ....................................................... 266
Conflicts with Plans, Policies, or Other Jurisdictions .................................... 267
Potential or Unusual Expenditures of Energy ............................................... 268
References .................................................................................................... 274
List of Tables

Table 1. Land use allocations in the project area. ................................................................. 7
Table 2. Summary & Comparison of Alternatives ................................................................. 20
Table 3. Residual Stream Buffers for RR Condition 1 and RR Condition 2 ....................... 30
Table 4. Road Management Proposed Changes ................................................................. 34
Table 5. Approximate miles of road proposed for timber haul by maintenance level, estimated type of work needed, and total miles of NFS road within the Snoquera project area. ........... 38
Table 6. Proposed Road Treatments by Subwatersheds ...................................................... 39
Table 7. Large wood tree tipping into channels .................................................................. 41
Table 8. Designated Dispersed Camping Corridors ............................................................... 45
Table 9. Proposed management actions for dispersed camping sites ................................... 46
Table 10. Proposed addition of pit toilets within each designated dispersed camping corridor. 47
Table 11. Mitigation measures and design criteria for Alternatives 2 and 3 ......................... 57
Table 12. Resource indicators and measures for alternatives 1-3 direct/indirect effects ....... 88
Table 13. Terrestrial Wildlife Species Considered for the Snoquera Project Area Analysis .... 95
Table 14. Potential cumulative effects of the Snoquera Project when combined with the effects to wildlife of other ongoing and reasonably foreseeable future projects ......................... 108
Table 15. Comparison of indicators for potential effects on the Northern Spotted Owl ....... 115
Table 16. Indicators of Potential Effects on Dispersal Habitat, a Primary Constituent Element of Spotted Owl Critical Habitat (Acres) .............................................................................. 117
Table 17. Comparison of Indicators of potential effects on the marbled murrelet between each of the three alternatives .......................................................... 121
Table 18. Indicators of Potential Effect on Marbled Murrelet Critical Habitat ................. 122
Table 19. Indicators of Potential Effects on the Grizzly Bear ............................................. 124
Table 20. Comparison of indicators of potential Impacts on Gray Wolves ......................... 125
Table 21. Comparison of indicators of potential impacts on the American Peregrine Falcon. 127
Table 22. Comparison of indicators of potential impacts on the Harlequin duck ................ 129
Table 23. Comparison of indicators of potential impacts on the Pacific bald eagle .......... 130
Table 24. Comparison of indicators of potential impacts on the Northern Goshawk ........ 132
Table 25. Comparison of indicators of potential impacts on the little brown bat and Townsend’s big-eared bat .............................................................................. 134
Table 26. Comparison of indicators of potential impacts on the mountain goat and MA-15. 136
Table 27. Comparison of indicators of potential impacts on the wolverine ......................... 137
Table 28. Comparison of indicators of potential impacts on the Cascades red fox ............ 139
Table 29. Comparison of indicators of potential habitat impacts for the broadwhorl tightcoil snail. .............................................................................. 140
Table 30. Comparison of indicators of potential impacts on the Western bumble bee ....... 142
Table 31. Comparison of Indicators of potential impacts on the Johnson’s Hairstreak Butterfly. .............................................................................. 144
Table 32. Comparison of indicators of potential impacts on the valley silverspot butterfly .... 145
Table 33. Comparison of indicators of potential impact on Larch Mountain Salamander and Van Dyke’s Salamander between alternatives .............................................. 147
Table 34. Comparison of indicators of potential impacts on the Marten-MIS ..................... 150
Table 35. Comparison of indicators of potential impacts on the Pileated Woodpecker-MIS and Primary Cavity Excavators-MIS .............................................................................. 153
Table 36. Comparison of indicators of potential habitat impacts on neotropical migratory birds. .............................................................................. 155
Table 37: Comparison of indicators of potential impacts to deer and elk ......................... 159
Table 38. Determination Summary by Alternative for Analyzed Species ......................... 159
Table 39. Project area subwatersheds .................................................................................. 162
Table 40. Miles of existing Forest Service roads within Riparian Reserves ....................... 165
Table 43. Miles of roads by aquatic risk on NFS land by watershed .............................................. 168
Table 44. Fish species and habitats of interest and special designations........................................... 169
Table 45. Miles of documented presence on the Mt. Baker-Snoqualmie National Forest by fish species of interest .......................................................................................................................................................... 171
Table 46. Existing NFS system road network and acres of compacted area ........................................ 176
Table 47. Proposed miles of decommissioning, storage, and targeted stormproofing treatments of NFS roads by subwatershed .................................................................................................................................. 179
Table 48. Summary of miles of unclassified routes mapped using LiDAR, displayed by subwatershed ........................................................................................................................................ 180
Table 49. Road density before and after treatments ........................................................................... 180
Table 50. Summary of catchments with road density metrics exceeding thresholds in Upper White River subwatersheds ................................................................................................................................. 181
Table 51. Summary of catchments with road-impairment metrics exceeding thresholds by subwatershed in Upper White River ................................................................................................................. 182
Table 52. Acres of Riparian Reserve by subwatershed reclaimed ........................................................ 186
Table 53. Temporary roads in Riparian Reserves for Alternative 2 and 3, displayed by type and subwatershed ..................................................................................................................................... 187
Table 54. Comparison in number of miles of roads by aquatic risk before and after treatments; FS-managed roads on NFS land within project area only .................................................................................. 190
Table 55. Project area wide soil disturbance estimates for Alternative 2 ........................................... 192
Table 56. Soil area moved from detrimental to improved conditions due to road decommissioning and closure area ........................................................................................................................................ 193
Table 57. Cumulative Effects table for hydrology, and fisheries ......................................................... 196
Table 58. Vegetation zones in the project area .................................................................................... 200
Table 59. Survey and Manage (S&M) and Sensitive plant species known to occur within the project area .................................................................................................................................................. 201
Table 60. Survey and Manage (S&M) and Sensitive plants occurring outside, but within 2 miles of the project area ........................................................................................................................................ 202
Table 61. Documented Invasive Species of Concern ......................................................................... 203
Table 62. Summary of Special Status Species by Proposed Action .................................................... 204
Table 63. Determination Summary by Alternative for Analyzed Species .......................................... 213
Table 64. Proposed Maintenance Level Changes ............................................................................... 230
Table 65. Post implementation transportation system road miles within the project area by maintenance level .................................................................................................................................................. 235
Table 66. Summary of effects to cultural resources ......................................................................... 248
Table 67. Inventoried Roadless Areas (IRA) in the project area ....................................................... 257
Table 68. Acres of activities that occur within Inventoried Roadless Areas in the Snoquera project planning area ........................................................................................................................................ 258
Table 69. Size Class and acres of other undeveloped lands in the project area ................................... 261
Table 70. Acres of activities and miles of road proposed under Alternatives 2 and 3 that occur within other undeveloped lands in the Snoquera project planning area ........................................................................ 263
Table 71. Changes in other undeveloped lands in the Snoquera project area under action alternatives .............................................................................................................................................. 264

List of Figures

Figure 1. Snoquera Landscape Analysis Project Vicinity Map .......................................................... 2
Figure 2. Snoquera Landscape Analysis Project Area Map .............................................................. 3
Figure 3. Snoquera land management allocations ............................................................................ 11
Figure 4. Forest-wide results of the integrated landscape restoration model to identify restoration opportunities for each subwatershed. Blue box identifies the Snoquera Project Area. Warmer
colors/Higher scores refer to subwatersheds with more area available for active restoration.

Figure 5. Distribution of Mature (OGSI-80) and Older (OGSI-200) forest in the Snoquera Project Area. Old Growth Structure Index (OGSI) is a measure of the development of old growth characteristics at two different times since the forested area was established following a disturbance................................................................. 14

Figure 6. Landscape categories for arrangement and distribution of Mature forest (Old-growth Structure Index meeting the 80-year development threshold, OGSI-80) for the Snoquera Project Area. Patches of OGSI-80 are composed of core and edge categories while the finger category connects two or more patches................................................................. 16

Figure 7. Landscape categories for arrangement and distribution of Older forest (Old-growth Structure Index meeting the 200-year development threshold, OGSI-200) for the Snoquera Project Area. Patches of OGSI-200 are composed of core and edge categories while the finger category connects two or more patches................................................................. 16

Figure 8. Norse Peak Fire Vicinity Map................................................................. 17

Figure 9. Terrestrial Restoration Proposed Projects.................................................. 28

Figure 10. Transportation System Proposed Changes.................................................. 30

Figure 11. Watershed Restoration Proposed Projects.................................................. 44

Figure 12. 7013 Pit Target Shooting Closure Area.................................................. 50

Figure 13. Recreation Enhancement Projects.............................................................. 56

Figure 14. High severity burn area near Corral Pass within the Norse Peak Fire in 2017........ 86

Figure 15. OGSI-80 landscape categories for LSR stands west of State Route 410 showing proposed variable density treatments stands that would increase connectivity of wildlife habitat................................................................................................................. 92

Figure 16. OGSI 80 landscape categories for LSR stands in the Lower Greenwater subwatershed showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat................................................................................................................. 93

Figure 17. OGSI 80 landscape categories for matrix stands in the Upper Green watershed showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat................................................................................................................. 93

Figure 18. OGSI 80 landscape categories for Snoqualmie Pass AMA stands showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat................................................................................................................. 93

Figure 19. Current and projected changes in dominant precipitation types for 2040 and 2080 for the Subwatersheds of the Project Area................................................................................................................. 254

Figure 20. Potential Percent Change in Peak Flood Risk Under the 2080 Climate Change Scenario for Subwatersheds of the Project Area. Increasing Percent Values represent greater increase in flood risk from the historic period (1916-2006) under the 2080 scenario........... 255

Figure 21. Potential Percent Change of Increased Soil Moisture Under the 2080 Climate Change Scenario for the Subwatersheds of the Project Area. Percent Values represent greater increase in land slide potential from the historic period (1916-2006) under the 2080 scenario. ................................................................................................................................. 256

Figure 22. Predicted Changes in Earlier Onset of Snowmelt (number of weeks) for the Subwatersheds of the Project Area under the 2040 Climate Change Scenario. ............................ 257

Figure 23. Extent of Inventoryed Roadless Areas and other undeveloped lands within the Snoquera project area. ............................................................. 262

Figure 24. Planting activities within other undeveloped lands........................................ 265
Introduction

The USDA Forest Service is proposing to accelerate the development of late successional and old-growth forest characteristics, implement a number of restoration activities to improve the aquatic and terrestrial environment and address impacts to water quality, enhance huckleberry productivity, improve the health and vigor of Forest communities while providing renewable forest products, and improve recreation opportunities across the Snoquera Landscape Analysis (Snoquera) project area. These actions are proposed to be implemented on the Snoqualmie Ranger District of the Mt. Baker-Snoqualmie National Forest (MBS).

This environmental assessment (EA) has been prepared to determine whether implementation of the proposed project may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA). For more details of the proposed action, see the Proposed Action and Alternatives section of this document.

Project Location

The Snoquera project is located on the Snoqualmie Ranger District of the Mt. Baker-Snoqualmie National Forest (MBS), King and Pierce Counties of northwest Washington. It is located to the east, and southeast of the city of Enumclaw. The project area boundary encompasses approximately 191,215 acres, with approximately 115,597 acres on National Forest System lands.

The project is located in the Middle Green, Upper Green, Lower White and Upper White watersheds. Partially located within the project boundary is the recent (2017) Norse Peak fire burn area (11,502 acres within the Snoquera project area). Completely within the project boundary is the recent (2017) Sawmill Creek Fire (1,062 acres total, only 1 acre on National Forest System land).

The Project area is located in portions of townships T17N-R10E, T17N-R11E, T18N-R9E, T18N-R10E, T18N-R11E, T19N-R9E, T19N-R10E, T19N-R11E, T19N-R12E, T20N-R8E, T20N-R9E, T20N-R10E, T20N-R11E, T20N-R12E, T21N-R9E, T21N-R10E, T21N-R11E and T21N-R12E. See Figures 1: Snoquera Landscape Analysis Project Vicinity Map, and Figure 2: Snoquera Landscape Analysis Project Area Map.
Figure 1. Snoquera Landscape Analysis Project Vicinity Map
Figure 2. Snoquaera Landscape Analysis Project Area Map
Tribal Consultation

The Forest Service has a duty to consult and coordinate with Tribes on a government-to-government basis (Executive Order 13175, Consultation and Coordination with Indian Tribal Governments). Government-to-Government Consultation is a process that enables Tribes to provide meaningful, timely input and, as appropriate, exchange views, information, and recommendations on Forest Service proposed policies or actions that may affect tribal rights or interests prior to a decision. FSM 1563.05. As part of Government-to-Government Consultation the Forest Service fully considers information from and recommendations of tribes, and addresses tribal concerns on proposed decisions. FSM 1563.11(5). The Forest Service also informs Tribes how their information and recommendations were considered in Forest Service decisions, including explanations in the event that tribal recommendations are not adopted or incorporated. FSM 1563.11(6).

The Mt. Baker-Snoqualmie National Forest and Tribal representatives meet periodically to discuss new and ongoing concerns, partnership opportunities, and issues that may Tribes, the exercise of treaty rights, and the protection of sacred and spiritual sites. The Forest Service recognizes the long history of Tribes harvesting and managing for sustainability, fish, animals, plants and other resources, and their integral role in the stewardship of these lands, now managed by the Forest Service to meet their subsistence, spiritual, cultural, and medicinal needs, and for the purposes of trade and commerce.

Project-specific consultation with the following Tribes was invited during the development of this EA: Muckleshoot Indian Tribe, Tulalip Tribes, Puyallup Tribe of Indians, Yakama Nation, Snoqualmie Indian Tribe, and Confederated Tribes of the Colville Reservation. In a letter addressed to each of the Tribal chairpersons, the Snoqualmie District Ranger requested information on Tribal interests or knowledge of cultural uses or properties, concerns about possible effects on historic properties of religious or cultural significance, or information on reserved treaty rights within the project area.

The Snoqualmie District Ranger and Staff met with Tribes to discuss their questions and concerns for the Snoquera project area. Concerns raised by Tribes included the following:

- Restoration of traditional food, medicinal or technical resources, and access for elders to these locations
- Protection of archaeological, sacred and traditional properties, and maintaining the suitability of these areas for cultural and spiritual uses in perpetuity
- Continued access to treaty-reserved resources, and access for elders to these locations
- Shared stewardship opportunities on the national forest with tribes
- Water quality, and fish habitat, including habitat for all salmonid species in addition to those listed as threatened or endangered under ESA and access to those resources.
- Wildlife habitat, including elk security, beaver and mountain goat reintroductions
- Climate change and USFS appropriate adaptive response
Need for careful management of recreational use to address potential environmental impacts to forest lands and to reserved treaty rights/cultural uses given increasing numbers of visitors on the MBS.

The effects of the proposed action and alternatives were evaluated with consideration for both written and verbal responses received from Tribes regarding Tribal interest and Treaty reserved rights that could be affected by the project.

Public Involvement

As part of developing objectives for the Snoquera project area, the Snoqualmie Ranger District reached out to the local Tribes, communities, and partners to discuss the values and benefits they feel are important in the project area. This was prepared with values mapping exercises with the Snoquera IDT, public meetings, and from pre-scoping mailings. The feedback received from these contributed to the need for the Snoquera Landscape Analysis. Prominent values and interests expressed include:

- Cultural areas
- Diverse and increased public recreation opportunities
- Rapidly increasing population in the Puget Sound area, and the resulting impacts on recreational experiences, including user conflicts, and resource damage.
- Nearby private land and communities - recreational shooting is a safety and fire concern throughout this area.
- High quality wildlife habitat for a variety of species
- Vegetation management including timber harvest, huckleberry restoration, special forest products

The proposal was listed in the Schedule of Proposed Actions (SOPA) in June 2017 and has been listed on subsequent SOPAs on a quarterly schedule. 517 pre-scoping notifications were sent June 9, 2017; and public meetings were held in Enumclaw and Greenwater, WA in June 2017 that 35-40 members of the public attended. The proposal was provided to the public and other agencies for comment during scoping May 2, 2018 – June 1, 2018. Legal notices were published in the Everett Herald, and the Seattle Times. 1,477 scoping notifications were sent. A public meeting was held in Enumclaw on May 17, 2018 that about 40 members of the public attended. Approximately 276 letters and emails were received from the public in response to scoping. The complete scoping mailing list and all scoping letters and emails received are in the project record.

In addition, as part of the public involvement process, public meetings and field trips for interested parties, tribal governments, and other organizations were held on several dates. Between 85-90 members of the public attended or participated in these events. More detailed information is available in the project record.

Snoquera project scoping documents, maps, and other associated information can be found in the project record and online at https://www.fs.usda.gov/project/?project=51969.
Using the comments from the general public, organizations, tribal governments, and other federal and state agencies, the interdisciplinary team (ID team) developed a list of issues and subsequently developed alternatives to address those issues.

**Management Direction**

This Environmental Assessment has been prepared in accordance with regulations for implementing the National Environmental Policy Act of 1969 (NEPA), located at 40 CFR 1500-1508. It is tiered to the Final Environmental Impact Statement (FEIS) for the Mt. Baker-Snoqualmie Land and Resource Management Plan (Forest Plan, USDA Forest Service 1990), as amended. Major plan amendments since 1990 include:

Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl, as adopted and modified by the April 1994 Record of Decision (ROD), which provides additional standards and guidelines (USDA-FS and USDI-BLM 1994, and commonly known as the Northwest Forest Plan (NWFP)); Record of Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy Amending Resource Management Plans (USDA Forest Service and USDI Bureau of Land Management 1994).

Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA Forest Service and USDI Bureau of Land Management 2001).

The Snoqualmie Pass Adaptive Management Area (AMA) FEIS and ROD (USDA 1997) amended the Forest Plans of the Wenatchee and Mt. Baker-Snoqualmie National Forests, as previously amended by the 1994 ROD for the NWFP, to include specific standards and guidelines for the AMA.

Forest-wide Environmental Assessment for Invasive Plants Record of Decision, Prevention Strategy/Best Management Practices for Noxious Weed Management (USDA Forest Service 2005); Region 6 Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service 2005); Mt. Baker-Snoqualmie National Forest Invasive Plant Treatment Record of Decision (USDA Forest Service 2015)

Huckleberry Land Exchange (USDA SEIS as – ROD 2001)

Additional Documents Incorporated by Reference

The following documents are incorporated by reference.

- The Upper White and Greenwater Watershed Analysis (USDA Forest Service 2000) characterized the watershed processes and aquatic conditions for the Upper White River, West Fork White River and Greenwater River, and Huckleberry Creek and the associated subwatersheds.

- Other sources of information cited in this EA and its project file, such as specialist reports, published studies and books.
Prior recent EAs in this area include: Upper White River Vegetation and Restoration Project (USDA Forest Service 2012), Greenwater Access and Travel Management Project (USDA Forest Service 2017).

## Land Allocations

National Forest System land within the project area is allocated into management areas (MA’s) by the Forest Plan, as amended by the NWFP. These areas include:

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<td>815</td>
<td>.71</td>
</tr>
<tr>
<td>21A ~ Green River Municipal Watershed</td>
<td></td>
<td>11,002</td>
<td>9.52</td>
</tr>
<tr>
<td>21A AMA ~ Green River Municipal Watershed, Adaptive Management Area</td>
<td>AMA</td>
<td>9,503</td>
<td>8.22</td>
</tr>
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</table>
### Merged Land-Use Allocation

<table>
<thead>
<tr>
<th>Merged Land-Use Allocation</th>
<th>NWFP Allocation</th>
<th>Acres</th>
<th>% NFS Lands in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>21A AMA  LSR ~ Green River Municipal Watershed, Adaptive Management Area</td>
<td>LSR4</td>
<td>613</td>
<td>.53</td>
</tr>
<tr>
<td>21A LSR ~ Green River Municipal Watershed, LSR</td>
<td>LSR4</td>
<td>620</td>
<td>.54</td>
</tr>
<tr>
<td>21A LSOG ~ Green River Municipal Watershed, LSOG</td>
<td>LSOG</td>
<td>1,383</td>
<td>1.19</td>
</tr>
<tr>
<td>23A ~ Other Municipal Watersheds</td>
<td>LSR4</td>
<td>531</td>
<td>.46</td>
</tr>
<tr>
<td>23A LSR ~ Other Municipal Watersheds</td>
<td>LSR4</td>
<td>99</td>
<td>.09</td>
</tr>
<tr>
<td>LSR ~ Late-Successional Reserve</td>
<td>LSR</td>
<td>50,146</td>
<td>43.39</td>
</tr>
<tr>
<td>Forest Service Land acquired after completion of Forest Plan</td>
<td>Forest Service Land acquired after completion of Forest Plan</td>
<td>5,929</td>
<td>5.13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>115,597</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Riparian Reserves (RR): This Northwest Forest Plan allocation includes areas along all streams, wetlands, ponds, lakes and unstable or potentially unstable areas. Riparian Reserves may overlay all other management areas, and the Riparian Reserve standards and guidelines apply wherever Riparian Reserves occur (including within Late-Successional Reserves). There are 45,331 acres of RR on Forest System land within the project area.

Late-Successional Reserves (LSR): The objective of these reserves, in combination with other allocations’ standards and guidelines, is to protect and enhance conditions of late-successional and old-growth forest ecosystems. They are designed to serve as habitat for late-successional and old-growth related species. Proposed actions should be designed to contribute to attainment of the Aquatic Conservation Strategy (ACS) objectives. A forest-wide LSR Assessment has been completed (USDA Forest Service 2001).

Matrix: These are lands that fall outside other allocations. It is the area in which most timber harvest and other silvicultural activities are conducted. Some lands within this allocation may be non-forested and technically unsuitable for timber production. Matrix lands within the Project Area include MA 21A – Green River Municipal Watershed. The Forest Plan Goal for that management area allocation is: “Provide for the production of water at a level of quality which, with adequate treatment by the purveyor, will result in a satisfactory and safe water supply. Timber production is emphasized to the extent that the water quality goal is met. There is varying emphasis on other uses.” (MBS Forest Plan, p. 4-264).

Snoqualmie Pass Adaptive Management Area (AMA): The goal of projects in this area will be to enhance late-successional, riparian, or aquatic habitat conditions while providing for a spectrum of social and economic needs. (Snoqualmie Pass Adaptive Management Area Implementation Guide, Mount Baker-Snoqualmie and Wenatchee National Forests, September 1998).

Greenwater Special Area: Other Special Areas, designated by the Forest Plan, are lands not scheduled for timber harvest. Timber harvest is not precluded and vegetation management prescriptions are designed to maintain or enhance the areas desired vegetation characteristics. Within Snoquera, the Greenwater Special Area includes MA 8E - lands within inventoried elk
winter range plus one section of elk summer range would be managed to provide elk and deer forage habitat.

Congressionally Reserved Areas include Wilderness Areas, Wild and Scenic Rivers, and other lands with congressional designations. There are no Wilderness Areas within Snoquera. The Norse Peak Wilderness is adjacent to the project area boundary. There are no congressionally designated Wild and Scenic Rivers in the project area (see Wild and Scenic Rivers section under the Environmental Impacts of the Proposed Action and Alternatives).

Inventoried Roadless Areas refer to those areas identified and mapped in accordance with the Roadless Area Conservation Rule (36 CFR Part 294). Approximately 8,428 acres of IRA are located within the project area. With limited exceptions, the 2001 Roadless Rule prohibits new road construction and reconstruction as well as timber harvesting within IRAs. 36 CFR 294.12-294.13. No road construction or timber harvesting are proposed within any IRA as part of this project. Snoquera does propose some planting within IRAs that burned at high severity by the Norse Peak Fire (see Inventoried Roadless Areas section under the Environmental Impacts of the Proposed Action and Alternatives).

There is considerable overlap among some allocations, and more than one set of standards and guidelines may apply. Where the standards and guidelines of the 1990 Forest Plan are more restrictive or provide greater benefits to late-successional forest-related species than do those of the 1994 NWFP ROD, the existing standards and guidelines apply. Table 1 identifies the acres of MA's within the project area. See also Figure 3: Snoquera Landscape Analysis Project Land Management Allocations map.

Travel Analysis and the MBS Sustainable Roads Strategy

To comply with the 2005 Travel Management Rule (36 CFR 212) and move forward with identifying the minimum road system, the MBS published the Sustainable Roads Strategy (SRS), an interdisciplinary science-based analysis (USDA Forest Service 2012). Development of the SRS included outreach to the public, local governments, and Tribes to understand what areas of the Forest received the most use, what those uses are, and what access needs are priorities.

The SRS ranked roads based on their: (1) benefit to recreation use, forest product access, agency and permittee access, and vegetation management access; and (2) risks to natural and cultural resources. However, the SRS interdisciplinary team determined that access needs, and not risks, should be the primary driver of recommendations for how roads should be managed. The rationale was that risks can be managed with mitigation and conservation measures during road maintenance activities, and through site-specific NEPA analysis. The SRS is not a formal decision document, as such, protections for natural and cultural resources were not named or discussed in detail in the SRS. Instead, the SRS identified opportunities for changing how the forest transportation system may be managed in the future to address administrative, tribal and public access issues.

The SRS is the starting point for travel analysis, which includes the site-specific analysis necessary to identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. See 36 CFR 212.5(b).
Survey and Manage Direction

Federal agencies (BLM and Forest Service) are currently implementing the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, the December 2003 species list with Red tree vole as Category C across its range and giving special consideration to 12 species, and the four categories of projects exempt from the Survey and Manage standards and guidelines as stipulated by Judge Pechman (October 11, 2006 “Pechman Exemptions”).

Survey and Manage Project Exemptions—Northwest Ecosystem Alliance, et al. v. Mark E. Rey, et al., No. C04-844P (District Court Order of January 2006, modified October 11, 2006): This court order re-instated the 2001 ROD and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measure Standards and Guidelines. The October 2006 modification allowed four categories of activities to proceed without performing pre-disturbance Survey and Manage related surveys and known site management, also known as the “Pechman Exemptions.” These categories are: 1) thinning in forest stands younger than 80 years of age, 2) culvert replacement/removal, 3) riparian and stream improvement projects including the decommissioning of roads, and 4) hazardous fuel treatments, which apply prescribed fire.
Figure 3. Snoquera land management allocations.
Need for the Proposal

Analysis at the landscape scale is a process used to characterize human, aquatic, and terrestrial resources, and interactions within an area. The proposed actions contained in this project are a product of analysis designed to improve the health and vigor of Forest communities while providing renewable forest products, enhance fish and wildlife habitat, address impacts to water quality, and improve recreation opportunities across the project area. The need for action is driven by a discrepancy between the existing conditions and the desired conditions as defined by the 1990 Mt. Baker Snoqualmie N.F. Land and Resource Management Plan, as amended, 2000 Upper White and Greenwater Watershed Analysis and 1996 Greenwater River Watershed Analysis; as well as the 2001 Mt. Baker-Snoqualmie N.F. Forest-Wide Late-Successional Reserve Assessment.

While recreational experiences are a driving force to take action in the Snoquera area, the restoration projects included in this proposal are of equal importance ecologically. The Multiple-Use Sustained Yield Act of 1960 is a principle piece of legislation guiding management of the national forests. Section 1 states, “It is the policy of the Congress that the National Forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes”. Management actions proposed for the Snoquera project area would work towards providing these multiple uses along with the long-term improvement of ecological conditions described in the Forest Plan, as amended.

Furthermore, there is a need to protect and enhance the resources, habitat, access and places upon which Tribal reserved treaty hunting, fishing and gathering and other cultural rights depend.

In order to provide these multiple uses on the landscape into the future, there is a need to balance improving terrestrial and aquatic conditions and processes, while providing a variety of recreational opportunities:

- **Terrestrial**: Accelerate the development of late-successional and old-growth forest habitats by promoting structural diversity in young stands (USDA Forest Service and USDI Bureau of Land Management 1994a, p. C-12), improving nesting or roosting, and foraging habitat in mature forest, increase forest biological complexity, maintain or improve forest health and vigor to meet multiple resource objectives, maintain or create meadow or other open habitats, and restore native plant communities.

- **Aquatic**: Enhance the health of streams and associated aquatic ecosystems by modifying the transportation system (e.g. storm proofing, decommissioning, rerouting or closing roads) to reduce road derived impairments, increase floodplain, channel and riparian structure (e.g. large wood components), remove barriers to aquatic species migration, and speed the development of large conifers and hardwoods in riparian areas.

- **Recreation**: Provide a variety of visitor experiences while improving public safety, and management capacity by maintaining and enhancing developed and dispersed recreational opportunities, including special uses.

- **Contribute to local and regional economies by providing timber, firewood, other forest products, and a variety of recreational opportunities.**

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In addition to descriptions in this section, including Landscape Restoration Context and 2017 Fires Context, some details of existing conditions are elaborated on as applicable in the specific sections where proposed activities are described. This is in part due to aspects of proposed actions within Snoquera using condition based management (described under Alternative 2).

**Landscape Restoration Context for Snoquera Project Area**

Integrated restoration at the landscape scale seeks to restore terrestrial and aquatic processes to the ecosystem. The MBS developed a strategy to identify restoration opportunities across the forest to prioritize areas where active management will contribute to restoring ecological pattern and processes at the subwatershed scale. Current condition for 22 metrics was integrated into a single model to develop a restoration opportunity score for each subwatershed on the MBS (n=150). Metrics addressed available land base, vegetation structure, wildlife habitat, aquatic habitat, and hydrology-access. The Snoquera Project Area encompasses all or a portion of fifteen subwatersheds. Model results indicated the subwatersheds associated with the Snoquera Project Area contained the greatest opportunity for active management to contribute to ecosystem restoration.

The model drivers for restoration need in the Project Area are forest fragmentation, reduced connectivity for wildlife habitat, proximity of roads to critical fish habitat, and road system susceptibility to climate change. These terrestrial findings are consistent with 2001 Late Successional Reserve Assessment for the LSR portion of the Project Area, which labeled LSR 125 a Priority 1 reserve for restoration (<60% functioning of late successional old-growth habitat) and Aquatic Conservation Strategy.

The Project Area is in a Key Watershed yet only partially functioning according to the Watershed Condition Framework. Past land ownership and timber harvest resulted in a road system with major portions within listed fish bearing streams and rivers. When taken together, aquatic processes are in need of active restoration to assist with the development of critical habitat of listed species and aquatic organism passage across the dense road system. Riparian corridors within previously managed stands are of particular focus where lack of both down wood and diverse understory plant community exist. Promoting wood recruitment into fish bearing streams along with encouraging the development of a diverse understory of shrubs, forbs and grasses within the riparian corridors benefits both the aquatic organisms and the overall upland ecological processes.

Existing forest structure is a reflection of a long fire history mixed with recent management. Three major fire periods have occurred over the entire Project Area. The widespread periods of burning occurred about 200 years apart beginning in the early 1300’s and ending in the first decade of the 1700’s ce. Since then, some local natural fires have burned smaller portions of the Project Area, specifically in the 1890’s and the recent Norse Peak fire in 2017. Out of each fire episode, large patches of new forest emerged interspersed with forested areas the fire avoided. The resulting mosaic of forest succession is still present along with the areas of active harvest beginning in the 20th century (Figure 4).
Figure 4. Forest-wide results of the integrated landscape restoration model to identify restoration opportunities for each subwatershed. Blue box identifies the Snoquera Project Area. Warmer colors/higher scores refer to subwatersheds with more area available for active restoration.

Forested areas where old growth characteristics are not yet developing are typically younger stands (<80 years of age) more recently affected by natural disturbance (fire or wind event) or regeneration harvest. Nearly all of the current young forested stands have resulted from past timber harvest across the Project Area. These young, dense stands are interspersed among older stands which originated from past natural disturbances (primarily fire). Old-growth structure
Old Growth Structure Index (OGSI) index integrates four metrics in order to characterize forest structure: density of large live trees, density of large snags, percent cover of down woody classes and the diversity of live tree size classes (Davis et al. 2015). Old Growth Structure Index (OGSI) is a measure of the development of old growth characteristics at two different times since the forested area was established following a disturbance (80 and 200 years). The range of OGSI values from low to high reflect changes from simple to complex forest structure for each forest type. The point at which young forests start to mature on the succession timeline (as determined by comparing OGSI components against stand age) is labeled OGSI-80. Here OGSI-80 is also referred to as mature forest. Older forest (or the beginning of old-growth) is defined at the 200-year mark (OGSI-200). Younger stands resulting from timber harvest are structurally simple (numerous smaller diameter trees, lacking large trees, few if any large snags or large down wood) and thus do not meet the OGSI-80 threshold.

Patches of OGSI-80 and OGSI-200 illustrate how natural forest succession and past timber harvest intersect in the Project Area (Figure 5). Patches of OGSI-80 and -200 are composed of core and edge areas (minimum patch size is 2.5 acres; Figure 6 and Figure 7, respectively). Forested connectivity among similar patch types is referred to as fingers.

Fingers are areas <2.5 acres in size and provide connected pathways for wildlife and seed movement.
Figure 5. Distribution of Mature (OGSI-80) and Older (OGSI-200) forest in the Snoquera Project Area. Old Growth Structure Index (OGSI) is a measure of the development of old growth characteristics at two different times since the forested area was established following a disturbance.

Figure 6. Landscape categories for arrangement and distribution of Mature forest (Old-growth Structure Index meeting the 80-year development threshold, OGSI-80) for the Snoquera Project Area. Patches of OGSI-80 are composed of core and edge categories while the finger category connects two or more patches.
Figure 7. Landscape categories for arrangement and distribution of Older forest (Old-growth Structure Index meeting the 200-year development threshold, OGSI-200) for the Snoquera Project Area. Patches of OGSI-200 are composed of core and edge categories while the finger category connects two or more patches.

Forested areas in the Project Area fall into Western Hemlock, Pacific Silver Fir, or Mountain Hemlock vegetation zones. When comparing the stand age class distribution of each vegetation zone against the range of natural variability, the Project Area is near the upper range of mid-seral (30-80 year old stands) while at the low end of the range in the mature seral class (80-200 year old stands) in both the Western Hemlock and Pacific Silver Fir zones. Therefore accelerating the development of old growth characteristics in these areas would help to reduce the amount of mid-seral stands and promote the increase of mature stands over time. Furthermore, increasing the development of old growth characteristics in younger stands in close proximity or adjacent to mature or older forest patches would act to reduce edge effects, increase patch size and increase connectivity among forest patch types.
2017 Fires Context for Snoquera Project Area

Initial public outreach for the Snoquera project began in June 2017. Later that summer two wildland fires occurred within or partially within the project area boundary: Sawmill Creek Fire and Norse Peak Fire. The 1,062-acre Sawmill Creek Fire was located completely within the project boundary, with just one acre burned on National Forest System managed land.

The Norse Peak Fire was among several starts ignited by lightning in the Norse Peak Wilderness August 11, 2017. The fire, initially started on the Okanogan-Wenatchee National Forest, spotted over the crest and onto the MBS around September 5, 2017. The fire was approximately 22 miles southeast of the community of Enumclaw, WA, in Pierce County. Figure 8 is the vicinity map for the Norse Peak Fire.

The fire burned approximately 11,502 acres within the Snoquera project area (23,235 acres on the Mt. Baker-Snoqualmie NF) predominantly in steep rocky terrain with limited access and dominated primarily by timber fuels. The severity of the burn varied throughout the landscape, burning primarily within the Norse Peak Wilderness, Late-Successional Reserve, and a small proportion of administratively withdrawn management area. Within the project area portion of the fire, approximately 28% burned at high severity, 13% at moderate, 16% low severity, and 42% was unburned or burned at very low severity within the fire perimeter, based on Composite Burn Index (Rapid assessment of vegetation condition after wildfire (RAVG), 2017).

The fires did not alter the purpose and need for Snoquera. The fires did alter the specific proposals for project activities within the Norse Peak Fire burn area.
Figure 8. Norse Peak Fire Vicinity Map
Proposed Action and Alternatives

Summary of Alternatives
Estimated differences between Alternatives 1, 2 and 3 are compared in Table 2.

Table 2. Summary & Comparison of Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>acres unless otherwise specified</td>
<td>acres unless otherwise specified</td>
<td>acres unless otherwise specified</td>
<td></td>
</tr>
<tr>
<td>Variable Density Thinning - LSR</td>
<td>0</td>
<td>Up to 7,221</td>
<td>Up to 7,221</td>
</tr>
<tr>
<td>Variable Density Thinning - Snoqualmie Pass AMA</td>
<td>0</td>
<td>Up to 2,561</td>
<td>Up to 2,561</td>
</tr>
<tr>
<td>Variable Density Thinning – Greenwater Special Area*</td>
<td>0</td>
<td>Up to 1,572</td>
<td>Up to 1,572</td>
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<tr>
<td>Variable Density Thinning - Matrix</td>
<td></td>
<td>Up to 891</td>
<td>Up to 891</td>
</tr>
<tr>
<td><strong>Variable Density thinning total</strong></td>
<td>0</td>
<td>Up to 12,245</td>
<td>Up to 12,245</td>
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<tr>
<td>Elk Forage Habitat (MA 8E) Permanent Openings</td>
<td>0</td>
<td>Up to 272</td>
<td>Up to 272</td>
</tr>
<tr>
<td>Elk Forage Habitat (MA 8E) Thinning</td>
<td>0</td>
<td>Up to 117</td>
<td>Up to 117</td>
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<tr>
<td><strong>Elk Forage Habitat total</strong></td>
<td>0</td>
<td>Up to 389</td>
<td>Up to 389</td>
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<tr>
<td>Variable Density Thinning – Riparian Reserves**</td>
<td>0</td>
<td>Up to 5,057</td>
<td>Up to 5,057</td>
</tr>
</tbody>
</table>

**Riparian Reserve Variable Density Thinning**

| | Alternative 1 | Alternative 2 | Alternative 3 |
| | acres unless otherwise specified | acres unless otherwise specified | acres unless otherwise specified |
| Perennial Fish Bearing (stream miles) | 0 | 8.13 | 8.13 |
| Perennial Non-fish Bearing (stream miles) | 0 | 28.75 | 28.75 |
| Intermittent (stream miles) | 0 | 78.13 | 78.13 |
| Instream Wood connected to Riparian Reserves Variable Density Thinning | 0 | RR condition 1 | RR condition 1 |
| Non-commercial thinning - LSR | 0 | Up to 636 | Up to 636 |
| Non-commercial thinning – Snoqualmie Pass AMA | 0 | Up to 1,217 | Up to 1,217 |
| Non-commercial thinning - Matrix | 0 | Up to 30 | Up to 30 |
| Huckleberry Enhancement Non-commercial Thinning | 0 | Up to 400 | Up to 400 |
| Non-commercial thinning - Riparian Reserves** | 0 | Up to 571 | Up to 571 |

**Riparian Reserve Non-commercial Thinning**

| | Alternative 1 | Alternative 2 | Alternative 3 |
| | acres unless otherwise specified | acres unless otherwise specified | acres unless otherwise specified |
| Perennial Fish Bearing (stream miles) | 0 | .04 | .04 |
| Perennial Non-fish Bearing (stream miles) | 0 | 3.72 | 3.72 |
| Intermittent (stream miles) | 0 | 14.12 | 14.12 |
| Planting | 0 | Up to 133 | Up to 133 |
| Planting – Inventoried Roadless Areas | 0 | Up to 225 | Up to 225 |

**Roads Used – Haul Routes**
<table>
<thead>
<tr>
<th>Maintenance of system roads (miles)</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open (operational maintenance level 2-5)</td>
<td>0</td>
<td>61.85</td>
<td>61.85</td>
</tr>
<tr>
<td>Closed (operational maintenance level 1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reconstruction of system roads (miles)</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open (operational maintenance level 2-5)</td>
<td>0</td>
<td>197.53</td>
<td>197.53</td>
</tr>
<tr>
<td>Closed (operational maintenance level 1)</td>
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<tr>
<th>Other Road Activity</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>New temporary road construction (miles) (All temporary roads would be decommissioned post project)</td>
<td>0</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Temporary road on unclassified roads with existing road prisms (miles) (All temporary roads would be decommissioned post project)</td>
<td>0</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Temporary road on previously decommissioned roads (miles) (All temporary roads would be decommissioned post project)</td>
<td>0</td>
<td>13.6</td>
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<tr>
<td>Total temporary road construction (miles)</td>
<td>0</td>
<td>34.8</td>
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<table>
<thead>
<tr>
<th>Danger Tree Removal</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td>As Needed</td>
<td>As Needed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance Level - Road Changes</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decommission</td>
<td>0</td>
<td>23.83 miles</td>
<td>23.83 miles</td>
</tr>
<tr>
<td>Maintenance Level 1 Closed/Storage</td>
<td>0</td>
<td>5.68 miles</td>
<td>5.68 miles</td>
</tr>
<tr>
<td>Maintenance Level 2 – High Clearance</td>
<td>0</td>
<td>2.39 miles</td>
<td>2.39 miles</td>
</tr>
<tr>
<td>Maintenance Level 3 – Suitable for Passenger Cars</td>
<td>0</td>
<td>0.2 miles</td>
<td>0</td>
</tr>
<tr>
<td>Storm proofing</td>
<td>0</td>
<td>54.11 miles</td>
<td>54.11 miles</td>
</tr>
<tr>
<td>Aquatic Organism Passage</td>
<td>0</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Instream Wood (2-4 Trees &gt;20” dbh per site)</td>
<td>0</td>
<td>Up to 12 sites</td>
<td>Up to 12 sites</td>
</tr>
<tr>
<td>Existing Instream Structure Maintenance/Enhancement</td>
<td>0</td>
<td>Within 7 reaches</td>
<td>Within 7 reaches</td>
</tr>
<tr>
<td>Acclimation Pond Improvement</td>
<td>3 ponds</td>
<td>3 ponds</td>
<td></td>
</tr>
<tr>
<td>Designated Dispersed Camping/Riparian Restoration***</td>
<td>Within 5 corridors, approx. 24.2 miles</td>
<td>Within 5 corridors, approx. 24.2 miles</td>
<td></td>
</tr>
<tr>
<td>Pit Toilets</td>
<td>0</td>
<td>Up to 10</td>
<td>Up to 10</td>
</tr>
<tr>
<td>Recreational Target Shooting Improvements</td>
<td>2 sites</td>
<td>2 sites</td>
<td></td>
</tr>
<tr>
<td>Shooting area closure</td>
<td>1 site</td>
<td>1 site</td>
<td></td>
</tr>
<tr>
<td>Trailheads- Expansion/Reestablish</td>
<td>3 Trailheads</td>
<td>2 Trailheads</td>
<td></td>
</tr>
<tr>
<td>Road to Trail Conversions and/or Reroutes</td>
<td>2 miles</td>
<td>2 miles</td>
<td></td>
</tr>
</tbody>
</table>
The proposed action and following alternatives were considered:

**Alternative 1 – No Action**

The No-Action Alternative forms the basis for a comparison between meeting and not meeting the project needs. This alternative provides baseline information for understanding changes associated with the action alternative(s) and expected environmental responses as a result of past management actions.

Under this alternative, none of the proposed treatments or activities described in the Proposed Action and Alternatives section would occur. The densely stocked second growth stands would not be thinned and actions that would improve late seral or old growth attributes, enhance huckleberry, and improve watershed function would not be authorized.

Ongoing activities such as recreation, fire exclusion, firewood cutting, and road maintenance (including danger tree removal) would continue. Current aquatic and riparian habitat conditions may continue to degrade. Except for the methods associated with wildland fire, forest management would rely on natural processes. No additional projects at the landscape scale are anticipated for the next 10 years in this planning area, unless a catastrophic event such as a flood or fire occurs. There would be no changes to the existing road network, other than those already approved in the Greenwater ATM decision (USDA Forest Service 2017). Other roads would be evaluated and managed by reacting to individual events—such as slides, road slippage, or culvert failures—that make roads impassable or affect natural resources. Previously approved decisions, with actions not yet completed, would continue to be implemented.

Because the existing environment is not static, environmental consequences from selecting this alternative are expected. Current biological and physical processes would continue on their present trajectories along with associated risks and benefits.

**Alternative 2 - Proposed Action**

The Snoquera Landscape Analysis project proposes a suite of activities to meet the purpose and need for action, including condition based management.

Condition based management involves authorizing projects or activities to implement on the ground, with flexibility allowed during implementation to account for current conditions. This
analysis considers projects or activities to implement, but some of the specific locations and treatments for those locations may be identified during implementation based on conditions at that location. Guidelines or mitigations are identified and applied to all implemented activities as relevant. Condition-based management stems from the recognition that the environment is dynamic, changing as ecosystems respond to changing natural and human caused events.

The flexible toolbox approach is a condition-based management strategy that allows predetermined treatments to be aligned, prior to implementation, with current conditions on the ground. For example, with vegetation treatments, a combination of selection criteria and vegetation conditions are used to determine habitat and forest cover filters and modifiers, as well as the appropriate treatments for each. Using existing stand data, these conditions and criteria are quantified to estimate the acreages of specific treatments to propose in a project area. These estimates are used to analyze the effects from those treatments. Site-specific field reviews are conducted before implementation to verify that ground conditions match those predicted. If they do not, the same selection criteria are applied again based on the actual ground conditions to be sure that the right treatment occurs on the right acre.

While this approach accommodates making changes based on updated information from field reviews, it differs from what is conventionally referred to as adaptive management. With the flexible toolbox approach, a suite of potential treatment types and intensities are proposed and analyzed as a response to specific resource conditions. Additional field review is conducted later before implementation. Using this ground-based information, the most appropriate treatments to move resources toward the desired conditions are selected from the analyzed suite.

Using this approach, a series of current conditions is described and then treatments identified that could be applied to move the landscape toward desired conditions. Decision points, based on conditions at the time of implementation, would be used to help lead to the desired condition.

**Terrestrial Restoration**

**Variable Density Thinning**

Unless noted otherwise, the actions described under Variable Density Thinning apply to LSR, Snoqualmie Pass AMA, Greenwater Special Area, and Matrix land allocations. Commercially thin, with variable density thinning and using skyline and ground-based logging systems (including tethered logging), up to 12,245 acres of plantations, including about 7,221 acres in late-successional reserve, 891 acres in matrix, 1,572 acres in Greenwater Special Area, and 2,561 acres in the Snoqualmie Pass AMA. Due to the past timber harvest history in the project area, all stands currently identified for commercial thinning are 70 years of age or younger. The acres identified for treatment are the maximum for all stands identified that would contribute toward meeting the purpose and need to:

- Accelerate the development of late-successional and old-growth forest habitats by improving habitat diversity in young stands, improving nesting or roosting, and foraging habitat in mature forest, increase forest biological complexity, maintain or improve forest health and vigor to meet multiple resource objectives, maintain or create meadow or other open habitats, and restore native plant communities.

- Contribute to local and regional economies by providing timber and other forest products.
An estimated additional 6,476 acres of plantations have been identified that would meet the purpose and need if thinned, but are not likely to meet the conditions needed for a commercial thinning harvest within the next decade.

Stands would be thinned to a stand density index of approximately 225 to 350 using a variable density thin from below, incorporating irregular spacing and clumps of residual trees, as an intermediate treatment (not stand regeneration). Thinning would remove primarily smaller trees to allocate additional growing space to remaining larger trees. Trees of the most abundant conifer species in a stand would generally be removed, while retaining less abundant conifer and hardwood species. In MA8 Douglas fir would be the primary species favored for retention (USDA Forest Service 1990, p. 4-199). The residual trees would generally be dominant or codominant, and may include trees with damage or defects such as root rot, multiple tops, spike tops, bear damage, and dwarf mistletoe that contribute to structural complexity and diversity within the stand and have potential to develop future snags, nesting cavities, and nesting platforms.

Heavy thinning areas would be used to emphasize large-tree growing space and increase understory vegetation. Thinning would be from below to approximately 20-50 trees per acre, retaining hardwoods and minor conifer species. Heavy thinning areas would be approximately ½ acre to 3 acres in size and cover approximately 3-10 percent of the stand area. Heavy thinning would only be prescribed in stands or areas with low windthrow potential.

Gaps would be created to increase stand heterogeneity, and culture individual trees specifically for big crowns and limbs. All conifers larger than the minimum diameter limit (for merchantability) and less than 20 inches DBH would be removed from gaps, while all hardwoods would be retained. Gaps would be approximately ¼ to ½ acre in size and cover 3-10% of the total stand area and avoid being located immediately adjacent to old growth forest or potential nest trees.

Skipped areas would retain uncut, densely stocked areas in at least 10 percent of the stand area. Areas within stands proposed for treatment that would be left un-thinned include riparian no-cut buffers, hardwood and minor species areas, plant or cultural resource protection buffers, and areas otherwise unsuitable for commercial thinning. Additional skips may be designed as needed in stands that lack these features.

Trees greater than 20 inches DBH would not be cut in late-successional reserves. Any trees greater than 20 inches DBH that are required to be cut for safety or operational reasons, such as temporary road building, landing clearing, or log yarding, would remain on site as coarse woody debris.

Where activity-generated debris (e.g., slash) is not needed as soil surface cover within harvest units, it would be disposed of by piling and burning or by mechanical chipping or removal. Burning would occur in the spring or fall during weather patterns appropriate for dispersion of smoke emissions, and when the threat of fire spreading from pile locations would be minimal. Pile specifications would ensure that pile burning would have minimal damage to residual trees in the stand. Landing piles that could create a considerable area of bare soil and not expected to naturally revegetate would be replanted using seed from approved sources.

**Decision Points for Variable Density Thinning**

Unless noted otherwise, these decision points apply to Variable Density Thinning in LSR, Snoqualmie Pass AMA, Greenwater Special Area, and Matrix land allocations. Commercial
thinning treatments would take place over approximately 15 years. As the environment is not static, the assumption is conditions are likely to change over time. The stands identified for thinning are those that are likely to meet the conditions necessary for commercial thinning in the next decade or that could be non-commercially thinned at an acceptable cost. Stands selected for inclusion in commercial thinning activities would be prioritized during implementation based on the conditions below. Utilizing condition based management, if the parameters described below are met, then implementation may proceed.

- Stands that regenerated, either by planting or natural regeneration, following past timber harvest.
- Stands that are not within nesting, roosting, or foraging habitat for northern spotted owl or marbled murrelet.
- Stands less than 80 years old. Any forested stands which are found to be 80 years of age or greater would be dropped from proposed treatment.
- Stands that have commercially viable timber product. Commercially-thinned stands must have product value that meets or exceeds the cost of harvesting. Experience from past commercial thinning on the Mt. Baker-Snoqualmie National Forest has been that commercially viable sales generally have at least 12 thousand board feet (MBF) per acre of timber product with a quadratic mean diameter at breast height (DBH) of approximately 11 inches. Transportation and logging cost estimates would be considered in determining which stands are commercially viable.
- Stands that are found to have greater than 10 percent basal area mortality from the Norse Peak fire will be dropped from proposed treatment.

**Snoqualmie Pass AMA Variable Density Thinning**

The approach to variable density thinning in the Snoqualmie Pass AMA would be very similar to that described above for late-successional reserves. Thinning to a density appropriate to the site specific plant association, heavy thinning, gaps, and skips would be implemented as described above. The following difference may be applied:

- There is no tree diameter restriction in the adaptive management area.
- As described in the Snoqualmie Pass Adaptive Management Area Implementation Guide, experimental silvicultural practices could be used in stands younger than 80 years old to accelerate the development of compositional and structural attributes of late-successional forest (USDA Forest Service, 1998a, p. 4).

**Non-Commercial Thinning (NCT)**

To maintain stand health and growth of stands generally less than 30 years old, some stands would be non-commercially thinned. Non-commercial thinning is designed to improve diameter growth rates by reducing the density of trees of less than commercial size, improve species composition, and to reduce susceptibility to insects and disease. NCT would occur as stand-alone treatment in stands where most of the trees needing removal are seedling and sapling sized, up to a maximum of 5 inches dbh. Trees would be thinned from below to a density of trees per acre appropriate for, and depending upon, the plant association and site characteristics. Treatments would primarily be accomplished with hand thinning. Exceptions to this may occasionally
include Huckleberry or Elk Forage Habitat NCT treatments. Slash would be piled and burned, or scattered where appropriate.

**Decision Points for NCT**

Non-commercial thinning treatments would take place over approximately 10 to 15 years. As the environment is not static, the assumption is conditions are likely to change over time. The stands identified for thinning are those that are likely to meet the conditions necessary NCT in the next decade and that could be non-commercially thinned at an acceptable cost. Stands selected for inclusion in NCT activities would be prioritized during implementation based on the conditions below. Utilizing condition based management, if the parameters described below are met, then implementation may proceed.

- Stands that regenerated, either by planting or natural regeneration, following past timber harvest.
- Stands with a dominant tree canopy height of less than 20 feet.
- Stands with greater than 750 trees per acre that are less than five inches at DBH
- Stands will be thinned to approximately 200 to 300 trees per acre. The intent is to maintain the stand at a density that allows the trees within the stand to grow rapidly and to retain a healthy and vigorous condition until the stand has reached a condition where it can be managed through a commercial harvest.

**Elk Forage Habitat in Management Area 8E (Greenwater Special Area)**

Elk Forage enhancement would occur in deer and elk (ungulate) winter range within the Greenwater river basin in portions of Sections 19, 21, 23, and 31 in T19N, R10E. These lands are among the acres acquired from Weyerhaeuser Timber Company, as part of the Huckleberry Land Exchange (USDA Forest Service 2001). The 2001 land exchange Record of Decision (ROD) designated the Greenwater Special Area as Management Area 8E (MA 8E) for creating and maintaining forest openings as permanent elk forage habitat (Forest Plan Amendment #16). The objective of management in MA 8E is to establish and enhance ungulate forage to help reverse trends of declining elk herds particularly where current Forest Land Allocations on the landscape (i.e., LSR) emphasize late-successional habitat types, where forage is less plentiful. In addition to forage production, the activities would provide commercial wood fiber and special forest products as a by-product from creating the forage clearings, consistent with the Forest Plan, as amended (USDA Forest Service1990).

Approximately 389 acres would be specifically managed for forage enhancement in Management Area 8E. This would include permanent forage openings as well as areas managed for forage with thinning. Up to 272 acres of the estimated 389 acres of permanent forage openings would be converted from forested stands to shrub/grass/forb types and maintained using a variety of methods including mechanical treatment, hand tools and prescribed fire. Openings would be maintained, as described below, as funding is available, and thru partnerships with Tribes and interested organizations.

The small openings (patch cuts) would generally average less than 10 acres in size (range 0.5 to 27 acres), would be created by timber harvest and would be maintained in order to increase forage production for elk and deer. The footprint of the permanent forage openings may also include areas of thinning or no-cut buffers intended to reduce sight distance and increase elk or
deer security along unit edges or open roads, or to address other resource concerns. Openings that contain commercial size conifers (> 8 inches DBH) would require conventional harvest methods (e.g., ground, cable). Low cutting-heights of stumps or other treatment of stumps (e.g., mastication) may be considered on a site-specific basis in order to facilitate future forage maintenance activities within forage enhancement units.

The remaining 117 acres of elk forage enhancement in Management Area 8E would occur as pre-commercial or commercial thinning in summer range (Section 31). Thinning in these areas would be designed to meet elk forage enhancement objectives, but would still include a combination of thinning with skips and gaps. Road reconstruction and temporary road construction that may be required for timber harvest activities would follow the description provided under Transportation. Temporary roads would be closed and decommissioned following forest management activities.

Any activity-generated debris (e.g., slash) would be disposed of by broadcast burning (burning slash as it lays in the unit) burning piled debris in ground-based harvest units, or mechanical treatment, as previously described above for Variable Density thinning. Pile burning and broadcast burning operations would occur in the spring or fall during weather patterns that provide good mixing and dispersion of smoke emissions, as well as subsequent conditions that are conducive to successful grass germination.

The forage enhancement openings would be seeded after initial harvest, and as needed during maintenance activities, with appropriate grasses and forbs. Where suitable site conditions exist after harvest, heavy thinning areas and gaps that are part of restoration thinning efforts, especially in Management Area 8E, may also be considered for seeding. Forage species would also be considered for other revegetation needs associated with proposed activities (Revegetation of landings, decommissioned roads, etc.), as appropriate. Native forage species will be the first choice for revegetation, but desirable non-invasive non-native seed would also be considered. Maintenance activities in forage enhancement areas would include cutting or otherwise removing undesirable vegetation using motorized or non-motorized equipment and tools, and periodic burning (i.e., 3 to 5 years) to maintain growing conditions conducive for the preferred forage species and to reduce slash from maintenance activities. Invasive weeds would also be treated as authorized under the 2015 Forest Plan Amendment, Mt. Baker-Snoqualmie National Forest Invasive Plant Treatment Record of Decision, which provides management directions for invasive species within the MBS.
Figure 9. Terrestrial Restoration Proposed Projects

Riparian Reserves Variable Density Thinning
All subwatersheds in the project area have naturally high tributary densities. These tributaries range from perennial (fish bearing and non-fish bearing) to intermittent. However, all streams have a collective importance in their function, as they can highly influence the larger watershed
scale hydrologic regime and water quality parameters. Past timber practices cut and harvested trees over and through stream channels and valley bottoms, and yarded most commercial value logs out of the Riparian Reserve.

Variable density thinning in Riparian Reserves would take place to help attain Aquatic Conservation Strategy objectives, especially by maintaining and restoring species composition and structural diversity of plant communities in riparian areas. No-cut buffers adjacent to streams, and identified in Where RR condition 2 occurs, large wood (from fallen second growth trees) has begun performing desired riparian reserve functions (adding roughness to streams and floodplains, trapping sediment, rebuilding stream channel base levels, naturally creating tree spacing, etc.). In these instances, larger no-cut buffers would be applied to allow the ongoing process of natural recruitment to streams and valley bottoms to occur, especially in perennial and intermittent streams. The remaining portion of Riparian Reserve that is thinned would be consistent with the overall non-Riparian Reserve stand area.

Table 3, would be retained to maintain shade and undisturbed soil conditions. Variable density thinning in Riparian Reserves would include the components of late-successional reserve variable density thinning described above.

Sample field verification of varying stream classifications showed two common ecological relationships connected to vegetation function. These ecological conditions in Snoquera are referred to and categorized as Riparian Reserve (RR) condition 1 and RR condition 2:

- **RR condition 1** streams where second growth has recruited few or no trees to the stream channel, floodplain or valley bottom; and
- **RR condition 2** streams where second growth has recruited moderate to high amounts of trees to the stream channel, floodplain and valley bottom.

Where RR condition 1 occurs, the silviculture prescription would create tree spacing through thinning that promotes larger trees over time, while retaining higher basal areas post-harvest. Small patches ¼ to ½ acre in size would be thinned to promote tree growth, while other patches would be left unthinned or lightly thinned with a higher tree density retained. In unthinned or lightly thinned patches, a few individual trees, 18” to 24” in diameter, would be evaluated to be manually felled into the channel to improve channel function in the short-term. The occasional tree that falls due to windthrow as a side effect of thinning (Roberts et al. 2007) would represent additional, natural recruitment of wood into the channel. These treatments would add trees to the stream in the short-term, and address recruitment over the next few decades.

Where RR condition 2 occurs, large wood (from fallen second growth trees) has begun performing desired riparian reserve functions (adding roughness to streams and floodplains, trapping sediment, rebuilding stream channel base levels, naturally creating tree spacing, etc.). In these instances, larger no-cut buffers would be applied to allow the ongoing process of natural recruitment to streams and valley bottoms to occur, especially in perennial and intermittent streams. The remaining portion of Riparian Reserve that is thinned would be consistent with the overall non-Riparian Reserve stand area.
Table 3. Residual Stream Buffers for RR Condition 1 and RR Condition 2.

<table>
<thead>
<tr>
<th>Stream Classification</th>
<th>NWFP Riparian Reserve Stream Buffers</th>
<th>RR Condition 1 – Retained No-Thin Buffers</th>
<th>RR Condition 2 – Retained No-Thin Buffers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish Bearing (Perennial and Intermittent)</td>
<td>300 ft</td>
<td>100 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>Perennial Non-fish Bearing</td>
<td>150 ft</td>
<td>50 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>Intermittent Non-fish Bearing</td>
<td>100 ft</td>
<td>25 ft</td>
<td>50 ft</td>
</tr>
</tbody>
</table>

Riparian Reserves Non-Commercial Thinning

In stands proposed for non-commercial thinning within riparian reserves, no trees would be cut within 50 feet of fish-bearing streams, and 20 feet of all other streams. These stands are generally higher elevation areas along headwater tributaries drained by intermittent channels. Thinning would reduce tree density, promoting tree growth and canopy development, which would help to restore riparian function and future instream conditions. Stands would be thinned to a canopy cover of approximately 60%. Unthinned patches (skips) would be left to promote earlier initiation of dead wood recruitment as trees die at the higher density.

Decision Points for Riparian Reserves Thinning

See Table 2 for stream types and miles that overlap with proposed commercial and non-commercial treatment areas. Utilizing condition based management implementation may proceed if the parameters described in Decision Points for Variable Density Thinning, and Decision Points for non-commercial thinning (as applicable per treatment) are met AND when combined with RR condition 1 and RR condition 2. Implementing the variable RR condition 1 and 2 approach would be an interdisciplinary practice across hydrology, fisheries and silviculture during commercial unit design and lay-out.

Huckleberry Enhancement

- Enhance up to 400 acres of huckleberry habitat to promote the health and production of harvestable berry field through the following methods:
  - Density reduction non-commercial thinning prescriptions, reducing canopy cover to 30% or less,
  - Prescribed fire to accomplish broadcast burning where conditions are appropriate, post-thinning underburning, and pile burning of accumulated slash.
  - Planting of site-appropriate huckleberry.

Harvesting of huckleberry (Vaccinium spp.) fruit is an important activity among multiple user groups and is an action largely restricted in this area to NFS lands due to habitat and elevation constraints. Although huckleberry species are widespread across the MBS (observed in approximately 1/3 of Forest ecology plots) (Nelson 2015), opportunities for reasonable access to higher quality harvest sites are not abundant nor sustainable enough to meet the needs of tribal and recreational gatherers while also providing adequate sustenance to wildlife and pollinators.

Huckleberry on the MBS is largely considered an early seral species, most often occurring in open-forest conditions associated with disturbances such as logging or fire. Huckleberry has historically occurred in the understory in dispersed locations throughout the project area. Trees in these stands have continued to grow until the canopies have nearly closed, which limits the
growth of huckleberry, a sun-loving species. Dense forest conditions are not conducive to producing high quality huckleberry sites, where numerous productive shrubs are relatively connected and habitat potential is otherwise suitable. An existing study (Nelson et al. 2015) has identified areas across the MBS where habitat suitability is projected to be high, moderate, or low. High suitable habitat is generally associated with higher elevation and drier, open conditions, though areas with more precipitation can provide habitat opportunities at a microsite level.

The 2015 study (Nelson et al.) identified approximately 35% of highly suitable huckleberry habitat on the Snoqualmie Ranger District as occurring within LSR. Huckleberry enhancement within LSR would not occur within or immediately adjacent to stands that currently provide habitat for the northern spotted owl or marbled murrelet, and would remain consistent with the direction for which LSR has been designated. Stands currently functioning as spotted owl dispersal habitat would not be treated with this prescription, and larger, older trees would be retained. Enhancement opportunities would largely be restricted to areas identified for pre-commercial thinning. Huckleberry enhancement is not proposed within riparian reserves.

In coordination with local Tribes, this project would enhance up to 400 acres of huckleberry habitat to promote the health and production of harvestable berry fields. Sites identified as highly suitable and reasonably accessible would be prioritized for enhancement. Habitat enhancement would largely consist of density reduction non-commercial thinning prescriptions, reducing canopy cover to 30% or less, to provide more open-forest stands in areas where huckleberry species are currently established but lacking desired conditions and production. Prescribed fire would also be a tool available for achieving desired results in the form of broadcast burning where conditions are appropriate, post-thinning underburning, and pile burning of accumulated slash. Planting of site-appropriate huckleberry would be considered for areas where the species is not expected to increase naturally to desired levels. Sites would vary in size depending on potential, ranging from approximately 0.25 acres to 5 acres in area. Many sites would be located within mapped NCT stands, but location selection would not be limited only to those units. Each site would be evaluated individually to gauge current condition and potential. Conditions of the remaining post-treatment overstory would be monitored and treated as necessary to maintain adequate sunlight to promote sustainable huckleberry vigor, following protocol established in the Management and Monitoring Plan for Big Huckleberry (Potash et al. 2008).

**Decision Points for Huckleberry Enhancement**

Utilizing condition based management implementation may proceed utilizing the criteria described in Decision Points for NCT combined with appropriate elevation levels for huckleberry.

**Planting in the Norse Peak Fire area**

Within the Snoquera Project Area, approximately 3,588 acres inside the perimeter of the Norse Peak Fire in 2017 were burned at an intensity that killed enough trees to cause a reduction of greater than 75 percent of the basal area. These high mortality areas with greater than 75% basal area reduction currently have little or no cover of live trees and, in much of the area, there are no live trees nearby to provide a source of natural reseeding of the area. Much of the high fire-caused mortality area within the project area is in LSR and resulted in a decrease in late-successional forest.

The high fire-caused mortality stands have high numbers of snags and down wood due to the fire, which will contribute to the development of high value early seral habitat (Swanson et al. 2014), but other late-successional characteristics such as large trees and multiple canopy layers are essentially absent. Within the of high mortality areas identified (3,588 acres), we anticipate that
no more than 10% of the area or 358 acres (225 acres within Norse Peak IRA and 133 acres outside of IRA) would be planted with species appropriate to the site, including subalpine fir, noble fir, Pacific silver fir, Douglas-fir, and western white pine. This will ensure that an ample amount of area is left to regenerate at a natural pace and retain high early seral habitat values for an extended period.

Planting would entail variable spacing and low density intended to maintain horizontal variability, and would generally employ the use of ½ to 5 acre founder stands that would eventually provide a seed source. Subsequent density management would not occur in these planted areas. Potential founder stand location would be based on site considerations including potential to improve forest connectivity between surviving patches of mature or late-successional forest. Sites would also be chosen to maximize worker safety so that snag felling would not be anticipated in planting areas. The diversity of species planted and a variety of abiotic and other factors related to tree planting for the Snoquera project reforestations efforts are expected to produce variation in the vertical structure and horizontal spatial pattern of the developing stands.

Whitebark pine (*Pinus albicaulis*) would also be planted, where appropriate for the species, in other high mortality areas within the perimeter of the Norse Peak Fire. Whitebark pine is a high elevation species that has been declining in the western United States from the combined effects of outbreaks of mountain pine beetle (*Dendroctonus ponderosae*), fire exclusion policies, and the non-native disease white pine blister rust (Keane, Holsinger, Mahalovich & Tomback, 2017). Whitebark pine is a candidate species for listing under the Endangered Species Act. Seedlings resistant to white pine blister rust would be planted as part of a restoration strategy for whitebark pine. The areas selected for planting whitebark pine are expected to remain relatively free from competition from other conifer species for one or more decades because the Norse Peak Fire killed all surrounding conifers, eliminating a source of natural re-seeding.

**Transportation System**

NFS roads within and adjacent to the project area could be used as haul routes. All NFS roads would be maintained in accordance with standard timber sale road maintenance specifications. Throughout this EA, maintenance levels reported are operational unless noted otherwise. Maintenance levels assigned to roads in the project area are maintenance level (ML) 1, ML 2, ML 3, ML 4, and ML 5\(^2\). Closed system roads used for project activities would not be opened to the public during project implementation.

The interdisciplinary team identified roads that are creating resource damage or, after implementation of the Snoquera project, would no longer be needed for future management activities of NFS lands within the project area. These roads would be evaluated for treatments to mitigate resource damage while balancing tribal and user access needs. Most system roads would remain the same after project implementation. Proposed exceptions are in Table 4 and mapped in Figure 10. Transportation System Proposed Changes.

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\(^2\) ML 1: closed roads that have been placed in storage between intermittent uses; ML 2: roads open for use by high clearance vehicles; ML 3: roads open and maintained for travel by a prudent driver in a standard passenger car; ML 4: roads open and maintained for travel with a moderate degree of user comfort; ML 5: roads open and maintained for travel with a high degree of user comfort.
Figure 10. Transportation System Proposed Changes
Table 4. Road Management Proposed Changes.

<table>
<thead>
<tr>
<th>Road Number</th>
<th>Segment Length</th>
<th>Current ML</th>
<th>Upper White Decision (if applicable)</th>
<th>Greenwater ATM Decision (if applicable)</th>
<th>Proposed ML</th>
<th>Rationale for Proposed Future Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>7000-001</td>
<td>0.21</td>
<td>2</td>
<td></td>
<td>L2</td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7000-810</td>
<td>0.40</td>
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<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
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<td>7010-360</td>
<td>0.12</td>
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<td>L1 Storage</td>
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<td>7020-110</td>
<td>0.23</td>
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<td>D</td>
<td>Decommission post-harvest</td>
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<tr>
<td>7030-110</td>
<td>0.54</td>
<td>1</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Potential harvest unit dropped due to excessive bridge cost</td>
</tr>
<tr>
<td>7065-000</td>
<td>1.55</td>
<td>3</td>
<td></td>
<td>L2</td>
<td>D</td>
<td>Decommission and convert to trail</td>
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<td>7068-211</td>
<td>0.13</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7140-000</td>
<td>2.00</td>
<td>1</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
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<td></td>
<td>L2A</td>
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<td></td>
<td>L2A</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7200-224</td>
<td>0.23</td>
<td>2</td>
<td></td>
<td>L2A</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7200-226</td>
<td>0.24</td>
<td>2</td>
<td></td>
<td>L2A</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
</tbody>
</table>

3 Table abbreviations not defined previously – D: Decommission Road, L2A: Maintenance Level 2A roads would be closed to public motorized use, but open to administrative use or motorized uses authorized under special use permits. Other than this limitation on access, other aspects of ML 2A roads would be the same as those that apply to ML 2 roads. The term 2A was used in Greenwater ATM, also applies to Snoquera, and is not found in the FSH. Maintenance work would be identical to ML 2 roads.
<table>
<thead>
<tr>
<th>Road Number</th>
<th>Segment Length</th>
<th>Current ML</th>
<th>Upper White Decision (if applicable)</th>
<th>Greenwater ATM Decision (if applicable)</th>
<th>Proposed ML</th>
<th>Rationale for Proposed Future Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>7220-110</td>
<td>0.23</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7222-005</td>
<td>0.13</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7222-219</td>
<td>0.25</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7224-240</td>
<td>0.20</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Determined to not be needed for timber due to high severity burn</td>
</tr>
<tr>
<td>7224-250</td>
<td>0.20</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7230-110</td>
<td>0.11</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7230-120</td>
<td>0.23</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7230-130</td>
<td>0.44</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7230-133</td>
<td>0.11</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7230-140</td>
<td>0.15</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7265-410</td>
<td>0.72</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7265-414</td>
<td>0.07</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7265-416</td>
<td>0.04</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7290-000</td>
<td>1.00</td>
<td>2</td>
<td></td>
<td>L1 Storage</td>
<td>D</td>
<td>Segment is beyond landslide. Potential future timber access is uneconomical with this route</td>
</tr>
<tr>
<td>7300-120</td>
<td>0.50</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>High aquatic risk</td>
</tr>
<tr>
<td>7300-195</td>
<td>0.71</td>
<td>2</td>
<td></td>
<td></td>
<td>D</td>
<td>High aquatic risk and low productivity potential harvest units</td>
</tr>
<tr>
<td>7300-227</td>
<td>0.10</td>
<td>2</td>
<td></td>
<td></td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7305-200</td>
<td>0.20</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for access</td>
</tr>
<tr>
<td>7305-200</td>
<td>0.40</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for access</td>
</tr>
<tr>
<td>7305-101</td>
<td>0.25</td>
<td>3</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7305-112</td>
<td>0.40</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7315-160</td>
<td>0.50</td>
<td>2</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7400-000</td>
<td>1.79</td>
<td>5</td>
<td></td>
<td></td>
<td>D</td>
<td>Decommission segment from about Nosedive Creek to Bridge. Currently not usable and mostly washed out</td>
</tr>
<tr>
<td>7400-050</td>
<td>0.23</td>
<td>3</td>
<td>Berm L1</td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7500-550</td>
<td>1.10</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>Road Number</td>
<td>Segment Length</td>
<td>Current ML</td>
<td>Upper White Decision (if applicable)</td>
<td>Greenwater ATM Decision (if applicable)</td>
<td>Proposed ML</td>
<td>Rationale for Proposed Future Management</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------</td>
<td>-------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>7510-610</td>
<td>0.20</td>
<td>2</td>
<td>L1 Storage</td>
<td></td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>7550-000</td>
<td>3.50</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Road is in flood plain and has riverside structural issues</td>
</tr>
<tr>
<td>7550-210</td>
<td>0.30</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Road is in flood plain and not needed for timber access</td>
</tr>
<tr>
<td>7550-220</td>
<td>0.20</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Road is in flood plain and not needed for timber access</td>
</tr>
<tr>
<td>7560-110</td>
<td>0.60</td>
<td>1</td>
<td></td>
<td></td>
<td>D</td>
<td>Decommission post-harvest</td>
</tr>
<tr>
<td>5063-112</td>
<td>0.20</td>
<td>2</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>5210-145</td>
<td>0.70</td>
<td>2</td>
<td></td>
<td></td>
<td>D</td>
<td>Determined to not be needed for timber access</td>
</tr>
<tr>
<td>7013-000</td>
<td>1.88</td>
<td>3</td>
<td>L2</td>
<td>L1</td>
<td></td>
<td>Associated with area closure for shooting</td>
</tr>
<tr>
<td>7013-110</td>
<td>2.00</td>
<td>2</td>
<td>L2</td>
<td>L1</td>
<td></td>
<td>Associated with area closure for shooting. Access to rock source</td>
</tr>
<tr>
<td>7500-220</td>
<td>0.30</td>
<td>2</td>
<td></td>
<td>L1</td>
<td></td>
<td>Needed for future timber use</td>
</tr>
<tr>
<td>7500-410</td>
<td>0.70</td>
<td>2</td>
<td>Full Decom</td>
<td>L1</td>
<td></td>
<td>Needed for future timber use to 7500-430 junction</td>
</tr>
<tr>
<td>7500-430</td>
<td>0.80</td>
<td>2</td>
<td>Full Decom</td>
<td>L1</td>
<td></td>
<td>Needed for future timber use</td>
</tr>
<tr>
<td>7031-000</td>
<td>0.34</td>
<td>3</td>
<td>L2</td>
<td>L2A</td>
<td></td>
<td>Gated at MP 0.103 Keep road closed beyond gate. Access to rock source</td>
</tr>
<tr>
<td>7150-210</td>
<td>0.04</td>
<td>2</td>
<td>L2</td>
<td>L1 Storage</td>
<td>L2</td>
<td>Keep this portion of road for dispersed use parking</td>
</tr>
<tr>
<td>7305-000</td>
<td>1.10</td>
<td>3</td>
<td></td>
<td>L2</td>
<td></td>
<td>Seasonal gate closure 12/15 to 03/15 Level 2 to 200 spur</td>
</tr>
<tr>
<td>7500-510</td>
<td>0.70</td>
<td>2</td>
<td>Full Decom</td>
<td>L2</td>
<td></td>
<td>Keep for rock pit access and future timber use</td>
</tr>
<tr>
<td>7510-300</td>
<td>0.20</td>
<td>2</td>
<td>L1 Storage</td>
<td>L2</td>
<td></td>
<td>Rock pit access</td>
</tr>
<tr>
<td>7065-000</td>
<td>0.20</td>
<td>3</td>
<td></td>
<td>L2</td>
<td>L3</td>
<td>To MP 0.20 for trailhead access</td>
</tr>
</tbody>
</table>
New temporary-use road construction is proposed to facilitate project implementation. These roads would be designed to minimize soil disturbance, stabilize the roadbed and fill slopes, and would include measures that facilitates effective drainage. Temporary roads would be closed and rehabilitated following project activities. Rehabilitation typically consists of reducing compaction, planting with native seed, adding surface cross drains, removal of temporary culverts, camouflaging road junctions and scattering with slash as needed.

Unclassified (non-system) roads with existing road prisms, on existing road templates, may be utilized for temporary use. These roads would be closed and rehabilitated after management activities have been completed.

Maintenance and reconstruction of existing system roads is proposed Table 5. Road maintenance consists of a variety of activity components that can include, but are not limited to: spot surfacing, roadside brushing, erosion control, logging out, road surface blading, ditch cleanout, debris removal, dust abatement, culvert cleaning or replacement, danger tree removal, removal and installation of road closure devices, and other items such as installation of road cross-drains that contribute to the preservation of the existing road and its safe use.

Reconstruction work is done to improve and restore National Forest System roads. Improvements would provide for serviceability for project haul vehicles and harvest equipment, as well as for proper hydrologic function and stream protection in accordance with applicable best management practices (BMPs). Actions could include clearing and grubbing shrubs and trees; replacing fill; reconditioning and surface improvement; bridge replacement; ditch reconstruction; drainage dip or cross drain construction; installing culverts, adding culvert riprap fill, or other drainage or stabilization features with potential disturbance outside the established roadway; stream crossing replacements; roadway realignment; widening select corners/switchbacks to improve access safety; and curve widening as needed to accommodate log truck off-tracking. Reconstruction also includes actions described under maintenance, including removal of roadside danger trees.

Reconstruction would improve road conditions as needed for safe and efficient hauling forest products. Existing rock sources would be utilized for crushed rock aggregate sites.

Roads that are decommissioned are removed from the National Forest Road System and receive no further maintenance. The road surface of system roads are treated to restore hydrologic connectivity and function by applying various treatments, including one or more of the following: reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation; blocking the entrance to a road or installing water bars; removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed; eliminating the roadbed by restoring natural contours and slopes; and other methods designed to meet the specific conditions associated with the unneeded road.

In all road activities, drainage structures would be added where needed to protect water resources and maintain the integrity of the road surface.

Danger Tree Removal

A danger tree is defined as any standing tree that presents hazard to public or forest worker due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem, or limbs and the direction or lean of the tree (FSH 6709.11). For purposes of this analysis, the terms danger tree and hazard tree are interchangeable. Along roadways, danger trees would be evaluated in accordance with the Field Guide for Danger Tree Identification and Response,
Pacific Northwest Region, 2008. A tree’s potential failure zone is the area that could be reached by any part of a failed tree. This is generally one and one-half tree lengths, but can vary depending on slope, tree height, lean, individual tree characteristics, and other factors.

Danger trees would be felled and potentially removed along all haul routes used for timber sale activity and around trailheads. Only danger trees with an imminent failure potential would be felled on closed system roads. Trees with an imminent failure potential and those deemed likely to fail within a 5-10 year period would be felled along open system roads. Danger tree removal, for public safety, is part of Forest Service general road maintenance for these roads. Danger tree removal is currently occurring where needed on these roads as long as they remain open for public use. If considered economically feasible, danger trees could be sold as part of a timber sale. Danger trees within stands would be felled and left to provide additional coarse woody debris where course wood amounts are deficient.

Table 5. Approximate miles of road proposed for timber haul by maintenance level, estimated type of work needed, and total miles of NFS road within the Snoquera project area.

<table>
<thead>
<tr>
<th>Transportation System by Maintenance Level</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Miles of road proposed for potential use as haul routes</strong></td>
<td></td>
</tr>
<tr>
<td>1 - Basic custodial care (Closed)</td>
<td>9.2</td>
</tr>
<tr>
<td>2 - High clearance vehicles</td>
<td>88.18</td>
</tr>
<tr>
<td>3 – Suitable for passenger cars</td>
<td>155.88</td>
</tr>
<tr>
<td>4 – Moderate degree of user comfort</td>
<td>0.2</td>
</tr>
<tr>
<td>5 – High degree of user comfort</td>
<td>5.35</td>
</tr>
<tr>
<td><strong>Total NFS Road Miles</strong></td>
<td><strong>258.81</strong></td>
</tr>
<tr>
<td>Temporary road on previously decommissioned roads (miles) (All temporary roads would be decommissioned post project)</td>
<td>13.6</td>
</tr>
<tr>
<td>Temporary road on unclassified roads with existing road prisms (miles) (All temporary roads would be decommissioned post project)</td>
<td>18</td>
</tr>
<tr>
<td>Estimated New Temporary Roads-Logging System (All temporary roads would be rehabilitated post project)</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Total Temporary Road Miles</strong></td>
<td><strong>34.8</strong></td>
</tr>
<tr>
<td>Maintenance of system roads (miles)</td>
<td></td>
</tr>
<tr>
<td>Open (operational maintenance level 2-5)</td>
<td>61.85</td>
</tr>
<tr>
<td>Closed (operational maintenance level 1)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>61.85</strong></td>
</tr>
<tr>
<td>Reconstruction of system roads (miles)*</td>
<td></td>
</tr>
<tr>
<td>Open (operational maintenance level 2-5)</td>
<td>197.53</td>
</tr>
<tr>
<td>Closed (operational maintenance level 1)</td>
<td>12.41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>222.35</strong></td>
</tr>
<tr>
<td>Transportation System by Maintenance Level</td>
<td>Miles</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Total estimated miles of road within the project area</strong>&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>1 - Basic custodial care (Closed)</td>
<td>31.7</td>
</tr>
<tr>
<td>2 - High clearance vehicles</td>
<td>187.6</td>
</tr>
<tr>
<td>3 - Suitable for passenger cars</td>
<td>250.3</td>
</tr>
<tr>
<td>4 - Moderate degree of user comfort</td>
<td>2.7</td>
</tr>
<tr>
<td>5 – High degree of user comfort</td>
<td>14.3</td>
</tr>
<tr>
<td><strong>Total Road Miles</strong></td>
<td><strong>486.6</strong></td>
</tr>
</tbody>
</table>

**Watershed Restoration**

Forest roads can alter water flow, sedimentation, and habitat for aquatic organisms. The legacy road network and associated infrastructure, constructed in locations that resulted in altered riparian and aquatic processes, are the primary sources impeding water quality and fisheries habitat function in the project area. Actions described in this section are proposed to improve the health of watersheds and the aquatic ecosystems they contain.

**Road Decommissioning, Storage, Stormproofing, and Aquatic Organism Passage**

Throughout the Snoquera Project area the current network of National Forest system and unclassified roads interacts with streams, floodplains and other forms of surface water runoff. The result has been large scale alteration of hydrologic regimes, impingement of floodplains and increase in sedimentation to streams. Proposed road treatments are targeted to decrease or eliminate various impairment mechanisms from road crossing streams at high densities (number of crossings per mile), road contribution to increase in drainage area (road drainage length to stream length), the amount of roads in Riparian Reserves (generally roads within 300 feet of streams) and road density in smaller HUC14 watersheds or catchments (roads per square mile). Proposed road treatments (Table 6) were identified by first analyzing predicted road derived impairment on watershed conditions and then coupling that with field verification. The Aquatic Resources report describes this process in greater detail. Heavy equipment is generally used for these treatments. In areas where a road prism is already naturally closing and reopening it to mobilize heavy equipment is undesired, alternative methods to remove culverts at risk of leading to resource damage may be utilized, such as blasting. Where blasting is utilized, mitigations and design criteria would be employed to minimize effects.

<table>
<thead>
<tr>
<th>Table 6. Proposed Road Treatments by Subwatersheds</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUC 12 Subwatershed(s)</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
</tr>
</tbody>
</table>

<sup>4</sup> Operational level, miles estimated from Geographic Information Systems (GIS) database. Discrepancy noted for ML-5.
Road decommissioning includes but is not limited to: re-contouring the road prism, decompaction such as ripping, full removal of fill and culverts from stream crossings, and seeding and other types of ground cover establishment.

Road storage: NFS system road would be managed to ML-1 standards, which includes disconnecting the road from the hydrologic system (termed hydrologic closure). ML-1 roads are “stored” until administrative access is needed, for which the road is re-opened (i.e. reconstructed), then stored again post-use or decommissioned if no future use is needed. During the period of storage motorized access is not allowed. Hydrologic closure focuses on a range of methods to move surface water off the road and decrease road impacts at stream crossings, such as removal of culverts.

Stormproofing: a range of treatments designed to decrease road-water interactions would be implemented on roads that continue to be open for administrative and public use (ML 2 – 5 roads). These treatments would include ditch line cleaning, installing cross drainage, surface rocking at stream crossings, enlarging culvert sizes at intermittent and perennial fishless streams, etc. Roads were prioritized and targeted based on modeled impacts to streams where most of the indicators were rated at high or very high. Roads proposed for targeted stormproofing include: 7160, 7160-210, 7300, 7315, 7500, 7530, and 7560.

Aquatic Organism Passage: Coupled with storm proofing treatments are targeted methods to restore aquatic organism passage at road crossings with perennial fish bearing streams. Existing undersized culvert (which causes a fish migration barrier) would be removed and replaced with a larger appropriately-sized crossing, designed to both effectively pass 100 year flood return interval flows and simulate natural stream and habitat function, restoring passage for fish.

Instream Wood
Past timber management activities completely removed large old growth trees in the riparian zones of harvest units throughout the project area. In the late 1970s, a stream cleanout practice was employed that removed all instream and floodplain wood with minimum dimensions of 8 inches in diameter and 10 feet long in the Greenwater River, West Fork White River, and Huckleberry Creek (USDA FS 2000, USDA FS 2010). The result was the loss of critical large wood components and subsequent channel erosion and degradation of fish habitat. Streambank erosion and channel down-cutting, as well as accumulation of excess coarse bedload (bedload

<table>
<thead>
<tr>
<th>Road Name</th>
<th>Width (ft)</th>
<th>Length (ft)</th>
<th>Culvert Size</th>
<th>Fish Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Twin Creek – White River</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Silver Creek – White River, Headwaters White River</td>
<td>2.33</td>
<td>0</td>
<td>13.81</td>
<td>10</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>2.66</td>
<td>0</td>
<td>17.65</td>
<td>7</td>
</tr>
<tr>
<td>Upper and Lower West Fork White River</td>
<td>7.82</td>
<td>1.80</td>
<td>22.65</td>
<td>11</td>
</tr>
<tr>
<td>Lester Creek – Green River</td>
<td>0.20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sunday Creek – Green River</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Twin Camp Creek – Green River</td>
<td>0.70</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Headwaters Green River</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>23.83</strong></td>
<td><strong>5.68</strong></td>
<td><strong>54.11</strong></td>
<td><strong>53</strong></td>
</tr>
</tbody>
</table>
describes particles flowing in the stream), reduce water quality and fish habitat. The biggest impact on fisheries where this dynamic occurs is the lower gradient river and stream reaches that support Chinook salmon spawning and rearing.

Tributaries in the project Area that support Chinook salmon spawning and rearing include the upper White River, Greenwater River, Huckleberry Creek and the West Fork White River. Analysis of aquatic habitat data and field verification showed that Greenwater River, Upper White River and Huckleberry Creek still display cumulative impacts from past timber management practices. However, opportunities to increase in-channel roughness elements with large wood are primarily in Greenwater River and Huckleberry Creek due to the pattern and amount of National Forest Service system land and available trees in desired size classes. This project element would fall (or tip) trees adjacent to targeted channel reaches. Trees would be manually felled into the stream channel and left where felled. It is expected that those felled trees would improve natural processes and increase spawning and rearing habitats both in the short-term and over time by increasing the number and quality of pools, increasing instream cover, decreasing stream gradients to more historic conditions favorable to various salmonid life stages, trapping sediments to aggrade the channel and allow more effective use and function of the floodplain, and decreasing flow velocities and related channel bed and bank erosional processes. Felled trees are also expected to help form future wood jams by collecting logs and related debris transported by floods. The formation of wood jams further increase the likelihood for other aquatic habitat and riparian-forming processes (i.e. side channels) important for juvenile salmon development.

Several sites have been identified in the Greenwater River, one reach in Huckleberry Creek, and one reach in Whistler Creek for this activity. Two to four trees greater than 20 inches dbh would be identified per site to perform various ecological functions. Trees to be identified and felled would be from second growth stands immediately adjacent to tree-tipping reaches. Trees chosen for felling would be reviewed by Heritage, Botany, and Wildlife specialists to avoid removal of suitable nest trees and/or suitable habitat for ESA listed or Survey and Manage Species.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Sites</th>
<th>Trees &gt;20” dbh per site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenwater River</td>
<td>Up to 6</td>
<td>2-4</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>Up to 2</td>
<td>2-4</td>
</tr>
<tr>
<td>Whistler Creek</td>
<td>Up to 4</td>
<td>2-4</td>
</tr>
</tbody>
</table>

In the 1980s, the Forest began adding wood to streams in the project area, particularly in the Greenwater River and tributaries (Midnight Creek, Foss Creek, Pyramid Creek), in Huckleberry Creek, and also in Sunday and Snow Creeks in the Green River. Some of these structures were damaged (or bypassed) and are no longer functioning properly, primarily due to storms during the 1990s. These instream structures would be maintained in the reaches noted at existing site locations, by removing exposed rebar pins, and/or enhanced by felling additional streamside trees where appropriate. Trees to be identified and felled would be 18 inches or greater from second growth stands immediately adjacent to the damaged structure. Trees chosen for felling would be reviewed by Heritage, Botany, and Wildlife specialists to avoid removal of suitable nest trees and suitable habitat for ESA or Survey and Manage Species. Other opportunities to enhance Riparian
Reserves through vegetation treatment would be evaluated on a site-specific basis, and are described separately.

**Acclimation Ponds**

In coordination with local Tribes, enhance the functioning of existing Chinook and steelhead trout acclimation facilities at Twentyeight Mile Creek and Huckleberry Creek, and reissue a 30-year special use permit for their operation and maintenance. The permit would include operation and maintenance of the existing acclimation pond facility on the upper Greenwater River by George Creek, however no changes are proposed at this site.

**Twentyeight Mile Creek**

The existing intake shifted during storm events, is no longer efficient in providing consistent flow to the acclimation pond, and is also a partial barrier to fish migration. This project would repair the water supply intake and outlet, and add a roughened channel.

The existing intake manifold would be leveled and a 95-foot roughened channel constructed downstream with 24”- 48” rocks from the excavated area to stabilize the stream bed. Any excavated materials not re-used in construction would be hauled to an upland disposal nearby and graded to match surrounding topography. Voids would be filled with 2” minus washed gravels and sand. The existing 36” diameter culvert would be reset, and the upstream cobble berm rebuilt. During construction, a diversion consisting of a temporary culvert and sandbag dam would be placed for flow bypass, with fish recovery, or an alternate bypass may be utilized such as a generator-powered pump. Estimated bypass would consist of 2ft high sandbag dam and 140ft long bypass in 18” culvert segments with 45-degree bends.

**Huckleberry Creek**

The Huckleberry Creek Acclimation pond was constructed by the Army Corps of Engineers in 1993 as partial mitigation for fisheries impacts associated with operations of the Mud Mountain Dam flood storage project downstream on the White River. Up to 500,000 spring Chinook can be reared in the Huckleberry Pond and studies have shown that spring Chinook reared at Huckleberry acclimation pond have the highest survival rates of any of the three other acclimation ponds located on the Upper White River (Ladley, pers. comm. 2018). The existing pond intake is dewatered, making the acclimation pond unusable. This project would repair the water supply intake and construct a section of roughened channel to create consistent intake flow.

An estimated 75 foot by 65 foot roughened channel, with an approximate 7% slope would be constructed, along with an intake extension that spans the width of Huckleberry Creek at the existing concrete intake. The roughened channel would be constructed using 30”- 60” rocks from the excavated area to stabilize the stream bed. Any excavated materials not re-used in construction would be hauled to an upland disposal nearby and graded to match surrounding topography. Voids would be filled with 2” minus washed gravels and sand. The new inlet screen and 50ft long concrete sill would be set at the head of the roughened channel. A 10in diameter pipe would be installed to connect the new screen to the existing intake. During construction, a diversion, consisting of a temporary culvert and sandbag dam would be placed for flow bypass, with fish recovery, or an alternate bypass may utilize a generator-powered pump.

**Other Proposed Actions that Restore Aquatic Conditions**

To decrease impacts to water quality, riparian, floodplain, and other aquatic resources from dispersed recreation within Riparian Reserves, this alternative would designate dispersed...
camping locations in some riparian corridors within the project area. This is described in Recreation below under “Dispersed Camping – Designated Sites”.
Figure 11. Watershed Restoration Proposed Projects
Recreation Enhancement

Visitation to this landscape is high with its easy accessibility, and the rapid, ongoing, population increase in the greater Puget Sound area. With high visitor use, there is a need to manage the area for both resource protection as well as a variety of recreational opportunities. The proposed activities attempt to balance access and protection, and include a variety of management actions to consider that may address recreational opportunities, user conflicts, management capacity, and resource damage concerns, while providing for visitor experiences within the project area.

Dispersed Camping – Designated Sites

Dispersed camping in the project area occurs as either isolated sites or an interconnected grouping of sites. Many of the sites are located adjacent to fish-bearing streams and throughout riparian areas. Streams where these dispersed sites occur support ESA-listed and other native fishes and can overlap with designated critical habitat. Dispersed sites are often compacted and denuded of ground vegetation. Runoff from these sites add sedimentation to the adjacent stream and degrades spawning and rearing habitats. In many locations streamside trees have been cut down by recreationists and are no longer providing shade over the channel, or have become hazards due to user impacts. These trees also have the potential to provide habitat for ESA-listed birds, and removal by recreationists or associated hazard tree removal can also impact wildlife habitat quality in important riparian corridors. Further, in a number of instances the dispersed site directly overlaps with active streambanks, accelerating undesired bank erosion.

This proposed action focuses upon the most heavily impacted dispersed camping areas with the greatest effects to fish-bearing streams. Road corridors have been identified where the Forest would designate dispersed camping opportunities. The boundaries of these corridors are proposed to be approximately ¼ mile from center line of the following Forest Service roads on both sides. Within these corridors a designation of “Closed unless designated Open” would apply, meaning all dispersed camping would be prohibited unless physically marked on the ground as “open to dispersed camping”.

Table 8. Designated Dispersed Camping Corridors

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Location Description: ¼ mile on both sides from centerline of NFS roads</th>
<th>Approx. miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSR 7000</td>
<td>Forest Service boundary off of Hwy 410 to the end of the pavement at Pyramid Sno Park</td>
<td>8</td>
</tr>
<tr>
<td>FSR 7010</td>
<td>Forest Service boundary off of FSR 7000, following FSR 7010, ending where FSR7010 enters private land in Sec. 5</td>
<td>6.7</td>
</tr>
<tr>
<td>FSR 7030</td>
<td>Junction of FSR 70/7030, following FSR 7030 to the junction of FSR7030/FSR spur 7030-250</td>
<td>1.5</td>
</tr>
<tr>
<td>FSR 7300</td>
<td>Junction of Hwy 410/FSR 73, following FSR 73 to the Huckleberry trailhead</td>
<td>6</td>
</tr>
<tr>
<td>FSR 7160/7160-210</td>
<td>Junction of Hwy 410/7160, following FSR 7160 to the junction of 7160/7160-210 approx. ¼ mile, following FSR 7160-210 to its end (road loops back on itself)</td>
<td>2</td>
</tr>
</tbody>
</table>
Recreation and Aquatic Specialists would identify and evaluate the dispersed camping sites within the designated corridors. Existing dispersed campsites outside of the corridors described above could also be evaluated. Many dispersed camping sites are currently accessed via unauthorized and illegal motorized vehicle routes. These unauthorized motor vehicle routes to dispersed camping sites would be rehabilitated to allow non-motorized access only or would be eliminated. Along with these routes, the dispersed camping sites associated with unauthorized routes would be eliminated, eliminated and replaced, or reduced, based on conditions evaluated on the ground (Table 9).

Table 9. Proposed management actions for dispersed camping sites

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Action</th>
<th>Description of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>When dispersed camp sites overlap with the active streambank, undesired</td>
<td>Eliminate</td>
<td>Eliminate existing dispersed camp site and relocate it outside of the riparian area,</td>
</tr>
<tr>
<td>accelerated bank erosion is occurring, the footprint of the camp site is</td>
<td>Replace</td>
<td>to a more sustainable site. Replacement sites would be chosen to maximize use of</td>
</tr>
<tr>
<td>denuded of vegetation that normally would be composed of riparian species,</td>
<td></td>
<td>previously disturbed sites, and would be reviewed by wildlife specialists to avoid</td>
</tr>
<tr>
<td>and potential designated dispersed sites exist in the area, then:</td>
<td></td>
<td>future hazard tree removal of potential habitat trees.</td>
</tr>
<tr>
<td>When dispersed camp sites overlap with the active streambank and undesired</td>
<td>Reduce</td>
<td>Reduce the footprint of the existing dispersed camp site, while restoring streambanks</td>
</tr>
<tr>
<td>accelerated bank erosion is occurring, or sites are outside the active</td>
<td></td>
<td>and vegetation.</td>
</tr>
<tr>
<td>streambank and do not meaningfully contribute erosion into the stream, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the footprint of the camp sites are denuded of vegetation that normally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>would be composed of riparian species and are adjacent to other sites farther</td>
<td></td>
<td></td>
</tr>
<tr>
<td>from the stream where use is acceptable, but is denuded of vegetation that</td>
<td></td>
<td></td>
</tr>
<tr>
<td>would normally be composed of riparian species, then:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When dispersed camp sites overlap with the active streambank, undesired</td>
<td>Eliminate</td>
<td>Eliminate the dispersed site. For this treatment, the dispersed site would not be</td>
</tr>
<tr>
<td>accelerated bank erosion is occurring, and other accepted dispersed sites</td>
<td></td>
<td>replaced elsewhere.</td>
</tr>
<tr>
<td>exist in the area, then:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each of the actions could include activities such as: recontouring the site adjacent to the stream to reestablish a more natural slope and floodplain, decompacting ground hardened by use, then seeding or planting where feasible to reestablish riparian vegetation. Where sites are eliminated in a stream’s floodplain and the channel has downcut, 2-4 streamside trees may be felled into the channel to help restore channel migration. These would be in addition to those described under Instream Wood in the Watershed Restoration section. Trees felled would not remove or impact suitable habitat for ESA-listed wildlife or Survey and Manage species.
Once designated dispersed camping sites have been identified, either within corridors or elsewhere in the project area, they would be enhanced with a picnic table and fire ring. Sites would be walk in only with established vehicle parking (1 to 2 vehicles) along the side of the roads in the designated corridors. Barriers would be put in place to help establish the designated parking areas to prevent cross country travel. In addition, parking areas would be designated with site numbers and universal camp symbols on a sign post adjacent to the parking area for each dispersed camping spot to help identify the designated camping sites. “Entering and Leaving Designated Camping Area” signs would be installed at each entrance and exit spots along the road to help identify the designated camping corridors. Existing parking areas already established could be made more level. Sites would be monitored by recreation staff, and re-evaluated over time to determine if additional actions are needed.

Sanitation in dispersed camping areas is also a concern. Pit toilets would be added to help contain the spread of human waste along the forest floor within each corridor. The addition of these toilets would be evaluated on the amount of designated camping sites within the corridors, allowing for up to one to two toilets per corridor being installed as budgets allow. Preferred sites would be in previously disturbed locations within the corridors and would not remove or impact suitable habitat for ESA-listed wildlife or Survey and Manage species.

Table 10. Proposed addition of pit toilets within each designated dispersed camping corridor

<table>
<thead>
<tr>
<th>Corridors</th>
<th>Current pit toilets within the established corridor</th>
<th>Description of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSR 7000</td>
<td>Two pit toilets exist within this corridor. One single pit toilet at 28 Mile Creek, one at single pit toilet at the lower Pyramid SnoPark</td>
<td>Install 1 to 2 pit toilets in the corridor</td>
</tr>
<tr>
<td>FSR 7010</td>
<td>There are no pit toilets within this corridor</td>
<td>Install 1 to 2 pit toilets in the corridor</td>
</tr>
<tr>
<td>FSR 7030</td>
<td>There are no pit toilets within this corridor</td>
<td>Install 1 to 2 pit toilets in the corridor</td>
</tr>
<tr>
<td>FSR 7300</td>
<td>There are no pit toilets within this corridor. During winter months, a temporary porta-potty is brought in for the cross-country ski/snowshoe SnoPark, and is removed at the end of winter ski/snowshoe season.</td>
<td>Install 1 to 2 pit toilets in the corridor</td>
</tr>
<tr>
<td>FSR 7160/7160-210</td>
<td>Two pit toilets exist within this corridor, both associated with the Ranger Cr Campground and Air Strip. One double pit toilet is located on the east side of the Ranger Cr air strip, one single pit toilet located on the west side of Ranger Cr air strip</td>
<td>Install 1 to 2 pit toilets in the corridor</td>
</tr>
</tbody>
</table>
Designated Dispersed Camping permit – Public Education

For dispersed camping within the designated corridors, a “Free Permit” program would be put in place requiring the public to obtain a permit, from the local district office, prior to camping within any of the designated camping corridors on the Snoqualmie Ranger District. The permit would contain specific camping information such as, but not limited to: campfire safe practices/restrictions, pack it in/pack it out, light on the land principles, human waste issues, and stay limits. This free permit would also contain personal contact information that would be important for Law Enforcement and Forest Protection Officers when making public contacts in the field. Campers would be required to have these free permits displayed in the windshields of their vehicles while camping in designated spots within the closed corridors.

With the proposed facility additions to the designated camping sites within the “closed to dispersed camping unless designated open” corridors, these corridors have future potential to be evaluated as possible Northwest Forest Pass Fee areas, as they would meet the five standards to qualify as a fee area:

1. Parking provided
2. Trash collection provided
3. Bulletin board/public information provided
4. Picnic table provided
5. Pit toilet provided.

Recreational Target Shooting

There are many sites that are currently being used for recreational target shooting within the project area. During the project proposal development process, the interdisciplinary team assessed the project area for current existing shooting sites and evaluated the sites for resource damage and capacity for safe and legal recreational target shooting areas. Sites found to be unsafe, have resource degradation issues, and/or are illegal per 36 CFR 261.10 (d) include: the FSR 7013 area. This alternative would improve the recreational target shooting opportunity at two locations.

Two areas currently being used for recreational target shooting activities have been identified for site improvements:

- 70 rock pit, located on Forest Service Road (FSR) 7000 approximately 4 miles on FSR 7000 from the junction of the forest boundary with Hwy 410, and

- 72 rock pit, located on FSR 7200 approximately 6.5 miles along FSR 7200 from the junction of FSR 7000 and 7200.

This project would enhance recreational shooting opportunities at both sites with an objective of providing an improved facility and safe target shooting opportunities, while also reducing the amount of recreational target shooting in areas that do not meet the safe and legal definitions for recreational target shooting.

Improvements would include the following:
expand and rearrange the flow of parking areas for better ingress and egress, incorporate sound mitigation measures with the addition of earth mounds and vegetation to reduce surrounding ambient noise;

- enhance target shooting opportunities to include options for rifle and pistol shooting (providing both long and short range shooting opportunities); and

- adjust shooting lanes to promote best opportunities for health and safety of target shooters and surrounding public.

Ambient noise levels from firing guns has resulted in noise complaints from members of the public and this noise can also be a nuisance to certain T&E wildlife species. The adjustment of shooting lanes, earthen mounds and vegetation would be incorporated into the design behind the line of fire to reduce noise levels to the non-shooting public and surrounding wildlife habitat. Enclosed shooting benches would be constructed to contain more ambient noise from shooting while also helping to define firing lines and control the directional line of shooting. Kiosks, picnic tables, garbage receptacles and toilets would be added over time as budgets allow.

Shooting regulations and information would be posted to kiosks. Ongoing partnerships with interested organizations would help facilitate volunteer pit clean ups and staffing of volunteer “Range Masters” at these two areas on agreed upon days. Range Masters would help control “hot” and “cold” ranges to encourage safe shooting practices and allow for target trash clean up.

A “Free Permit” program would be put in place requiring the public to obtain a free permit prior to engaging in recreational target shooting on Forest Service Lands on the Snoqualmie Ranger District. This free permit would contain specific target shooting information such as, but not limited to: safe shooting practices, pack it in/pack it out, appropriate targets, general Code of Federal Regulations (CFR’s) related to target shooting opportunities on Forest Service Lands, and suggested safe target shooting areas. This free permit would also contain personal contact information that would be important for Law Enforcement and Forest Protection Officers when making public contacts in the field. The recreational target shooter would be required to have these free permits displayed in the windshields of their vehicles, or have them on their person, while engaging in target shooting experiences on public land.

7013 Pit Target Shooting Closure

The area known as the “7013 shooting pit,” would be closed to target shooting. A Forest order would be utilized to implement the closure and it’s expected that the initial closure would be for a 5-year term. The need for the closure would continue to be evaluated and the order rescinded or a new order issued as necessary based on conditions. The closure would apply to National Forest System land beginning at a point located in T19N, R10E, of Section 19 at the intersection of Section line 19 & 24 with Forest Service Road 70, continuing South on Section line 19 & 24 to the Southwest corner of Section 19, continuing East along Section line 19 & 30 to the Southeast corner of Section 19, continuing North along Section line 19 & 20 to the point of intersection with Section line 19 & 20 with Forest Service Road 70, continuing West along the South side of Forest Service Road 70, ending at the beginning point at the intersection of Section line 19 & 24 with Forest Service Road 70, as shown in Figure 12.
Figure 12. 7013 Pit Target Shooting Closure Area
The use of firearms in the area commonly known as the 7013 shooting pit and its proximity to the Crystal River Ranch subdivision and Road 7013, is a concern for public safety and health, and vandalism to government property. In the vicinity of the 7013 pit, the Forest Service has responded to frequent reports of recreational shooting in areas without a backstop, stray bullets “whizzing” by people who are hiking and recreating nearby on National Forest System land, and stray bullets found in the neighboring Crystal River Ranch private community. These actions have caused Forest visitors and neighboring landowners to fear for their life and safety when recreational shooting activities are being performed in the area. In addition, shooting targets include propane cylinders, aerosol containers, appliances, and “tannerite” (i.e., legal binary explosive shot indicator), which have accumulated in the pit and adjacent areas and may contain potentially toxic materials. Recreational shooting in the area frequently occurs after sunset and this explosive noise lasting into the night is disruptive to Forest visitors, and neighboring landowners. In addition to these concerns for public safety, recreational shooting activity in the area has resulted in extensive vandalism of government property in the form of bulletin boards being shot, garbage cans shot, burned, and destroyed beyond repair, live trees purposely being shot to the point of felling them to the ground in and around the 7013 pit. Therefore, closing the 7013 pit and immediate surrounding area to discharging a firearm is needed to reduce the risk to life and property.

The early seral habitat openings adjacent to Road 7013, where the shooting is occurring, were originally created to fulfill elk and deer forage enhancement objectives under the Huckleberry Land Exchange (USDA 2001b). The noise from the firearms, related human activity and trash dumping are degrading the intended function of approximately 40 acres of this early seral habitat. Closing this area to recreational target shooting would allow this area to better serve its intended purpose.

A one year order (ORDER NO. 06-05-18-05) prohibiting target shooting in this area was issue in July 2018 and preliminary information indicates the closure has been effective at starting to address the concerns identified above. However, a longer term closure is needed to prevent continued resource degradation and ensure protection of public safety in the area. The proposal in this EA would issue a closure order for five years.

**Naches Trailhead Expansion**

The Naches Tr. #1175 is a dual use motorized trail that has shared use between the Naches Ranger District of the Okanogan-Wenatchee National Forest (6.4 miles motorized) and the Snoqualmie Ranger District of the Mt. Baker-Snoqualmie National Forest (0.7 miles non-motorized, 5 miles motorized).

Currently, the trailhead for the motorized section of the Naches Tr. #1175 on the Snoqualmie Ranger District is located approx. 0.1 mile up Forest Service Road (FSR) #7065. The current parking area would be expanded to approximately twice its current size, resulting in a final parking area of approximately one acre to accommodate passenger vehicles pulling trailers. A fence would be built to define the boundary of the trailhead, trail signs/posts and kiosk would be installed to further identify the trailhead on the ground.

**Road to Trail and Trail Reroute - Naches Trail #1175 motorized trail section**

The Naches motorized trailhead’s location off of FSR#7065 does not provide a direct link from trailhead to trail. Motorized recreational users utilizing all-terrain vehicles (ATV) or utility vehicles (UTV) have to travel approx. 0.1 miles on FSR #7065 to access the Naches motorized Tr. #1175 section, which under the Mt. Baker-Snoqualmie Motorized Vehicle Use Map (MVUM;
USDA Forest Service 2017), is a prohibited travel action. The current travel route for ATV/UTV recreational trail use would be changed from a Forest Service passenger road system route to a Forest Service trail system route. This road to trail conversion would start at the Naches Trailhead and follow FSR #7065 to its end, a total length of approx. 1.75 miles, which would put the ATV/UTV recreational rider at the entrance of the existing winter recreation snowmobile route, following this to connect to the Naches Summer trail. The total distance of this reroute is approximately 2.0 miles from the Naches Trailhead to reconnect to the Naches Tr. #1175.

The entire 5.7 miles of the Naches Trail #1175 would be reevaluated for heavy trail maintenance and reroutes of areas where the trail tread follows straight up the fall line and/or is unsustainable in its current condition. Particular areas of concern are:

- Start of the motorized trail section off of FSR #7065
- Jct. of FSR #7068/Naches Tr. #1175 headed south
- Multiple internal areas along the trail with grades of 12% or greater.

Areas where the current trail tread is poorly located and does not meet minimum manual and handbook standards, will be brought up to Forest Service standards by relocating the existing trail tread to a more sustainable route. These trail reroutes would be implemented to meet FSH/FSM Trail Management Standards for depth, width, drainage, and tread for motorized trails.

In conjunction with rerouting areas of trail tread to meet Forest Service standards on the Naches trail #1175, the abandoned sections of this trail would be reclaimed and rehabilitated. Reclamation strategies could include: closure, stabilization, recontouring, revegetation, and monitoring. Total rehabbed trail length is estimated at approximately one mile with the addition of new routes estimated to be the same distance. Trail rehabilitation and rerouting would be done with manual and mechanical methods, including heavy equipment such as an excavator. This motorized trail route is currently approximately five miles, and would remain the same distance with a one for one decommission of old route to construction of new route.

**Corral Pass**

In 2017 the Norse Peak wildfire destroyed recreation facilities at Corral Pass and Noble Knob trailheads at the end of FSR #7174. These two associated trailheads, which are located approx. 100 yards from each other, provide access to three Forest Service system trails: Noble Knob Tr. #1184 (Hike, Equestrian, Mtn. Bike), Rainier View Tr. #1155 (Hike, Equestrian – leads into Norse Peak Wilderness), and the Greenwater Lakes Tr. #1176 (Hike, Equestrian – leads into Norse Peak Wilderness). (Note: There are two Noble Knob trailheads on the Snoqualmie Ranger District. Noble Knob Trailhead in this proposed action is located next to Corral Pass trailhead. The other Noble Knob trailhead is located off of FSR #7222-410, which was not affected by the Norse Peak Fire and changes for it are not being considered in this project).

There are ongoing evaluations of trees left behind from the Norse Peak fire; any identified as hazard or danger trees would be removed up to a tree length away from all established parking opportunities for public health and safety. Felled trees would be left on site or sold with non-commercial firewood permits.
**Trailheads**

**Corral Pass**
This trailhead is the main destination for access into the Norse Peak Wilderness for hiking and equestrian use. The existing footprint would be maintained. Fill material would be added to establish a flat parking opportunity for recreational vehicles and trailer access, while also allowing proper ingress and egress for emergency vehicles. A fence would be built to define the boundary of the trailhead and to help prohibit any vehicle cross country travel into the exposed burn area. Openings large enough to accommodate hiker and equestrian access to trails and facilities would be included.

Pre Norse Peak fire, a pit toilet existed at this trailhead. The fire burned the structure, leaving only the pit and cement foundation. During post-fire operations, the pit was capped for safety. The waste vault and cement foundation would be repaired and the structure on the existing footprint would be rebuilt. Other facilities that would be included in this rebuild are stock rails and/or high lines, feed and water troughs, and possible small holding pen for stock, a kiosk, trail signs and posts, garbage receptacles, and picnic tables.

**Noble Knob**
This multiple use trailhead/trail while providing hiker and equestrian access, is also a popular destination for mountain biking. The current parking area would be expanded to approximately twice its current size, bringing it to an estimated 0.5 acre. A fence would be built to define the boundary of the trailhead and to help prohibit any vehicle cross country travel into the exposed burn area. Openings large enough to accommodate hiker and equestrian access to trails and facilities would be included. Facilities that would be reestablished include trail signs and posts, kiosk, picnic table, and garbage receptacle.

**Corral Pass Campground**
In 2017 the Norse Peak wildfire destroyed the campground adjacent to the Corral Pass trailhead. Under this alternative the pre-fire campground would not be reestablished. The entrance would be closed with a gate, or other barrier, and remaining facilities that survived the fire, such as picnic tables, would be removed. Up to five day use only sites would be located closer to the Noble Knob trailhead. These sites would include picnic tables, fire rings, and where possible designated parking slots with barriers. Vegetation would be reestablished to rehabilitate the pre-fire campground footprint.

**Vegetation**
Vegetative cover would be reestablished through natural and human methods. Revegetation may include actions such as hand seeding, hydro seeding, transplanting of local vegetative species, and planting of appropriate nursery vegetation into the burned area surrounding the identified trailheads. Native plant materials are the first choice in revegetation where timely natural regeneration of the native plant community is not likely to occur. Manual revegetation will contribute to reducing erosion and preventing the introduction and establishment of non-native and/or invasive plant species, as well as contributing to other resource objectives.

**Ranger Creek State Airstrip**
The Washington State Department of Transportation – Aviation Division (WSDOT Aviation) manages a group of general aviation airstrips in Washington, known as “State-Managed
Airports.” Ranger Creek airstrip, consists of just over 22 acres within the NFS Buck Creek Campground complex and is operated by WSDOT Aviation through a Special Use Permit.

This State-Managed airstrip system at Ranger Creek provides unique benefits including: support of forest firefighting activity and emergency medical operations, transportation access to recreational areas, and flight safety enhancement.

This proposal would bring the airstrip in conformance with acceptable FAA and WSDOT Aviation Airport design standards per the recommendations of the WSDOT Airport Layout Plan (ALP). A complete conformance review is provided in the ALP; a copy of the ALP can be found on the Snoquera project website.

This project includes basic facility improvements and new facilities summarized below:

- Pilot Flight Planning Station with telephone; guest sign in stations.
- Emergency Management Staging Areas- WA Interagency Incident Management Team Facilities
- Install webcam.
- Reconfigure/Relocate Helicopter Parking.
- Aircraft Tiedowns.
- Restrooms- maintain designated access to neighboring facilities (2 vault type toilets located east of airport), install one new vault type located southwest of the airstrip, and install one new restroom with showers adjacent to emergency operations staging area.
- Add aircraft turnaround at Runway 33 end (west side) to provide aircraft wingtip and tail clearance.
- Widen runway to 50 feet.
- Relocate existing midfield wind cone approximately 15 feet east to clear runway OFA (Object Free Area – minimum 100 feet from runway centerline).
- Upgraded aircraft campsites (tent sites, potable water, fire rings, picnic tables).
- Vehicle parking
- Improve airstrip maintenance road.

Changes to the Proposed Action between the May 2018 Scoping Package and Draft Environmental Assessment

Following a review of public comments received during the scoping period combined with input from resource specialists, modifications were made to the proposed action.

The 7222 Connector Road, Special Use authorizations, Daylighting, and removal of the West Fork White River Bridge, and Wrong Creek Bridge on FSR 74 were dropped from this project for
analysis. In addition, the initial phase of the Ranger Creek State Airstrip – Obstruction/Tree removal to clear approaches and departures was removed from this project, as well as any tree clearing needed to accommodate other improvements at the airstrip. The proposed Type 1 helicopter-spot proposed at the Ranger Creek State Airstrip was found to be unnecessary, so dropped from further analysis. The Silver Creek Guard Station is considered in alternative 3, but is no longer part of alternative 2. Proposed actions dropped from the Snoquera Landscape Analysis project will be considered for cumulative effects as applicable.

**Alternative 3**

Alternative 3 is identical to Alternative 2 (Proposed Action) except for the changes described below.

**Corral Pass**

The proposal for Alternative 3 is as described in Alternative 2, *except* for the campground. Alternative 3 would reestablish up to five individual sites in a portion of the existing footprint of the campground, with parking slots, fire rings, and picnic tables. The remainder of the existing footprint would be revegetated.

**Silver Creek Guard Station Visitor Center Improvements**

The proposal for Alternative 3 would restore and upgrade the historic Silver Creek Guard Station Visitor Center building for American Disability Act (ADA) accessibility and security. Upgrades to the building would include expanding public pathways and public ingress/egress to be readily accessible to and usable by individuals with disabilities. The upgrades and alterations to this historic building would comply with the provisions applicable to historic properties in the design standards to meet State Historic Preservation Office (SHPO) requirements as well as the requirements of the National Historic Preservation Act (NHPA) This proposal would also build a public restroom facility adjacent to the historic guard station. This public restroom facility would be built to ADA compliance standards with running water and waste management systems, which would require the installation of a new larger septic system.

**Naches Trailhead Expansion and Trail Reroute**

The proposal for Alternative 3 is as described in Alternative 2, except Alternative 3 would not expand the existing Trailhead footprint at the bottom of FSR #7065. Alternative 3 would designate dual motorized use from the Pyramid SnoPark to FSR #7065, authorizing mixed motorized traffic on FSR#7000 for approx. 1.1 miles allowing ATV’s/UTV’s to travel the same route as passenger vehicles are using currently. This would eliminate the 0.20 miles proposed for changing to ML-3 in Alternative 2.
Figure 13. Recreation Enhancement Projects
Project Design Criteria and Mitigation Measures

Project design criteria and mitigation measures are developed to avoid, reduce, eliminate, rectify, or compensate for undesirable effects from proposed activities. They apply to both Alternatives 2 and 3. Unless noted otherwise in the decision document, the mitigation measures and design features are mandatory if the Responsible Official selects an action alternative for implementation.

The mitigation measures and design features listed in Table 11 were developed to address site-specific environmental concerns and to meet applicable Forest Plan standards and guidelines. Each measure or feature is stated, followed by its objective, a rating of its effectiveness and basis for that rating, regulatory or scientific basis for the measure, and the person(s) responsible for enforcement.

**High.** The mitigation is highly effective (estimated at greater than 90 percent) at meeting the objective, and one or more of the following types of documentation is available: research or literature; administrative studies; Experience: professional judgment of an expert; or Fact: evident by logic, or reason.

**Moderate.** The mitigation is moderately effective (estimated at 60 to 90 percent), and its effectiveness is supported either by evidence or logic. Implementation of this mitigation needs to be monitored, and the mitigation may be modified if needed to achieve its objective.

**Low.** The mitigation is considered to be somewhat effective (estimated at less than 60%), because its effectiveness is not supported by substantial evidence, or professional judgment indicates that it has limited success in implementation or in meeting objectives. Implementation should be monitored, and the mitigation may be modified if necessary to achieve its objective.

Table 11. Mitigation measures and design criteria for Alternatives 2 and 3.

<table>
<thead>
<tr>
<th>Mitigation Measure or Project Design Criteria</th>
<th>Objective</th>
<th>Effectiveness and Basis</th>
<th>Regulatory or Scientific Basis</th>
<th>Enforcement</th>
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<tr>
<td><strong>Botany- All Activities</strong></td>
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<tr>
<td>B1 - Any previously undocumented Threatened or Endangered (T&amp;E), or Regionally Sensitive (R6), or Survey and Manage (S&amp;M) plants located before or during project implementation, will be appropriately managed by active coordination between contractor or purchaser, Forest Service Line officer, project administrator and botanist.</td>
<td>Prevent impacts to Threatened &amp; Endangered, Sensitive, and Survey &amp; Manage plants.</td>
<td>HIGH (Logic)</td>
<td>Forest Plan p. 4-127, USDA Forest Service 1990.</td>
<td>Contract/Project Administrator</td>
</tr>
<tr>
<td>B2 - Protect TES and S&amp;M plants by applying site-specific mitigations. Mitigations may include buffering occurrences, avoidance of occurrences, or other measures to provide for the persistence of the species at the site.</td>
<td>Prevent impact to TES, S&amp;M plant species.</td>
<td>HIGH (Logic)</td>
<td>R6 TES list management requirements</td>
<td>Presale Layout Crew, Project/Contract Administrator</td>
</tr>
<tr>
<td>Mitigation Measure or Project Design Criteria</td>
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<tr>
<td>B3 - No activities will occur within no-disturbance TES and S&amp;M buffers.</td>
<td>Prevent impact to TES, S&amp;M plant species.</td>
<td>HIGH (Logic)</td>
<td>R6 TES list management requirements</td>
<td>Presale Layout Crew Project/Contract Administrator</td>
</tr>
<tr>
<td>B4 – Suppliers must provide annual documentation indicating that the following products have been examined by a qualified inspector and deemed free of State listed noxious weeds: Straw or other Mulch Gravel, Rock, or other fill Seeds (according to AOSA standards)</td>
<td>Prevent introduction of weeds.</td>
<td>MODERATE (USDA Forest Service 2005a)</td>
<td>USDA FS 2005a S&amp;G #3 &amp; 7 Forest Plan BMPs, USDA FS 1999</td>
<td>Project or Contract Administrator</td>
</tr>
<tr>
<td>B5 - All equipment and gear that comes in contact with a known noxious weed infestation must be cleaned before moving to non-infested areas within the project to avoid spreading the infestation further.</td>
<td>Prevent weed spread.</td>
<td>HIGH (USDA Forest Service 1999)</td>
<td>BMPs, USDA FS 1999</td>
<td>Contract Preparer and Administrator</td>
</tr>
<tr>
<td>B6 - Revegetate areas of bare soil exposed by project activities. Native plant materials are the first choice in revegetation where timely natural regeneration of the native plant community is not likely to occur. If native plant materials are not available, use the appropriate MBS non-native seed mix (ask FS Botanist). Seeds must be covered with certified weed-free straw, wood straw, slash, or mulch after ground-disturbing work has been completed and prior to the onset of the wet season.</td>
<td>Prevent erosion; prevent introduction and spread of weeds; maintain, and restore habitat.</td>
<td>HIGH (USDA Forest Service 2005a)</td>
<td>2005 Region 6 Record of Decision for Preventing and Managing Invasive Plants Standard 13, and Forest Service Manual 2070.</td>
<td>Contract Administrator</td>
</tr>
<tr>
<td>B7 - Any salvage and installation of plants will be approved by and coordinated through a FS Botanist.</td>
<td>Prevent impacts to TES &amp; S&amp;M species and ensure regeneration of native plant communities.</td>
<td>Moderate (Logic)</td>
<td>Forest Plant p 4-122 &amp; 4-123, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
</tr>
<tr>
<td>B8 - No wheeled or tracked equipment would be allowed within 100 feet of fens.</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
</tr>
<tr>
<td>B9 - Temporary roads, skid trails, landings, or piles would not be located within 100 feet of fens.</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
</tr>
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<tr>
<td><strong>B10</strong> Treatment within fens would be limited to hand felling of trees and would require assessment by qualified botanist prior to implementation. All woody material (chips, piles, cut and chunk, logs, etc.) would be removed from the fen area with as little impact to the fen as possible (i.e. hand carrying out via a single trail).</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
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<tr>
<td><strong>Botany – Road Construction/Maintenance</strong></td>
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<tr>
<td><strong>B11</strong> Neither magnesium chloride nor calcium chloride would be used for dust abatement within 500 feet of fens or known rare plant sites.</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
</tr>
<tr>
<td><strong>B12</strong> New road construction would not occur within 100 feet of fens</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
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<tr>
<td><strong>Botany – Invasive Plant Treatments</strong></td>
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<tr>
<td><strong>B13</strong> Treat selected, known infestations of invasive plants before ground disturbance begins. Coordinate and consult with the FS Botany Staff for required treatments.</td>
<td>Prevent the spread of invasive plants.</td>
<td>HIGH (USDA Forest Service 2005a)</td>
<td>BMPs, USDA FS1999 USDA FS 2005a S&amp;G #16</td>
<td>FS Botany or Invasives Staff Project or Contract administrator</td>
</tr>
<tr>
<td><strong>B14</strong> Spraying treatments would not occur within 200 feet of fens.</td>
<td>Prevent impacts to fens and potential rare plant occurrences</td>
<td>HIGH (Logic)</td>
<td>Forest Plan Chapter IV, USDA Forest Service 1990</td>
<td>FS Botany Staff, Implementation Crew</td>
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<td><strong>Fire and Fuels</strong></td>
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<tr>
<td><strong>FF1</strong> Dispersed recreation sites existing within timber harvest units shall have activity fuels removed for utilization or piled for burning within a 100 feet radius of sites within proposed harvest units.</td>
<td>Reduce the occurrence and fire severity of human-caused wildfires.</td>
<td>HIGH. Majority of human-caused wildfires on the MBS occur in dispersed recreation sites.</td>
<td>1990 Forest Plan, p. 4-143-145, 147-149. 1994 Record of Decision NWFP, p. C-18 &amp; C-36.</td>
<td>Timber Sale Administrator with Fire Management Officer consultation</td>
</tr>
<tr>
<td><strong>FF2</strong> Log landings utilized in harvest units will have activity fuel piled and removed for utilization or piled and later burned by USFS personnel</td>
<td>Reduce the occurrence and fire severity of human-caused wildfires.</td>
<td>HIGH. Majority of human-caused wildfires on the MBS occur in dispersed recreation sites.</td>
<td>1990 Forest Plan, p. 4-143-145, 147-149.</td>
<td>Timber Sale Administrator</td>
</tr>
<tr>
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<td>to reduce the risk of human-caused wildfire.</td>
<td>severity of human-caused wildfires.</td>
<td>caused wildfires on the MBS occur in dispersed recreation sites, harvest landings are popular dispersed camping sites post-harvest.</td>
<td>149. 1994 Record of Decision NWFP, p. C-18 &amp; C-36.</td>
<td>with Fire Management Officer consultation</td>
</tr>
<tr>
<td>FF3 - Timber harvest units at a minimum shall have harvest activity fuels removed, chipped, piled and burned or broadcast burned within 200 feet of road sides bounding units or 100 feet on either side of Level 1, 2 or 3 system roads running through harvest units.</td>
<td>Reduce the occurrence of human-caused wildfires and create fuel breaks along system roads to increase fire suppression effectiveness.</td>
<td>HIGH. Reducing or removing activity generated fuels along roads creates a control point in the event of a wildfire.</td>
<td>1990 Forest Plan, p. 4-146. 1994 Record of Decision NWFP, p. C-18 &amp; C-36.</td>
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<td>FF4 - Prescribed burning activities will be consistent with the requirements of the “Smoke Management Plan” administered by the Washington State Department of Natural Resources. All prescribed burning activities are pre-approved on the day of ignition after weather observations and forecasts anticipate a neutral effect to the Air Quality resource, which includes Class 1 airsheds (designated wilderness areas) down-wind from the project area. All prescribed burning activities will be in compliance with policy direction contained within the NWCG Interagency Prescribed Fire Planning and Implementation Guide (2008) and FSM 5140.</td>
<td>Neutral air quality impacts to smoke sensitive areas and class 1 air sheds.</td>
<td>HIGH. All prescribed fire projects are subject to daily approval by WA DNR prior to ignition.</td>
<td>(1990 Forest Plan, p. 4-118). NWCG Interagency Prescribed Fire Planning and Implementation Guide (2017) and FSM 5140.</td>
<td>Washington State Department of Natural Resources. District Ranger approval of Prescribed Fire Implementation Plan.</td>
</tr>
<tr>
<td>FF5 - All prescribed fire projects will be executed in accordance with air quality and smoke management guidelines.</td>
<td>Neutral air quality impacts to smoke sensitive areas and class 1 air sheds.</td>
<td>HIGH. All prescribed fire projects are subject to daily approval by WA</td>
<td>(1990 Forest Plan, p. 4-118).</td>
<td>Washington State Department of Natural Resources. District Ranger</td>
</tr>
<tr>
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<td>FF6 - To minimize effects on emergency response to fires or other emergencies in and around the project area, a maximum 2 hour wait time for road closures during timber harvest operations for major access roads shall be implemented. At the end of the work day these roads shall be left open and passable for emergency responses. Due to low emergency response use spur roads, and temporary roads can be kept closed during logging activities, but should be able to be re-opened for USFS or cooperator emergency access within 2 hours.</td>
<td>To reduce response time to reported wildfires or lightning strikes.</td>
<td>HIGH. Fast response and action on wildfires reduces fire size and fire severity.</td>
<td>Standard Timber contract specification in Region 6.</td>
<td>Timber Sale Administrator with Fire Management Officer Consultation.</td>
</tr>
<tr>
<td>H1 - Conduct cultural resource surveys prior to implementing ground-disturbing activities.</td>
<td>Protect historic properties.</td>
<td>MODERATE TO HIGH (experience)</td>
<td>36 CFR 800</td>
<td>Archaeologist</td>
</tr>
<tr>
<td>H2 - Complete section 106 compliance prior to project implementation.</td>
<td>Protect historic properties.</td>
<td>MODERATE TO HIGH (experience)</td>
<td>36 CFR 800</td>
<td>Archaeologist</td>
</tr>
<tr>
<td>H3 - Until proper evaluation occurs, all known cultural resource properties shall be protected.</td>
<td>Protect historic properties.</td>
<td>MODERATE TO HIGH (experience)</td>
<td>36 CFR 800</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>H4 - If a previously unidentified resource is discovered during implementation, or if an identified resource is affected in an unanticipated way, stop work &amp; secure find; notify FS Heritage Specialist and adhere to PA.</td>
<td>Protect historic properties.</td>
<td>MODERATE TO LOW (experience)</td>
<td>PA 1997 &amp; 36 CFR 800</td>
<td>Project Administrator or their representative Contractor Operator</td>
</tr>
<tr>
<td>H5 - If human remains are discovered all work must stop in the area of the discovery and NAGPRA protocols followed.</td>
<td>Protect American Indian burials and cultural items.</td>
<td>MODERATE TO HIGH (literature)</td>
<td>43 CFR 10</td>
<td>Project Administrator or their representative Contractor</td>
</tr>
<tr>
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<td><strong>Recreation and Scenery</strong></td>
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<tr>
<td>REC1 - District visitor information specialist and Fire Management Officer shall be notified at least a week in advance of anticipated harvest or contractual activities along a given road or series of roads that could cause delay so that this information can be posted at the Snoqualmie Ranger District Enumclaw Office and to the Forest website.</td>
<td>Safety of Forest users and emergency response.</td>
<td>HIGH (Experience)</td>
<td>1990 Forest Plan p. 4-84</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC2 - Signage informing visitors of project activities, potential delays and/or closures shall also be posted.</td>
<td>Safety and minimize effects on Forest users.</td>
<td>HIGH (Experience)</td>
<td>1990 Forest Plan p. 4-84</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC3 - On roads open to the public, no construction or traffic delays would occur Friday noon through Sunday 6:00 PM, or on holidays (Memorial Day, Fourth of July and Labor Day) between Memorial Day and Labor Day. This mitigation would apply to Roads 75, 73, 7305 and 7305-200.</td>
<td>Public safety and reducing the risk of accidents.</td>
<td>HIGH (Experience)</td>
<td>1990 Forest Plan p. 4-140 &amp; FSM 2330.3 (6)a and c</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC4 – When decommissioning or treating closed roads, keep up to 150 feet at the beginning of the closed road.</td>
<td>Minimize the effects on dispersed camping</td>
<td>HIGH (Experience)</td>
<td>1990 Forest Plan p.4-84 &amp; FSM 2330.3 (6) a and c</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC5 - The gate on the 73/7305 junction, just beyond the access road to the acclimation pond off of 7305, would be closed and vehicle access beyond that point would not be allowed from December 15-March 15 to accommodate winter recreation and the gate closure on 73/7315 Huckleberry Creek and Suntop Sno-parks.</td>
<td>Winter Recreation, Safety and minimize impact to Forest users.</td>
<td>HIGH (Experience) Partnership with WA. State Parks Sno-Parks. Funding received to administer Sno-Park</td>
<td>1990 Forest Plan p 4-84, 4 - 87</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC6 – If road closures prevent access to existing trailheads, relocate trailhead parking to the beginning of the closed road</td>
<td>Provide parking for trail access</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-140, FSM 2330.3 (6)a and c</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC7 – When closing Forest Service Roads, plan and design closures to ensure winter access (Snowmobile/Cross country skiing).</td>
<td>Provide for winter recreation</td>
<td>HIGH (Experience)</td>
<td>1990 Forest Plan p. 4-140</td>
<td>Project Administrator or</td>
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<tr>
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<td>REC8 – Temporary trail closures for public safety during reconstruction and/or repair will occur during mid-week</td>
<td>Health and safety of users</td>
<td>MODERATE (Experience/Professional judgment)</td>
<td>1990 Forest Plan p. 4-86</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC9 – Dispersed camping, target shooting areas, and day-use area closure during reconstruction, to ensure public health and safety, will be scheduled during low use times such as shoulder seasons (April through June or September through November) and midweek. Signs will be posted to notify the public of pending closure periods.</td>
<td>Health and safety of users</td>
<td>MODERATE (Experience/Professional judgment)</td>
<td>1990 Forest Plan p 4 - 84</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC10- Manage public recreational use as necessary to protect resource values, experience and public health and safety</td>
<td>Health and safety of users</td>
<td>MODERATE (Experience/Professional judgment)</td>
<td>1990 Forest Plan p 4 - 84</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC11- As appropriate, place interpretative panels to aid in public information and education of fuels management and forest health around recreation sites nearby during and after project activities.</td>
<td>Provide information and education to inform public</td>
<td>MODERATE (Experience/Professional judgment)</td>
<td>1990 Forest Plan p. 4-140</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>REC12 – For visual aesthetics, restore and vegetate all decommissioned roads per included Soil, Water, Fish and Botany mitigation measure and design features.</td>
<td>Safety, provide for recreation opportunities, reduce loss of dispersed recreation sites.</td>
<td>HIGH (Past experience on revegetation of decommissioned roads)</td>
<td>1990 Forest Plan p. 4-93</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>VIS1 - Retain vegetation screening in areas of Retention and Partial Retention from Forest roads 7000, 7010, 7030, 7300, 7160-210, whenever not in conflict with other resources.</td>
<td>Emphasize the natural appearance seen from roads and</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-93</td>
<td>Project Administrator or their representative</td>
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<tr>
<td>Mitigation Measure or Project Design Criteria</td>
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<tr>
<td>VIS2 - Rehabilitate areas of mechanical disturbance to appear natural. When closing roads, blend earth mounds and large boulders to the shape and pattern of the natural appearing forest canopy.</td>
<td>Provide an attractive forest setting, Emphasize the natural appearance seen from roads and recreation sites</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-93</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>VIS3 - Minimize the amount of paint seen in foreground visual areas.</td>
<td>Emphasize the natural appearance seen from roads and recreation sites</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-93</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>VIS4 - Repair and rehabilitate any incidental damage caused by project implementation to recreation improvements/facilities after project activities are completed. This would include removing debris, re-contouring the landing, seeding native vegetation and treating noxious weeds.</td>
<td>Provide an attractive forest setting, Emphasize the natural appearance seen from roads and recreation sites</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-93</td>
<td>Project Administrator or their representative</td>
</tr>
<tr>
<td>VIS5 – Mather Memorial Parkway (Hwy. 410 Corridor) will be managed at a high visual quality level in both the foreground and middle ground</td>
<td>Emphasize the natural appearance seen from roads and recreation sites</td>
<td>HIGH</td>
<td>1990 Forest Plan p. 4-24</td>
<td>Project Administrator or their representative</td>
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</tbody>
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**Soil, Water, and Fisheries**

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<thead>
<tr>
<th>Mitigation Measure or Project Design Criteria</th>
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<th>Effectiveness and Basis</th>
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<tr>
<td>SWF1 – For commercial harvest not in elk forage enhancement units, 100 foot slope distance minimum no-cut buffer along the Green River, Sunday Creek, White River, Greenwater River, West Fork White River, and Huckleberry Creek. Buffer is to be measured from outer edge of channel migration zone or floodprone area on either side of channel (not from edge of stream), to the top of the inner gorge slope break, whichever is greater. No cutting within buffer will occur except where individual trees are identified to be felled and retained for instream wood. No-cut buffer will be determined during sale layout by pre-sale and/or aquatics staff.</td>
<td>Retain riparian vegetation to maintain shade for stream temperature, large wood recruitment, slope stability, and minimize soil erosion. Provide protection for aquatic and riparian dependent species.</td>
<td>HIGH (Literature and Forest Experience)</td>
<td>1994 ROD ACSOs p. B-11&amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 WDOE 2004 Anderson and Poage 2014, Benda et al. 2016, Groom et al. 2011, Rashin et al. 2006, Anderson et al.</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF2 – For commercial harvest not in elk forage enhancement units, 100 foot slope distance minimum no-cut buffer along all other fish-bearing perennial and intermittent streams. Buffer is to be measured from outer edge of streambank or floodprone area to the top of the inner gorge slope break, whichever is greater. No-cut buffer will be determined during sale layout by pre-sale and/or aquatics staff.</td>
<td>Retain riparian vegetation to maintain shade for stream temperature, large wood recruitment, slope stability, and minimize soil erosion. Provide protection for aquatic and riparian dependent species.</td>
<td>HIGH (Literature and Forest Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 Rashin et al. 2006, McAuley et al. 1990, Anderson and Poage 2014</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF3 – For commercial harvest not in elk forage enhancement units, along all perennial non-fish bearing streams, no-cut buffer would be minimum 50 foot slope distance where few to no trees have been recruited (Riparian Reserve condition 1), and 100 foot slope distance where moderate to high numbers of trees have been recruited (Riparian Reserve condition 2). Buffer is to be measured from outer edge of streambank or floodprone area, to the top of the inner gorge slope break, whichever is greater. No-cut buffer will be determined by pre-sale and/or aquatics staff.</td>
<td>Retain riparian vegetation to provide shade to maintain stream temperatures and slope stability, minimize soil erosion, and protect riparian vegetation. Provide protection of aquatic and riparian dependent species.</td>
<td>MODERATE to HIGH (Literature)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 Rashin et al. 2006, Benda et al. 2016, Groom et al. 2011, Anderson et al. 2007</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF4 – For commercial harvest not in elk forage enhancement units, along all intermittent non-fish bearing streams, no-cut buffer would be minimum 25 feet slope distance where RR condition 1 exists, and 50 feet slope distance where RR condition 2 exists. Buffer is to be measured from outer edge of streambank or floodprone area, to the top of the inner gorge slope break whichever is greater. No-cut buffer will be determined by pre-sale and/or aquatics staff.</td>
<td>Retain riparian vegetation to provide shade to maintain stream temperatures and slope stability, minimize soil erosion, and protect riparian vegetation. Provide protection of aquatic and riparian dependent species.</td>
<td>MODERATE (Literature)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 Rashin et al. 2006, Benda et al. 2016, Anderson and Poage 2014, Groom et al. 2011, Anderson et al. 2007</td>
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<td>SWF5 – For non-commercial harvest not in elk forage enhancement units, minimum no-cut buffer of 50 feet for fish-bearing streams, and 20 feet for all other streams.</td>
<td>Maintain shade for stream temperature, increase future recruitment of large wood while maintaining slope stability and minimizing soil erosion.</td>
<td>MODERATE to HIGH (Literature)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF6 – For commercial or non-commercial harvests in elk forage enhancement units, full RR buffer widths would apply (300 feet along fish-bearing streams, 150 feet along perennial non-fish bearing streams, and 100 feet along intermittent non-fish bearing streams).</td>
<td>Retain riparian vegetation to maintain shade for stream temperature, large wood recruitment, slope stability, and minimize soil erosion. Provide protection for aquatic and riparian dependent species.</td>
<td>HIGH (Literature and Forest Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 USDA Forest Service 2001</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF7 – work near fens would follow Botany measures (B8-10, 12, 14). Otherwise, 30 foot slope distance minimum no-cut buffer around ponds, wetlands, seeps and springs. Buffer is to be measured from the edge of the water, the outer edge of the riparian vegetation or the extent of seasonally saturated soil, whichever is greater. No-cut buffer will be determined by pre-sale and/or aquatics staff.</td>
<td>Minimize soil disturbance, protect riparian vegetation, and provide protection of aquatic and riparian dependent species. Provide a buffer of no disturbance around waterbody for movement by amphibians to and from breeding sites.</td>
<td>HIGH (Literature and Forest Experience)</td>
<td>1994 ROD ACSO p. B-11 &amp; RR p. C-30 USDA FS 2012 FS National Core BMPs – Veg. #1-3 Rashin et al. 2006</td>
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<td>SWF8 – 30-foot slope distance minimum no-cut buffer around unstable and potentially unstable areas. Buffer is to be measured upslope from major slope breaks that define a headwall, inner gorge or other potential unstable areas. Buffer is to be measured upslope from major slope</td>
<td>Prevent management related slope instability within headwall, failure of</td>
<td>HIGH (Literature and Forest Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; S&amp;Gs p. C-31 USDA FS 2012</td>
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<td>breaks that define a headwall, inner gorge or other potential unstable areas. Landforms with slope stability concerns will be identified by a Soils Scientist and/or Hydrologist. No-cut buffers will be identified by pre-sale in coordination with soils and hydrology staff.</td>
<td>inner gorges, or unstable areas.</td>
<td>MODERATE (Avoid activity when impact would occur)</td>
<td>USDA FS Region 6 Soil Quality Standards FSM 2520,R-6 Supplement No 2500.98-1 1994 ROD ACSOs p. B11 #2, #8, &amp; #9; RR pp. C31-32 FW-1 &amp; p. C-37 USDA FS 2012 National Core BMPs – Veg. #1 &amp; #4</td>
<td>Timber Sale Administrator and/or Project Engineer, Hydrologist or Soils specialist where pertinent</td>
</tr>
<tr>
<td>SWF9 – Most if not all yarding and haul activities are expected to occur during the Normal Operating Season (NOS), defined as June 1 to October 15. However, if extended dry season conditions occur, then yarding activities and haul may proceed beyond October 15. During periods outside the NOS, yarding and haul operations may proceed with monitoring of weather and on-the-ground conditions such as saturated soil conditions to evaluate if logging operations meet project design elements and Management Requirements and Mitigation Measures. Any pre-approved hauling activities occurring outside the NOS will require monitoring of conditions as follows: Implementation and effectiveness monitoring of BMPs will be implemented. BMP monitoring on haul roads (NFS system roads and temp roads), skid trails, landings, etc. plus other on-site observations of ponding, rutting, rilling, scour or sediment transport and deposition downstream of cross drains will inform when to curtail logging activities and/or take additional actions to mitigate water quality and aquatic resource impacts.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts at the project level and off-site.</td>
<td>FS National Core BMPs – Veg. #1-3</td>
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<td>SWF10 – For all commercial harvest units, outside Riparian Reserves directionally fall trees away from no-cut riparian buffers where possible to protect riparian vegetation and soils from damage. Trees inadvertently felled into no-cut buffers may be removed with one-end suspension. Portions of these trees that reside within 30 feet of the aquatic resource will be left in place.</td>
<td>Minimize short- and long-term soil, hydrologic and limit water quality impacts. Meet FS region 6 Soil Quality standards</td>
<td>HIGH (Avoidance)</td>
<td>USDA FS Region 6 Soil Quality Standards (FSM R6 2521.03) USDA FS 2012 National Core BMPs – Veg. #1 &amp; #5 1994 ROD p. B-11 # 2, #8, #9; pp. C31-32; FW-1 &amp; p. C-37</td>
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<td>SWF11 – Avoid harvest on areas that have average sideslopes greater than 80 percent. Some trees may be cut on slopes steeper than 80 percent for occasional skyline corridors in order to access areas of a unit less than 80 percent.</td>
<td>Minimize soil erosion, maintain slope stability, and damage to felled and residual trees. Meet FS Region 6 Soil Quality Standards</td>
<td>MODERATE (Limits activity where impact would occur)</td>
<td>USDA FS Region 6 Soil Quality Standards (FSM R6 2521.03) USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5 1994 ROD ACSOs p. B-11 #2, #8, &amp; #9; RR p. C31-32 FW-1 &amp; p. C-37 USDA FS 1990</td>
<td>Layout Crew and Watershed Specialist</td>
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<td>SWF12 – If it is necessary for equipment to travel away from approved corridors or temporary roads, the machines will operate on a slash mat of limbs and tops that is deposited directly in front of the machine. This mat will be as thick and continuous as practicable. Activities will be planned to make as few trips as possible.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts.</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #4</td>
<td>Timber Sale Administrator</td>
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<td>SWF13 – If mobile or other anchors are needed outside of cutting units that may result in impacts to soils or adjacent forest stands, the aquatics specialist will be notified.</td>
<td>Minimize impacts to soils and vegetation outside of harvest units</td>
<td>MODERATE (Limits activity where impact would occur)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5</td>
<td>Sale Preparation, Timber Sale Administrator</td>
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<td>SWF14 – When constructing landings or new turnarounds: No unanalyzed landings or turnarounds will be constructed outside of EA stand boundaries without consultation with the IDT. Make all attempts to locate new landings or turnarounds a minimum 150-foot slope distance from rivers, streams, ponds, seeps, wetlands, and wet areas. If location outside of the 150-foot slope distance is not possible, then landings or turnarounds shall be located outside of the applied no-thin buffer for that stream type. Landings needed within the no-thin buffer of fish-bearing streams will require approval from aquatic specialist prior to implementation. If landings or turnarounds must be located within 150-foot slope distance, they will be placed on existing roadways or on existing landings that require only minimum reconstruction (e.g., clearing</td>
<td>Minimize soil disturbance, protect riparian vegetation, protect aquatic and riparian habitat, and minimize impacts to other resources (e.g. heritage or wildlife).</td>
<td>HIGH (Avoidance)</td>
<td>USDA FS 1990 USDA FS &amp; USDI BLM 1994</td>
<td>Presale Layout Crew</td>
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<td>vegetation, sloping for drainage, or surfaced for erosion control purposes) to be made suitable for use. Any new landing or turnaround construction areas (or portions thereof), which are not located on existing roadways or cleared, compacted areas, will be treated with one or more of the following: decompaction and mulching with certified weed-free straw, woodstraw, or slash after use, and/or seeding with erosion control seed mix.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts.</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5 T-6 and T-13 standard timber sale contract clause BT6.6 Erosion Prevention and Control</td>
<td>Timber Sale Administrator, Project Engineer</td>
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<td>SWF15 – Maintenance and erosion control on landings, disturbed skyline corridors, skid roads, and temporary and permanent roads will be completed prior to the onset of expected seasonal periods of precipitation or runoff, and kept current during and outside of NOS. As conditions require, sediment filters (straw bales, slash filter windrow, and/or sediment fence) will be placed in ditches along the haul route or in areas where ground is disturbed and sediment has the potential for delivery to streams (i.e. stream crossing fills, adjacent to downhill skyline units). Sediment filters will be maintained and adjusted as needed. Removal of sediment filters will be done when site conditions are dry, and captured sediment will be relocated locally to stable locations away from stream courses.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts.</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5 T-6 and T-13 standard timber sale contract clause BT6.6 Erosion Prevention and Control</td>
<td>Timber Sale Administrator</td>
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<td>SWF16 – Areas of gouging or soil displacement on steep slopes resulting from yarding systems will be treated to prevent rill and gully erosion and possible sediment delivery to stream courses. Erosion control treatments may include, but are not limited to: repositioning displaced soil to re-contour disturbed sites; creating small ditches or diversions to redirect surface water movement; installation of coir logs along slope contours; and scattering slash material to create flow disruption and surface soil stability. These measures will be in place prior to expected seasonal periods of precipitation or runoff, and kept current during and outside of NOS.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts.</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5 T-6 and T-13 standard timber sale contract clause BT6.6 Erosion Prevention and Control</td>
<td>Timber Sale Administrator</td>
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<td>SWF17 – For skyline systems: Yarding with full suspension would be allowed across or over potentially unstable slopes, streams, wetlands, wet areas, and other no-cut buffers with BMPs. Whenever possible, corridors will be no more than 15 feet wide. All corridors will generally be approximately 120 feet apart.</td>
<td>Minimize short- and long-term soil, hydrologic and water quality impacts.</td>
<td>HIGH (Avoidance)</td>
<td>USDA FS Region 6 Soil Quality Standards (FSM R6 2521.03) USDA FS 2012 National Core BMPs – Veg. #1 &amp; #5</td>
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<td>SWF18 – Traditional ground-based log transport equipment is restricted to sustained slopes that are no greater than 35 percent. Non-yarding ground-based equipment (such as a self-leveling feller-buncher) is restricted to sustained slopes less than 50%. Tethered ground-based equipment is restricted to sustained slopes that are no greater than 80 percent, with monitoring to determine if operations are meeting thinning objectives and standards and guidelines to minimize impacts to other resources. Stands proposed for tethered based harvest and yarding will have approved monitoring criteria identified prior to operations. Stands proposed for tethered based harvest and yarding will be approved by the Timber Sale Administrator (in consultation with the ID team) prior to operations.</td>
<td>Minimize extent and degree of soil in a detrimental condition and meet desired stand conditions. Monitor amount of soil disturbance created by tethered based operations. Compare soil disturbance and impacts to aquatic resources from tethered based operations to standard harvest and yarding methods.</td>
<td>MODERATE (Limits activity where impact would occur) UNKNOWN (tethered equip) Monitoring will allow data to be collected and analyzed for evaluation of equipment operations and incorporation into future planning</td>
<td>1994 ROD p. B-11 # 2, #8, &amp; #9; pp. C31-32 FW-1 &amp; p. C-37 USDA FS Region 6 and MBSNF Soil Quality Standards (FSM 2520,R-6 Supplement No 2500.98-1); USDA FS 2012 National Core BMPs – Veg. #1 &amp; 4</td>
<td>Timber Sale Administrator</td>
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<td>SWF19 – For ground-based yarding: Skid trails must be approved by the Timber Sale Administrator prior to felling and construction operations. Old skid trails will be used wherever possible, as long as they avoid wet areas and will prevent sediment delivery to streams. Skid trails will generally be no closer than 100 feet apart, center-to-center, and be only as wide as necessary for the equipment to travel (less than 12 feet wherever possible). Erosion control devices such as waterbars and/or slash will be used as necessary on sloped skid roads, and kept current, particularly preceding expected seasonal precipitation or runoff. Ground-based skidding and yarding operations shall be conducted with one-end suspension to minimize soil erosion. Line pulling will be accomplished by yarding logs to lead, or at a 30-45 degree angle towards skid trails for one-end suspension whenever possible.</td>
<td>Prevent management-related unacceptable degree and extent of surface erosion and other long-term detrimental soil conditions.</td>
<td>MODERATE (Limits activity where impact would occur)</td>
<td>USDA FS 2012 National Core BMPs – Veg. #1-3 &amp; #5 BMP #T-11</td>
<td>Timber Sale Administrator</td>
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<td>possible. Full suspension of logs is not required during lining operations. Wherever possible, skid trails will be located a minimum of 25 feet away from riparian no-cut buffers. To travel off approved skid trails, equipment (e.g., harvester, feller/buncher, shovel) will operate on a slash mat whenever possible. The slash mat should consist of limbs and tops deposited directly in front of the machine. The mat will be as thick and continuous as practicable. Activities will be planned to make as few trips as possible.</td>
<td>Avoid or minimize direct soil and water disturbance during periods of the year when heavy precipitation and runoff are likely to occur.</td>
<td>MODERATE (Avoid activity when impact would occur)</td>
<td>USDA FS 2012 FS National Core BMPs - Roads #5 T-5, R-3, R-7</td>
<td>Timber Sale Administrator</td>
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<td>SWF20 – Schedule road reconstruction activities (includes rock additions) during the NOS. Additional spot rocking may be required to keep roads in acceptable condition during operational periods outside of the NOS per specifications outlined in SWF9 above.</td>
<td>Ensuring compliance with State regulations that protect aquatic and related resources</td>
<td>MODERATE</td>
<td>WDFW and USDA FS 2017 (HPA)</td>
<td>Timber Sale Administrator</td>
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<td>SWF21 – Comply with provisions of the Memorandum of Understanding (MOU) between the WDFW and USFS for Hydraulic Project Approval (most recent is effective through 10/1/2022) including the “General Provisions Applicable to all Appendix A Projects,” and specific applicable provisions including but not limited to: bank protection; permanent culvert installation and replacement; permanent bridge installation; permanent culvert, bridge, and ford removal; temporary culvert and bridge installation and removal; culvert and bridge debris removal; instream habitat improvement; and streambank restoration.</td>
<td>Compliance with Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899, Section 7 of the Endangered Species Act, and the Magnuson-Stevens Fishery Conservation and Management Act</td>
<td>MODERATE</td>
<td>USACE 2017 (RGP-8) NMFS 2013 (ARBO II); USFWS 2013 (ARBO II)</td>
<td>Contract provision 5.1 Option 1, Timber Sale Administrator</td>
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<td>restoration.</td>
<td>Protect and minimize Riparian Reserve impacts</td>
<td>MODERATE (Consultation, BMP, MBS Forest Experience)</td>
<td>USDA FS 2012, ACS, 1990 Forest Plan, p. 4-126, 119 &amp; USACE 2017 (RGP-8)</td>
<td>Timber Sale Administrator and/or suitable specialists/ or contract administrator</td>
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<td>SWF23 – Disturbance of vegetation shall be limited to the minimum amount necessary for all activities.</td>
<td>Avoid or minimize negative impacts to fish</td>
<td>HIGH (Consultation with USFWS and NMFS regulatory agencies concur this is effective)</td>
<td>WDFW and USDA FS 2017 (HPA)</td>
<td>Engineering or their representative</td>
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<td>SWF24 – Ground-disturbing activities within channels, and along the banks of fish-bearing streams or streams located within ¼ mile of fish-bearing streams shall be performed during instream work window approved by WDFW and USFS Fisheries Biologists.</td>
<td>Prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. This may involve cleanout of plugged culvert inlets, lowering of road fill at the culvert crossing, and/or construction of a drivable dip downgrade of the crossing.</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp;33 (RF-3a &amp; RF-4) USDA FS 2012 FS National Core BMPs - Roads #7</td>
<td>Timber Sale Administrator or their representative, Project Engineer</td>
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<td>SWF25 – When reconstructing roads, install stream-crossing structures at the location where water flows into roadbed. All installed culverts or crossing features should maintain flow down primary, natural pathway of flow and not redirect flow into a ditch, pond, or another channel. All installed/replaced culverts on perennial and intermittent streams will be done to design criteria specifications of ARBO II. Exceptions, such as installing non-culvert type structures (e.g., drainage dips, armored fords, etc.) may be approved by the Aquatics Specialist.</td>
<td>Minimize disruption of natural hydrologic flow paths, including surface and subsurface flow. Ensuring compliance with State regulations that protect aquatic and related resources.</td>
<td>WDFW and USDA FS 2017 (HPA) USDA FS 2012 FS National Core BMPs - Roads #7</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp;33 (RF-3a &amp; RF-4) USDA FS 2012 FS National Core BMPs - Roads #7</td>
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<td>SWF26 – Where existing culverts on perennial stream crossings stay in place during haul and related activities, they should be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. This may involve cleanout of plugged culvert inlets, lowering of road fill at the culvert crossing, and/or construction of a drivable dip downgrade of the crossing.</td>
<td>Prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. Such failures can result in debris flows or mass wasting events due to fillslope or culvert failures downgrade of</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp;33 (RF-3a &amp; RF-4) USDA FS 2012 FS National Core BMPs - Roads #7</td>
<td>Timber Sale Administrator or their representative, or other contracts representative</td>
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## Mitigation Measure or Project Design Criteria

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<th>SWF27 – New temporary roads will be located and designed to minimize disruption to hydrologic flows by:</th>
<th>Minimize disruption of natural hydrologic flow paths, including surface and subsurface flow. Protect and minimize impacts to riparian areas, habitats, and dependent species, including amphibians.</th>
<th>MODERATE (BMP, NFS Experience)</th>
<th>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp; 33 (RF-2e, 2g &amp; RF-3b) USDA FS 2012 FS National Core BMPs - Roads #2 &amp; 7</th>
<th>Timber Sale Administrator or their representative</th>
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<td>Minimizing clearing limits (generally no more than 16 feet on level ground, 20 feet for curves, slightly more for steeper hillslopes); Minimizing excavation of cutslopes and fill slopes; and Routing drainage away from potentially unstable hillslopes, sidecast, and channels. Fully decommission new temp roads after the period of use has concluded.</td>
<td>Minimize disruption of natural hydrologic flow paths, including surface and subsurface flow. Protect and minimize impacts to riparian areas, habitats, and dependent species, including amphibians.</td>
<td>MODERATE (BMP, NFS Experience)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp; 33 (RF-2e, 2g &amp; RF-3b) USDA FS 2012 FS National Core BMPs - Roads #2 &amp; 7</td>
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<td>SWF28 – If temporary roads are proposed for construction they would be located within EA stand boundaries and avoid sensitive sites such as shallow soils, unstable landforms; wetlands and minimize disruption of natural hydrologic flow paths, including surface and subsurface flow. Upon additions or changes to the road system, consult the ID Team to ensure changes are within the effects analyzed.</td>
<td>Minimize disruption of natural hydrologic flow paths, including surface and subsurface flow. Protect and minimize impacts to riparian areas, habitats, and dependent species, including amphibians.</td>
<td>HIGH (Avoidance)</td>
<td>1994 ROD ACSOs p. B-11 &amp; RR pp. C-32 &amp; 33 (RF-2e, 2g &amp; RF-3b) USDA FS 2012 FS National Core BMPs - Roads #2 &amp; 7</td>
<td>Timber Sale Administrator or their representative</td>
</tr>
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<td>SWF29 – Any timber sale temporary access roads identified to remain in place over the winter (into a second year of operation) shall use drainage features (culverts and/or water bars) that would accommodate a 100-year flood and associated debris flow, including seeding and mulching of any exposed or disturbed soils.</td>
<td>Prevent erosion and/or mass wasting and road damage</td>
<td>MODERATE (Relatively new requirement, but based on permanent road requirements)</td>
<td>USDA FS USDI BLM 1994 p. C-33, RF-4 and RF-5</td>
<td>Timber Sale Administrator or their representative</td>
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<tr>
<td>SWF30 – Design road drainage features to hydrologically disconnect road surface runoff from stream channels and wetland areas. On roads to be closed or decommissioned, cross-drains or water bars will be installed at a maximum spacing of 400 feet where road grade exceeds 2 percent or modified with approval from an Aquatics Specialist.</td>
<td>Protect stream channel from water quantity and quality impacts</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012a. FS National Core BMPs, Road-6, USACE 2017 (RGP-8)</td>
<td>Timber Sale Administrator or their representative</td>
</tr>
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<td>SWF31 – Where existing unclassified and previously decommissioned roads will be reconstructed for temporary use, adequately address road drainage, cut slope and fill slope instability, and potential water diversions. Sidecasting of loose material is prohibited within 150 feet of aquatic</td>
<td>Protect and minimize Riparian Reserve impacts. Minimize disruption of natural</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 FS National Core BMPs - Roads #2 &amp; 7</td>
<td>Project Administrator or their representative,</td>
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<td>resources.</td>
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<td>SWF32 – All decommissioned roads would be reclaimed to resist erosion, improve subsurface hydrology, improve regrowth, and deter motorized traffic. Reclamation may include: (1) improving the infiltration by decompaction to a depth of 18 inches where feasible, and/or outsloping towards the natural contour; and (2) stabilizing the surface by either applying mulch or by distributing slash across 70 percent of the disturbed ground surface, whichever is appropriate, and seeded with appropriate mix as described in PDC B6. Asphalt removed from road surfaces (FS Road 7400) shall be removed from National Forest system land and disposed of properly.</td>
<td>Restore eco-hydraulic function of soils and soil productivity</td>
<td>MODERATE to HIGH (BMP, NFS Experience)</td>
<td>USDA FS 2012 FS National Core BMPs Road-5 &amp; 6</td>
<td>Project Administrator or their representative, Project Engineer</td>
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<td>SWF33 – During decommissioning activities, remove all fill material and man-made structures from stream channels. After removal, stream channel shall match upstream and downstream channel dimensions, channel roughness, bank shape, natural floodplain contours, and natural adjacent hillslope. Extent of activities may need to be adjusted where road would be used as a trail. Notify Aquatic Specialist of any changes in final specifications for stream crossing removal, outsloping and road-decommissioning designs.</td>
<td>Restore eco-hydraulic function of channel, valley bottom and riparian areas</td>
<td>MODERATE to HIGH (NFS Experience)</td>
<td>USDA FS 2012, ACS, 1990 Forest Plan, p. 4-126, 119, USACE 2017, WDFW and USDA FS 2017 (HPA)</td>
<td>Project Administrator or their representative, Project Engineer</td>
</tr>
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<td>SWF34 – Dust abatement for use on haul roads will be limited to the use of clean water or Lignin.</td>
<td>Protect water quality. Prevent chemically laden water from entering waterways.</td>
<td>HIGH</td>
<td>USDA FS 2012, ACS</td>
<td>Timber Sale Administrator or their representative, Project Engineer</td>
</tr>
<tr>
<td>SWF35 – Trash and removed culverts shall be removed from National Forest System (NFS) lands and disposed of at an appropriate disposal area.</td>
<td>Keep forest clean and free of trash.</td>
<td>HIGH</td>
<td>USDA FS 2012 Road-6</td>
<td>Timber Sale Administrator or representative</td>
</tr>
<tr>
<td>SWF36 – Heavy machinery and project service vehicles shall be free of leaks. Operators shall check heavy machinery for leaks prior to commencement of daily work. Repairs will be conducted before commencement of or continuing work.</td>
<td>Prevent and minimize potential effects to water quality</td>
<td>HIGH (NFS Experience)</td>
<td>USDA FS 2012, FP-03, ACS, 1990 Forest Plan p. 4-118, &amp; USACE 2017</td>
<td>Project Administrator or representative, Project Engineer</td>
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<td>SWF37 – Establish a Spill Prevention Control and Containment Plan (SPCCP) when total oil products storage exceeds 1,320 gallons in containers of 55 gallons or greater. Maintain a spill remediation kit onsite for any fuel stored on NFS lands in association with this project. Fuels stored on NFS lands shall be 100 feet from aquatic resources.</td>
<td>Prevent and minimize potential effects to water quality</td>
<td>HIGH (Standard for Construction)</td>
<td>USDA FS 2012, FP-03, ACS, &amp; 1990 Forest Plan p. 4-118 40 CFR 112 Standard provision in contract</td>
<td>Project Administrator or representative, Project Engineer Timber Sale Administrator</td>
</tr>
<tr>
<td>SWF38 – Pumps and generators shall be kept and operated on a sorbent pad or petroleum containment basin with 150% of the pumps’ fuel capacity. All petroleum products will be secured in self-contained safety cans.</td>
<td>Prevent and minimize potential effects to water quality</td>
<td>HIGH (NFS Experience)</td>
<td>USDA FS 2012, ACS, 1990 Forest Plan p. 4-118, &amp; USACE 2017</td>
<td>Timber Sale Administrator; Project Engineer</td>
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<tr>
<td>SWF39 – Approved water sources will be shown on timber sale maps and/or listed in the sale contract. No more than 10% of the instantaneous stream flow may be removed at any time. An air gap or positive anti-siphon device shall be provided between the water source and the holding tank if the tank has been used for purposes other than water haul, if the source is a domestic water supply, or if the water is being mixed with any other materials. The withdrawal hose or pipe must be fitted with a screen with a minimum effective surface area of at least one square inch of functional screen area for every gallon per minute (gpm) of water drawn through it, a round or square screen mesh that is no larger than 2.38 mm in the narrow dimension, or any other shape that is no larger than 1.75 mm in the narrow dimension. Designated water sources may require work including cleaning ponded areas, pipe repair, and pump installation. Bags filled with pea gravel may be used, or a weir may be placed across the stream to pond water. No fill or woody material may be used to seal the water retention area within the bankfull channel. All bags or weirs shall be completely removed at the end of the NOS. Obtain approval from Timber Sale Administrator prior to working on water sources.</td>
<td>Protect aquatic organisms. Minimize channel disturbance and associated sedimentation.</td>
<td>HIGH NFS Experience</td>
<td>NMFS 2013; WDFW and USDA FS 2017 (HPA) USDA FS 2012a, WatUses-3 WAC 173-201A-200</td>
<td>Timber Sale Administrator; Project Engineer</td>
</tr>
<tr>
<td>SWF40 – follow Mt. Baker-Snoqualmie National Forest Blasting Guidelines for Protection of Fish where possible. Where effects cannot be avoided, minimize effects though one or more of the following: timing restrictions; size of charges; blasting caps with 40msec delays; and</td>
<td>Minimize effects of blasting on fish</td>
<td>Consultation with USFWS and NMFS</td>
<td>USFWS and NMFS 2007; Timothy 2013</td>
<td>Project engineer; Aquatics specialist</td>
</tr>
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<td>keeping blasted materials out of fish-bearing stream channels.</td>
<td>Minimize extent and degree of soil in a detrimental condition and meet desired stand conditions. Monitor amount of soil disturbance.</td>
<td>MODERATE (Limits activity where impact would occur)</td>
<td>USDA FS Region 6 Soil Quality Standards (FSM R6 2520.3)</td>
<td>Hydrologist or soil scientist</td>
</tr>
<tr>
<td>SWF41 – Pre-harvest monitoring will be done to establish baseline detrimental soil conditions (DSC) and determine whether levels are at, below, or above the Forest Plan Standard. Monitoring may result in requiring mitigation measures which limit DSC post-harvest levels. Conduct harvest activities in a manner that minimizes DSCs (compaction, puddling, displacement, and severe burning) so as not to exceed 20 percent of the total activity unit, including landings and system roads. Post-implementation monitoring (prior to the close of harvest operations) will be done to ensure that DSC levels remain within Forest Plan Standards. Monitoring may result in implementation of mitigation measures including soil remediation involving decompaction and/or Redistribution of the topsoil layer (soil horizon A) Ensure organic matter, vegetation and/or coarse woody debris is dispersed within harvested areas to provide the greatest extent of soil surface cover practicable.</td>
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<td>SWF42 – Pile burning will be conducted outside all no-cut stream buffers. Direct ignition of prescribed broadcast or other related under-burning will be conducted outside full Riparian Reserve buffers.</td>
<td>Minimize effects to riparian resources.</td>
<td>MODERATE Logic, NFS experience</td>
<td>USDA FS 2012 Fire-2</td>
<td>Timber Sale Administrator or Fire Mgmt Officer</td>
</tr>
<tr>
<td>SWF43 – Disposition of danger/hazard trees not associated with vegetation treatment stands, and particularly if within Riparian Reserves, should be considered for instream uses if not left on-site as down wood.</td>
<td>Minimize effects to Riparian Reserve function</td>
<td>MODERATE Logic</td>
<td>USDA FS and USDI BLM 1994, ACS</td>
<td>Project lead, Aquatics specialist</td>
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<td>Transportation Roads</td>
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<td>TR1 – Aggregate and un-suflaced roads used for haul will be bladed and cross-drained commensurate with use.</td>
<td>Preservation of roadway; prevent silt-laden water from entering stream.</td>
<td>MODERATE</td>
<td>BMPs T-5:R-3;R-7</td>
<td>Timber Sale Administrator or Project Engineer</td>
</tr>
<tr>
<td>TR2 – Weather conditions will be monitored, and log haul temporarily suspended during prolonged periods of precipitation when soil moisture becomes elevated (when rutting other damage are occurring). If maintenance cannot be performed adequately due to weather, haul will be discontinued until conditions improve.</td>
<td>Avoid rutting and compaction damage to susceptible wet soils.</td>
<td>MODERATE (Avoid activity when impact would occur)</td>
<td>Forest Plan S&amp;Gs Soils; #s 1, 2, 3</td>
<td>Forest Service Project Administrator and/or Project Engineer after consultation with Forest</td>
</tr>
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<td>TR3 - For any timber sale temporary access roads identified to remain in place over the winter into a second year of operation, use drainage features (culverts and/or water bars) that would accommodate a 100-year flood and associated debris flow, Including seeding and mulching of any disturbed soils. ROD – RF-4 and RF-5</td>
<td>Prevent erosion and/or mass wasting and road damage.</td>
<td>MODERATE (Relatively new requirement, but based on permanent road requirements)</td>
<td>USDA FS USDI BLM 1994 p. C-30, RF-4 and RF-5</td>
<td>Hydrologist, Fish Biologist, or their representative</td>
</tr>
<tr>
<td>TR4 – Hauling outside of the Normal Operating Season may require additional spot rock ing as needed in order to protect and maintain National Forest system roads. Amounts, extents and location of spot rock ing will be as needed to facilitate wet weather haul.</td>
<td>Preservation of roadway; prevent silt-laden water from entering stream.</td>
<td>MODERATE</td>
<td>BMPs T-5;R-3;R-7</td>
<td>Timber Sale Administrator or Project Engineer after consultation with a Forest Hydrologist</td>
</tr>
<tr>
<td>TR5 – As conditions require, to minimize sediment delivered to streams, sediment filters (straw bales, slash filter windrow, and/or sediment fence) will be placed in ditches lines along the haul route or in areas where ground is disturbed and sediment has the potential for delivery to streams (i.e. stream crossing fills). Sediment filters will be maintained and adjusted as needed. Removal of sediment filters will be done when site conditions are dry, and captured sediment will be relocated to stable locations away from stream courses.</td>
<td>Preservation of roadway; prevent silt-laden water from entering stream.</td>
<td>MODERATE</td>
<td>BMPs T-5;R-3;R-7</td>
<td>Timber Sale Administrator or Project Engineer</td>
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<tr>
<td>Wildlife</td>
<td>To maintain suitable habitat for listed species</td>
<td>HIGH Forest Experience</td>
<td>ESA Section 7 consultation</td>
<td>Project administrator, layout personnel, Timber sale contract and administrator, or their representative</td>
</tr>
<tr>
<td>WL1 - Activities will not occur within or modify suitable nesting, roosting or foraging habitat for the northern spotted owl, or marbled murrelet nesting habitat, suitable nest trees or buffer trees.</td>
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<td>WL2 – Wildlife biologist will be consulted prior to implementation to ensure that recreation management and watershed restoration activities</td>
<td>To prevent impacts to habitat for Survey</td>
<td>HIGH Forest</td>
<td>NWFP</td>
<td>Project administrator,</td>
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<td>will not occur within or affect suitable habitat for survey and manage wildlife species.</td>
<td>and Manage Species</td>
<td>Experience</td>
<td></td>
<td>Timber sale contract and administrator, or their representative</td>
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<tr>
<td>WL3 – Trees greater than 20 inches DBH will generally not be cut in LSR. Any trees greater than 20 inches DBH that are required to be cut for operations or safety will remain on site as coarse woody debris.</td>
<td>To maintain and retain late-successional conditions</td>
<td>HIGH Contract requirement</td>
<td>AMA plan implementation – exemption to REO letter</td>
<td>Timber sale contract and administrator, or their representative</td>
</tr>
<tr>
<td>WL4 – Retain existing down woody debris and standing snags that are not deemed a hazard.</td>
<td>Maintain and enhance habitat diversity</td>
<td>MODERATE - LOW Availability within project stands.</td>
<td>Wildlife Forest-wide S&amp;G (p. 4-124)</td>
<td>Timber sale contract and administrator, or their representative</td>
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<tr>
<td>WL5 – Any raptor nests or bald eagle winter roosts discovered in proximity to activities will receive appropriate protection buffers and/or seasonal operating restrictions at the discretion of the wildlife biologist. If a raptor nest site or bald eagle winter communal roost is incidentally located during the course of sale layout or project implementation activities will stop and a Forest Service Wildlife Biologist will be consulted.</td>
<td>Minimize changes to microhabitat features adjacent existing nest sites &amp; the protection of active nest sites and communal bald eagle roosts</td>
<td>HIGH Forest Experience</td>
<td>Migratory Bird Act Wildlife Forest-wide S&amp;G (4-125) Bald and Golden Eagle Protection Act (Eagle Act). Final Rule Federal Register on September 11, 2009.</td>
<td>Wildlife Biologist, Project administrator, Timber sale administrator, or their representative</td>
</tr>
<tr>
<td>WL6 – Trees with interlocking branches with trees that have suitable nest structure for owl and murrelet nest would be retained (visible suitable cavities or nest structure (platforms 4” at 30 ft.).</td>
<td>Maintain microhabitat conditions around potential nest trees</td>
<td>HIGH Forest Experience</td>
<td>ESA Section 7 consultation</td>
<td>Timber sale contract, layout and Timber sale administrator, or their representative</td>
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<tr>
<td>WL7 - Any tree ≥ 21 inch dbh located in adjacent old-growth habitat proposed as a tailhold tree or anchor will first be field reviewed by a Forest Wildlife Biologist or their representative to determine if the selected tree is a spotted owl or marbled murrelet potential nest tree (PNT). All tailhold trees will be retained as future wildlife trees.</td>
<td>Protect occupied nest trees of federally protected species (northern spotted owl and marbled</td>
<td>HIGH Contract requirement</td>
<td>Wildlife Forest-wide S&amp;G (4-124)</td>
<td>Timber sale contract and administrator, or their representative</td>
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<td>WL8 - The thinning prescription would designate wildlife trees to retain that include dominant trees for future large snags, and marking of deformed green trees to retain for future wildlife trees. Snags would be created or protected through treatment of green trees with high stumping of hazard trees, and leaving green trees around snags of greater than 21 inches.</td>
<td>Snags and green trees would be designated for retention during sale layout to meet standards and guidelines for cavity nesters</td>
<td>HIGH Contract requirement</td>
<td>Wildlife Forest-wide S&amp;G (4-124)</td>
<td>Timber sale contract and administrator, or their representative</td>
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<td>WL9 - Activities generating noise above ambient levels will not occur between March 1 and July 15, within 65 yards (e.g. Chainsaws, heavy equipment) or 0.25 mile (Blasting) of suitable habitat in spotted owl core areas (0.7 mi radius around activity center) determined to have a high occupancy probability. Slash pile burning and broadcast burning would not occur within this period when within ¼ mile of suitable habitat of these same core areas.</td>
<td>Minimize disturbance to adult spotted owls during peak nesting period and brooding of young owlets</td>
<td>HIGH Forest Experience, references in BO (USDI FWS 2002)</td>
<td>BA (USDA FS 2002) BO (USDI FWS 2002) ESA Section 7 consultation</td>
<td>Project administrator, Timber sale contract and administrator, or their representative, and Forest fire staff</td>
</tr>
<tr>
<td>WL10 - Activities generating noise above ambient levels would not occur between April 1 and September 23 when within 110 yards (e.g. Chainsaws, heavy equipment) or 0.25 mile (Blasting) of suitable habitat with a high occupancy probability. Elsewhere, noise generating project activities would occur between two hours after sunrise to two hours before sunset when within 110 yards of suitable nesting habitat, between March 1 and Sept 23.</td>
<td>Reduce the potential disruption of marbled murrelet feedings or nesting.</td>
<td>MODERATE 90% impacts reduction post-incubation stage; pre-incubation, the, mitigation would be ineffective</td>
<td>ESA Section 7 consultation</td>
<td>Project administrator, Timber sale contract and administrator, or their representative</td>
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<td>WL11– All project activities associated with timber harvest operations including related road reconstruction/temporary road construction within or adjacent to mountain goat wintering habitat (MA 15) would not be permitted between October 31 and June 15.</td>
<td>Protect wintering mountain goats</td>
<td>HIGH Contract requirement</td>
<td>Wildlife Forest-side S&amp;G (4-124)</td>
<td>Timber sale administrator or their representative</td>
</tr>
<tr>
<td>WL12 – Slash pile burning and broadcast burning would occur during the time period of Sept 5 to February 28, when within ¼ mile of suitable marbled murrelet habitat.</td>
<td>Reduce the potential disruption of marbled murrelet feedings or nesting</td>
<td>HIGH Contract requirement</td>
<td>ESA Section 7 consultation</td>
<td>Timber sale contract and administrator, Forest fire staff and wildlife biologist</td>
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<td>WL14 - Canopy gaps, heavy thins, temporary roads or permanent elk forage openings would not be created within 100 feet of old forest edges</td>
<td>Maintain integrity of old and mature forests adjacent to proposed vegetation management units</td>
<td>MODERATE Contract requirement</td>
<td>ESA Section 7 Consultation</td>
<td>Timber sale contract and administrator, or their representative</td>
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<tr>
<td>W15- All harvest, road construction and reconstruction activities will not be permitted between May 15 and July 1 within units where elk calving habitat has been identified. This seasonal restriction does not apply to timber haul on roads through these units from unrestricted units.</td>
<td>Minimize/avoid disturbance to elk calving habitat</td>
<td>HIGH, logic (measure will be inserted into the contract)</td>
<td>Wildlife Forest-wide S&amp;G (4-125)</td>
<td>Project and sale administrator, FS staff</td>
</tr>
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</table>
Alternatives Considered but Eliminated from Detailed Study

The following alternatives represent those that were considered by the IDT and responsible official, but for various reasons, were eliminated from detailed study. These alternatives were considered to address the purpose and need; concerns raised during public scoping for this project; informal collaboration meetings; public involvement with recent, similar Forest projects, and concerns raised during monitoring of similar District projects that were implemented in the past. Many of the project design criteria described for the proposed action are a result of review and consideration of the alternatives proposed by commenters.

Recreational Target Shooting Alternatives

Several alternatives were considered but not fully developed regarding recreational target shooting. These include: closing the area entirely to target shooting; closing the area to target shooting while leaving some designated corridors open to this activity; closing the first five miles of FSR 70 (from Hwy 410) to target shooting; closing an area near Government Meadows to target shooting; establishing a one mile buffer adjacent to highway 410 that would be closed to target shooting; and including improvements for recreational shooters, such as parking capacity or shooting lanes, at additional sites.

During the analysis process, the IDT assessed the overall project area and existing shooting sites. Sites were evaluated for resource damage and their capacity to be safe and legal recreational target shooting areas. The IDT concluded sites that may be illegal per 36 CFR 261.10 (d) did not require any additional closure orders. The project area is heavily used for numerous recreation activities, and large areas of target shooting closure could present an enforcement challenge. In addition recreational target shooting, in appropriate locations, has been a longtime approved use on the MBS when done safely and with respect for the land and property. The respect of the recreational shooting community to the one year closure for public safety that is in place on the FSR 7013 pit area, has contributed to coordinating with interested groups to clean up areas with some resource degradation issues instead of proposing additional closures at this time. Therefore, an alternative including additional recreational target shooting area closures was not fully developed.

Alternative 2, the proposed action, includes two recreational shooting pit areas for site improvements. The IDT considered additional areas for improvements, however some were in locations that the team was concerned may not have convenient enough access. In addition, recreational sites with the enhancements proposed in alternative 2 would be new to the MBS, and the team determined there would be benefit in post-implementation evaluation of their success prior to evaluating additional sites. Therefore, additional sites to augment recreational target shooting opportunities were considered but not fully developed.

No Temporary Roads

An alternative that excluded the use of temporary roads, whether newly constructed or reconstructed from previously used road beds, would only allow treatment of stands adjacent to existing roads and/or would require the use of helicopter logging. Helicopter logging would not be a viable alternative for accessing many stands with high residual canopy covers, and would not be economically viable for most stands. Furthermore, helicopter logging creates noise that can impact federally listed species such as the northern spotted owl, which could limit the time of implementation in an area where operating seasons may already be limited due to weather. The
result would likely be an inability to implement the actions proposed and in inability to achieve the desired conditions.

Road Reroutes

Road relocation is used to move a segment of a system road to a higher capability part of the landscape, and eliminate its undesired interaction with road crossings, riparian areas and floodplains. Segments of NFS system roads are decommissioned and re-routed, using other adjacent system roads. Access to the same/similar part of the landscape is maintained but the road segment is moved. The IDT considered a few road reroutes but eliminated them from detailed consideration after assessing specific site and resource conditions on the ground.

One specific road relocation considered then eliminated was in the West Fork White River subwatershed to reroute a section of FS Road 75, and decommission about 0.6 mile of Road 75 that includes eight cross-drain culverts and two culverts that are barriers to fish migration. The relocation would have begun at the intersection of the 7500-410 spur, utilize about 0.1 mile of the 7500-410, constructed a new connector segment about 0.33 mile to the 7560-110, following for 0.2 mile to its intersection with Road 7560. The reroute would have used the lower 1.3 mile of Road 7560 to its junction with the 7550 then 0.4 mile to Road 7500. This option would not decommission enough road (would have had to be 1 for 1, as the new dead end would be needed for stand treatments).

A reroute was considered in the Twentynight Mile Creek drainage that would have connected FS Road 72 with 7258-110 to decommission approximately three miles of Road 72. Due to the topography, a new crossing was not feasible.

In the Huckleberry Creek drainage, a reroute connecting FS Rd 7300-180 with 7300 was reviewed. It was determined the new route would likely have drainage issues and may also need to be constructed through older forest.

Road to Trail and User Created Trails

During the initial project development process of this project, there were several areas and trails within the project area that the public recommended as additional trail routes to the current Forest Service trail system. The IDT evaluated some current non-system trail routes and decommissioned road beds, including roads proposed for decommissioning in this EA, for potential adoption into the current Forest Service trail system. In general, decommissioned or proposed decommissioned roads would not appreciably add to trail system connectivity, and road decommissioning may be implemented in a way that allows for these old roads to still be utilized on foot. Some road to trail conversion is proposed and fully analyzed in this EA for the Naches Trail area. User created routes or trails may be retained, pending resource conditions, but are not being considered for addition to the Forest Service trail system in this EA to prevent further impacts on the Forest’s trail maintenance budget.

Add Unclassified, non-system roads that are managed to NFS road system

The IDT considered adding unclassified, non-system roads, proposed for use, or currently being used, to the NFS road system. These either have existing templates on the ground or were previously system roads that were decommissioned. Priority consideration was given to these unclassified roads that may require culverts, or other aquatic resource improvements, if used during commercial harvest implementation. Some roads do not appear in the NFS road system, but are used by Forest Service staff to access and maintain administrative or recreational sites. As
a result of public input and previous objection resolution processes, this alternative was not fully
developed or analyzed. Some of these roads are proposed for temporary use and fully considered
in this EA as temporary roads.

Government Meadows
The IDT proposed to restore the function of the Government Meadows ecological complex in
order to maintain source groundwater flows important to maintaining downstream water quality
and base flow conditions, as well as native plant communities. Additional field work and review
led the team to conclude that more detailed study would be needed to propose an adequate
restoration plan for this area, and that necessary additional time was not compatible with the
timing scheduled for the Snoquera project. This does not preclude future studies or proposals.

Environmental Impacts of the Proposed Action
and Alternatives

This section summarizes the potential impacts of the proposed action and alternatives for each
impacted resource. Project acres presented in this EA are derived from GIS planning-level
shapefiles involving information-based layers and associated attribute files. Slight discrepancies
that may appear between reports are likely due to rounding errors.

Forest Vegetation

Methodology
Identification of previously harvested stands using existing maps and polygons created using
geographic information systems (GIS). Light Detection and Ranging (LIDAR) is a remote
sensing method that can be used to collect measurements which can then be used to create three-
dimensional models and maps of objects and environments. LIDAR was used to estimate tree
canopy height, locate streams and drainages, locate old roads, and estimate percent slope and
aspect. Stands were characterized using gradient nearest neighbor (GNN) methods based on
Current Vegetation Survey (CVS) and Forest Inventory and Analysis (FIA) data.

Recent stand exams from the Upper White River Vegetation and Restoration Project, which
overlaps a portion of the Snoquera project area, were used as examples of potential growth and
stand development that could be expected in the Snoquera project. The stand exams included data
collected from many of the Elk Forage stands included in this project and from stands within the
Snoquera project area with similar stand and site conditions to units proposed for Snoquera.
Many of the stands included in the stand exams were recently included in recent timber sales
authorized by the Upper White River Vegetation and Restoration Project Decision Notice in 2012.

Indicators were selected to show how alternatives respond to the Need for the Proposal and, in the
case of elk forage treatments, to the ROD for the Huckleberry Land Exchange (USDA Forest
Service 2001b). Indicators selected to show the effects of the proposed action and alternatives on
the forest vegetation resource are:

- Number of acres treated to improve health and vigor and to accelerate late-successional
  and old-growth habitat through variable density commercial thinning
- Number of acres treated to improve health and vigor and to accelerate late-successional and old-growth habitat through variable density non-commercial thinning
- Number of acres treated to accelerate late-successional and old-growth habitat by planting areas affected by high-severity fire
- Acres of openings and forage habitat in MA 8E
- Million board feet (MMBF) of timber harvested

**Spatial and Temporal Bounding of Analysis Area**

The spatial boundaries for analysis of effects to forest vegetation related to thinning and elk forage production are the boundaries of previously harvested stands within the project area. The stands previously harvested include lands harvested under management by the Forest Service as well as stands harvested under ownership of industrial forest landowners in sections that have been acquired by the Forest Service after original industrial timber harvest. The spatial boundaries also include areas of high fire severity in the Norse Peak Fire in 2017. The high fire severity areas would have effects related to proposed planting, but would not have effects from timber harvest since no timber harvest is proposed in those areas.

The proposed activities would have short-term effects that are caused directly by the silvicultural treatments and timber harvest over approximately 15 years. The proposed activities would have long-term effects that influence stand development throughout the life of the stands which could last several hundred years.

**Affected Environment**

Historically, large fires were the major natural disturbance factor that led to the current condition of the vegetation as discussed above in the Landscape Restoration Context for Snoquera Project Area section. Smaller scale disturbances from insects, diseases, animals, and wind have affected individual trees or groups of trees, but generally have not had a pronounced effect on entire stands or at the landscape level. Prevailing winds in this area are from the southwest, bringing storms over Mt Rainier, dumping precipitation and then passing over the Snoquera analysis area before more moisture is accumulated in them. This rain shadow effect leaves the Snoquera area generally drier than other areas of the Forest USDA Forest Service, 2000).

The Forest Service conducts aerial surveys to identify insect and disease activity at the time of the survey and to provide an overview of recent tree damage and damage agents. The most common cause of tree mortality identified in the surveys was bear damage. Although bear damage has increased recently, especially in the Huckleberry Ridge area, the damage occurs in small numbers and in scattered pockets throughout the planning area. Other damage agents such as fir engravers, Douglas-fir beetles, and root diseases were also identified, also in small numbers (Mehmel 2018). Overall, the mortality identified through the surveys creates small canopy gaps, thus introducing some within stand variability, but does not produce notable impacts on forest vegetation at larger scales.

The current condition of the stands considered for treatment in this project is largely the result of past timber harvest, frequently followed by broadcast burning, planting and in some cases, non-commercial thinning or fertilization. Very little timber harvest in the project area occurred prior to 1950. Starting in the 1950s timber harvest, primarily clearcut regeneration harvesting, became a common practice and continued until the early 1990s (Table 12). Young stands regenerated
following clearcut harvest are generally structurally simple and have few late-successional or old-growth characteristics such as large trees. See the Landscape Restoration Context for Snoquera Project Area section for a more extensive description of the stand structure of current stands resulting from previous clearcut harvest.

Table 12. Clearcut harvest by decade within the Snoquera project area

<table>
<thead>
<tr>
<th>Decade</th>
<th>Acres Harvested</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930s</td>
<td>67</td>
</tr>
<tr>
<td>1940s</td>
<td>320</td>
</tr>
<tr>
<td>1950s</td>
<td>3,195</td>
</tr>
<tr>
<td>1960s</td>
<td>5,439</td>
</tr>
<tr>
<td>1970s</td>
<td>13,992</td>
</tr>
<tr>
<td>1980s</td>
<td>15,820</td>
</tr>
<tr>
<td>1990s</td>
<td>2,588</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41,421</td>
</tr>
</tbody>
</table>

The age of the stands proposed for treatment range from approximately 20 years to 62 years across the project area. Table 13 displays current average stand conditions by potential vegetation zone.

Table 13. Snoquera stand data summarized by potential vegetation zone

<table>
<thead>
<tr>
<th>Potential Vegetation Zone</th>
<th>Canopy Cover (%)</th>
<th>Basal Area (Sq Ft / Ac)</th>
<th>QMD (Inches in overstory)</th>
<th>Trees per Acre (&gt; 1 inch)</th>
<th>SDI (All tree size classes)</th>
<th>Volume per Acre (CCF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific silver fir zone</td>
<td>72</td>
<td>166</td>
<td>12.6</td>
<td>554</td>
<td>330</td>
<td>55</td>
</tr>
<tr>
<td>Western hemlock zone</td>
<td>70</td>
<td>156</td>
<td>12.9</td>
<td>450</td>
<td>311</td>
<td>51</td>
</tr>
</tbody>
</table>
Approximately 3,588 acres were burned at high severity in the Norse Peak Fire in 2017 (RAVG, 2017). Figure 14 shows an area typical of the high severity burn areas of the Norse Peak Fire. Approximately 75% or more of the total basal area of trees were killed in the high severity burn areas. All of the area burned at high severity within the project area is in late-successional reserve and most of the high severity burned acres are within the Norse Peak Inventoried Roadless Area.

Environmental Consequences

Direct and Indirect Effects

**Alternative 1 - No action**

No direct effects would occur as a result of this alternative. The stands would continue to grow in dense conditions, causing additional suppression mortality (Oliver and Larson, 1996). This mortality would lead to a higher number of snags than if the stands were thinned, although they would mostly be from suppressed or intermediate crown classes and therefore relatively small and short-lived. Quadratic mean diameter would be lower than if thinned, since tree growth rates would be below potential due to continued competition for growing space and resources, and small trees would not be removed (Tappeiner, Maguire, Harrington, & Bailey, 2015) (Oliver & Larson, 1996). Given current stand ages and conditions, another 100-200 years could be needed for development of old growth structural characteristics. Crown width and branch diameter in dominant and co-dominant trees would be limited by competition for light between adjacent trees.
Higher tree density could contribute to increased stress and higher height-diameter ratios, making trees more susceptible to breakage, windthrow, and attack by insects or disease.

Approximately 3,588 acres of high severity burned area within the perimeter of the Norse Peak Fire, and within the Snoquera project area, would rely entirely on natural re-seeding of conifers. Much of the high severity fire areas are at upper elevations where the most common conifer species prior to the fire were noble fir and subalpine fir. Most noble fir seed falls within one to two tree heights of the tree and about one-half of subalpine fir seed falls within about 100 feet of the tree (Burns & Honkala, 1990). Seed production of noble fir has been found to start at about 20 years of age. Without a seed source in the interior of the high severity fire area, re-seeding would take many decades.

No openings for elk forage production would be created. Stands identified for elk forage production following the Huckleberry Land Exchange are currently in the stem exclusion stage (Oliver and Larson 1996) and would continue to develop through the understory reinitiation stage and eventually into the old growth stage. Open stand conditions would not be present until a disturbance event such as a fire or a large insect outbreak or wind event occurs.

No timber would be harvested and there would be no contribution to local and regional economies by providing timber or other forest products.

**Alternatives 2 and 3**

The effects of alternatives 2 and 3 on forest vegetation are essentially the same. Recreation enhancement projects are the only actions that differ between alternatives 2 and 3 and the recreation enhancement projects will have a negligible effect on forest vegetation.

This section will describe the direct, indirect and cumulative effects as they relate to forest vegetation components of the need for proposal identified above. Specific actions and the components of the need for proposal addressed in this section include variable density thinning, planting, and creation of permanent openings to increase elk forage production.

Variable density thinning is designed to address several components of the need for the proposal including: accelerating late-successional and old-growth habitat, increasing forest biological complexity, maintaining or improving forest health and vigor to meet multiple resource objectives, speed the development of large conifers and hardwoods in riparian areas, contributing to local and regional economies by providing timber.

Planting is proposed in some portions of areas the Norse Peak Fire burned at high severity in 2017. All areas proposed for planting are within LSR land-use allocations (Table 1) and are designed to accelerate development of late-successional and old-growth habitat.

Creating openings and thinning to increase elk forage habitat would contribute toward accomplishing the intent of the Huckleberry Land Exchange ROD (USDA Forest Service, 2001). Elk forage habitat openings and thinning would take place within the Greenwater Special Management Area 8E (Table 1).

Table 14 displays the estimated acres treated by both commercial and non-commercial variable density thinning, planting, elk forage production, and timber volume harvested for alternatives 1, 2, and 3.
### Table 14. Resource indicators and measures for alternatives 1-3 direct/indirect effects

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of acres treated to improve health and vigor and to accelerate late-successional and old-growth habitat through variable density commercial thinning</td>
<td>0</td>
<td>Up to 12,245 acres</td>
<td>Up to 12,245 acres</td>
</tr>
<tr>
<td>Number of acres treated to improve health and vigor and to accelerate late-successional and old-growth habitat through variable density non-commercial thinning</td>
<td>0</td>
<td>Up to 1,883 acres</td>
<td>Up to 1,883 acres</td>
</tr>
<tr>
<td>Number of acres treated to accelerate late-successional and old-growth habitat by planting areas affected by high-severity fire</td>
<td>0</td>
<td>Up to 3,588 acres</td>
<td>Up to 3,588 acres</td>
</tr>
<tr>
<td>Acres of openings and forage habitat in MA 8E</td>
<td>0</td>
<td>389 acres</td>
<td>389 acres</td>
</tr>
<tr>
<td>Million board feet (MMBF) of timber harvested</td>
<td>0</td>
<td>63</td>
<td>63</td>
</tr>
</tbody>
</table>

### Variable Density Thinning

Up to 12,245 acres of commercial thinning and 1,883 acres of non-commercial thinning would occur under alternatives 2 and 3 (Table 14). The actual acres treated would likely be substantially less than that. Silvicultural treatments would be implemented over a period of 10 to 15 years. The number of acres actually treated would be determined during implementation based on the project design criteria (Table 11) and the projected costs and revenues at the time of implementation. Experience on the Mt. Baker-Snoqualmie National Forest in recent years has been that only 30% to 50% of the total acres identified for potential commercial thinning are actually treated. The most common reasons for reductions in acres treated have been the relatively high costs of logging and transportation systems compared to the expected revenue from commercial thinning, portions of units not treated because of riparian area no-cut buffers, areas inaccessible to logging equipment, and acres deleted for protection of wildlife habitat.

Stands proposed for non-commercial thinning acres might be left untreated because of lack of funding or because the cost of non-commercial thinning is too high relative to the benefits that would be gained by the treatment. Trees in stands thinned at a young age typically retain larger crowns and respond more quickly than trees in stands thinned at a later age after crowns have started receding (Tappeiner, et al 2015). Conversely, the cost of non-commercial thinning typically increases in older stands with larger trees because of the size of the trees thinned and cost of treating the high volumes of slash created by the thinning in order to reduce fire risk.

Stands would be thinned with a variable density prescription to an average stand density index of 225 to 350. Variable density thinning in comparable stands on the Mt. Baker-Snoqualmie National Forest have produced approximately 15 MBF/acre. Assuming 30% of the total stand area is commercially thinned, approximately 55 million board feet of timber would be harvested in the variable density thinning treatments over the 10-15 years estimated for implementation.

Portions of the commercially thinned stands would not be thinned because they are in no-cut riparian or wetland buffers, are in areas of sensitive or unstable soils, cannot be accessed by timber harvesting equipment, or are otherwise unsuitable for treatment. These “skips” are part of the project design, and no harvest activity would occur in them. Small skip areas would be used as needed to protect legacy features such as large snags and remnant old-growth trees from disturbance during harvesting. Such unthinned areas may help conserve mycorrhizal fungal mats by minimizing soil disturbance in the unthinned areas and allowing fungal recolonization as residual trees increase growth and carbohydrate flow to their root systems increases (Carey, 2003).
Gaps approximately ¼ to ½-acre in size would be located in 3 to 10% of the total stand area. All merchantable trees under 20” DBH would be harvested within gaps, except for minor species that are retained for species diversity. Within gaps canopy closure would be greatly reduced, possibly providing enough light for shade-intolerant trees species such as Douglas-fir and red alder to regenerate. The amount of light reaching the forest floor depends on the height of the surrounding tree canopy, aspect, and orientation of the opening relative to the angle of sunlight, so combined with the availability of seed from mature trees nearby the regeneration of shade-intolerant species is not entirely predictable. The small gap areas would provide limited patches of early-seral vegetation within the treatment stands.

Heavy thin patches approximately ½ to 3 acres in size would be located in 3 to 10% of the total stand area. Patches would be thinned to less than 50 trees per acre. Immediately after thinning relative density and canopy closure would be reduced to the degree that even after tree crowns expand after thinning to capture more available light, small gaps in the canopy would allow light to reach the forest floor. This additional light would benefit existing understory trees and increase abundance of understory vegetation. Large branches develop on widely spaced trees (Maguire, et al, 1991), so this treatment would increase the development of large branches and thus availability of nesting platforms for marbled murrelet in the future. Preference for retaining Douglas-fir as leave trees would create opportunities for epicormic branch development (new branch growth from dormant buds on the trunk) when additional light is available to the sides of the trees. Epicormic branches are an important habitat characteristic of old-growth forests and provide platforms that are important for wildlife and epiphytic plants.

The additional light available to the forest floor after thinning would provide for increased understory vegetation and growth of tree seedlings to create a multi-layered canopy. If the increase in understory vegetation leads to an increase in use of the area by deer, natural regeneration of western redcedar may be limited by deer browse as cedar is typically preferred over other conifer species.

Thinning may be used in dense young stands where the management objective is to speed development of old-growth characteristics (Tappeiner et al, 2015). With more resources available to the trees remaining following a thinning treatment, trees can be grown to large diameters at a faster rate ((Harrington, Roberts, & Brodie, 2005) to provide late-successional stand characteristics earlier. In overstocked stands, crowns expand, diameter growth increases and height growth increases (Tappeiner et al, 2015). Flower and fruit production of understory shrubs can be enhanced by thinning ((Wender, Harrington, & Tappeiner, 2004) (Thysell and Carey, 2001).

In stands on the Olympic Peninsula similar in age to those included in this project, one recent study found significant increases in the diameter growth of individual trees within 5 years of a variable density thinning treatment (Roberts and Harrington, 2008). A subsequent study 14 years after thinning indicated that the largest trees did not show an increase in diameter as a result of thinning, but the more shade tolerant trees in the mid-canopy showed an increase in size and crown depth (Willis, Roberts, & Harrington 2018).

Skips provide undisturbed areas within thinning operations that continue to suppress the development of an understory and maintain a component of dense overstory lacking much understory vegetation, providing for species of birds and small mammals that need closed canopy forest. These areas can be used to provide protection to existing snags and logs during thinning. Their locations around existing snags or coarse woody debris concentrations can appear random.
Gaps can increase the development of very large crowns and stems on edge trees that are able to occupy additional growing space and can allow the rapid introduction and development of a mid-level canopy of conifers and hardwood trees and shrubs. Gaps can range in size with the largest being the most effective in providing understory development of shrubs and forbs (Fahey and Puettmann, 2008).

Heavily thinned areas (less than 50 trees per acre) would encourage development of large tree characteristics of those found in old-growth stands.

Trees respond to thinning with crown expansion (in both width and length), and increasing foliage density (Tappeiner, 2015). Research has shown increased spacing results in increased crown volume and surface area. Thinning generally does not affect height growth of dominant and co-dominant trees on productive sites, except for a possible temporary thinning shock immediately after harvest (Tappeiner, 2015).

Thinning can also improve a stand’s resistance to wind. Height to diameter ratios of trees in the stand are reduced by thinning, although there is a period of time where a stand may be considered more vulnerable immediately after thinning, in the long term, trees can become more vigorous and stable with thinning (Tappeiner, 2015). The dominant trees in a stand typically exhibit lower than stand-average ratios and a thinning from below can favor these trees and improve the average stand height-to-diameter ratio.

Implementing the thinning proposed under Alternatives 2 and 3 would result in stands composed of farther spaced, larger trees, fewer trees in the lower crown classes (intermediate and overtopped), and a variety of conifer tree species. Structurally, the stands would include more variation. Small gaps would be created and heavy thinnings areas would be included as well as some areas of no treatment “skips”. All this variety is intended to created diversity of stand structure across the stands and across the landscape. The resultant harvested stands would have a generally mixed composition of Douglas-fir, western hemlock, western redcedar, and Pacific silver fir. Residual trees would be generally healthy, with good form, but trees with deformations beneficial to wildlife would be left to enhance wildlife habitat. Most leave trees would be those with the best growth in the stand, and most capable of taking advantage of the increased growing space created by the thinning disturbance.

The Silviculture Specialist Report for the Upper White Restoration and Vegetation Environmental Assessment (Lorentz 2012) modelled the effects of variable density thinning using Upper White stand exam data that are also within the Snoquera Project Area and are of similar age and site conditions to those included in the alternatives 2 and 3. FVS modelling predicted that residual stand density index on variable density thinning prescriptions like those proposed under alternatives 2 and 3 would be within the range of 225-350.

**Planting within the Norse Peak Fire perimeter**

Approximately 3,588 acres burned at high severity with greater than 75% reduction in basal area compared to the pre-fire condition. Mortality of conifers was at or near 100% over much of the high severity area.

All of the high severity area within the Snoquera Project Area is in LSR allocations where the management emphasis is on protecting or enhancing late-successional forest conditions, including providing large trees, snags and down wood. Planting would reintroduce conifers over a larger area than if the burned areas were left to regenerate naturally. Planting would entail variable spacing and low density intended to maintain horizontal variability, and would generally employ
the use of ½ to 5 acre founder stands over approximately 10 to 15 percent of the total high severity fire area to provide a seed source more quickly than if the entire area were left to regenerate naturally. By reinitiating conifer growth earlier, stands would progress to late-successional and old-growth conditions more quickly than if reinitiating conifer growth was left entirely to re-seeding from surrounding trees not killed by the fire.

**Elk Forage Habitat**

Approximately 389 acres of permanent elk forage habitat would be provided by creating openings and thinning to a density of approximately 35% canopy cover. 272 acres of openings, generally less than 10 acres in sized, would be created by clearcutting the stands and managing them as permanent forage openings. Approximately 117 acres within elk summer range would be thinned to approximately 35% canopy cover and maintained at that density to maintain elk forage habitat over time. Approximately six million board feet of timber would be harvested in the elk forage openings and thinnings.

**Cumulative Effects**

The spatial boundaries for analysis of effects to forest vegetation related to thinning and elk forage production are National Forest lands within the project area. The Landscape Restoration Context for the Snoquera Project earlier in this report describes a strategy used on the Mt. Baker-Snoqualmie National Forest to identify restoration opportunities across the forest to prioritize areas where active management will contribute to restoring ecological pattern and processes at the subwatershed scale. Model results indicated the subwatersheds associated with the Snoquera project area contained the greatest opportunity for active management to contribute to ecosystem restoration. The model further identified forest fragmentation and reduced wildlife habitat connectivity, primarily caused by past clearcut regeneration harvesting, as drivers of the need for restoration in the project area.

**No Action**

Under this alternative, the forested stands within the Project Area would continue to develop from the stem exclusion stage, through understory reinitiation as small canopy gaps begin to develop and finally to the old growth stage. Over time, patch sizes of late-successional and old growth habitat would increase, reducing forest fragmentation. Individual patches of late-successional and old growth habitat would become reconnected as stands develop. Modelling using the Forest Vegetation Simulator based on stand data collected from stands within the Snoquera Project area in similar stand and site conditions indicates that some old growth stand structure conditions would be present within about 88 years (Lorentz 2012).

**Alternatives 2 and 3**

As described in the Landscape Restoration Context, Old Growth Structure Index (OGSI 80) is a measure of the development of old growth characteristics at 80 years since the forested area was established following a disturbance. One of the objectives of variable density thinning in the Snoquera Project is to improve late-successional and old growth habitat by reducing forest fragmentation and increasing wildlife habitat connectivity. The proposed variable density thinning treatments would accelerate the development of some characteristics of late-successional habitat such as large tree size, multi-layered tree canopy, and understory vegetation.

Modelling using the Forest Vegetation Simulator (FVS) indicates that variable density thinning treatments like those proposed in alternatives 2 and 3 would reduce the time for stands to shift
from the stem exclusion stage into the old forest stage at about 66 years from present, as opposed to 85 years from present in the untreated stands; 19 years faster (Lorentz 2012).

Figure 15 - Figure 18 display changes in patch size and connectivity that would be improved through the variable density thinning treatments proposed in alternatives 2 and 3. The effects would vary throughout the project area. For example, in the area west of State Route 410 existing patches of OGSI 80 are highly fragmented due to past clearcut timber harvest (Figure 15). The fragmented patches of OGSI 80 habitat in that area would be reconnected more rapidly as the proposed treatment stands develop late-successional habitat conditions. Figure 16 shows the stands in the Lower Greenwater subwatershed. Much of the Lower Greenwater subwatershed was acquired recently and was previously managed as industrial forest land. Patches of OGSI 80 do not exist in much of the subwatershed. In the Lower Greenwater subwatershed, the variable density thinning treatments would accelerate the development of large patches of late-successional and old growth habitat.
Figure 16. OGSI 80 landscape categories for LSR stands in the Lower Greenwater subwatershed showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat.

Figure 17. OGSI 80 landscape categories for matrix stands in the Upper Green watershed showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat.
Figure 18. OGSI 80 landscape categories for Snoqualmie Pass AMA stands showing proposed variable density treatments stands that would increase patch size and connectivity of wildlife habitat.

Compliance with law, regulation, policy, and the Forest Plan

All Alternatives would meet Forest Plan Standards and Guidelines. However, Alternative 1, No Action, would forego opportunities for silvicultural treatments to better meet wildlife habitat objectives.

Alternatives 2 and 3 would benefit the creation and maintenance of late-successional forest conditions, consistent with the Late-Successional Reserve Standard and Guideline in the Northwest Forest Plan ROD (p. C-12), and would control stocking, manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives consistent with the Riparian Reserve Standard and Guideline (p. C-32). Alternative 1, No Action, would not control stocking or further development of late-successional forest conditions.

Wildlife

Affected Environment

Additional information for the species discussed herein is provided in the Wildlife Specialist Report (project record). Table 15 provides the list of threatened, endangered, and sensitive species; Management Indicator Species, species of concern, Survey and Manage species; and
migratory birds considered in this analysis. The table also indicates each species’ status on the Mt. Baker-Snoqualmie National Forest.

The section entitled “Landscape Restoration Context for the Snoquera Project Area” describes factors contributing to the current state of terrestrial and aquatic habitat for wildlife species in the project area. Figure 4 - Figure 7 show the current distribution of mature and older forest in the project area. Considerable habitat fragmentation has occurred in portions of the project area as a result of past clearcut timber harvesting, along with associated road construction and railroads (USDA 2000). This has led to reduced habitat connectivity and fragmented late seral habitats for a number of species. The late-successional reserve that encompasses much of the project area (LSR 125) was identified as a high priority for treatment given that the proportion of early seral and mid-seral stands was determined to be too high to provide adequate habitat for spotted owls and other late-successional or old-growth species of wildlife (USDA 2001).

Species Considered
The following federally listed endangered and threatened, Forest Service Sensitive, Management Indicator Species (MIS) and other species are addressed in this document. These species are known to or are suspected to occur in the project area or were historically present (Table 15).

Table 15. Terrestrial Wildlife Species Considered for the Snoquera Project Area Analysis

<table>
<thead>
<tr>
<th>Species or Habitat</th>
<th>Status</th>
<th>Preferred Habitats</th>
<th>Occurrences in or Adjacent to Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Spotted Owl (<em>Strix occidentalis caurina</em>)</td>
<td>Threatened/MIS</td>
<td>Mature, old-growth forests (nesting, roosting, foraging); second-growth used for dispersal</td>
<td>Documented</td>
</tr>
<tr>
<td>Northern Spotted Owl Critical Habitat</td>
<td>Designated</td>
<td>Primary Constituent Elements: Forest types that provide Nesting, Roosting, Foraging, and Dispersal habitat</td>
<td>Documented</td>
</tr>
<tr>
<td>Marbled Murrelet (<em>Brachyramphus marmoratus</em>)</td>
<td>Threatened</td>
<td>Mature, old-growth forests (nesting, roosting)</td>
<td>Documented</td>
</tr>
<tr>
<td>Marbled Murrelet Critical habitat</td>
<td>Designated</td>
<td>Primary Constituent Elements: Individual trees with potential nesting platforms (PCE-1), and forested areas within 0.5 miles of PCE-1 that have a canopy height of at least one-half the site-potential tree height (PCE-2).</td>
<td>Documented</td>
</tr>
<tr>
<td>Grizzly Bear (<em>Ursus arctos horribilis</em>)</td>
<td>Threatened/MIS</td>
<td>Core Security habitat with adequate forage and &gt; 300 m from motorized roads and high-use trails</td>
<td>Not documented</td>
</tr>
<tr>
<td>Gray Wolf (<em>Canis lupus</em>)</td>
<td>Endangered/MIS</td>
<td>Security habitat with reliable prey base and &gt; 300 m from road and high-use trails</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>American Peregrine Falcon (<em>Falco peregrinus anatum</em>)</td>
<td>Sensitive/MIS</td>
<td>Cliff habitat for nesting near adequate prey base</td>
<td>Documented</td>
</tr>
<tr>
<td>Bald Eagle (<em>Haliaeetus leucocephalus</em>)</td>
<td>Sensitive/MIS</td>
<td>Roost, nest habitat and forage areas near lakes, reservoirs, rivers with readily available food source (fish and carrion)</td>
<td>Documented</td>
</tr>
<tr>
<td>Common Loon</td>
<td>Sensitive</td>
<td>Large lakes</td>
<td>Suspected, but...</td>
</tr>
<tr>
<td>Species or Habitat</td>
<td>Status</td>
<td>Preferred Habitats</td>
<td>Occurrences in or Adjacent to Project Area</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>(Gavia immer)</td>
<td></td>
<td></td>
<td>not documented</td>
</tr>
<tr>
<td>Harlequin Duck</td>
<td>Sensitive</td>
<td>Swift, moving streams (rivers and creeks), adequate pool habitat for foraging and brooding.</td>
<td>Documented</td>
</tr>
<tr>
<td>(Histronics histronics)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern goshawk</td>
<td>Sensitive</td>
<td>Mature or old forest habitat for nesting</td>
<td>Documented</td>
</tr>
<tr>
<td>(Accipiter gentilis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little brown myotis</td>
<td>Sensitive</td>
<td>Conifer and hardwood forests, but also occupies open forests, forest margins, and shrub-steppe clumps of trees in open habitats, cliffs and urban areas</td>
<td>Documented</td>
</tr>
<tr>
<td>(Myotis lucifugus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Townsend's big-eared bat</td>
<td>Sensitive</td>
<td>Abandoned mine shafts and other human-made structures for roosting and hibernacula; Foraging in forest edges</td>
<td>Documented</td>
</tr>
<tr>
<td>(Corynorhinus townsendi)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain goat</td>
<td>Sensitive/MIS</td>
<td>Habitat of cliffs, isolated rock outcrops, forest cover in winter</td>
<td>Documented</td>
</tr>
<tr>
<td>(Oreamnos americanus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California wolverine</td>
<td>Sensitive</td>
<td>Large expanse of minimally disturbed habitats, persistent snow fields, &amp; reliable prey base.</td>
<td>Documented</td>
</tr>
<tr>
<td>(Gulo gulo luscus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cascade Red Fox</td>
<td>Sensitive</td>
<td>Inhabits the upper forest, subalpine parkland, and alpine areas of the Cascade Range. It is only found in Washington where it has been documented from 2,500 feet but primarily occurs above 4,900 feet.</td>
<td>Documented</td>
</tr>
<tr>
<td>(Vulpes vulpes cascadensis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giant Palouse Earthworm</td>
<td>Sensitive</td>
<td>Native habitat consists of the bunch grass prairies of the Palouse region. The fertile soil consists of deposits of volcanic ash and rich layers of organic matter.</td>
<td>Not documented</td>
</tr>
<tr>
<td>(Driloleirus americanus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broadwhorl Tightcoil</td>
<td>Sensitive</td>
<td>Includes abundant ground cover, conifer or hardwood overstory, and moderate to deep litter</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Pristiloma johnsoni)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shiny Tightcoil</td>
<td>Sensitive</td>
<td>Ponderosa pine and Douglas-fir forests at moderate to high elevations</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Pristiloma wascoense)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Bumblebee</td>
<td>Sensitive</td>
<td>A generalist forager and has been reported to visit a wide variety of flowering plants</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Bombus occidentalis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnson’s Hairstreak</td>
<td>Sensitive</td>
<td>Old-growth coniferous forests; associated with conifer mistletoe (genus Arceuthobium)</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Callophrys johnsoni)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melissa Arctic</td>
<td>Sensitive</td>
<td>Dry tundra, talus slopes, fellfields, rocky summits and saddles, ridges, and frost-heaved clear-cuts; generally occurs above the timberline, which, in Washington, is at about 7,000 to 8,000 ft.</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Oeneis Melissa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valley Silverspot</td>
<td>Sensitive</td>
<td>Inhabits windy peaks with nearby forest openings. It is also found in native prairies and grasslands, often</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td>(Speyeria zerene bremneri)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Federally-listed Threatened and Endangered Species

The Endangered Species Act of December 28, 1973, as amended requires every federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or results in the adverse modification of critical habitat. Consultation with the U.S. Fish and Wildlife Service will be facilitated for federally listed species using stand-alone consultations or programmatic consultation where appropriate. The grizzly bear, gray wolf, northern spotted owl and marbled murrelet are considered, with two of four listed species identified as the focal species for formal consultation. There is designated critical habitat for the northern spotted owl and marbled murrelet within the project area boundary. The project area is outside of occupied habitat for the lynx, which is high-elevation forest habitats of Washington in the northern Cascades, north of Interstate-90. Therefore, there would be no effect to the lynx from proposed activities and consultation is not required. The lynx will not be discussed further.

<table>
<thead>
<tr>
<th>Species or Habitat</th>
<th>Status</th>
<th>Preferred Habits</th>
<th>Occurrences in or Adjacent to Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Larch Mountain Salamander</strong> <em>(Plethodon larselli)</em></td>
<td>Sensitive/ Survey and Manage</td>
<td>Associated with hardwood logs, leaf litter, and beneath cool and moist rocks and talus.</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Van Dyke’s Salamander</strong> <em>(Plethodon vandykei)</em></td>
<td>Sensitive/ Survey and Manage</td>
<td>Associated with hardwood logs, leaf litter, and beneath cool and moist rocks and talus.</td>
<td>Not Documented</td>
</tr>
<tr>
<td><strong>Puget Oregonian (Cryptomastix devia)</strong></td>
<td>Survey and Manage</td>
<td>Mature to old growth conifers with bigleaf maples</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td><strong>Evening Fieldslug</strong> <em>(Deroceras hesperium)</em></td>
<td>Survey and Manage</td>
<td>Perennially wet meadows in forested habitats</td>
<td>Suspected, but not documented</td>
</tr>
<tr>
<td><strong>Pacific Marten</strong> <em>(Martes caurina)</em></td>
<td>MIS</td>
<td>Old-Growth and Mature Forest for denning, resting</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Pileated Woodpecker</strong> <em>(Dryocopus pileatus)</em></td>
<td>MIS</td>
<td>Old-Growth and Mature Forest</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Primary Cavity Excavators</strong></td>
<td>MIS</td>
<td>Availability of snags and downed Logs</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Neotropical Migratory Birds</strong></td>
<td>Species of Concern</td>
<td>Vegetation of all successional stages including diverse seral stages, water features and rock/cliff features.</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Mountain Goat Winter Range (MA-15)</strong></td>
<td>MR</td>
<td>Forested stands, steep rocky cliffs, projecting pinnacles, ledges, talus generally tree-line and below.</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Elk</strong></td>
<td>Local Species of Concern</td>
<td>Early seral habitats for foraging, forested areas for cover and snow interception.</td>
<td>Documented</td>
</tr>
<tr>
<td><strong>Columbian Black-tailed Deer</strong></td>
<td>Local Species of Concern</td>
<td>Forested areas with understory forage, small openings, and cover.</td>
<td>Documented</td>
</tr>
</tbody>
</table>

\*Documented – species is known/documented to occur in or adjacent (w/in 1 mile) of proposed project area.\n
Suspected, but not documented – species is known (documented) to occur within the Snoqualmie Ranger District, but has not been documented within or adjacent the project area.

Not documented – species considered locally extirpated, or not documented on the Snoqualmie Ranger District.
The Snoquera Project Area includes a large number of northern spotted owl activity centers that have been monitored in the Rainier Northern Spotted Owl Demographic Study Area (hereafter, Rainier DSA) from 1993 to the present. Monitoring indicates a very low occupancy in the Rainier DSA currently. Occupancy rates have declined in Washington in general (Duggar et al. 2016) and several different meta-analyses of population trends (Anthony et al. 2006, Duggar et al. 2016, and Forisman et al. 2011) have shown a continued decline of northern spotted owl populations across their range. The marbled murrelet also continues to display strong evidence of a declining population trend across its range (Lynch et al. 2017, Raphael et al. 2018), which includes the Mt Baker-Snoqualmie National Forest. While both the spotted owl and marbled murrelet are known to occur in the project area, neither the grizzly bear nor the gray wolf have been documented in the project area in recent history.

**Sensitive Species**

Designation as a “sensitive” species means that these species are given special management consideration to ensure their continued viability on National Forest lands. Forest Service Sensitive Species have no federal status and are managed under a Regional program. The species listed above are on the Regional Forester’s Sensitive Animal List for the Pacific Northwest Region, and are documented or suspected to occur on the Mt Baker-Snoqualmie National Forest.

**Survey and Manage Species**

Pre-disturbance surveys were conducted for the Larch Mountain Salamander and Van Dyke’s salamander within the proposed permanent elk forage enhancement openings. Neither species was detected during those surveys. Some of the areas of potential disturbance were below 1,500 feet elevation and would normally trigger pre-disturbance surveys for the mollusk, Puget Oregonian (*Cryptomastic devia*), but due to the lack of suitable habitat such as old-growth features and the mollusk’s obligate association with Bigleaf maple (*Acer macrophyllum*) habitats, pre-disturbance surveys were deemed unnecessary for this species. Likewise, suitable habitat for the evening fieldslug is not present in areas proposed for project activities. Pre-disturbance surveys were not required. Neither of those mollusk species has been documented on the Forest.

Proposed activities that would involve thinning in stands less than 80 years old, culvert replacement or removal, and riparian and stream improvement activities (riparian planting, recruitment and placement of large wood, road and trail decommissioning) fall under the Pechman Exemptions for pre-disturbance surveys for Survey and Manage Species and do not require pre-disturbance surveys. Pre-disturbance surveys for Survey and Manage fauna species were not required for all other activities proposed under the Snoquera Project. A Forest Service wildlife biologist determined that due to constraints on activities or lack of suitable habitat, the remaining proposed activities would not disturb suitable habitat or affect persistence for these species.

**January 2001 Survey and Manage ROD and Standards and Guidelines - Protection Buffer Species**

Protection Buffer species include the white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl. These are no records of these species in the project area.

The Northwest Forest Plan Standards and Guidelines call for protection of caves, and abandoned mines, wooden bridges and buildings that may be used as roost sites by bats, specifically fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, pallid bat, and Townsend’s big-eared bat. These roost site features could be located in or near the project area.
Management Indicator Species

Management indicator species (MIS) are animal species identified in the Mt Baker-Snoqualmie Nation Forest (MBS), Record of Decision (ROD) signed 1990, which was developed under the 1982 National Forest System Land and Resource Management Planning Rule (1982 Planning Rule) (36 CFR 219). Guidance regarding MIS are set forth in the Forest LRMP which directs Forest Service resource managers to (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS affected by such projects, and (2) at the forest scale, monitor populations and/or habitat trends of MIS, as identified in the LRMP. Viability assessments and estimated trends for habitat and populations of these MIS are included in the 2011 Forest MIS Assessment (USDA 2011).

Neotropical Migratory Bird Species

The Migratory Bird Treaty Act requires federal agencies to assess project actions that may affect avian species and their habitats. In late 2008, a Memorandum of Understanding (MOU) between the USDA Forest Service and the USDI Fish and Wildlife Service to Promote the Conservation of Migratory Birds was signed, and has been periodically renewed. The intent of the MOU is to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the US Fish and Wildlife Service, as well as, other federal, state, tribal, and local governments. The Mt Baker-Snoqualmie NF falls within the Northern Pacific Rainforest delineation of Bird Conservation Regions (BCR) identified by the North American Bird Conservation Initiative (Partners in Flight 1998).

Management Area 15 – Mountain Goat Winter Range

Forest Plan management areas allocated for mountain goat winter range (MA-15) occur in the project area. Under the Mt Baker-Snoqualmie LRMP (USDA 1990), the management area prescriptions for MA-15 state that vegetative practices applied shall be for the primary purpose of maintaining mountain goat winter range (USDA 1990). In addition, the Mt. Baker-Snoqualmie National Forest has timing restrictions for projects in mountain goat winter range (USDA 1990).

Local Species of Concern – Deer and Elk

Deer and elk are considered for analysis (and were included as part of the proposed action) because of their recreational, aesthetic, spiritual, and subsistence values to residents of northwestern Washington. The Mt Baker-Snoqualmie LRMP (USDA 1990) has standards and guidelines intended to promote elk and deer habitat capability as well as reduce disturbance to seasonally-important habitats. Both species are present in the project area.

Environmental Consequences

Methodology

The wildlife analysis focuses on potential effects to six categories of wildlife species: Federally listed Threatened and Endangered Species (and associated designated critical habitat, administered under the Endangered Species Act), Forest Service Sensitive Species, Forest Management Indicator Species (MIS), Northwest Forest Plan Survey and Manage Species, species with specific habitat management prescriptions under the LRMP (i.e., MA-15; Mountain Goat Winter Range), and migratory birds, as affected by proposed project activities. Two additional species of local importance are also discussed.
The analysis approach focused on the existing major vegetation types, a review of species ecology literature, historical wildlife data on file, watershed analysis (USDA 2000), late-successional reserve assessments (USDA 2001a), review of Climate Change Vulnerability and Adaptation in the North Cascades Region (Raymond et al. 2014), personal communications with researchers, and field review. A comprehensive species inventory within the project area was considered impracticable for most species of concern due to expense and complexity of a species behavior and ecology.

The Snoquera Project area includes the majority of the Rainier Demography Study Area (DSA) for the northern spotted which has been monitoring spotted owl occupancy since 1993. Inferences to northern spotted owl presence in or adjacent the project area is derived from that long term monitoring as well as other historic data collected, and personal communications.

Northern spotted owl activity centers, other raptor nests, and marbled murrelet detections are generally described within a relatively broad area on the landscape. This is a precaution to inhibit any unintentional or malicious intent to harm or harass federally protected wildlife species.

Pre-disturbance surveys were conducted for the Larch Mountain salamander and Van Dyke’s salamander (Survey and Manage species) within the proposed permanent elk forage enhancement openings, as described above.

Spatial and Temporal Bounding of Analysis Area

The spatial scope of this analysis includes all federally owned lands and waters largely included in the Project area boundary as well as within the boundaries of the Green River, Green Water River, and South Fork White River drainages. The analysis area for direct effects to wildlife is the area of potential effects, including potential noise effects (chainsaw and large equipment); the analysis area for indirect effects was primarily the project area. The respective spotted owl and marbled murrelet critical habitat unit boundaries comprise the analysis areas for designated critical habitat. Snag and down wood was assessed both at the project and landscape scale (DecAID Analysis, Project Record). The cumulative effects analyses areas are the same as direct or indirect effects, except where noted.

This analysis uses “short term” to describe effects that have a limited duration. For direct effects to species, such as disturbance or displacement, short term generally refers to one season of use or less, or the duration of specific project activities. For effects to habitat, short term generally refers to less than 5 years. Effects which require or occur over the duration of one or more decades, such as those which relate to tree development and snag or down log recruitment, are described as “long term”.

Direct and Indirect Effects

Potential impacts to wildlife include the direct impact of vegetation treatments, commercial thinning (timber harvest) and associated ground disturbing activities to support all aspects of timber harvest from road maintenance, temporary road construction, the use of gas-powered machinery including hand tools, yarding equipment, and all motorized wheeled vehicles. Other indirect impacts include slash disposal, by burning and scattering, and incidental damage to residual vegetation. Other impacts may occur from road treatments, recreational site creation, and aquatic organism passage improvements. These impacts may be considered separately depending on the anticipated impact to each resource.
Alternative 1 – No Action

Under Alternative 1, no project activities would occur. The densely stocked second growth stands would not be thinned and actions that would improve late seral or old growth attributes, enhance huckleberry, and improve watershed function would not be authorized. These stands would continue to be overly dense, structurally simplified and have minimal understory development and support lower abundance and diversity of wildlife. Mature and old-growth forest patches would continue to be isolated by large patches of early to mid-seral forest.

Implementing Alternative 1 would have no direct effects on spotted owl habitat, marbled murrelet nesting habitat, spotted owl or marbled murrelet nest sites, or the Critical Habitat of both species. Since no activities would occur under this alternative, there would be no disturbance effects to either species under Alternative 1. Nesting habitat would continue to be limited for both species, with growth development on individual trees decreasing over time due to tree-to-tree competition. Spotted owl activity centers below habitat thresholds would continue at that level for a longer period. Large trees with nesting potential for spotted owls or branch structure for marbled murrelet nesting would not be expected for another 100 to 200 years or more. The residual older forest in the landscape and adjacent areas would retain potential nesting structure for both species.

Issues affecting water quality and limited aquatic organism passage due to contributions of culverts, other transportation issues, and dispersed camping in riparian areas would continue to affect wildlife that rely on aquatic and riparian habitat. Ongoing firewood cutting, and road maintenance (including danger tree removal) would continue to remove hazard trees or snags, although this would generally be limited to areas adjacent to open roads. These activities have limited impact on standing and down wood levels.

Recreational shooting would continue in a variety of areas throughout the project area and the unabated sound levels would continue to disturb wildlife. Current aquatic and riparian habitat conditions may continue to degrade, and impact wildlife dependent upon the quality of these habitats. There would be no changes to the existing road network, other than those already approved in the Greenwater ATM decision (USDA Forest Service 2017). Open road density would remain high for a variety of wildlife species, which can lead to disturbance, temporary displacement from habitat, increased mortality, and trash dumping, which can attract nest-predating species.

Effects determinations for Alternatives 1, 2, and 3 are summarized in Table 40.

Alternatives 2 and 3

Effects of alternatives 2 and 3 would be the same for wildlife so they are discussed together. The recreation enhancement activities proposed as differing activities under Alternative 3 would all occur within existing disturbed footprints and would not affect habitat for these species, nor would they create any difference in disturbance impacts to these species.

General Effects on Wildlife

All Activities – Human-caused Disturbance

Disturbance can result from human presence and the modification of the natural sound and light regimes in the area due to recreation, road traffic, aircraft and other machinery, and management activities that directly or indirectly affect wildlife habitat (Hockin et al. 1999). Generally, disturbance that occurs during the breeding season is most impactful on wildlife. Loud impulsive
noises such as blasts or gunshots cause hearing damage or loss in birds when greater than 125 decibels (A-weighting system; dBA) and continuous noise above 93 dBA can mask important bird communication signals and have other behavioral or physiological effects (Dooling and Popper 2007).

**Terrestrial Habitat Restoration**

**Variable Density Thinning**

The stands selected for harvest are relatively homogenous mid-seral stands which comprise large portions of the Snoquera landscape. The variable density thinning from below would retain the larger trees and improve the mixture of tree species in the residual stand. As previously discussed under the Forest Vegetation section, thinning would provide more resources for the remaining trees to increase height, diameter, limb size, and live crown depth. This would increase their potential to provide nesting, roosting, foraging, or denning structure for a variety of species or their prey. Prescriptions would maintain unique features that contribute values as wildlife nesting, roosting, foraging, and denning structures, especially as the stands continue to develop. This would also include trees with damage or defects. For example, the large witch’s brooms of dwarf mistletoes which provide nesting and roosting platforms for a variety of forest birds and other small mammals (Shaw et al. 2004) would be retained where possible.

Unthinned areas, such as skips within units, riparian buffers (Marcot et al. 2018) and other areas excluded from harvest (Mitigation Measures and Project Design Criteria; Table 11) would continue to provide opportunities for movement of species requiring high overhead canopy cover. Retention areas (e.g., skips) can be important refugia for smaller organisms (Wessell 2005, Foltz Jordan and Black 2012). Retention areas can also protect existing snags, hardwoods and other important features. The uncut riparian buffers would continue to act as connectivity areas for dispersing wildlife, and can be important for dispersing amphibians (Marcot et al. 2018). Trees greater than 20 inches in diameter that may need to be removed for safety or operational (i.e., skid trail or skyline corridor placement) reasons would be left on site to contribute to down wood resources for wildlife.

The prescriptions used in Alternatives 2 and 3 would increase the diversity and abundance of nonconifer vegetation. Non-conifer vegetation, including herbs and deciduous shrubs and trees, provides food resources for a wide variety of wildlife species, from insects to large ungulates, either by functioning as a direct source of food, or by supporting other species (e.g., insects) that are fed upon and support food webs (Hagar 2007).

**Non-commercial Thinning including Huckleberry Enhancement**

Stands proposed for non-commercial thinning and huckleberry enhancement are dominated by small diameter trees and typically do not provide habitat for the federally listed, Sensitive, MIS or Survey and Manage species discussed here. However, thinning these young stands can improve habitat for species that rely upon early seral deciduous vegetation and flowering plants by allowing more light for these plants. In the longer term, thinning these young stands can also provide benefits of habitat development similar to those described for commercial thinning, albeit on longer time frame.

**Elk Forage Openings/Enhancement**

The forage openings would be retained in an open condition in perpetuity. The stands selected for harvest are mid-seral stands, which are not limited on the landscape. Therefore, a reduction of up to 272 acres of mid-seral habitat is not expected to impact wildlife overall. After initial harvest, the burning, seeding and maintenance cycles would favor establishment of herbaceous and
shrubby vegetation. The total area proposed for the openings would comprise less than 1 percent of the Snoquera landscape. The elk forage thinning treatments (117 acres) would occur at higher elevations, in summer range, and would provide understory benefits similar to those described for other thinning. Elk Forage thinning units may receive an initial pre-commercial thinning treatment followed by a commercial thinning at a later time.

**Burning**
Pile burning and broadcast burning (alone or in combinations) would be associated with several terrestrial habitat restoration activities (Commercial thinning, forage enhancement, huckleberry enhancement). Burning would occur under prescribed conditions to limit impacts and potential for escape. Burning would reduce the accumulation of dead wood which can provide cover for smaller species, and would also temporarily reduce vegetative cover. Most species are mobile enough to avoid directly mortality from burning. However, smoke can also cause disturbance to species. Project design criteria that impose seasonal restrictions on burning activities would limit impacts to important habitats.

**Planting in Norse Peak Fire Area**
Currently these high severity areas are non-habitat for federally-listed, Sensitive, MIS, and Survey and Manage species. However, these areas will begin to provide forage for deer, elk and other early seral species, and provide open-snag habitat for primary cavity excavators. Planting would not impact habitat for any of these species. Snags and down logs would not be removed and would contribute to the value of the early seral habitats that develop (Swanson et al. 2014). Planting would accelerate the process of developing structurally diverse forested habitat and improving habitat connectivity for species at risk, while still maintaining areas where early seral habitat would remain for longer periods. Planting only a small proportion of the high severity burn area will ensure that an ample amount of area is left to regenerate at a natural pace and retain high early seral habitat values for an extended period. Irregular spacing, low density of planting and species diversity will contribute complexity for wildlife in the stands that develop.

**Transportation System**
High road densities are often associated with a reduction of wildlife use or other negative effects on wildlife (various studies as cited in Gaines et al. 2003). Open road densities vary across the project area, but are higher than 1 mile per square mile in many of the subwatersheds (Table 49. Road density before and after treatments.). Although there would be increased use on haul roads, wildlife are likely somewhat accustomed to traffic along the mainline roads. Reconstructing existing road prisms or previously decommissioned roads generally would not remove habitat for forest dwelling species since habitat would not have had sufficient time to develop. However, low growing vegetation on these previously disturbed areas may have flowering plants or other vegetation that provide foraging for pollinators and landbirds. A small amount of mid-seral forest habitat may be removed with the construction of new temporary roads.

The majority of road maintenance would typically involve working within the existing footprint of disturbed habitat (Brushing, surface blading, surface repair, etc), which would minimize impacts to wildlife species or their habitats. Road reconstruction in preparation for log haul typically does not remove or alter habitat for these wildlife species and project design criteria would reduce potential impacts on aquatic-phase species. The use of existing rock sources at disturbed sites would negate the potential for additional habitat modification, but there could be potential noise disturbance impacts (e.g., crushing or blasting operations) around these sites. These disturbance effects would be limited by seasonal operating periods where necessary.
Danger trees (AKA, hazard trees) would be felled and potentially removed along all haul routes used for timber sale activity and around trailheads or other recreation sites. Based on previous experiences in these areas, danger tree removal is unlikely to remove suitable nest trees for marbled murrelets or spotted owls. However, a small number of trees greater than 20 inches that contain larger limbs or platforms could be removed for safety or operational reasons. These trees can be potentially valuable structures for a variety of other species, and removal could occur during the breeding season. Danger trees within stands would be felled and left to provide additional coarse woody debris where course wood amounts are deficient.

**Watershed restoration**

Culvert replacement would occur within previously disturbed footprint and would generally not impact suitable habitat. Blasting for culvert removal would generally occur outside of the breeding season if within ¼ mile of suitable habitat for the spotted owl or marbled murrelet (late-successional forest). The felling of individual trees into rivers or streams for instream wood enhancement at up to 12 sites total along the Greenwater River, Whistler Creek and Huckleberry Creek would not impact nesting, roosting or denning structure for any of these species, given the selection process for the trees and the minimal number of trees involved. Ground disturbance would be negligible. The acclimation pond enhancements would create minor vegetative disturbances within riparian areas. However, much of this would occur in previously disturbed areas and suitable habitat for these species would not be impacted. For all of these activities, project design criteria would minimize impacts to water quality during project implementation, which would benefit wildlife associated with aquatic environments.

Road decommissioning typically resolves potential issues that may impact wildlife. This includes reducing harassment or disturbance to wildlife, poaching, off-road travel, destruction of vegetation associated with dispersed camping, and minimizing intentional or accidental release of petroleum-based or other potential toxins into the soil and water. The decommissioning process would be a short-term activity on the site that was previously disturbed during project activities (timber harvest, etc). In the long-term the source of potential harassment is removed and the soil and plant growth would eventually reclaim the road site.

**Recreation enhancement**

A variety of recreation enhancement activities would work within the footprint of existing disturbed sites, thereby minimizing impacts to wildlife habitat. The dispersed site management would focus on heavily impacted areas and the expected improvements to aquatic habitats would also have benefits for wildlife species that use aquatic or riparian habitats. Designated sites would be constructed within impacted areas, and the wildlife biologist would be consulted to ensure that suitable habitat for federally listed species or Survey and Manage Species would not be impacted. Overall, this activity would improve riparian and aquatic habitat quality and reduce impacts on wildlife.

Trailhead expansions and trail re-routes would operate within or along the fringes of previously disturbed sites (road surfaces, parking areas, etc) which do not provide optimal habitat for these species. Tree removal would be limited to small trees along the existing edges, would generally involve trees smaller than 18 inches, would not remove any suitable nest trees and would not alter the microclimate of the adjacent forest patch. Trail re-routes would occur only on pre-existing road templates. Ground disturbance would be limited to the previously disturbed footprint, which would limit impacts to wildlife.
Corral Pass and Noble Knob
The majority of the work around these area would occur in moderate or high severity burn areas of the Norse Peak Fire, and in areas that were previous impacted by recreational developments. In those areas, habitat for species that require closed canopy of forested habitats is not present. While flowering plants are among some of the early colonizers, it may take several more years before plants used by pollinators, deer, elk and other early seral species become more abundant. Therefore, ground disturbing activities in the short term are unlikely to disturb much habitat for these species.

Ranger Creek Airport Enhancements
The potential wildlife habitat in the Ranger Creek airstrip and adjacent recreational area has been heavily impacted by previous development, maintenance activities, and recreational presence. The area consists of early to mid-seral conifer-dominated habitat and scattered larger (>20 inches dbh) conifers in the more open areas. The understory is largely devoid of shrubby vegetation or down wood due to foot traffic and other activity. The open or patchy nature would not create optimal conditions for species that require a moist microsite. The area would be marginal or non-habitat for the majority of species analyzed in this document, although they may pass through the area. Therefore, the proposed ground disturbance or activities that would remove small patches of small trees or thin trees would have few impacts.

Recreational Target Shooting
The two sites designated for recreational target shooting sites would be managed to be open, and generally devoid of vegetation. Given the disturbance history at these sites (formerly rock pits), the footprint of these sites (Approximately 3 to 4 acres each) do not contain suitable habitat for any of the wildlife species discussed in this report. Garbage at the sites would be managed to avoid attracting wildlife. Because these sites do not contain nesting, denning, roosting, or foraging habitat, and would experience a high level of human activity, these wildlife species would be unlikely to travel through the shooting areas. Therefore, the potential for lead exposure would be minimal.

Recreational shooting generates noise disturbance that could affect a variety of wildlife species using adjacent habitats. These locations have experienced moderate to high levels of ad hoc target shooting for a number of years. Measured at the muzzle of the firearm or a short distance down-range, peak sound outputs from many popular calibers exceed 120 decibels (A-weighting system; dBA)(Swallow et al. 1999, Rasmussen et al 2009), which is a level that can cause damage or behavioral disruption. Un-attenuated sound from discharging firearms can still reach levels that are disruptive or harmful to wildlife (i.e., >90 dBA) out to 400 meters (0.25 miles) or more, depending on a variety of factors (Swallow et al. 1999). Generally, topographic features (ridges, hillside, berms), vegetation, directionality of the shooting, and any site improvements would reduce the sound levels travelling off-site (Swallow et al. 1999, Kajander and Parri 2014). In addition, proposed structural and engineering improvements to the sites such as shooting enclosures, would reduce ambient noise levels compared to current levels.

FSR 7013 Target Shooting Closure
The target shooting closure on FSR 7013 is adjacent to early seral habitat (approximately 40 acres) that was created for elk forage enhancement as part of the first phase of forage enhancement after the Huckleberry Land Exchange. The cessation of shooting would greatly reduce the human-related noise disturbance, along with trash dumping, and damage to residual trees, which has, to date, likely reduced the functionality of this habitat. It would also reduce the potential for lead exposure for wildlife that use the surrounding early seral habitat.
Impacts to Snags and Down Wood

Standing snags and down logs are important sources of refugia and foraging for most of the wildlife species presented in this document, as previously discussed in the species narratives. There are potential impacts to snags and coarse wood/down logs that could be expected with certain project activities.

Commercial thinning would occur in mid-seral stands that currently have few if any large (>20 inch dbh) snags or cavities in live trees that can provide nesting or denning opportunities. These stands may have moderate numbers of smaller snags (10 inches dbh) that resulted from competition-related mortality. Snags that need to be cut for safety reasons are left on the ground and contribute to down wood values for wildlife. In addition, post-thinning monitoring elsewhere has shown that a small amount of post-harvest windthrow will also generally occur (Roberts et al. 2007) and contribute additional down wood components.

Because thinning would improve the vigor and survival of remaining trees, there would be some loss of natural self-thinning (competition-related) mortality in stands that are thinned. Suzuki and Hayes (2003) found that thinning activities can reduce the frequency and cumulative length of small (defined as 4 to 12 inches diameter) and medium (13 to 19 inches diameter) downed wood. This likely would have the most impact on numbers of small snags and logs that would be naturally produced in the project area in the future, and that size class is currently better represented than larger snags. Trees remaining post-harvest will have increased growth opportunities to develop into future nesting or denning cavity structures and habitat for prey. Snags and down logs would be reduced on the 272 acres of elk forage enhancement openings, due to the initial harvest and maintenance burning. Non-commercial thinning would not be expected to remove snags, except as needed for worker safety. Slash treatment in huckleberry enhancement areas would reduce small diameter down wood, but would not be expected to affect existing large logs. Effects on future recruitment of snags and down logs in noncommercial thinning areas would be similar to that of commercial thinning. Watershed enhancement, transportation system activities, and recreation enhancement would only result in incidental removal of snags for safety reasons.

Additional details about snags and down wood in the project area, and the potential impacts of project activities, can be found in the DecAid Analysis for the Snoquera Restoration Project (Project Record).

Connected Actions

Alternative 2 would include connected actions associated with proposed project activities described above. Treatment to remove, control, or reduce the proliferation of invasive plants could have localized impacts on invertebrates, especially pollinators if they are sprayed when plants are flowering. However, the treatment would favor native species over the longer term which would benefit native pollinators and other wildlife. The re-seeding or propagating openings with native or non-invasive forage seed mixes would benefit species that browse or graze on herbaceous vegetation and planting of soft-mast producing shrubs would benefit pollinators and fruit-eating species.

Cumulative Effects

The cumulative effects area for the wildlife review encompasses the project area for most species discussed in this report. Designated critical habitat units were reviewed for impacts to marbled
murrelet and spotted owl. Effects to the home ranges (1.8 mile radius) of spotted owl sites analyzed here that occur outside of Project Area boundary would also be considered.

Timber harvest, related road building and fuels treatments, fire suppression, and wildfire are the primary past actions or events that have affected wildlife habitat quality and quantity in the analysis area. Past silvicultural treatments have influenced the abundance and distribution of mature, late-successional and old-growth habitat in the project area and have also influenced current habitat quality through stand structure conditions. Up until the early 1990s, silvicultural practices resulted in extensive canopy cover reductions which removed habitat for late-successional old-growth dependent species on USFS lands. Timber harvest and related road building also affected water quality and riparian habitat for species dependent on riparian or aquatic habitats.

The Norse Peak Fire had an effect on the amounts, types and distribution of wildlife habitat across approximately 11,246 acres (based on RAVG data) of the analysis area. This wildfire resulted in additional losses of late successional and mature forest habitat. The fire likely consumed some existing snags and down wood and other legacy structures, but also created new snags and down logs due to fire-related mortality. Based on RAVG data, approximately 3,470 acres within the Norse Fire perimeter in the project area experienced basal area mortality exceeding 75 percent, and an additional 2,133 acres experienced basal area mortality ranging from 25 to less than 75 percent. As understory vegetation begins to regrow, the presence of both an abundance of low-growing deciduous vegetation and an abundance of snags and other biological legacies would make these early seral areas biologically valuable (Swanson et al. 2014). Managed stands that had more than 25 percent mortality were dropped from consideration for the Snoquera project. In all, very little of the proposed terrestrial habitat restoration would occur within the Norse Peak Fire perimeter. No salvage logging would occur, leaving snags and coarse wood levels largely intact. Limited hazard tree removal, planting of small (1/2 to 5 acre) founder stands of mixed conifer species, and seeding with native grass and shrub species around Corral Pass would occur as vegetation management in the Norse Peak Fire footprint. Upon further field review, any proposed stands that are found to have more than 10 percent basal area mortality would be dropped.

Under the Alternatives 2 and 3, the following projects (Table 16) were found to be present and reasonably foreseeable future actions that could spatially and/or temporally overlap with the Snoquera project cumulative effects area, in terms of potential effects on wildlife. More details on the specific projects, and how Snoquera activities may add incrementally to them, are provided under the individual species discussions, where applicable.

Timber harvest is expected to continue on non-federal lands in the future as these stands mature. Ongoing road maintenance and firewood cutting would continue to remove hazard trees or snags, although this would generally be limited to areas adjacent to open roads. Ongoing recreation restoration associated with the Norse Peak Fire may result in a limited number of hazard trees being felled near areas of trail tread repair. These activities would have limited impact on standing and down wood levels. Alternative 2 and Alternative 3 would add incremental impacts to snag and down wood levels for the species which use these elements, but those impacts would not be substantive.

Climate change will affect wildlife differently, depending on their life history needs, habitat requirements and other factors. Climate change factors were reviewed from a previous assessment in Washington (Lawler et al. 2014). Climate change could lead to physiological effects such as changes in hibernation patterns, changes in the timing of amphibian
metamorphosis to less advantageous periods, changes in where species are found (e.g., elevational or latitudinal shifts), and greater exposure to disease organisms that become more widely distributed due to climate-induced variables (Lawler et al. 2014). Climate change may also cause changes in the habitat of different vegetation zones, due to altered snow pack or moisture regimes, changes in site productivity, tree encroachment, disturbance regimes and other factors that could ultimately change the structure and function of the habitat for a variety of wildlife species (Lawler et al. 2014).

Table 16. Potential cumulative effects of the Snoquera Project when combined with the effects to wildlife of other ongoing and reasonably foreseeable future projects.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description and Extent</th>
<th>Impacts on Wildlife</th>
<th>Cumulative Effect of Snoquera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper White River Vegetation and Restoration Project</td>
<td>Ongoing. Commercially thin 1,069 acres of mid-seral stands; Close 4.4 miles of system road, decommission 12.4 miles of system roads, and obliterate 0.4 mile of non-system road; Create 100-foot-wide clearing around the outside of the McCullough Seed Orchard fence.</td>
<td>Accelerate development of late-successional forest in long term, and improve understory development and forage in the short term. Short term noise disturbance to wildlife during breeding season.</td>
<td>Incremental benefits from additional thinning activities. Additional, but not substantive impacts from additional snag/down wood impacts and noise disturbance.</td>
</tr>
<tr>
<td>Forestwide invasive plant treatment</td>
<td>Treat about 5,250 acres of mapped invasive plants.</td>
<td>Potential direct impacts to pollinators and other less mobile species during spraying. Longer term benefit to native pollinators by favoring native flora.</td>
<td>Minor, not substantive. Short term impacts on pollinators, with greater longer term benefit.</td>
</tr>
<tr>
<td>Road maintenance</td>
<td>Brushing, grading, cleaning ditchlines, replacing ditch relief culverts, removing slide material.</td>
<td>Potential noise disturbance during breeding season. Activities occur in previously disturbed areas.</td>
<td>Minor, not substantive.</td>
</tr>
<tr>
<td>Recreation uses</td>
<td>Hiking, camping, hunting, target shooting, fishing, horseback riding, OHV, snowmobile use as allowed</td>
<td>Localized disturbance or displacement may occur. Target shooting can result in lead exposure and noise disturbance which extends to a greater distance.</td>
<td>Minor, not substantive.</td>
</tr>
<tr>
<td>Recreation maintenance</td>
<td>Trail and facilities maintenance as allowed</td>
<td>Localized noise disturbance. Hazard tree</td>
<td>Minor, not substantive.</td>
</tr>
</tbody>
</table>
### Annual Ungulate Winter Range Road Closures
- **Description**: Gates closed annually Dec. 15 through May 1 through agreement with WA State Dept. of Fish and Wildlife, Weyerhaeuser Corp., and the U.S. Forest Service. Only Periodic administrative access is allowed during closure period.
- **Impacts**: Reduced disturbance to and displacement of wildlife during closure period. Incremental positive impacts. Where thinning and forage enhancement occur behind these gates it would improve foraging efficiency during the closure.

### Puget Sound Energy/Century Link Greenwater to Crystal Mountain Utilities SUPs
- **Description**: Remove portions of existing utility system (lines, poles not left as raptor perches) and replace with underground installations within existing road prisms. Decommission nonsystem service road. Treat invasive plants.

### Harvest from WA State DNR lands
- **Description**: Commercial harvest on state-managed land by Wolf Creek, with haul on FS Rd. 7012 and 7010.
- **Impact**: Removal of mid-seral to mature habitat. Creates non-habitat for forest-dwelling species but improves conditions for early seral species in the short term. Would add incrementally to noise disturbance and creation of early seral habitat. Negative effects would not be substantive.

### Greenwater ATM
- **Description**: Modify maintenance level to high-clearance vehicles (level 2A) with authorized access on 18.1 miles of roads. Treat and store 68 miles of roads. Decommission and obliterate 17.8 miles of roads. Obliterate 10.4 miles of non-system roads and motorized trails to address resource damage. Close other non-system roads and motorized trails. Address resource damage as necessary.
- **Impact**: Benefits to wildlife include reduced disturbance and displacement from vehicle traffic, shooting, and other recreational activities. Reduces trash dumping which can attract corvids as nest predators. Incremental positive impacts. Where thinning and forage enhancement occur behind these gates it would improve foraging efficiency during the closure.

### 7222 Connector Road
- **Description**: Construct approximately 0.25 mile new road, extending Forest Service Road (FSR) 7222 to connect with FSR 7224; and then improve aquatic resource conditions by
- **Impact**: Removes a narrow strip of mature forest habitat (<1 acre) but would not impact connectivity for more mobile species. Increases vehicle disturbance and related impacts to mature Incremental positive impact to aquatic-dependent wildlife species. Minor incremental impact on forest dwelling species from road effects.
| Olympic National Park Mountain Goat Management Plan | Decommissioning about 4.22 miles of road (3.8 miles of FSR 7224 and all of spur road 7224-240). | Decommissioning would reduce disturbance impacts and improve conditions for aquatic wildlife. | Incremental positive impact as thinning may improve understory forage resources for a growing population. Minor disturbance impacts. |
| Smay Creek Bank Stabilization | Mountain goat translocation to Mt. Baker-Snoqualmie and Okanagon-Wenatchee NFs. | Increases number of goats in Cedar River watershed, and animals may use adjacent project area. | Positive long term incremental impacts. |
| West Fork White River Bridge | City of Tacoma project to install a log crib in the bank of Smay Creek to maintain stream alignment and prevent further erosion of the stream bank, protect a forest road and bridge and create habitat for aquatic species. | Improved conditions for wildlife using aquatic habitat. | Negligible. |
| Ranger Creek State Airstrip Phase 1 | Obstruction/Tree removal to clear approaches and departures, and tree removal for capital improvement projects around the airstrip | Minimal impacts expected. Area is disturbed and trees do not function as suitable nest trees. | Negligible impacts due to disturbance history in area. |
| Special Use Authorizations | Lodge, Resort, and Cabin Activities to expand buildings, upgrade utilities, etc | Areas highly disturbed therefore no impacts to habitat. Potential short term noise disturbance. | Minor increase in noise disturbance, not substantive. |
| Norse Peak Fire Burned Area Emergency Response (BAER) | Trail tread repair, culvert removal, drainage dips installed in roads and other road maintenance, toilets capped at Corral pass, and hazard tree removal associated with all activities, as needed. | High severity burn areas would not provide habitat for forest dwelling species. Localized and limited noise disturbance possible. Hazard tree removal could remove individual nesting, roosting, foraging, denning structures. | Minor increase in noise disturbance, though largely not overlapping in space. Not substantive. |

Federally-listed Threatened and Endangered Species

**Northern Spotted Owl**

**Direct and Indirect Effects**

Alternatives 2 and 3 would be expected to have minor short term negative effects on the northern spotted owl given that suitable nesting, roosting, or foraging (NRF) habitat would not be
degraded or removed, any potential prey impacts would be minimized at the larger scale, and the most likely nesting areas would be protected from disturbance. Alternative 2 and 3 would be expected to have longer term benefits to the species by accelerating the development of suitable habitat and creating larger contiguous blocks.

**Habitat**

Since implementation of the NWFP in 1994, the estimated habitat trend for spotted owls on the Forest is stable to slightly increasing (USDA 2011). Only activities that remove or degrade suitable nesting and roosting habitat are expected to have impacts of viability of the owl on the Mt Baker-Snoqualmie NF (USDA 2011).

No suitable spotted owl nesting, roosting, or foraging habitat in the project area (approximately 52,916 acres) would be degraded, modified, or removed under any alternative. This would greatly limit any potential negative effects on the spotted owl. Suitable spotted owl habitat would remain at current levels for functional fitness thresholds for core area and home range habitat conditions. Nesting core areas are approximated by a 0.7 mile radius circle around an activity center and home ranges are approximated by a 1.8 mile radius circle. The thresholds are based on a concept that it is necessary for a core area to have greater than 50 percent suitable habitat (approximately 500 acres), and a home range to have greater than 40 percent suitable habitat (approximately 2,606 acres) to maintain spotted owl life history functions associated with any given site. The majority of historic sites within the project area are below thresholds at the home range or nest core scale, primarily due to timber harvest in the 1900’s.

The proposed thinning would be consistent with the recommendations of the Forest-wide Late-Successional Reserve Assessment (USDA 2001). The LSRA identified LSR 125 as a high priority for silvicultural treatment given that the high proportion of early seral and mid-seral stands do not provide adequate habitat for spotted owls and other late-successional or old-growth species of wildlife (USDA 2001).

Based on GIS analysis, field review, and professional experience, the stands proposed for commercial harvest are assumed to meet, or by the time of harvest would meet, the definition for dispersal habitat. It is expected that up to 12,245 acres of spotted owl dispersal habitat would be commercially thinned by variable density thinning in LSR, AMA, Matrix and Riparian Reserves (Table 17). Habitat in commercial thinning units would retain the qualities and functions of dispersal habitat. Post-thinning stands would have a mean dbh of 11 inches or greater and more than 40% canopy closure, which would continue to meet the definition of dispersal habitat (Thomas et al. 1990) at the stand level. The small size and proportion of ephemeral gaps and heavier thinning patches in these thinning areas would not affect the overall function of the stands as dispersal habitat. Project design criteria would protect trees that meet the criteria for suitable nest trees for the spotted owl. Accelerating the development of suitable habitat structure through commercial thinning would increase the available suitable NRF habitat in the project area by approximately 19 percent. This would represent a positive longer term effect to the species.

The young stands proposed for non-commercial thinning, including huckleberry enhancement, are non-habitat for the northern spotted owl. Therefore, thinning those stands would not affect spotted owl dispersal habitat or the ability of spotted owls to move across the landscape. The heavier thinning prescriptions of the huckleberry enhancement areas (down to 15 to 30% canopy cover), however, may delay the development of dispersal habitat longer than a typical prescription, but would not prevent it. The location of up to 400 acres of non-commercial huckleberry enhancement thinning has yet to be determined but will primarily overlap with non-commercial thinning. Proposed non-commercial thinning within the home range circles of
documented activity centers (approximately 461 acres) would benefit the species by improving habitat quality within these important areas over the longer term. However, this comprises only one percent of the total home range areas.

The majority of spotted owl sites are below the recommended levels of suitable habitat at the home range or core area scale, or both. Thinning would accelerate development of suitable habitat at both scales in order to meet the minimum recommended levels of habitat in the future. The development of larger blocks of suitable habitat would also improve connectivity of habitat within and between spotted owl home ranges. Proposed planting would occur in non-habitat for spotted owls, and in the long term would accelerate connectivity of existing habitat patches.

Table 17 shows the estimated acreage of vegetation treatments that would occur within the home range or core areas of historic spotted owl sites. These contributions are relatively small across the combined core area and home range acres in the project area (3% of each) but would nonetheless contribute positively toward meeting minimum recommended levels of suitable habitat. Only 28 acres of proposed thinning in dispersal habitat would occur within 300 meters of a historic site, but it has been vacant for over a decade, so negative impacts to that site are not expected.

No removal of dispersal habitat is proposed in any of the 0.7 mile core areas which will limit impacts to the species. The elk forage enhancement permanent openings would remove up to 272 acres of dispersal habitat across the entire project area (Table 17). This represents a small amount of available dispersal habitat (<1% at project area scale and home range scale) and would not affect the spotted owl’s ability to move across the landscape or the home range. A total of approximately 72 acres of dispersal habitat would be permanently removed in spotted owl home ranges. However, dispersal habitat would still surround these units to facilitate movement. Initial non-commercial treatment of the elk forage thinning units (97 acres in home range circles) would occur when they are non-habitat. Subsequent treatments could occur when they have developed as dispersal habitat. Elk forage enhancement thinning treatments would not remove dispersal habitat and would not occur in any core areas.

New temporary road construction in thinning stands would temporarily remove up to 7 acres of dispersal habitat. This also represents less than 1 percent at the project area and home range scales. Other transportation system and aquatic restoration actions would not remove dispersal habitat. Hazard tree removal associated with project activities is unlikely to remove currently suitable nest trees for the spotted owl, through it could remove individual trees that could provide roosting structure, or prey structures. Trees felled into stream channels for in-stream wood enhancement would be reviewed to ensure they are not suitable nesting structures. Recreation enhancement would operate within existing disturbed areas and would not remove suitable nesting, roosting, or foraging or dispersal habitat.

Landscapes that contain at least 50 percent forest cover that is either suitable habitat or dispersal habitat are considered capable of supporting successful spotted owl movement across the landscape (Thomas et al. 1990). The project area exceeds this amount with dispersal habitat alone (approximately 78,880 acres of dispersal habitat). The permanent removal of up to 272 acres of dispersal and temporary removal of 7 acres of dispersal habitat is not likely to substantially affect spotted owls in the project area. Spotted owls regularly disperse through highly fragmented landscapes that are typical in western Washington and western Oregon (Forsman et al. 2002). Juvenile owls tend to select for old forest with closed canopy (>70%) and large diameter trees (>20 inches dbh, similar to nesting roosting and foraging habitat. This type of habitat would not be impacted by proposed action.
The impacts or benefits to spotted owl prey species from thinning and other project activities would depend on their varied habitat requirements, the response of the vegetation to the thinning treatments, and species-specific responses to forest structure. The mid-seral stands proposed for thinning likely have a limited current role in supporting prey populations and spotted owl foraging, irrespective of potential short-term effects on prey species in these areas. The disturbance and disruption to the understory and overstory layers from mechanical thinning would likely create short term impacts for a variety of species. Declines in flying squirrel abundance following thinning activities have been noted, and short term effects may last up to a decade (Holloway and Smith 2011, Manning et al. 2012). A generalist species such as the deer mouse, which tolerates diverse habitats, may not exhibit a noticeable response from thinning (Stephens et al. 2014).

These reported effects on flying squirrels may have to do with their increased susceptibility to predation following removal of tree cover (Wilson and Forsman 2013). Excessive post-treatment vegetative response of understory or shrub cover can also be an impediment during foraging (Manning et al. 2012). However, Sollmann et al. (2016) found that while thinning appeared to have negative effects on northern flying squirrels at the thinning unit scale, the animals appeared to shift into unthinned area, therefore minimizing density effects at the larger landscape scale. Slightly more than half (57%) of the thinning in dispersal habitat would occur initially, with the balance (43%) occurring 15 or more years later, once the stands become commercially viable (Table 17). This distribution over time should also serve to minimize any potential impacts on prey.

No-cut buffers established for riparian areas and other resource concerns would continue to provide unthinned refugia for prey. Courtney et al. (2004) summarize studies which suggested that spotted owl prey and foraging efficiency can potentially increase in areas enhanced for late-successional species (i.e., commercially thinned second-growth stands) and bordered by suitable habitat. However, there is also the potential for reduced truffle abundance, increased risk of predation to spotted owls, and habitat conditions that may favor barred owls (Courtney et al. 2004). Overall, management of young forests provides trade-offs between providing short-term, ephemeral habitat in dense unthinned stands, and thinning treatments to promote development of more complex and productive habitat in the long-term (Manning et al. 2012). This suggests that a mixture of thinned and unthinned areas at the stand level and landscape level, and spreading treatments out over time, would continue to provide for a diversity in prey species in the project area. Overall, proposed activities are expected to have relatively minimal short term negative impacts on prey densities in the project area.

Disturbance
Noise disturbance near nest sites can produce a stress response in spotted owl (Hayward et al. 2011), although exactly how this affects survival, reproduction and dispersal is unknown. Proposed activities would not occur directly within suitable spotted owl habitat. However, they could occur close enough to have a disturbance effect, especially during the early breeding season (March 1 through July 15). The distance thresholds used to determine adverse effects to suitable habitat are 65 yards for motorized equipment such as chainsaws and heavy equipment, and 0.25 mile for blasting. The 0.25 mile distance is also used here as a threshold to evaluate adverse effects from the proposed recreational shooting areas.

Because of the long term demography monitoring in the Rainier DSA, suitable habitat and historic spotted owl sites have been surveyed in the project area for many years, giving more
assurance to which sites are likely to be occupied. Based on past history and discussion with researchers (D. Herter 2018, pers. comm.), only the Burns Creek, Eleanor Creek, George Creek, and Twin Camp Creek Sites have a reasonable likelihood of being occupied during the timeframe of proposed activities. Therefore, in consultation with the USFWS, only early breeding season harassment to suitable habitat within the core area (0.7 mile radius) of these 4 sites was assessed. Those areas would be assigned seasonal restrictions on noise-producing activities.

Therefore, none of the proposed involving heavy equipment or chainsaws activities that could occur during the breeding season and create noise disturbance to suitable habitat within 65 yards would occur within the core areas of the Burns Creek, Eleanor Creek, George Creek, or Twin Camp Creek spotted owl sites. No blasting for rock sources would occur during the early breeding season within 0.25 mile of these areas as well.

By assigning these seasonal restrictions, all suitable nesting habitat within these four core areas would be protected from disturbance during the early breeding season. This reduces overall effects on the species by eliminating disturbance to activity centers during the breeding season. Only four proposed commercial thinning stands are close enough to suitable habitat within these core areas to warrant seasonal restrictions on activities.

Proposed shooting areas and culvert blasting areas (1/4 mile disturbance distance) are not close enough to create disturbance to these potential nesting areas. Other activities such as non-commercial thinning, watershed and transportation improvements, and recreational improvements would be scheduled to occur outside of the early breeding season where they are adjacent to suitable habitat within the core areas of these four sites. No adverse effects are expected for activities that occur outside of the early nesting season.

**Barred owl**

Competition with barred owls may be the primary cause of northern spotted owl population declines across their range (Duggar et al. 2016), and it has been implicated in the local decline of spotted owls in the Rainier Demographic Study Area (including the project area). While thinning effects to barred owls relative to spotted owls are not fully understood, Alternatives 2 and 3 have been designed to minimize impacts to northern spotted owls, while developing future habitat potential. Barred owls can utilize a greater diversity of forested environments, stand age, and elevations, and consume a wider variety of prey (Livezey 2007). Barred owls have been observed in the project area, therefore use of the stands by barred owls after thinning is likely to occur at some level.

**Cumulative Effects**

For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Periodic vegetation maintenance (burning, etc) is occurring across approximately 159 acres of previously completed (“Phase 1”) elk forage openings in MA 8E. Burning and other activities are timed to avoid disturbance to suitable habitat during the nesting season. Overall, this ongoing activity has minimal effect on the spotted owl.

The remaining timber sale from the Upper White River Vegetation Restoration Project is underway. It does not remove or modify suitable nesting, roosting or foraging habitat, and is thinning mid-seral forest to accelerate development of late-successional conditions, along with reducing transportation system effects. Timber harvest from state and other non-federal lands
would continue, would thin or remove dispersal habitat and have the potential to create short term disturbance effects to spotted owl habitat. Short term effects on the spotted owl could include minor prey impacts as well as noise disturbance. Snag recruitment may also be reduced in the short term, but in the longer term larger snags would be available. The 7222 Connector Road project would remove a small amount of habitat for road relocation. Other ongoing or planned projects would not remove or affect spotted owl habitat but would have the potential to create short term disturbance to suitable nesting, roosting and foraging habitat (Table 16).

Overall, the Snoqualmie project activities would add minimal short term negative effects to the spotted owl in conjunction with other present, ongoing and foreseeable actions. These additional effects would be primarily related to disturbance effects, as well as a small amount of temporary or permanent removal of dispersal habitat, but would not represent a substantive cumulative effect on the northern spotted owl.

With respect to climate change, model projections for the region forecast an increase in wildfire area burned and wildfire severity (Lawler et al. 2014). This is predicted to reduce habitat for species such as the northern spotted owl that require late-successional forests (Lawler et al. 2014). The spotted owl was ranked fairly high in terms of sensitivity to climate change. Climate-driven changes in the amount and distribution of late-seral forest, and prey resources could potentially affect this species (Lawler et al. 2014).

The Snoqualmie project will contribute positive incremental effects to the spotted owl, in light of climate change. Vegetation management strategies that are meant to increase resilience of stands through increase tree vigor, increasing species diversity and protecting existing critical habitat structures such as nest trees and snags will benefit the species.

**Effects Determination for Alternatives 2 and 3:**
- *may affect and is not likely to adversely affect* the northern spotted owl.
- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

**Summary**

**Table 17. Comparison of indicators for potential effects on the Northern Spotted Owl.**

<table>
<thead>
<tr>
<th>Habitat Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments in Dispersal Habitat to Accelerate Suitable NRF Habitat (Acres)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Dispersal Habitat Commercially Thinned</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Dispersal Habitat Commercially Thinned within 300 Meters of Historic (vacant) Nest Stand</td>
<td>0</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Dispersal Habitat Commercially Thinned in Core Areas (0.7 mile radius)</td>
<td>0</td>
<td>419</td>
<td>419</td>
</tr>
<tr>
<td>Dispersal Habitat Commercially Thinned in Home Range Areas (1.8 mile radius)</td>
<td>0</td>
<td>4,606</td>
<td>4,606</td>
</tr>
</tbody>
</table>
Snoquera Landscape Analysis

### Habitat Indicator

<table>
<thead>
<tr>
<th>Habitat Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Dispersal Habitat Removal</td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Permanent Dispersal Habitat Removal (Elk Forage Openings; MA 8)</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
</tbody>
</table>

| Non-commercial Thinning                               | 0             | 1,883         | 1,883         |
| Elk Forage Thinning (MA 8)                            | 0             | 117           | 117           |

### Potential Disturbance/Harassment (Acres)

| Acres of Harassment in Core Areas with High Likelihood of Occupancy | 0 | 0 | 0 |

### Temporal Distribution of Treatments in Dispersal Habitat

| Acres of Dispersal Habitat Thinned: 0-5 years | 0 | 6,964 | 6,964 |
| Acres of Dispersal Habitat Thinned: 15+ years | 0 | 5,280 | 5,280 |

All acres approximate and affected by rounding

---

**Northern Spotted Owl Critical Habitat**

### Direct and Indirect Effects

Alternatives 2 and 3 would minor negative effects on spotted owl critical habitat but longer term effects would be positive as habitat conditions are improved. There would be no effects to current primary constituent elements of nesting, roosting or foraging habitat. However, Alternatives 2 and 3 would have minor impacts on critical habitat by temporarily or permanently removing the primary constituent element of spotted owl dispersal habitat, but it would not adversely affect the function of the critical habitat unit.

The project area contains about 92,296 acres of spotted owl critical habitat. Alternatives 2 and 3 would commercially thin up to 12,245 acres and non-commercially thin up to 1,883 acres in critical habitat. The 117 acres of elk forage thinning (currently non-habitat) is also in critical habitat. Thinning would retain the 12,245 acres of dispersal habitat (constituent element) in the Critical Habitat Unit (CHU) 5, subunit WCC-1. The commercial thinning units would retain their ability to provide dispersal habitat and would develop into nesting, roosting, and foraging habitat earlier than if left untreated. The non-commercial thinning units (including huckleberry enhancement) are in non-habitat, but would retain the ability to develop into dispersal habitat, albeit at a later date in stands with heavier thinning. These silvicultural treatments would lead to future increases in suitable habitat in the CHU.

The construction of new temporary roads would temporarily remove approximately 7 acres of dispersal habitat in the CHU. The creations of elk forage openings would permanently remove up to 272 acres of dispersal habitat within the CHU. Together this represents less than 1 percent of current total suitable habitat in the project area and in the CHU. The permanent removal of 272 acres of dispersal habitat, spread across 40 or more sites, is not expected to impact the function of dispersal habitat in the project area or critical habitat unit. As mentioned above for the spotted
owl, landscapes with at least 50 percent of either suitable habitat or dispersal habitat are considered capable of supporting successful spotted owl dispersal (Thomas et al. 1990) and spotted owls regularly disperse through highly fragmented landscapes (Forsman et al. 2002). The other proposed activities would not result in removal of dispersal habitat.

The project does not propose to remove any large diameter (greater than 20 inches dbh) trees within designated critical habitat unless there is a safety concern or operational reason during thinning operations or during road and landing construction. Project design criteria would minimize impacts on trees that meet the criteria for suitable nest trees. Hazard tree removal related to transportation and recreation enhancements is unlikely to remove suitable nest trees and felling. Felling trees for in-stream wood recruitment would not impact such trees given that the wildlife biologist would review all candidate trees. Overall, both alternatives would be consistent with designated critical habitat objectives and the critical habitat unit 5, subunit WCC-1 would continue to function in its long-term goal of recovery of the spotted owl.

Cumulative Effects
For a general discussion of activities to which Snoqua Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Common Under All Alternatives” and Table 16.

The cumulative effects on spotted owl critical habitat would be similar to habitat effects discussed for the species in the northern spotted owl section, above.

Effects Determination for Alternatives 2 and 3:
- may affect and is not likely to adversely affect northern spotted owl designated critical habitat.

Summary

Table 18. Indicators of Potential Effects on Dispersal Habitat, a Primary Constituent Element of Spotted Owl Critical Habitat (Acres).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Dispersal Habitat</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Commercially Thinned in Critical Habitat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispersal Habitat: Long-term improvement</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Dispersal Habitat: Temporary Removal</td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Dispersal Habitat: Permanent Removal</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
</tbody>
</table>

Marbled Murrelet

Direct and Indirect Effects
Alternatives 2 and 3 would not remove, modify or degrade existing suitable habitat for the marbled murrelet, but would create short term adverse effects due to noise disturbance during the nesting season. The potential to create negative effects from the attraction of nest predators would be minimized through the use of project design criteria and mitigation measures. In the
longer term, the proposed habitat restoration activities would accelerate the development of suitable nesting habitat.

**Habitat**

Proposed activities would occur outside of suitable marbled murrelet nesting habitat. The second growth forests proposed for habitat restoration activities within the project area do not meet established definitions of suitable murrelet nesting habitat. Occupied habitat on the Forest has been associated with old-growth forests and “All records of nests, eggs, eggshell fragments, and downy chicks in Washington have been associated with old-growth forests (Leschner and Cummins 1992a, as cited in Hamer 1995, p. 170).

After accounting for potential effects of the Norse Peak Fire, the Snoquera Project area has approximately 630 acres of the highest suitability nesting habitat and approximately 12,817 acres of moderately high suitability nesting habitat. None of the approximate 13,447 acres of total suitable nesting habitat would be degraded or removed under any activities proposed for the Snoquera Project. This will greatly limit any potential negative effects on the marbled murrelet.

Maintaining and increasing the area and size of blocks of suitable nesting-habitat area on federal lands is likely to contribute to stabilizing and eventually recovering murrelet populations (Raphael et al. 2018). Alternatives 2 and 3 would contribute to this strategy by accelerating and improving the long-term development of nesting habitat for marbled murrelets on up to 12,245 acres across the project area, including areas adjacent to existing blocks of nesting habitat (Table 19). These efforts would lead to a near doubling of suitable nesting habitat within the project area and create larger contiguous blocks of habitat sooner than under Alternative 1. Non-commercial thinning of up to 1,883 acres of early seral habitat and elk forage thinning of 117 acres would also assist with the future development of habitat, albeit on a longer time frame. Proposed planting would occur in non-habitat for marbled murrelets.

The project area is within the potential nesting range of the marbled murrelet from saltwater. There are proposed activities within 0.5 mile of marbled murrelet detection sites. However, many of these detections occurred at survey points positioned on roads and landings and not in suitable nesting habitat, and there were no documented nesting sites. Buffering adjacent suitable habitat with a narrow no-cut buffer is intended to reduce the potential for nest-predating corvids to occupy areas immediately next to nesting habitat.

Although systematic surveys for suitable nesting trees were not conducted, none were detected during field reviews of areas potentially affected by proposed activities. Project design criteria would protect larger trees with potential nesting structure in proposed habitat restoration treatments. Hazard tree removal related to transportation and recreation enhancements is unlikely to impact trees that meet the criteria of marbled murrelet suitable nesting trees. Trees would be reviewed prior to being selected for in-stream wood enhancement to ensure that suitable nest trees are not removed by this activity.

The permanent elk forage openings would preclude the potential development of nesting habitat on up to 272 acres. The creation of small patches and hard edges can be detrimental in areas where maintenance of nesting murrelets is a priority (Raphael et al 2018). The openings would not be adjacent to suitable nesting habitat which will limit the potential for negative effects.

Approximately 35 miles of temporary roads (using existing road prisms, decommissioned roads or new temporary road construction) would occur in marbled murrelet non-habitat, including 3.2 miles of new temporary road construction (Table 19). Areas used by humans can result in...
increased garbage left at sites and this can attract corvids which may increase the chance of predation on nearby marbled murrelet nests (Nelson and Hamer 1995). Conservation measures, including garbage removal by project workers would minimize potential impacts during the project. Providing trash service at recreation facilities enhanced through Alternatives 2 and 3 would also reduce potential impacts of nest predation.

Edge effects, which have the potential to adversely affect marbled murrelet, would be minimized or avoided under these alternatives through the use of project design criteria. McShane et al. (2004) summarize information suggesting that murrelets are highly sensitive to fragmentation and that increased edge effects can affect nesting success through changes in predation rates and microclimate conditions (moss for platforms, etc). Predation rates on forest birds are generally higher at abrupt edges than at edges feathered by different forest types or partial harvest (McShane et al. 2004, Ratti and Reese 1988). Additionally, abrupt edges may serve as corridors for predators. However, permanent elk forage openings, gaps, heavy thinning, and temporary road construction would not occur immediately adjacent to suitable habitat where platforms are present. Project design criteria would designate a no-cut buffer along the edge of habitat restoration units that border currently suitable nesting habitat. This is intended to reduce the potential for nest predation. Thinning generally would not constitute a hard edge. The mid-seral forest surrounding the proposed elk forage openings are not currently nesting habitat which would limit the potential for impacts caused by these hard edges. Reducing predator risks by minimizing edge habitats and controlling corvid access to garbage and human food (e.g., at campsites) is also likely to benefit murrelets in modified landscapes (Raphael et al 2018).

**Disturbance**

The distance thresholds used to determine adverse effects to suitable marbled murrelet habitat are 110 yards for motorized equipment such as chainsaws and heavy equipment, and 0.25 mile for blasting or the proposed shooting areas. Based on these distances, a total of approximately 797 acres of suitable nesting habitat would be subject to noise disturbance during the nesting season (April 1 through September 23) (Table 19). This represents approximately 6 percent of the nesting habitat in the project area, which would minimize impacts to the species. Any murrelets nesting in those areas would be subject to adverse effects during the nesting season. Noise or visual disturbance during this period has the potential to cause nest abandonment and aborted feeding attempts by adults, which could result in undernourishment of the chick or premature fledging. Although up to 797 acres could be subject to adverse effects from noise disturbance, some noise generating activity is likely to occur outside the nesting season. Blocks of suitable nesting habitat with the highest likelihood of potential occupancy would be a higher priority for seasonal operating restrictions.

The noise generated from recreational shooting would be a long term disturbance factor, but represents a very small proportion (approximately 8 acres) of the total disturbance estimate. Any marbled murrelets using these areas have already been exposed to this noise for a number of years, although the potential to habituate to this noise is unknown. There is approximately 3 acres of suitable nesting habitat within 0.25 mile of the proposed recreational shooting enhancements at the FSR 70 rock pit. There are an estimated 5 acres of suitable habitat that would be disturbed at the FSR 72 site, but the shielding effects of local topography is expected to reduce this amount by approximately 50 percent. Noise abatement efforts at these sites would further reduce the amount of disturbance.
Cumulative Effects

For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Common Under All Alternatives” and Table 16.

Periodic prescribed burning, manual control, seeding with desirable forage species, and herbicide treatments are occurring across approximately 159 acres of previously completed (“Phase 1”) elk forage openings in MA 8E. Burning and other activities are timed to avoid disturbance to suitable habitat during the nesting season. Overall, this ongoing activity has minimal effect on the marbled murrelet.

The remaining timber sale from the Upper White River Vegetation Restoration Project is underway. It does not remove or modify suitable nesting habitat, and is thinning mid-seral forest to accelerate development of late-successional conditions, along with reducing transportation system effects. Timber harvest from state and other non-federal lands would continue in non-habitat and has the potential to create short term disturbance effects. The 7222 Connector Road project would remove a small amount of habitat for road relocation. Other ongoing or planned projects would not remove or affect marbled murrelet nesting habitat but would have the potential to create short term disturbance to suitable nesting habitat (Table 16).

Overall, the Snoquera project activities would add incrementally to the effects on the marbled murrelet. These additional effects would be primarily related to disturbance, but would not represent a substantive cumulative effect on the marbled murrelet.

Model projections for the region also forecast an increase in wildfire area burned and wildfire severity (Lawler et al. 2014) which will reduce habitat for species such as the marbled murrelet that require late-successional forests. This species was ranked fairly high in terms of sensitivity to climate change (Lawler et al. 2014). A variety of factors make the marbled murrelet very sensitive to climate change, including nesting structures which require specific microclimates that are not favored by climate change, and additional habitat loss brought on by changes in disturbance regimes (Lawler et al. 2014). Climate change is expected to have negative effects on suitable marbled murrelet nesting habitat through decreases in moss and other epiphytes, and increased tree mortality (Raphael et al 2018).

In the short term, these alternatives would contribute minor negative effects in terms of increase disturbance and a change in microclimate conditions of the thinned stands. Yet these stands do not currently have nesting structure. In the longer term, this alternative would contribute positive incremental effects to the marbled murrelet, in light of climate change. Vegetation management strategies that are meant to increase resilience of stands through increase tree vigor, increasing species diversity and protecting existing critical habitat structures such as nest trees will benefit the species.

Effects Determination for Alternatives 2 and 3:

- *may affect and is likely to adversely affect* the marbled murrelet due to up to approximately 797 acres of disturbance that may occur during the nesting season.
Summary

Table 19. Comparison of Indicators of potential effects on the marbled murrelet between each of the three alternatives.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Mid-seral Non-habitat Thinned</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Miles of Temporary Road</td>
<td>0</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Acres of Noise disturbance</td>
<td>0</td>
<td>797</td>
<td>797</td>
</tr>
</tbody>
</table>

Marbled Murrelet Critical Habitat

Direct and Indirect Effects

Alternatives 2 and 3 would have potential negative effects on critical habitat as well as longer term positive effects. Proposed activities would not remove or degrade any of the suitable nesting habitat in the critical habitat unit, which will reduce the potential for negative effects. There is approximately 60,476 acres of marbled murrelet critical habitat in the Project Area, with an estimated 6,350 acres of suitable marbled murrelet nesting habitat remaining after the Norse Peak fire.

Project activities have the potential to degrade or remove primary constituent elements of (PCE) of murrelet critical habitat, which could have negative effects. Primary constituent elements (PCEs) are those specific elements of the physical or biological features that provide for a species’ life-history processes and are essential to the conservation of the species (USDI 2016)...

PCEs of murrelet critical habitat include: 1) individual trees with potential nesting platforms (PCE-1), and 2) forested areas within 0.8 kilometers (0.5 miles) of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height (PCE-2). Marbled Murrelet nest trees in Washington are typically greater than 80 cm (32 inches) DBH (Hamer and Nelson 1995).

Overall, Project Design Criteria and lack of occurrence in activity areas would minimize impacts on PCE-1. Habitat restoration and other proposed activities would occur in second growth stands or within the footprint of previously disturbed sites where PCE-1 are unlikely to occur to begin with. In the Snoquera project area, these second-growth, mid-seral stands proposed for habitat enhancement are not likely to support platforms particularly in trees less than 26 inches dbh. Observations during field review support this contention. Trees larger than 20 inch dbh would not be cut in LSR thinning stands and trees exhibiting nesting platforms would not be cut as well. Larger clumps of legacy trees including PCE-1 would generally be part of skip areas or excluded from the harvest boundary.

However, based on past experience on the Forest, a very small percentage of any PCE-1 trees present within potential thinning stands may need to be cut for safety or operational (i.e., skyline corridors) reasons. Hazard tree removal related to transportation and recreation enhancements is unlikely to remove trees that meet the criteria of PCE-1. Felling trees for in-stream wood recruitment would not impact PCE-1 given that the wildlife biologist would review all candidate trees to ensure they do not contain nesting platforms.
Commercial thinning would occur within PCE-2 and would remove this individual PCE-2 trees within critical habitat. This could affect microsite buffering for PCE-1, although PCE-2 trees that have interlocking branches with any PCE-1 found within thinning stands would be retained to minimize this negative effect. This buffering element would recover over time. The construction of 0.9 mile of new temporary road would temporarily remove approximately 2 acres of PCE-2, though it would recover over time. The vegetation to be removed by the other temporary road construction does not provide PCE-2 function.

The accelerated development of approximately 5,681 acres in critical habitat represents a potential increase of approximately 89 percent of the current suitable habitat in the CHU. Given the minimal amount of suitable habitat in the Critical Habitat portion of the project area, these acres would provide a valuable addition to future suitable nesting habitat within proximity to marine foraging areas, which is an important feature to CHU function (USDI 1996).

The non-commercial thinning (314 acres in CHU) or huckleberry enhancement would not occur within stands that qualify as PCE-2 although the structural enhancement would benefit the development of suitable habitat in critical habitat on a longer time frame. The proposed elk forage enhancement openings and thinning in Management Area 8E would occur outside of marbled murrelet critical habitat, and would not affect primary constituent elements of critical habitat.

Cumulative Effects
For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Common Under All Alternatives” and Table 16.

The cumulative effects on marbled murrelet critical habitat would be similar to what was discussed for the marbled murrelet above. Additional effects would include a small amount of temporary or permanent removal of PCE-2, but this would not represent a substantive cumulative effect on the marbled murrelet.

Effects Determination for Alternatives 2 and 3:
- *may affect, is likely to adversely* affect Critical Habitat of the marbled murrelet due to incidental removal of PCE-1 and removal of PCE-2 during thinning and temporary road construction.

Summary

Table 20. Indicators of Potential Effect on Marbled Murrelet Critical Habitat.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Mid-seral Non-habitat (PCE-2) Thinned in Critical Habitat</td>
<td>0</td>
<td>5,681</td>
<td>5,681</td>
</tr>
<tr>
<td>Acres of PCE-2 Temporary Removal</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Grizzly Bear

Direct and Indirect Effects
The Snoquera project would be expected to have only minimal negative short term disturbance effects on the grizzly bear, at most, with likely longer term benefits in habitat quality. Grizzly bears are very rare and irregularly observed in the Cascades and very unlikely to occur in the
The grizzly population on the Forest is ranked as extremely rare (USDA 2011). The Snoquera project area is outside of the North Cascades Grizzly bear recovery zone and any designated Bear Management Units (BMU). There is no designated “core” habitat in the project area. Therefore, there would be no effects on core habitat. Potential reintroduction efforts proposed for the Cascades would not include release areas south of I-90. It would likely take a decade or more for dispersers from a re-established population to localize in the project area.

Project implementation would lead to short term increase in human use and disturbance during habitat enhancement, transportation system work, watershed restoration and recreation enhancement activities. Bears would likely avoid areas of chronic disturbance during project implementation and the areas enhanced for recreation opportunities. In the event that a grizzly bear den was located in the Project Area, the MBS would employ temporary restrictions related to any project activities (thinning, road construction, blasting, recreation enhancements, etc) within 0.25 mile of the den site. The likelihood of a grizzly bear den occurring in the project area is extremely low within the next 10 to 15 years, but incidental use of the project area by grizzly bears is possible.

High energy foods like huckleberries are particularly important for hibernating bears (Proctor et al. 2017). Habitat enhancement treatments that increase understory abundance and diversity, especially that of mast-bearing species (e.g., huckleberries) would benefit grizzly bears in the longer term. The 400 acres of specific huckleberry enhancement efforts would benefit grizzly bears in the longer term. Huckleberry patches have been shown to be an important driver in female grizzly bear habitat use, home range selection, density, and fitness (Proctor et al. 2017). The 272 acres of early seral elk forage openings would also provide grasses, forbs and shrubby vegetation that could be consumed by grizzly bears (Table 21).

While huckleberry patches can be a positive influence, road density can be a negative influence on grizzly bears because roads can increase mortality risk (Proctor et al. 2017). Because the project area is outside of the Recovery Zone, there is no mapped core habitat to evaluate. Table 21 (and Table 49 under the Aquatic Resources section) shows road density information for the Snoquera Project, which can be used as a proxy to evaluate potential effects on the grizzly bear. Open road density would temporarily increase as temporary roads are created and former roads are reconstructed in order to implement the project. However, the density would decrease once the activity requiring the access is completed (e.g., timber harvest). Proposed activities would have only minor effects on open road density in the project area. Road decommissioning and closure due to reduced maintenance level designation would slightly increase the amount of habitat that is secure from disturbance, although this security would be transitory for roads that are in storage until future management needs arise.

Recreation management activities would serve to minimize impacts of recreation on local habitats while continuing to provide recreation opportunities. Trash service provided at recreation enhancement sites would reduce the potential for conflict between grizzly bears and recreationists. The extent to which the OHV trailhead improvements would increase trail use is unknown, but increased OHV use could increase the potential for displacement of animals near the trail.

**Cumulative Effects**

For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Common Under All Alternatives” and Table 16.
As discussed in Lawler et al. (2014), decreased snowpacks brought on by climate change could affect hibernating species such as grizzly bears, and shortened hibernation periods could lead to more time out of the den and a greater potential for contact with humans.

In alpine and subalpine zones, lower soil moisture caused by lower snowpack and summer precipitation may also lead to reduced huckleberry (Vaccinium spp.) production and hence reduced food resources for wildlife including grizzly bears.

The Snoquera Project has the potential to add incrementally to these effects. Increased summer recreation could occur due to enhancements, but garbage service at recreation enhancement sites should reduce the potential for conflict. In addition, vegetation management would increase the diversity of habitat and potential food sources, which could lower the reliance on any one food source. In this sense, the Snoquera project would have positive effects. Overall, the additional effects would not be substantive.

**Effects Determination for Alternatives 2 and 3:**
- *may affect, not likely to adversely affect* the grizzly bear.
- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

**Summary**

**Table 21. Indicators of Potential Effects on the Grizzly Bear**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of huckleberry enhancement</td>
<td>0</td>
<td>Up to 400</td>
<td>Up to 400</td>
</tr>
<tr>
<td>Acres of early seral opening</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
<tr>
<td>Total Miles of Temporary road</td>
<td>0</td>
<td>34.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Miles of Road decommissioning</td>
<td>0</td>
<td>23.8</td>
<td>23.8</td>
</tr>
<tr>
<td>Miles Changed to ML1 Closed/Storage</td>
<td>0</td>
<td>5.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Open Road Density in Project Area (Mi/Mi²)</td>
<td>1.8</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**Gray Wolf**

**Direct and Indirect Effects**

The Snoquera project would be expected to have only minimal short term negative disturbance effects on the gray wolf, at most, with likely longer term benefits from improved habitat quality. There are no documented wolf packs using the project area. However, wolves in Washington in recent years have dispersed several hundred miles or more (WDFW et al. 2017, WDFW et al. 2018), and a female wolf was struck and killed along Interstate 90 east of Snoqualmie Pass. Therefore, the project area is well within the dispersal capability of the nearest established pack near Cle Elum, WA. This proximity increases the probability that individual dispersing wolves or a pack could become established in the project area within the next 5 to 10 years.

Project implementation would lead to short term increase in human use and disturbance during habitat enhancement, transportation system work, watershed restoration and recreation enhancement activities. In the event that a wolf den or rendezvous site (general pup-rearing area)
was located in the Project Area, the MBS would employ temporary restrictions related to any project activities (thinning, road construction, blasting, recreation enhancements, etc) within 0.25 mile of the den or rendezvous site. This would minimize disturbance effects to wolves during the breeding season.

Open road density would temporarily increase as temporary roads are created and former roads are reconstructed in order to implement the project. However, the density would decrease once the activity requiring the access is completed (e.g., timber harvest) and additional decommissioning is completed (Table 22).

Road decommissioning and storage would benefit wolves. Wolves generally favor areas of low road density compared to areas with high road density (Mladenoff et al. 1995). However, traffic volume and other human attributes can also be important determinants (Merrill 2000). Road decommissioning and closure would slightly increase the amount of habitat that is secure from disturbance, although this security would be transitory for roads that are in storage until future management needs arise.

Recreation management activities would minimize impacts of recreation on local habitats while continuing to provide recreation opportunities. The extent to which the OHV trailhead improvements would increase trail use is unknown, but increased OHV use could increase the potential for displacement of animals near the trail.

Proposed habitat enhancement activities such as restoration thinning and elk forage enhancement would increase understory forage resources for deer and elk, which are potential prey for wolves (Table 22, Table 39 [Deer and Elk]). While this would conceivably benefit wolves, the extent to which these vegetation treatments would benefit wolves is unknown.

Cumulative Effects
For a general discussion of activities to which Snoqualmie Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Common Under All Alternatives” and Table 16.

The mountain goat translocation efforts to increase populations are not likely to benefit wolves substantially given that their preferred escape terrain would generally make them unavailable to wolves as prey. However, because the use of forested areas by mountain goats appears to involve higher risk of predation (Festa-Bianchet and Côté 2008) translocated mountain goats could be more available to wolves as prey during initial exploratory movements after the translocation. The incremental benefit this might have to wolves in terms of slightly greater prey availability would not represent a substantive cumulative effect.

Effects Determination for Alternatives 2 and 3:
- **may affect, not likely to adversely affect** the gray wolf.
- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

Summary

Table 22. Comparison of indicators of potential impacts on Gray Wolves.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

125
## Sensitive Species

There would be no impact on the following Forest Service Sensitive Species based on review of available records: Common loon, giant Palouse earthworm, shiny tightcoil snail, and Melissa arctic. The area does not support habitat for these species, or the suitable habitat that is present near the project area would not be impacted, directly or indirectly, by implementation of the proposed activities. With respect to the above mentioned Sensitive Species, Alternative 2 and Alternative 3 would not cause any direct, indirect, or cumulative impacts and would not contribute to the loss of viability or move any of these species toward federal listing. These species will not be discussed further in this document.

### American Peregrine Falcon

#### Direct and Indirect Effects

Alternatives 2 and 3 could have minor short term disturbance impacts on individual peregrine falcons in the project area with longer term beneficial impacts expected from improved foraging habitat. The estimated habitat and population trend for peregrine falcons on the Mt Baker-Snoqualmie National Forest is stable, and activities on the Forest are not expected to impact potential nest sites or contribute to a decline in foraging habitat (USDA 2011). In the state of Washington, overall occupancy rates and productivity are indicative of stable to increasing populations (Vekasy and Hayes 2016).

Alternatives 2 and 3 would not remove or modify cliff habitat for nesting, which would greatly limit potential impacts of the project on the peregrine falcon. Peregrine falcons were documented nesting in the upper Green River watershed in the 1980’s, although nesting has not been documented in recent years.

After de-listing, the peregrine falcon continues to be protected under the Migratory Bird Treaty Act of 1918 and other management guidance. The Washington Department of Fish and Wildlife’s management recommendations for priority species and habitats include avoiding disturbance to peregrine falcons during the breeding season (March – June), avoiding forest practices within 0.5 mile of eyrie cliffs during the breeding season, and the retention of large trees and snags in winter feeding localities (Hayes and Milner 2004). While there are no currently occupied nests in the project area, any peregrine falcon nesting activity that is discovered would be subject to such measures to reduce potential disturbance impacts.

Peregrine falcons feed on a variety of smaller birds (Hayes and Milner 2004). Thinning mid-seral stands has been shown to increase the overall species richness and density of birds and a variety of thinning intensities from no-cut areas to heavy thinning areas has been recommended in order to maximize benefits while minimizing any negative responses for birds (Havari and Carey 2000,
Hagar et al. 2004). This suggests that commercially thinning up to 12,245 acres would benefit the peregrine falcon in terms of an abundance and diversity of prey species (Table 23).

Large tree and snag retention practices would protect this element of peregrine foraging habitat (Hayes and Milner 2004) under all action alternatives though there may be low level removal of snags due to safety concerns.

Proposed shooting and blasting areas would not occur within 1 mile of documented nesting sites. Peregrine falcons that are foraging within close proximity of noise producing activities could be temporarily disturbed or displaced. Other proposed activities would not impact this species.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Ongoing and reasonably foreseeable activities in the project area would not directly remove cliff-nesting habitat but have the potential to provide disturbance effects or to impact prey populations, especially through impacts to riparian and upland vegetation. The Project would not impact nesting habitat, and design criteria would minimize disturbance impacts and impacts to prey. Therefore, any incremental impacts would be minor and not substantive.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual American peregrine falcons, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

**Summary**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
</tbody>
</table>

**Harlequin Duck**

**Direct and Indirect Effects**

Alternatives 2 and 3 would cause short term disturbance impacts for harlequin ducks, but negative habitat impacts would be minimized by project design criteria and mitigation measures. Over the longer term, proposed activities would be expected to provide beneficial impacts in terms of habitat improvement.

Potential impacts to harlequin duck would be limited by focusing most activities in upland areas away from streams, by watershed restoration, transportation system improvements and recreation enhancement activities which have improved riparian and aquatic function as a stated goal or indirect effect, and by project design criteria which would reduce short term impacts to water quality and riparian health. Seasonal timing of activities in the riparian areas related to other resource concerns that avoided activities between May and July would also serve to reduce disturbance impacts to breeding harlequin ducks.
Vegetation management and related activities in the upland areas would not be expected to impact Harlequin ducks, given their affinity to riparian corridors. Activities that degrade water quality and reduce prey availability, degrade riparian vegetation or disturb nesting ducks can negatively affect reproductive success (Rockwell 2018). Project design criteria to prevent degradation of riparian vegetation and protect water quality would be expected to minimize negative impacts. Applying the minimum NWFP Riparian Reserve no-cut buffer based on stream type, a conservative estimate for acres to be treated in the Riparian Reserve allocation is approximately 3,953 acres of commercial thinning and 485 acres of non-commercial thinning. Given the total amount of Riparian Reserve allocation present in the project area, this amounts to thinning in approximately 8 percent.

Approximately one mile of new temporary road would be constructed within Riparian Reserve, which would equate to approximately 2 acres of vegetation clearing (Table 24). Another 10 miles of temporary roads in Riparian Reserve would use existing road prisms or previously decommissioned roads, where vegetation impacts would be minimal. Using the Riparian Reserve delineation includes areas beyond the riparian vegetation zone, and may overestimate the amount of riparian are affected. However, it offers a way to compare potential impacts on the riparian area. This small amount of vegetation removal in or near the riparian areas would not be expected to impact Harlequin duck nesting or loafing opportunities. However, the 11 miles of overall temporary road use, primarily using existing road prisms, would bring additional disturbance into riparian areas during project activities. This disturbance would largely cease once the roads are decommissioned.

Disturbance may also include humans walking, camping or otherwise recreating along shorelines of streams. Riparian or aquatic habitat restoration projects may also disturb nesting harlequins in the short term if they are implemented during the breeding season (Rockwell 2018). Rockwell (2018) also summarized several studies showing the effects of noise disturbance, which suggests that ducks in the vicinity of chronic shooting areas could also be disturbed. Noise abatement efforts would reduce potential impacts.

Vegetation management activities, transportation system management, watershed restoration and recreation management activities that occur within or near riparian areas may provide short term impacts to harlequin ducks in terms of disturbance during the breeding season and impacts to water quality. Riparian thinning would also create potential disturbance to Harlequin ducks. The small proportion (8%) of Riparian Reserve proposed for thinning would serve to limit potential short term impacts on harlequin ducks in the project area, though individual ducks could be disturbed by these various activities.

Longer term impacts would be expected to be positive as vegetation recovers and riparian health and water quality improve as a result of riparian thinning and watershed improvements, and recreation management activities reduce human use in sensitive riparian areas. The establishment of official recreational shooting areas would not likely increase disturbance to adjacent riparian areas, given that these areas are already established shooting areas and proposed design criteria would include sound abatement measures.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.
Ongoing or foreseeable activities such as timber harvest and road building have the potential to impact water quality for the Harlequin duck. Any additional short impacts to water quality and aquatic productivity caused by the Snoquera project would be minimal, due to conservation measures. In the longer term, proposed activities would have a positive impact on water quality.

Changes in in-stream flows, such as those that could be caused by climate change, can negatively impact harlequin duck reproductive success by causing juvenile mortality or reducing prey abundance, (Rockwell 2018). The Snoquera project would not contribute negatively to changes in in-stream flows, therefore it would not contribute substantive cumulative negative impacts on the Harlequin duck.

**Effects Determination for Alternatives 2 and 3:**
- may impact individual Harlequin ducks, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

**Table 24. Comparison of indicators of potential impacts on the Harlequin duck.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of commercial and non-commercial thinning within NWFP Riparian Reserve (outside of buffers)</td>
<td>0</td>
<td>4,438</td>
<td>4,438</td>
</tr>
<tr>
<td>Miles of New Temporary Road in Riparian Reserve</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Miles of Temporary Road in Riparian Reserve</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

**Pacific Bald Eagle**

**Direct and Indirect Effects**

The lack of any documented nests or communal roosts within the project area will limit the potential impacts of any proposed activities on the bald eagle. The breeding bald eagle population on the Mt Baker-Snoqualmie National Forest is ranked as extremely rare while wintering bald eagle are more common (USDA 2011). Proposed vegetation management activities in mid-seral stands in upland areas would not affect bald eagle nesting or roosting habitat, given that these stands do not contain the large tree structure used for these activities. The large nesting and roosting trees used by bald eagles would not be removed or altered under any alternative. The estimated habitat trend for bald eagle habitat on the Forest is stable (USDA 2011), and populations have been estimated as stable (USDA 2011) to increasing (Kalasz and Buchanan 2016). Activities on the Forest are not expected to impact potential nest and roost sites or contribute to a decline in viable populations of wintering bald eagles (USDA 2011).

Proposed riparian thinning, watershed restoration, transportation system improvements and recreation enhancement activities would improve long term health of riparian system health, including potential nesting or roosting structures, as well as longer term aquatic productivity for their primary prey, and would reduce recreation impacts within riparian corridors. Project design criteria and mitigation measure would reduce the potential for short term impacts on bald eagle prey or foraging from project activities that occur in or near aquatic or riparian habitat.

In the short term, noise generating activities in or near riparian areas could create disturbance for individual eagles occasionally using the area for foraging. Foraging is not believed to be
extensive under current conditions. Project design criteria would impose the appropriate seasonal restrictions on disturbance activities if any bald eagle nests or communal winter roosts are subsequently discovered in the project area.

The shooting are proposed for the FSR 70 rock pit is within 0.25 mile of a short section of the Greenwater River. Stahlmaster and Newman (1978) noted overt escape behavior by bald eagles in response to gunshots, but the distance from and nature of the shooting (random versus more constant) was not provided. And while wintering bald eagle habituated to routine human activities, they did not appear to habituate to shooting (Stahlmaster and Newman 1978). There are no known nests or communal winter roosts within one mile of the proposed target shooting areas. The noise from the proposed shooting areas would not likely have lasting impacts on eagles passing through the area. Watershed restoration activities that improve conditions for fish in the Greenwater River could improve future foraging opportunities for bald eagles in the area. Only a small amount of the river is within 0.25 mile of the proposed FSR 70 shooting area, and any noise abatement efforts would reduce the intensity of sound reaching the riparian areas.

Cumulative Effects

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Activities that degrade the conditions of prey populations (fish) and remove old growth or large tree structure used for nesting and roosting in the riparian areas would impact the bald eagle. The proposed FSR 7222 connector road may disturb bald eagles using the area during construction but the project could improve watershed quality and prey populations for the bald eagle in the long term.

The Snoquera project would add incidental, short term impacts to the bald eagle, but they would not be substantive, and the activities that restore riparian and aquatic health would represent incremental positive cumulative impacts for the bald eagle when added to past present or reasonably foreseeable actions.

Projected changes in the timing and volume of streamflow due to climate change have the potential to profoundly affect salmon and fish habitat in general (Lawler et al 2014). The proposed installation of 53 AOP culverts and culvert removal associated with road decommissioning would be a positive contribution of the Snoquera Project to offset some of the potential negative impacts from changes in stream flows. This would have potential benefits to bald eagle foraging.

Effects Determination for Alternatives 2 and 3:

- may impact individual Pacific bald eagles, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

Summary

Table 25. Comparison of indicators of potential impacts on the Pacific bald eagle.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
## Northern Goshawk

### Direct and Indirect Effects

Proposed activities would be expected to have only minor impacts on individual goshawks due to short term disturbance or prey impacts, with longer terms benefits expected from habitat enhancement. The mature and late-seral/old-growth forest with large trees and dense canopy cover that appears to be preferred goshawk nesting habitat (DeStephano et al. 2006) would not be altered or removed under Alternatives 2 or 3. The thinning from below prescriptions generally protect the largest trees, which are preferred for nesting. Project design criteria would protect goshawk nests from destruction or disturbance. Overall, neither alternative would be expected to impact goshawk nesting habitat. Limited operating periods around nest sites would minimize disturbance effects to nesting goshawks. Any incidental disturbance or displacement of goshawks foraging or moving through the project area during any of the activities would be minimal and generally limited to the time duration of activities.

Because goshawk population demography and productivity can be strongly influenced by prey availability or abundance (Squires and Kennedy 2006, Salafsky et al. 2007, Beier et al. 2008), Salafsky et al. (2007) recommended that forest management strategies provide the habitat elements necessary to maintain abundant populations of diverse prey species. Bloxton (2002) recommend variable density thinning-from-below as a way to provide for a variety of prey species while also improving flight space below canopy. Alternatives 2 and 3 are consistent with both of these recommendations.

Habitat elements that appear to be important for a variety of prey species include snags, large downed logs, large trees, openings and associated herbaceous and shrubby vegetation, interspersion of habitats, forested canopy cover, and hardwoods for mast (Reynolds et al. 1992, Squires and Kennedy 2006).

The large snags and down logs, large trees and forested cover associated with mature or old growth forest would not be impacted under Alternatives 2 and 3. Snags or trees with cavities or other decadent features would only be felled for operational or safety reasons and would be left to contribute to down wood objective. However, there would likely be impacts on the abundance of smaller snags in thinned stands due to reduced self-thinning mortality of the remaining trees (Suzuki and Hays 2003). Larger snags would develop over time.

The commercial thinning of up to 12,245 acres of mid-seral forest and non-commercial thinning of up to 1883 acres dense early-seral forest (largely inclusive of huckleberry enhancement), and elk forage enhancement (389 acres) would improve the overall abundance and diversity of goshawk prey on the landscape (Table 26). The thinning, gaps and small forage enhancement openings would increase the abundance of herbaceous and shrubby vegetation for prey as well as creating a finer-scale mosaic on the landscape. As discussed previously for the spotted owl, there could be short term impacts to prey species associated with habitat restoration efforts. However, over time, prey diversity and abundance would likely increase across the landscape.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of commercial and non-commercial thinning within NWFP Riparian Reserve (outside of buffers)</td>
<td>0</td>
<td>4,438</td>
<td>4,438</td>
</tr>
<tr>
<td>AOP</td>
<td>0</td>
<td>53</td>
<td>53</td>
</tr>
</tbody>
</table>
Observations by Bloxton (2002) suggest that heavier understory shrub cover that could develop after thinning or creation of openings may not impede foraging and prey capture, as long as the mid-story flight space is retained. In that sense, a heavy response by vine maple or sapling trees could limit foraging efficiency in some areas, but skips or lightly thinned areas would continue to provide adequate flight space and available prey.

The proposed recreational shooting areas are not within a mile of any known nest sites, and the amount of late seral forest within 0.25 mile of these sites is limited. Foraging goshawks could be displaced temporarily if foraging within close proximity. However, the disturbance has been ongoing, and sound abatement measures would likely reduce the impacts. Other proposed activities would be subject to similar seasonal operating restrictions near active nests, but would not impact nesting or foraging habitat.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Ongoing or planned thinning activities in mid-seral forest would not be expected to impact nesting habitat, as discussed above under direct and indirect effects. Wildfire has the potential to remove nesting habitat. The proposed activities in the Snoquera Project would contribute minor additional impacts in terms of short term disturbance for the goshawk. However, they would not be substantive, and the longer term benefits of accelerating development of habitat would be positive.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual northern goshawks, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Non-commercial Thinning</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
<tr>
<td>Acres of Elk Forage Enhancement Openings and Thinning</td>
<td>0</td>
<td>389</td>
<td>389</td>
</tr>
</tbody>
</table>

**Little Brown Bat and Townsend’s Big-Eared Bat**

**Direct and Indirect Effects**

Alternatives 2 and 3 would have the potential to create short term disturbance impacts to individual bats, but this would be greatly minimized by protecting important roost sites. Longer term beneficial impacts would be expected due to proposed habitat enhancement activities.

Protection of roosts is a priority for conservation of both species (Hayes and Wiles 2013). Alternatives 2 and 3 would protect the most commonly used and most important roosting structures. Caves, mines, and buildings are commonly used by Townsend’s big-eared bats and...
little brown bats for maternity colonies and winter hibernacula (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999, Fellers and Pierson 2002, Hayes and Wiles 2013) and these features would not be impacted under any alternative. The Townsend’s big-eared bat has been documented using basal hollows of large trees in coastal areas (Gervais 2017). Large decadent, hollow trees and snags have been used by the little brown bat (Hayes and Wiles 2013). These decadent structures would not likely be found in mid-seral stands proposed for habitat restoration and are found in areas that would be protected. The trees harvested would not generally provide the necessary microhabitat needs for maternity roosts, though there could be impacts to individual non-reproductive bats roosting in trees or snags that were felled. This would likely be minimal given the small size of trees in these stands. Bats roosting under bridges could potentially be disturbed by nearby road construction and reconstruction activities, though this work is mostly planned away from such bridge structures.

Commercial thinning of up to 12,245 acres of mid-seral forest, non-commercial thinning of up to 1,883 acres dense early-seral forest (largely inclusive of huckleberry enhancement), and elk forage enhancement (389 acres) would improve the overall foraging and roosting opportunities for bats in the Project Area (Table 27). Thinning in upland areas to accelerate late-successional conditions and riparian reserve thinning would likely benefit foraging and roosting little brown bats and foraging Townsend’s big-eared bats in the long term. Thinning would also lead to larger trees available as future roosts for bats.

Luszcz and Barclay (2016) reported on the importance of deciduous riparian forests (e.g., black cottonwood), along with old growth Douglas-fir forests, for foraging Myotis species. This was believed to be due in part to increased insect abundance and a more open structure for foraging, but also may relate to greater roosting opportunities. In fact, the researchers recommended efforts to increase riparian stands (Luszcz and Barclay 2016). The Townsend’s big-eared bat forages in a variety of habitats, but appears to prefer mesic habitat (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999, Gervais 2017). Thinning prescriptions which favor retention and growth of deciduous species would likely benefit prey production for both species. In the short term, the more open post-thinning conditions may be more conducive to foraging. The elk forage enhancement openings would also create potential foraging areas for both species because of the early seral vegetation and open conditions.

Thinning would also likely benefit bats in the long term as vine maple, and other deciduous understory shrubs and overstory trees that support Lepidopterans and other invertebrates (Braun et al. 2002), respond to more open understory conditions post-treatment. Given that Townsend’s big-eared bats preys on Lepidopteran moths as well as other invertebrates (Gervais 2017), this could benefit the species by increasing prey abundance.

Watershed restoration and recreation enhancement activities which improved riparian health and the productivity of aquatic ecosystems for aquatic invertebrate prey would also benefit bats. The other recreation enhancement projects would have minimal impacts on bats given that they would occur within previously disturbed footprints.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.
Mine closure has the potential to impact bats in the area, but in recent years closures have installed “bat gates” which allow bats continued access to these critical roosts while reducing potential human disturbance.

Currently, white nose syndrome is one of the greatest threats facing bats. Climate change could aid in the spread of diseases by creating more favorable environmental conditions where they did not previously exist (Lawler et al. 2014). The activities proposed could result in minor additional short impacts or stressors on bats, but they would not be substantive cumulative effects. In the longer term, proposed activities would create more favorable foraging and roosting conditions that may serve to make habitats more resilient to climate change.

**Effects Determination for Alternatives 2 and 3:**
- may impact individual little brown bats and Townsend’s big-eared bats, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the populations or species.

**Summary**

**Table 27. Comparison of indicators of potential impacts on the little brown bat and Townsend’s big-eared bat**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Non-commercial Thinning</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
<tr>
<td>Acres of commercial and non-commercial thinning within NWFP Riparian Reserve (outside of buffers)</td>
<td>0</td>
<td>4,438</td>
<td>4,438</td>
</tr>
<tr>
<td>Acres of Elk Forage Enhancement Openings and Thinning</td>
<td>0</td>
<td>389</td>
<td>389</td>
</tr>
</tbody>
</table>

**Mountain goat and Mountain Goat Winter Range Habitat (MA-15)**

**Direct and Indirect Effects**

Alternatives 2 and 3 would have few expected negative impacts on the mountain goat and MA-15 other than the potential for minimal short term disturbance, given that the structure and function of their primary habitat would not be negatively impacted. Mountain goat numbers are slowly increasing throughout the Mt. Baker-Snoqualmie National Forest (Rice and Gay 2010, USDA 2011), and animals translocated from the Olympic Peninsula beginning in 2018 (USDI 2018) may use portions of the project area.

Mountain goats are closely associated with steep, rocky terrain characterized, and spend the majority of the year in alpine or tree-less environments (Chadwick 1983, Festa-Bianchet and Côté 2008). Proposed habitat restoration, transportation system activities, watershed restoration, recreational enhancement and other connected activities would not negatively impact mountain goat summer range or impact escape terrain.

There would be no vegetation management in vicinity of Corral Pass/Castle Mountain or Mutton Mountain that would affect those bands in the summer or winter range, based on known animal movements. Trailhead and campground developments at Corral Pass and Noble Knob would use existing areas that have been disturbed and have a history of human use, and would revegetate
these areas using appropriate native vegetation. No changes to the mountain goat are anticipated from those activities.

Up to 81 acres of habitat restoration activities (commercial thinning) are proposed within MA-15 within the LSR (Table 28). Thinning prescriptions would be designed to maintain winter range capabilities, and provide forage and optimal thermal cover, as required by LRMP Standards and Guidelines (USDA 1990) and Management Area Prescriptions (USDA 1990). Canopy gaps and heavy thinning would not be used in these areas. Thinning prescriptions would maintain canopy cover while increasing understory forage resources minimally in the short term. No new temporary road construction would occur in MA 15, in accordance with Management Area Prescriptions (USDA 1990). Reconstruction of existing roads in these areas would follow seasonal restrictions as necessary, which would also reduce potential impacts to the mountain goat.

Typical populations of mountain goats are sensitive to human disturbance (Festa-Bianchet and Côté 2008). Chadwick (1983) made anecdotal observations that suggested that mountain goats could be displaced by the disturbance associated with timber harvest activities. This suggests that proposed activities in the vicinity of important wintering areas could have negative impacts by creating localized disturbance. LRMP standards for MA-15 would restrict timber harvest and other associated activities within MA-15 from late fall through spring (USDA 1990).

None of the recreation enhancement projects would occur directly within mountain goat habitat, however there could be indirect effects from any increases in recreational use. The potential for recreation to impact mountain goats in Washington has been identified, presumably through disturbance in alpine habitat (USDA 2011, WDFW 2017b). However, there are also instances of mountain goats becoming habituated to recreational presence (i.e., hiking), leading to human-mountain goat conflicts in heavily visited areas in the Olympic Mountains (USDI 2018), Cascades, and other areas. In some cases, mountain goats have learned to obtain minerals from human sources such as sweat and urine (Sarmento and Berger 2017). Sarmento and Berger’s (2017) research on mountain goats in Glacier National Park suggests that there are situations where mountain goats near human use areas may gain protection from predators through close proximity to people. The extent to which recreation impacts mountain goats through disturbance may depend on the type and amount of recreation (Hunting, hiking, etc), where it occurs relative to mountain goat seasonal habitat needs, and the extent to which the mountain goats have habituated to human presence.

Neither of the proposed shooting areas are within one mile of potential summer or winter range. None of the other proposed activities would occur in or impact mountain goat habitat or cause disturbance to those areas.

Cumulative Effects
For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Recreation in alpine areas in the project area is expected to continue, and will likely increase. This carries the potential for increased human-mountain goat interactions and potential for conflict, as mentioned above under Direct and Indirect Effects. However, indirect impacts from any increased recreation from the Snoquera project are not expected to be substantive cumulative effects on the mountain goat.
Like other species dependent on alpine ecosystems, climate change would be expected to impact the mountain goat (Festa-Bianchet and Côté 2008). Encroachment of trees into alpine meadow areas could reduce forage for mountain goats. The project would not add direct incremental impacts to summer range habitat in light of climate change projections. Indirect impacts from any increased recreation would not be substantive cumulative effects.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual mountain goats, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.
- would not contribute to a negative trend in the viability of this management indicator species on the Forest.
- would maintain or improve the existing winter range capabilities in all MA-15 areas in the project area.

**Summary**

**Table 28. Comparison of indicators of potential impacts on the mountain goat and MA-15.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial Thinning in MA15</td>
<td>0</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>New Road Construction in MA15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**California Wolverine**

**Direct and Indirect Effects**

Potential impacts to the wolverine from alternatives 2 and 3 would be limited to minor disturbance impacts, given that the primary use areas in wilderness and remote area would not be impacted. Human use and disturbance in habitat is a threat to the wolverine (USFWS 2011). Potential sources of human disturbance to wolverines that have been identified include winter and summer recreation, road corridors, and extractive industry such as timber harvest (USFWS 2011).

Alternatives 2 and 3 would not occur within or affect the currently remote alpine and subalpine habitats (i.e. wilderness) that have relatively low potential for human disturbance and that are important to wolverines (Krebs et al 2007). Proposed activities would not occur in or affect avalanche chutes, which are believed to be important year-round habitats for food sources (Krebs et al. 2007). Female wolverines with young may be particularly sensitive to human disturbance associated with roads and winter recreation activities, and will select rugged terrain to avoid these factors as well as predators (Krebs et al. 2007). Recreation enhancements proposed for the Snoquera project would not necessarily increase winter recreation in high elevation areas, which is the period when wolverine are more susceptible to human caused disturbance (Krebs et al. 2007). Recreation enhancements would occur within existing footprints of existing recreation sites. Therefore the recreation enhancements proposed would likely only have minimal effects on the wolverine.

Terrestrial habitat restoration efforts such as variable density thinning, huckleberry enhancement, and elk forage thinning that improve stand diversity and habitat for ungulates and large rodents at the higher elevations, as potential prey or carrion resources, would likely benefit the wolverine.
(Table 29). These activities would not occur within the remote and rugged terrain important for wolverines, though they would occur in areas outside of wilderness in the broader range of habitats that are occasionally used by wolverines during dispersal or exploratory movements. Disturbance impacts to wolverines in these areas would be expected to be minimal and only last the duration of the project activities.

Road access and open road densities would increase slightly in the short term, due to temporary road construction (Table 29). However, decommissioning after project activities are completed would reduce open road densities below pre-project levels. This would have longer term benefits for the wolverine in terms of reducing potential disturbance.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Threats to the wolverine include human use and disturbance in habitat and a reduction in habitat due and reduced snowpack to climate change (USFWS 2011). Winter recreation currently occurs in various areas of the project areas, and may increasingly encroach into areas historically free from human disturbance.

The project could contribute to increased recreation levels in the summer, but the proposed improvements have not specifically targeted winter recreation activities. Therefore, any additional impacts would be relatively minor and not substantive cumulative effects.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual California wolverines, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

**Table 29. Comparison of indicators of potential impacts on the wolverine.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Non-commercial Thinning</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
<tr>
<td>Acres of Elk Forage Enhancement</td>
<td>0</td>
<td>389</td>
<td>389</td>
</tr>
<tr>
<td>Miles of Temporary Road Construction</td>
<td>0</td>
<td>34.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Open Road Density (Mi/Mi²) in Project Area</td>
<td>1.8</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**Cascade Red Fox**

**Direct and Indirect Effects**

Alternatives 2 and 3 would have very limited potential to negatively impact Cascade red foxes given that the majority of proposed activities would not overlap with areas where they generally occur. Habitat enhancement would be expected to provide benefits for prey, although proposed activities could provide minor disturbance impacts to individual foxes.

Project activities such as forest thinning (pre-commercial thinning, commercial thinning) and recreation management have been proposed that would occur within the elevational range
reported for Cascade red foxes. However, above 4900 feet where there is the greatest probability of occurrence (Akins 2017), only a small/limited amount of commercial thinning (102 acres), non-commercial thinning (126 acres), elk forage thinning (one acre) and recreation management (Corral Pass, Noble Knob) has been proposed (Table 30). There is no temporary road construction planned for those areas.

Recreation enhancements would occur within the existing footprints and would not remove habitat. This will limit the potential for negative impacts to the Cascades red fox. Presumably, huckleberry enhancement opportunities could include areas above 4900 feet, but that along with other non-commercial thinning would likely have positive impacts on prey production and vegetative food sources. Revegetation efforts would assist in restoring habitat. Of the area identified for potential planting opportunities in the Norse Peak Burn, approximately two-thirds is above 4900 feet. This could benefit Cascades red foxes by creating small patches of cover for foraging and security sooner than under Alternative 1. Proposed activities below 4900 feet would be less likely to impact Cascade red foxes.

Cascade red foxes have a varied diet that includes snowshoe hares, red-backed voles, Douglas’ squirrels, pocket gophers, voles, fruit such as huckleberries, other plant matter, insects and birds (Aubry 1983). Commercial thinning, non-commercial thinning and huckleberry enhancement activities at these higher elevations which improve stand diversity and habitat conditions for a variety of animals and plants important in the fox’s diet. Cascade red foxes are adapted to spending the winter in higher elevations and remain in the same general vicinity of their summer home ranges in the winter (Aubry 1983). Therefore, improved prey abundance would likely improve year-round foraging by the Cascades red fox and provide benefits to the species.

The proposed work at Corral Pass would not be expected to impact Cascade red foxes directly given the habitat disturbance already created by the fire. Any associated revegetation work in the vicinity would likely benefit foxes by accelerating the development of prey habitat and a more limited recreation footprint would also potentially reduce the potential for human interactions. Habituation and food conditioning of Cascades red foxes has been documented at Mt Rainier National Park (Reese 2007). However, project design criteria which manage garbage and human foods associated with project activities or human recreation at higher elevations (E.g., campground at Corral Pass) would reduce the potential for those impacts.

In the short term, project activities at the higher elevations could disturb or disrupt Cascade red foxes, although this would likely only occur in the summer months. The proposed shooting area along the FSR 72 is just below 4900 feet elevation, but the topography at the site would limit the extent that noise would travel up into potentially occupied fox habitat.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Climate models suggest that wildlife restricted to high-elevation habitats may be at risk due to climate change. The Cascade Red Fox was rated as being moderate to highly sensitive to climate change under the recent assessment, primarily driven by the living in alpine habitats which are relatively sensitive to climate change, the dispersal barrier presented by lower elevation forests, potential effects on prey, and potential for more interactions with human and competitors (Lawler et al 2014, Akins 2017).
The project would add minor incremental impacts in terms of disturbance and the potential for increased recreation, but these would not be substantive cumulative effects. These would be counterbalanced to some extent by trash service at recreation sites to reduce the potential for conflicts, and habitat improvements which could benefit prey and foraging.

**Effects Determination for Alternatives 2 and 3:**
- may impact individual Cascade red foxes, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

**Table 30. Comparison of indicators of potential impacts on the Cascades red fox**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres Commercially Thinned Above 4900 feet</td>
<td>0</td>
<td>102</td>
<td>102</td>
</tr>
<tr>
<td>Elk Forage Thinning Above 4900 feet</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Non-commercial Thinning Above 4900 feet</td>
<td>0</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>Proportion of Planting Area Above 4900 feet</td>
<td>0</td>
<td>67%</td>
<td>67%</td>
</tr>
</tbody>
</table>

**Broadwhorl Tightcoil Snail**

**Direct and Indirect Effects**

Alternatives 2 and 3 would have minimal impacts on individual broadwhorl tightcoil snails given that their optimal habitat would not be removed or degraded and project design criteria would create protection for riparian corridors. Limited short term impacts to individuals could occur as a result of proposed activities within Riparian Reserves, but in the longer term, proposed habitat enhancement activities would be expected to provide benefits for this species.

This species is associated with a high level of structural diversity and moist microsite conditions including abundant ground cover and moderate to deep leaf litter (Frest and Johannes 1999), which is not expected in the mid-seral stands proposed for habitat restoration. The mature and old-growth forest habitat with large deciduous trees that would provide the best habitat for this species would not be removed or degraded under any alternative. In addition the species has not been documented on the Forest. Therefore, habitat restoration in upland mid-seral stands, and other transportation system work, watershed restoration, or recreation enhancement work that occurs in highly modified or open habitats is not expected to negatively impact this species.

Riparian thinning, overall temporary road construction in riparian areas, and canopy cover removal from new temporary road construction in riparian areas could temporarily reduce canopy cover and microsite conditions in areas that serve as transitions to suitable habitat (Table 31). Forest thinning has fewer impacts on mollusks than regeneration harvests, and retention areas (e.g., skips) can be important in maintaining the abundance and diversity of mollusks (Foltz Jordan and Black 2012). The short term impacts on mollusks in the thinned areas would be more open areas with greater fluctuation in soil and ambient temperatures, and lower relative humidity compared to unthinned forest (Wessell 2005). The no-cut stream buffers and remainder of the Riparian reserve that are not thinned (Approximately 92% of Riparian Reserve in project area) would provide connectivity and reduce short term impacts to the species.
Activities that compact soils or snow, disturb ground vegetation and/or litter, remove woody debris, alter temperature and/or humidity of the microsite, reduce canopy cover, or alter the water table can cause direct mortality and damage to habitat (Foltz Jordan 2010, Foltz Jordan and Black 2012). In this sense, ground-based logging systems have more potential to cause impacts.

Road construction activities not only removes habitat and food sources but creates open areas with unsuitable microclimate conditions and potential for direct mortality of mollusks in the construction, haul route preparation, maintenance and log-haul phases. Mortality may be direct from crushing or through desiccation caused by a change in the microclimate, and also can limit dispersal. Connected actions such as herbicide application related to invasive plant control can have direct impact on snails or their habitat (Foltz Jordan and Black 2012).

Overall, impacts to this species would likely be minimal given their optimal habitat would have little overlap with proposed activities. Silvicultural prescriptions which retain and promote maintaining hardwood species and shrub and ground cover species diversity should also provide microclimate, food and substrates for the fungi that mollusks feed upon and are consistent with management recommendations (Burke et al. 1999). Under all alternatives, project design criteria that reduce soil compaction, retain coarse woody debris, protect riparian areas, and protect or promotes vegetative diversity will minimize impacts to the broadwhorl tightcoil snail and improve their habitat in the long term.

**Cumulative Effects**

For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Timber harvest and fire have the greatest potential to impact the availability and distribution of the complex and moist forest conditions preferred by this species. Ongoing thinning activities may retain habitat but, along with road construction, can negatively impact the moist microclimate conditions needed in the short term.

Climate model projections for the region forecast an increase in wildfire area burned and wildfire severity, along with increased potential for summer drought (Lawler et al. 2014). Both of those factors can affect the availability and suitability of the moist forest conditions preferred by this species. The Snoquera project would add minor incremental short term impacts to microsite conditions from thinning, but it would not be substantive. In the long term, the improved structural conditions and forest resiliency would benefit the species in light of climate projections.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual Broadwhorl tightcoil snails, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

**Table 31. Comparison of indicators of potential habitat impacts for the broadwhorl tightcoil snail.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of commercial and non-commercial thinning within NWFP Riparian Reserve (outside of buffers)</td>
<td>0</td>
<td>4,438</td>
<td>4,438</td>
</tr>
<tr>
<td>Miles of Temporary Roads in Riparian Reserves</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Indicator</td>
<td>Alternative 1</td>
<td>Alternative 2</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Acres Temporarily Removed in Riparian Reserve from New Temporary Road Construction</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Western Bumble Bee**

**Direct and Indirect Effects**

Overall, Alternatives 2 and 3 would be expected to provide beneficial impacts to western bumblebees, although there could be short term impacts to individual bees. Terrestrial habitat restoration actions or events that thin or open dense stands and increase the diversity and abundance of native flowering plants on the landscape would generally benefit western bumble bees as well as other pollinator species. Proposed commercial thinning of (12,245 acres), non-commercial thinning (1,883 acres; largely inclusive of huckleberry enhancement), forage enhancement openings and thinning (389 acres), and huckleberry enhancement would reduce conifer cover and conceivably allow for more understory and flowering plant diversity in the project area (Table 32).

In general, an increase in herbaceous cover can benefit bumble bee species (Bombus spp.) community richness (Loffland et al. 2017). In fact, Loffland et al. (2017) suggested the use of canopy gaps to encourage preferred herbaceous and shrub communities with diverse blooming phenology to provide floral resources for bumble bees in general. Heavy thinning areas and small openings (“gaps”) would potentially benefit the western bumble bee in this way. The benefits of the thinning or openings could conceivably last decades, until expanding conifer cover eventually reduced the light available to the understory. Given that stands would be thinned across the span of several decades, so too would the benefits of increased understory resources be spread over time in the project area.

Western bumble bees would not likely be found in dense, mid-seral stands under current closed-canopy conditions, making impacts from initial thinning and forage enhancement treatments unlikely. However, maintenance activities in forage enhancement units, and transportation system activities, recreation enhancement or other activities in open habitats with herbaceous or shrubby cover may result in short term disturbances to foraging individuals and occasional mortality. Due to the mobile nature of this species and its ability to fly away from mechanical disturbances; direct mortality is expected to be minimal. Ground disturbing activities involving machinery may result in short term loss of suitable nesting and overwintering site availability for the bumble bee (i.e. rodent burrows). Spraying herbicides to control invasive plants in the project area is a connected action that has the potential to impact individual Western bumble bees, although spraying prior to the flowering period limits this potential.

Maintenance cycles of 3 to 5 years for prescribed fire or mechanical treatment in elk forage openings and huckleberry enhancement areas would periodically disrupt flowering plant communities and nesting or overwintering sites. Prescribed fire would not occur from March 1st to Sept 15th across 272 acres of elk forage openings, which would limit potential impacts to western bumble bees foraging during most of the flowering period. Hatfield et al. (2012) noted that any near-surface or subsurface disturbance of the ground, such as from fire and equipment use, is likely to have negative effects on bumble bee colonies or overwintering queens, as well as impacts on floral resources needed for colony growth. For this reason they also recommended having areas free from such practices as refugia as well as encouraging populations of rodents whose burrows they can use for nesting (Hatfield et al. 2012). In any given year, only a small
percentage of acres (approximately 10%) would likely be treated with equipment or prescribed fire as part of maintaining forage openings or huckleberry enhancement areas thereby providing adequate refugia elsewhere.

Re-opening decommissioned roads or other transportation repair work could disturb flowering plant communities on the road surfaces in the short term (Table 32). These areas would recover their flowering plant communities over time and provide floral resources after they are decommissioned. Additional roads proposed for decommissioning would also provide floral resources for Western bumble bees. However, as decommissioned roads grow in over time, the more open edge effect from the road corridor which can provide forage plant species for bees would eventually be lost. Roads that are placed in a (ML1) storage condition would also provide limited foraging opportunities along the roadside until the road is re-opened again.

Recreation enhancement work and Ranger Creek Airport enhancement work that involves ground disturbing activities in more open vegetated areas along roadways, trailheads, and dispersed camp sites may also temporarily disturb nectar plants, but these areas are already highly disturbed. Overall, project activities would be expected improve habitat conditions for the species.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Recently, areas in the Norse Peak fire that burned at moderate or high severity created sufficient canopy mortality that understory floral resources would be expected respond positively in the near future. The existing (159 acres; Phase 1) elk forage units provide more abundant floral resources for pollinators. However periodic forage maintenance activities such as prescribed fire, mechanical clearing, or connected invasive plant treatments could have negative effects on the species as previously discussed.

This alternative would add incrementally to the positive effects of forage enhancement across the project area, although the expected benefits from thinning may be relatively minor or short lived. Any cumulative negative impacts from ground disturbance would not be substantive.

**Effects Determination for Alternatives 2 and 3:**

- may impact individual Western bumble bees, but is not likely to result in a trend towards federal listing or loss of species viability.

**Summary**

*Table 32. Comparison of indicators of potential impacts on the Western bumble bee.*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial, Non-commercial, and elk Forage Thinning</td>
<td>0</td>
<td>14,245</td>
<td>14,245</td>
</tr>
<tr>
<td>Acres of Elk Forage Openings To Be Maintained with Periodic Burning and equipment use.</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
<tr>
<td>Miles of Temporary Road Construction</td>
<td>0</td>
<td>34.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Miles of Additional Road Decommissioning</td>
<td>0</td>
<td>23.8</td>
<td>23.8</td>
</tr>
<tr>
<td>Miles of Maintenance Level 1 Closed/Storage</td>
<td>0</td>
<td>5.7</td>
<td>5.7</td>
</tr>
</tbody>
</table>
Johnson’s Hairstreak Butterfly

**Direct and Indirect Effects**
Potential impacts to this species from Alternatives 2 and 3 would be very limited given that their preferred habitat would not be removed or degraded, although there could incidental impacts to trees containing substrate for their larvae.

Old-growth coniferous forests and late successional forests containing dwarf mistletoe (*Arceuthobium spp*) provide optimal or preferred habitat for this butterfly (Larsen et al. 1995, WDFW 1995, Miller and Hammond 2007), given that emerging Johnson’s hairstreak larvae feed solely upon the dwarf mistletoe (Pyle 2002, Fallon and Black 2017). Alternative 2 would not impact old growth and late-successional forest habitat for this species. This will greatly limit potential impacts of Alternative 2 on this species.

Younger forests where dwarf mistletoe is present can also support Johnson’s hairstreak populations (Larsen et al. 1995). The mid-serial forests proposed for commercial thinning (12,245 acres), forage enhancement openings (272 acres) and other project activities (new temporary road construction; 7 acres) could contain dwarf mistletoe (Table 33). This would be more likely in the portions of stands immediately adjacent to existing populations of dwarf mistletoe in late-successional or old growth forest because of the manner of propagation. Therefore, only a small proportion of the acres of proposed habitat restoration and other activities would be expected to have dwarf mistletoe. Selection criteria for residual trees in the thinning prescriptions include the retention of trees with dwarf mistletoe, because they can contribute to structural complexity and have the potential to develop into nesting platforms.

The selection process for trees to be felled for in-stream wood enhancement would ensure trees with dwarf mistletoe would not be removed. Recreation enhancement activities are occurring in previously impacted areas and generally would only remove young or small trees. However it is possible that hazard trees with dwarf mistletoe may need to be removed, but this is likely to be minimal. Overall, it is likely that only a small number of trees with dwarf mistletoe would be removed from thinning, forage enhancement openings, road construction, and other activities. In total, these factors will minimize impacts on the Johnson’s hairstreak.

**Cumulative Effects**
For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Unlike past harvest of old-growth forests, more recent and ongoing thinning or even-aged harvest of mid-serial stands is less likely to remove trees with dwarf mistletoe, which is a resource for the larvae. The Norse Peak fire is presumed to have killed or removed trees with dwarf mistletoe, especially in moderate to high severity burn areas. The Snoquera project would add only very minimal impacts to the species in terms of the potential to remove trees with dwarf mistletoe, and it would not be a substantive cumulative effect.

**Effects Determination for Alternatives 2 and 3:**
- may impact individual Johnson’s hairstreak butterflies, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.
Summary

Table 33: Comparison of Indicators of potential impacts on the Johnson’s Hairstreak Butterfly.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Mid-seral Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Mid-seral Removal (Elk Forage Openings and New Temporary Road Construction)</td>
<td>0</td>
<td>279</td>
<td>279</td>
</tr>
</tbody>
</table>

Valley Silverspot Butterfly

Direct and Indirect Effects

Potential impacts to the valley silverspot butterfly from Alternatives 2 and 3 will be limited to incidental impacts in open habitats given that the majority of proposed activities will not occur within suitable habitat for this species. The valley silverspot butterfly would not likely be found in most proposed stands under current closed-canopy conditions, because the larval host plants (*Viola adunca*) and nectaring plants require more open conditions (Foltz 2011, Hoffman 2012). Therefore impacts from commercial thinning, non-commercial thinning, huckleberry enhancement or the initial creation of openings is unlikely. Reducing densely stocked second growth forests and creating (permanent or ephemeral) openings could benefit a variety of native pollinators, including this species, as understory flowering plants become more abundant, depending on the species of understory plants that colonize the more open areas.

Maintenance activities in forage enhancement units, huckleberry enhancement areas, and transportation system activities, recreation enhancement or other activities in open habitats with herbaceous or shrubby cover may result in short term disturbances to foraging individuals and occasional mortality. Periodic burning, seeding and other maintenance activities in the forage enhancement openings and huckleberry enhancement areas would periodically disrupt flowering plant cover and larval host plants, if present, but would also maintain open habitat conditions generally favorable to flowering plants. The adults of the species are mobile but there could be limited mortality of larvae on host plants during disturbance activities. Connected actions such as herbicide application could also cause incidental adverse effects in the event of accidental overspray onto nectar plants, larval plants or individuals of the species.

Transportation system and recreation enhancement and Ranger Creek Airport enhancement activities that involve ground disturbance in more open vegetated areas along roadways, trailheads, and dispersed camp sites may also temporarily disturb nectar plants and larval host plants.

Overall, project activities would be expected to improve habitat conditions for the species.

Cumulative Effects

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Fire suppression and vegetation management under the Northwest Forest Plan have reduced the amount of early seral habitat where nectar resources and larval host plants would be expected. The recent Norse Peak fire created areas where understory floral resources would be expected.
respond positively in the near future. The existing (159 acres; Phase 1) elk forage units provide more abundant floral resources for pollinators as well. However periodic forage maintenance activities such as prescribed fire, mechanical clearing, or connected invasive plant treatments could have negative effects on the species as previously discussed.

Alternative 2 and 3 would add incrementally to the positive effects of forage enhancement across the project area, although the expected benefits from thinning may be relatively minor or short lived. Any cumulative negative impacts from ground disturbance would not be substantive.

**Effects Determination for Alternatives 2 and 3:**

- *may impact individual* valley silverspot butterflies, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

**Summary**

**Table 34. Comparison of indicators of potential impacts on the valley silverspot butterfly.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial, Non-commercial, and Elk Forage Thinning</td>
<td>0</td>
<td>14,245</td>
<td>14,245</td>
</tr>
<tr>
<td>Acres of Elk Forage Openings To Be Maintained with Periodic Burning and Equipment use.</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
<tr>
<td>Miles of Temporary Road Construction</td>
<td>0</td>
<td>34.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Miles of Additional Road Decommissioning</td>
<td>0</td>
<td>23.8</td>
<td>23.8</td>
</tr>
<tr>
<td>Miles of Maintenance Level 1 Closed/Storage</td>
<td>0</td>
<td>5.7</td>
<td>5.7</td>
</tr>
</tbody>
</table>

**Larch Mountain Salamander & Van Dyke's Salamander**

**Direct and Indirect Effects**

Alternatives 2 and 3 would create only incidental impacts to individuals from thinning and associated temporary road construction in or near riparian areas. Optimal habitat would be protected by project design criteria and mitigation measures and these two species are not likely to be found in areas proposed for activities. Proposed activities would be expected to provide longer term beneficial impacts by improving the diversity and health of riparian areas.

Proposed activities would not occur in or impact caves, lava tubes, mature or old-growth forest which are optimal habitat for the Larch Mountain salamander (Crisafulli et al. 2008). Although limited project activities would occur within riparian zones, project design criteria would minimize impacts to areas potentially used by the Van Dyke’s salamander near seeps and stream banks (Olson and Crisafulli 2014), splash zones of creeks or waterfalls under debris (Leonard et al. 1993), or under rocky or woody debris deposited by stream flows (Olson and Crisafulli 2014).

While younger forests with legacy components such as remnant large trees or snags can serve as potential habitat for the Larch Mountain salamander (Crisafulli et al. 2008), these types of stands have not been observed among those proposed for project activities. Hazard tree removal and pre-commercial thinning are likely to have minimal or no effects on Larch Mountain salamander due to minimal substrate disturbance (Crisafulli et al 2008). Uniform, even-aged managed stands with a history of being clear-cut harvested and burned are unlikely to contain habitat features
necessary to support Larch mountain salamanders, although they could be colonized as they mature (Crisafulli et al. 2008), and those are primarily the types of stands proposed for habitat restoration activities.

Indeed, pre-disturbance surveys across more than 400 acres of mid-seral managed stands proposed for elk forage openings or other activities for this project and others in the Greenwater and White River drainages failed to detect either the Larch Mountain salamander or the Van Dyke’s salamander. In addition, 2017 salamander surveys through a more decadent mature forest near NFS Road 7222 failed to detect these two species as well. The small number of sites in the Green River watershed (3 sites for Larch Mountain salamander, 1 site for Van Dyke’s salamander) where these two species were historically detected (1990s) are outside areas of potential activity and would not be impacted. All of these factors combine to lower the potential for impacts on these species from Alternatives 2 and 3.

Given the above, neither species would be expected to be found in upland forest proposed for activities such as habitat restoration or site preparation for recreation enhancement under current conditions. However, as noted by Crisafulli et al. (2008), these types of stands could be colonized as they mature. In addition, given their needs for moist microsites and the potential for riparian areas to serve as movement corridors for these species, activities within riparian areas have the potential for incidental impacts, although these would generally be limited by project design criteria which protect the integrity of riparian and aquatic habitats.

Thinning affects microclimate variables important to terrestrial amphibians, such as raising the ambient air temperature and soil temperature, and lowering relative humidity compared to unthinned stands (Wessell 2005), and has the potential to reduce coarse woody debris in the short term. Changes in micro-climate of the thinned stands could have minor impacts on Van Dyke’s salamanders in the terrestrial environment as well as Larch Mountain Salamander, but they would be unlikely to use these stands under current conditions. The Riparian Reserve thinning (4,438 acres total) and 11.2 miles of temporary road construction and reconstruction through riparian reserves could have impacts on Larch Mountain salamanders and Van Dyke’s salamanders in terms of microclimate effects and the potential for direct mortality of individuals (Table 35). However, thinning would occur outside of the no-cut buffers that are immediately adjacent to the streams or rivers, where the species would be more likely to be found. In addition, thinning in Riparian Reserve represents only 8 percent of the total Riparian Reserve allocation in the project area. These thinned areas would recover over time. Permanent forage enhancement openings, gaps and heavy thin areas would not be placed adjacent to riparian no-cut buffers or adjacent late-successional stands under any alternative, which would limit microclimate impacts to suitable habitat for these species.

Watershed restoration activities such in-stream wood recruitment, culvert replacement, or acclimation pond improvements would have negligible short term impacts on both species given either the low intensity of the work of conservation measures. In the longer term, the improvements to riparian and aquatic system health would benefit both species.

Ground disturbing activities associated with recreation enhancement would occur within the footprint of existing disturbed sites, with little or no impact to the microclimate of the surrounding forest. In fact, relocation of recreation sites away from the waterways would minimize future impacts from recreation and allow the vegetation of these areas to recover, which would benefit both species.
Stream buffers, riparian corridors and heavy non-commercial thinning slash, along with other no-cut areas, skips, and areas outside of thinning units have been suggested as part of a strategy to provide connectivity and dispersal potential for these two species between riparian and upland habitats and to other areas on the landscape (Marcot et al. 2018). These measures are included in both Alternative 2 and 3 and would improve connectivity and dispersal potential for these two species, along with minimizing impacts.

Cumulative Effects
For a general discussion of activities to which Snoquera Project may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Upland mid-seral stands being harvested as part of ongoing activities would not generally provide suitable habitat for these species. The future 7222 connector road project would remove a narrow strip of potentially suitable habitat, but neither species were detected during pre-disturbance surveys for that project. The Snoquera project would not remove late-seral or old growth habitat for these species. Impacts to micro-climate and connectivity from the Snoquera project would be minimal and not substantive when added to these other activities.

For amphibians that breed in streams, higher peak flows associated with climate change could wash away eggs and individuals. In addition, more frequent droughts in the dry season could alter the riparian vegetation that serves as breeding habitat (Lawler et al. 2014). Many amphibian species are likely to be sensitive to higher temperature and drier conditions in the summer due to climate change. In addition, amphibians may become affected more by diseases that become more widely distributed (Lawler et al 2014). These two species would likely be vulnerable to climate warming because of their specialization for cool microclimates, their limited dispersal capabilities, and their lack of physiological tolerance to warmth-induced stresses (several studies as cited in Marcot et al. 2018).

Forest management practices that retain canopy cover, and maintain or supplement surface refugia such as down wood and logs may help to ameliorate the effects of climate change (Marcot et al. 2018). The thinning and watershed restoration treatments proposed in the Snoquera Project would improve forest structure, riparian and upland habitat quality over time. Although the short term impacts could increase microclimate effects, this would not occur in optimal habitat for these species which will limit negative impacts. Overall, Snoquera would add minor impacts to both species, but they would not be substantive cumulative effects, and longer term impact would be positive.

Effects Determination for Alternatives 2 and 3:
- may impact individual Larch Mountain Salamander or Van Dyke’s Salamander, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Summary

<table>
<thead>
<tr>
<th>Table 35. Comparison of indicators of potential impact on Larch Mountain Salamander and Van Dyke’s Salamander between alternatives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
</tr>
<tr>
<td>Acres of Commercial Thinning</td>
</tr>
</tbody>
</table>
Survey and Manage Species

Potential impacts of project activities on the Larch Mountain salamander and Van Dyke’s Salamander are discussed above. No known sites for these species are within areas proposed for activities, nor would any such sites be impacted. Pre-disturbance surveys for these species were conducted in all of the elk forage units proposed as permanent openings (272 Acres) to comply with Survey and Manage direction. Neither species was detected in these mid-seral stands, which would not be expected to provide optimal habitat. Other proposed project activity areas did not require surveys because they either do not occur within or would not impact suitable habitat for either species or the activity falls under one of the Pechman exemptions. Thinning activities, culvert replacement or removal, (road and trail decommissioning) and tree placement into streams for aquatic restoration are exempt from survey requirements.

Alternatives 2 and 3 would not be expected to impact the two mollusk species. Habitat for the Puget Oregonian, and evening field slug is not present in any of the areas proposed for activities. There would be no direct, indirect or cumulative impact to the Puget Oregonian or Evening field slug under any alternative. Therefore, pre-disturbance surveys are not required for these species. These species will not be analyzed further discussed in this document.

January 2001 Survey and Manage ROD and Standards and Guidelines - Protection Buffer Species

The Northwest Forest Plan Standards and Guidelines protect sites for these species with buffers appropriate to each species (USDA and USDI 1994). Currently there are no known sites of these species with the potential to be impacted by Alternatives 2 and 3. This would minimize potential impacts to these Protection Buffer Species.

Management Indicator Species

The Mt Baker-Snoqualmie National Forest Management Indicator Species Assessment (USDA 2011) provides information on the status and trends of habitat and populations of MIS on the Forest. The grizzly bear, gray wolf, bald eagle, peregrine falcon, and northern spotted owl (Current or former Threatened and Endangered Species Habitat MIS) and the mountain goat (Mountain Goat Habitat MIS) were analyzed above, and incorporated this MIS Assessment information where relevant. Alternative 2 and 3 would not contribute to a negative trend in the viability of these management indicator species on the Forest. Under the Mt Baker-Snoqualmie LRMP (1990), the marten and pileated woodpecker are MIS for Mature and Old Growth Forest habitat. Primary Cavity Excavator species are MIS for snags and downed logs. Because mature and old-growth forest would be protected under all alternatives, and the snag component is the...
part of the pileated woodpecker’s life history needs that could be impacted by project activities, it will be discussed in tandem with the Primary Cavity Excavators.

**Mature and Old Growth Forest Habitat – Marten**

**Direct and Indirect Effects**

The potential impacts of Alternatives 2 and 3 on marten are expected to be minimal given that their preferred habitat would not be removed or degraded by proposed activities. Alternatives 2 and 3 would not contribute to a negative trend in the viability this management indicator species on the Forest. Since the implementation of the NWFP in 1994, the estimated habitat trend for pine marten on the Forest is stable to slightly increasing, and the estimated population trend is stable (USDA 2011). Projects consistent with the NWFP are expected to maintain viability of late-successional associated species such as the marten on the Mount Baker-Snoqualmie National Forest (USDA 2011).

High canopy cover with an abundance of decadence (e.g., snags and down logs) and complex physical structure near the ground is an important feature of marten habitat (Buskirk and Ruggiero 1994, Buskirk and Zielinski 1997, Moriarty et al. 2016). This complexity provides features used to meet daily resting and seasonal denning needs as well as providing food and cover for prey species. In north-central California, Moriarty et al. (2016) found that martens strongly selected complex-structured forest stands over simple stands and openings. Mature and old-growth habitat provides this type of complexity for the marten and would not be affected by Alternatives 2 and 3. The early and mid-seral stands proposed for habitat restoration, as well as other areas potentially affected by proposed activities, do not have this level of complexity and would be comparable to the simple stands or openings that the marten avoided. The larger diameter of trees, snags, and log preferred by this species (e.g., >40 inches for rest sites; Spencer et al. 1983) would not be expected in these mid-seral stands with their intensive management history. For the montane mixed conifer wildlife habitat type, data from the DecAid Analysis suggests that under current conditions, there are adequate numbers of ≥20” dbh snags for marten on a sizeable portion of the landscape (DecAid Analysis, Project Record), which would likely occur in the mature or old-growth stands.

Thinning treatments would increase stand complexity preferred by the marten, over time. Thinning would improve tree growth which would contribute to larger structures available as denning and resting sites sooner than under Alternative 1. Marten will pursue and consume a variety of prey species (Buskirk and Ruggiero 1994, Bull 2000, USDA 2001). Impacts on prey species from thinning will vary, but variable density thinning with skips and gaps is expected to improved conditions for a variety of potential prey species. The gaps and elk forage enhancement openings would likely be avoided by marten (Moriarty 2016), but their placement on the landscape would not limit movement given the amount of high canopy cover forest that would remain (Table 36).

Limited planting in the Norse Peak Burn would accelerate the development of complex forest conditions with high canopy cover for the marten. Disturbance associated with recreational shooting would not impact the structure of preferred marten habitat. Other recreation enhancement activities would not impact mature and old growth habitat.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.
The ongoing timber harvest in simplified mid-seral stands likely has little negative impact on marten, given their selection of complex stands over simplified stands or openings (Moriarty 2016). The positive impact of other thinning occurring in the project area would be to accelerate the development of more complex habitat for this species. Recently, mature and old growth forest in the project area was modified by the Norse Peak Fire, and was assumed to be removed in area of moderate and high burn severity.

Alternatives 2 and 3 would not remove or modify the mature or old-growth habitat of this MIS. The project may add short term impacts on prey from habitat restoration activities, but they would not be substantive. Longer term cumulative impacts would be a positive incremental impact from additional habitat that would have improved forest complexity for this species in the future.

**Effects Determination for Alternatives 2 and 3:**
- would not contribute to a negative trend in the viability of this management indicator species on the Forest.

**Summary**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Non-commercial Thinning</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
<tr>
<td>Acres of Elk Forage Thinning</td>
<td>0</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>Acres of Permanent Elk Forage Openings</td>
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<td>272</td>
<td>272</td>
</tr>
</tbody>
</table>

**Pileated Woodpecker and Primary Cavity Excavators**

**Background**

The Forest Plan, as amended, requires that the Forest retain snags across the landscape at levels sufficient to support major west-side Cascade cavity nesting birds at 40 percent of potential population levels using guides from the Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington (Brown 1985). In addition to snags, the LRMP also requires large dead and downed logs to be left (USDA 1990).

For this project, the area of pileated woodpecker and primary cavity excavator’s effects is federal lands within the Snoquera project area. DecAID is an online advisory tool developed to assist land managers in evaluating forest conditions and proposed forest management activities on organisms (bats, marten, pileated woodpecker and other primary cavity excavators, and mollusks) that use snags and downed wood, and Version 3.0 is now available (Mellen-MacLean et al. 2017). A more in-depth analysis of snags and down wood, and the potential impacts of the Project, can be found in the DecAID Analysis for the Snoquera Restoration Project (Project Record).

The data from the DecAID analysis suggest that the Snoquera analysis area, compared to historical levels, has a considerably smaller percentage of the large tree structural condition and considerably larger percentages of small/medium tree and open canopy structural conditions. This is not surprising given the amount of timber harvest activities that has occurred since the 1930s (our historic reference point), which resulted in the loss of a large portion of stands with large trees and their replacement by many younger stands (DecAid Analysis, Project Record).
Past management activities in the Snoquera Analysis Area have resulted in overstocked second growth stands that are exhibiting increased mortality due to lack of nutrients and sunlight. This single story structure has also led to poor habitat conditions for many wildlife species. In a landscape that once exhibited diverse vegetative composition and heterogeneity, the need for large down wood, snag and understory structure is needed for species persistence (DecAid Analysis, Project Record).

Direct and Indirect Effects

Overall, project design criteria and mitigation measures will minimize potential direct impacts to snags and down wood, although habitat restoration activities may have impacts on future recruitment of these resources. Alternatives 2 and 3 would not contribute to a negative trend in the viability these management indicator species on the Forest. Since the implementation of the NWFP in 1994, the estimated habitat trends for both the pileated woodpecker and primary cavity excavators on the Forest are stable to slightly increasing and estimated population trends are stable (USDA 2011). Projects consistent with the NWFP should be expected to maintain viability of late-successional associated species such as the pileated woodpecker as well as primary cavity excavators (USDA 2011).

The mature and old growth forest structure associated with the pileated woodpecker as an MIS would not be impacted by Alternative 2 or 3, as described above for the marten. This greatly limits any potential impacts on the Pileated woodpecker as a Management Indicator Species. Project design criteria would protect snags and down logs, except for safety or operational reasons, so that only a minimal number would be impacted.

Snags

Thinning would capture some of the future snag and down wood that would be created from competition mortality as understory and intermediate trees are shaded out, and become snags over the next 50-100 years. There would be a reduction in potential snag and down wood biomass from the removal of these co-dominant and smaller diameter trees (less than 12 inches dbh). Small diameter snags would continue to be provided through the "skips" in treatment provided by buffers on streams, and other areas excluded due to resource concerns or logging system limitations. Snag creation within these “skip” areas and the thinned areas would be supplemented by natural mortality from storms, disease, bear damage, insects, drought, competition, etc.

Following thinning, residual trees would likely have less competition, and more of the stand biomass would be captured in fewer, larger diameter trees. The concentration of growth on fewer stems has the potential to result in larger snag, and the recruitment of another age class in the understory that would provide for future small diameter snags.

Alternatives 2 and 3 are designed to maintain snag numbers at and above the 40 percent population level and meet the 30 percent to 50 percent tolerance level of snag densities for west-side cavity associated species as per the DecAID review. Desired snag levels are managed at both the project level and the 6th field watershed level with special emphasis on large diameter snag retention and creation due to the lack of this cohort in the second-growth stands (DecAID Analysis, Project Record).

Snag retention, under the project design criteria, would contribute to meeting the 30 to 50 percent tolerance level of snag densities for all cavity nesting species within the thinned stands of the project area. As the thinned stands mature and dominate and co-dominate trees overshadow lesser trees, larger diameter snags would be created. Alternative 2 would require 30 to 100 years to
develop trees in the larger diameter size classes and initiate recruitment of large diameter snags to levels to contribute to an 80 percent tolerance level for snag using species of greater than 20 inch dbh snags.

The combined commercial thinning and elk forage enhancement treatments (up to 14,517 acres) would impact under 10 percent of the USFS lands in the project area. As stated previously in this document, it is expected that the gross acreage of the commercial thinning portion (12,245 acres) could be reduced by as much as 50 to 70 percent by the time project implementation occurs. This would reduce the potential impact area for snags and down wood. The reduced snag densities that could result in the proposed thinned areas are balanced by the amount of mid-serial habitat left untreated, old forest snag contributions, and the recent contributions of the Norse Peak Fire. The Norse Peak fire and mature and old-growth forest in the Project area would both likely maintain snag levels at the 80 percent tolerance level for species associated with snags greater than 10” dbh and with snags greater than 20” dbh for both the Western Lowland Conifer Hardwood Forest (WLCH) and the Montane Mixed Conifer Forests (MMC) vegetation types.

Wisdom and Bate (2008), Rochelle et al. (1999) and Gaines et al. (2003) reported road- or access-related effects that include removal of snags and coarse wood due to firewood cutting and hazard tree removal. Wisdom and Bate (2008) found significantly higher numbers of snags in stands that did not have a road adjacent to them. Within stands adjacent to roads, they found that snag density was 40 percent lower within 50 meters (55 yards) from adjacent roads. This suggests that temporary road construction and related access during project activities could impact snag and down wood levels near the roads. Reductions in open road densities through decommissioning of temporary roads and other roads as part of watershed restoration efforts, would likely have positive impacts on snag and down wood retention.

**Coarse Woody Debris**

Thinning would capture some of the future snag and down wood that would be created from competition mortality as understory and intermediate trees are shaded out, become snags, and then fall, becoming down wood over the next 50-100 years. There would be a reduction in potential down wood biomass from the removal of co-dominant and smaller diameter trees (less than 12 inches dbh). The concentration of growth on fewer stems has the potential to result in larger pieces of down wood biomass when a remaining tree falls, and the recruitment of another age class in the understory that would provide for future small diameter wood debris. However, tree mortality would be expected to decrease for several decades. Most of the thinning slash generated from the non-commercial thinning of up to 1,883 acres would remain on the ground as a potentially dense layer of small diameter woody debris.

Small diameter down wood would continue to be provided through the "skips" in treatment provided by buffers on streams, and other areas excluded due to resource concerns or logging system limitations. Existing logs would be retained according to LRMP Standards and Guidelines (USDA 1990). Coarse woody debris in these “skip” areas and thinned areas would have additional down wood from natural mortality from storms, disease, bear damage, insects, drought, competition, etc. Post-thinning monitoring elsewhere has shown that a small amount of post-harvest windthrow will generally occur (Roberts et al. 2007) and contribute additional down wood components. While it is expected that coarse woody debris biomass would be less during the establishment of another understory cohort (10 to 30 years), both alternatives would meet the objectives of retention of the both small diameter (<20 in) and large diameter (> 20 inches) down wood, and future recruitment of large wood.
Cumulative Effects
For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16. 

The 7222 Connector Road project would remove a small amount of older habitat for road relocation where larger snags could be present. The area adjacent to the road would then be subject to additional removal from firewood cutting. Current thinning and other timber harvest likely removes a smaller number of snags (smaller diameter), and reduces recruitment as previously discussed, but also leads to larger snags on the landscape over time. 

The 2017 Norse Peak Fire likely consumed a portion of the existing snags and down wood. However, the net result of the range in burn severity would be large areas of high snag and down wood levels and no overhead canopy, along with forested areas with a more moderate number of snags and down wood. This will provide conditions for a wider variety of species associated with snags and down wood, including the Pileated woodpecker-MIS and Primary Cavity Excavator-MIS. 

Overall, activities would add minimal negative effects to the Pileated woodpecker-MIS and Primary Cavity Excavator-MIS in conjunction with other present, ongoing and foreseeable actions, but would not represent a substantive cumulative effect on the MIS. 

Climate model projections for the region also forecast an increase in wildfire area burned and wildfire severity, and other directly or indirectly related stressors will also increase mortality (Lawler et al. 2014). This would conceivably increase snag and down wood resources, although it could change the distribution across space and time. Project activities would improve forest resilience to these factors. Fire and disease would continue to create tree mortality on the landscape, especially in untreated areas. Alternative 2 and 3 would not contribute substantive negative impacts on the Pileated woodpecker-MIS and Primary Cavity Excavator MIS when added to the potential effects of climate change.

Effects Determination for Alternatives 2 and 3:
- would not contribute to a negative trend in the viability of the Pileated Woodpecker-MIS and Primary Cavity Excavators-MIS on the Forest.

Summary

Table 37. Comparison of indicators of potential impacts on the Pileated Woodpecker-MIS and Primary Cavity Excavators-MIS.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
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</thead>
<tbody>
<tr>
<td>Acres of Mid-seral Forest Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Acres of Non-commercial Thinning (Woody debris)</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
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</table>

Neotropical Migratory Birds

Direct and Indirect Effects
Potential impacts to neotropical migratory birds from Alternatives 2 and 3 would be limited given that most high value habitats or habitat elements would be excluded from treatments or provided protections under project design criteria and mitigation measures. Impacts would be primarily
limited to short term disturbance impacts and minor habitat degradation, and would not trigger the need for additional conservation action. In the longer term, proposed activities would be expected to improve habitat conditions for neotropical migratory birds.

Biologically diverse mature and old-growth forest habitats that are important habitat for a variety of migratory bird species, along with wetlands, fens and meadows, would not be removed or degraded by Alternative 2 or 3. Project design criteria that protect the health and integrity of riparian and aquatic systems would minimize potential impacts on these important habitats. Retention of large residual snags, and individual large trees such as suitable nest trees or legacy trees would help to retain structural features valuable for perching and singing and are in line with management recommendations for species such as the olive-sided flycatcher (Altman and Alexander 2012). Limited operating periods proposed for other species or resources (northern spotted owl, marbled murrelet, elk calving, etc.) would reduce the potential impacts of noise disturbance on breeding migratory birds in those same affected areas. These measures would minimize impacts to neotropical migratory birds.

Thinning mid-seral stands has been shown to increase the overall species richness and density of birds, and a variety of thinning intensities from no-cut areas to heavy thinning areas has been recommended in order to maximize benefits while minimizing any negative responses (Havari and Carey 2000, Hagar et al. 2004). Alternative 2 would be consistent with these recommendations and would provide benefits to a variety of bird species. Because a variety of wildlife including birds benefit from non-conifer vegetation (Hagar 2007), habitat restoration prescriptions that would increase non-conifer vegetation in thinning areas, huckleberry enhancement units, and elk forage areas would benefit a variety of bird species. Therefore, the combination of commercial thinning (12,245), non-commercial thinning including huckleberry enhancement (1,883 acres), elk forage openings (272 acres), and elk forage thinning are expected to benefit a wide variety of neotropical migratory birds while minimizing impacts (Table 38). The subset of commercial and non-commercial thinning that includes Riparian Reserve Thinning (4,438 acres) would also be expected to benefit birds in the long term due to the importance of riparian habitats.

Project activities would use motorized tools or machinery and blasting, which could disturb birds. Stands proposed for thinning could be thinned during the summer breeding seasons, which may impact birds nesting in these stands at that time. Disturbance from human presence and related activities during the breeding season can impact birds through nest abandonment, increased predation of eggs and young, direct destruction of nests, negative effects on nest-site choice, and disruption of breeding (Hockin et al. 1999). Disruptions outside of the breeding season can also impact birds in terms of how they use habitat and the overall landscape, including seasonal movements (Hockin et al. 1999). In most cases, these noise impacts related to proposed activities would only apply to one or two seasons.

The small proportion of permanent forage enhancement openings and gaps (thinning) would benefit migratory bird species. There are a wide variety of plants and animals associated with naturally-formed early seral forest and these areas have high value for a variety of species, including some species which benefit from having this habitat intermixed with mature or late-successional forest (Swanson et al. 2014). These created openings would develop an abundance of short-statured deciduous vegetation associated with the lack of conifer cover, which is one key component contributing to the value of early seral openings (Swanson et al. 2014). However, biological legacies such as a “hyper-abundance” of large snags and logs are also a key attribute
for high value early seral communities (Swanson et al. 2014), and these created openings would be relatively lacking in that component.

Road construction or reconstruction associated with temporary roads through Riparian Reserves would result in the temporary removal of approximately 24 acres (two acres from new construction) of habitat in or adjacent to riparian areas (Table 38). Thinning would also occur in a proportion of the Riparian Reserves outside of no-cut buffers. Both of these activities could result in short-term impacts to hardwood-associated, riparian and aquatic wildlife species. However, the implementation of project design features related to hardwoods, wetlands, streams, Riparian Reserves, and other unique habitats in the project area, would ensure Alternative 2 and 3 do not limit the availability of habitat for riparian and deciduous-associated species of migratory landbirds.

Cumulative Effects
For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Upland mid-seral stands being harvested as part of ongoing activities would not generally provide suitable habitat for a wide range of species under current conditions. Thinning treatments would be expected to improve overall conditions for a variety of species as previously discussed. The 7222 connector road project would remove a narrow strip of older, and likely more diverse habitat. Alternatives 2 and 3 would not remove late-seral or old growth habitat for these species and would add incremental beneficial impacts through activities that improve conditions in riparian or upland habitats. Negative impacts on birds from noise disturbance would be minimal, short term, and not substantive when added to these other activities.

Effects Determination for Alternatives 2 and 3:
- would not contribute toward the need for additional conservation action for these species of neotropical migratory birds.

Summary

| Table 38. Comparison of indicators of potential habitat impacts on neotropical migratory birds. |
|-----------------|--------------------------------|----------|----------|
| Indicator                    | Alternative 1 | Alternative 2 | Alternative 3 |
| Acres of Commercial Thinning | 0              | 12,245       | 12,245    |
| Acres of Non-commercial Thinning | 0              | 1,883       | 1,883     |
| Acres of Elk Forage Thinning   | 0              | 117         | 117       |
| Acres of Permanent Elk Forage Openings | 0              | 272        | 272       |
| Acres of commercial and non-commercial thinning within NWFP Riparian Reserve (outside of buffers) | 0              | 4,438      | 4,438     |
| Acres Temporarily Removed in Riparian Reserve Due to Temporary Road Construction | 0              | 11         | 11        |
Deer and Elk

Direct and Indirect Effects
Alternatives 2 and 3 would have potential to negatively affect individual deer and elk, through short term disturbance from project activities, although the expected longer term effects of proposed activities would be improved foraging conditions.

Standards and guidelines in the LRMP discourage activities in calving and fawning areas and require timing to minimize disturbance impacts, which can include restrictions on access and operations (USDA Forest Service 1990). Reducing disturbance in calving areas can have positive effects on elk productivity (Shively et al. 2005). Telemetry monitoring of elk by the Muckleshoot Indian tribe provides valuable information on the location and extent of use of elk calving areas. This information would be used, where available, to establish priority areas for timing restrictions on activities that could be disruptive to calving elk, which would reduce potential disturbance impacts.

Up to 14,517 acres of terrestrial restoration, in various forms of commercial thinning, non-commercial thinning and permanent openings would benefit elk and deer to varying degrees in terms of forage production (Table 39). The Westside Elk Nutrition Model predicts that reducing canopy cover and increasing the hardwood component would improve the available nutrition to elk (Boyd et al. 2011). Therefore, these treatments would be expected to benefit elk. Given that small openings and structural heterogeneity within and between stands are beneficial to black-tailed deer (Nelson et al. 2008), terrestrial habitat enhancement would also be expected to benefit deer.

Elk forage enhancement openings and thinning units are proposed in areas designated for forage production (MA 8E) under the ROD for the Huckleberry Land Exchange (USDA 2001). Up to 272 acres of the elk forage openings would occur within areas identified as elk winter range and up to 117 acres of elk forage thinning units would occur in areas identified as summer range, both within MA 8E. Prescribed fire and seeding with desirable mix of grasses and forbs would be used to establish and maintain a higher quality and abundance of forage for elk and deer. Leaving vegetative screens along roads adjacent to important foraging areas to reduce potential traffic effects has been recommended for elk (Montgomery et al. 2015) and deer (Nelson et al. 2008). This concept would be incorporated into layout of the elk forage units where applicable.

Other proposed terrestrial restoration activities such as commercial thinning would complement the elk forage enhancement areas and include a greater distribution of forage improvement on the landscape. Variable density thinning prescriptions would reduce canopy cover, allowing more understory forage development than under current closed canopy conditions, where the understory is sparse. Nutritional gains in digestible energy from thinning may be relatively modest (Cook et al. 2016, Rowland et al. 2018) compared to early seral openings, but would represent an improvement over existing conditions nonetheless. Thinning would also improve forage production for deer (Nelson et al 2008). More forage is expected to develop within the gaps of 1/4 to 1/2 acre openings over 3 to 10 percent of the treated areas and the heavy thinning areas of ½ to 3 acres in size that cover approximately 3 to 10 percent of each stand area. A number of these proposed thinning units would surround the proposed elk forage openings, which would create a larger effective area of improved forage. Non-commercial thinning (including huckleberry enhancement) in early seral stands would also improve forage on up to 1,883 acres, although heavy slash accumulations in these stands could impede deer and elk movements if not treated in some manner (Nelson et al. 2008). The portion of non-commercial thinning that
includes huckleberry enhancement (up to 400 acres) would have slash treatment, which would reduce this potential impediment.

The forage benefits to deer and elk from the treatments depend somewhat on the understory species that colonize the thinned areas. For example, species such as salal are generally less palatable to elk and are avoided compared to grasses or forbs such as pearly everlasting, which are actively selected (Cook et al. 2016). Improvements in the nutritional quality of forage would be expected to have a positive influence on the reproductive rates and survival of elk (Cook et al. 2004, Hutchins 2006). The 12,217 acres of treatment in summer range (>2500 feet) would help to address what Cook et al. (2013, 2016) noted as deficiencies in summer nutrition in elk in western states such as Washington State (Table 39). Huckleberry enhancement thinning areas, yet to be identified, would presumably all be above 2,500 feet, and would largely overlap with proposed non-commercial thinning. Slightly more than half (57%) of the commercial thinning would occur initially, with the balance (43%) occurring 15 or more years later, once the stands become commercially viable (Table 39). Given that the forage benefits of thinning do not last indefinitely, this would spread forage enhancement benefits over time.

Still, more than half (>60%) of the forested area in the project area would continue to provide the size of trees and density of canopy cover adequate to provide hiding and thermal cover for deer and elk. Adjacent areas of mature forest, old growth forest, and unthinned mid-seral forest along with unthinned skips and no-cut buffers within terrestrial restoration areas would distribute this hiding and thermal cover across the landscape at a variety of elevations. Maintaining areas of high (>60% canopy cover) forest cover for snow interception has also been shown to be important in local areas during heavy snow years, although providing forage in winter range is also important (Vales et al 2017). Thinning-from-below is also expected to benefit snow interception capability for deer (Nelson et al. 2008).

Project activities would temporarily increase road densities and associated disturbance through new temporary road construction (3.2 miles) and reconstruction of unclassified and previously decommissioned roads. A high density of roads can negatively impact elk (CEMG 1999) and deer (Nelson et al. 2008). However, temporary roads would be decommissioned after timber harvest is completed, and additional road decommissioning is proposed. Currently, open road density in the project area is higher than the 1.5 miles per square mile in summer/fall range and the 1.0 miles per square mile in winter/spring range threshold levels recommended for elk (WDFW 1996)(Table 39). Current densities are also above the 1 mile per square mile recommended for deer (Nelson et al 2008). Reducing road densities has been shown to reduce disturbance to elk (Witmer and deCalesa 1985) and has also been recommended for black-tailed deer (Nelson et al. 2008). While open road densities would be slightly reduced compared to the No Action Alternative, the average open road density for the project area would still remain above these thresholds after project activities are completed.

Forest roads that experience high levels of human use (and the habitat near them) may be used markedly less by elk compared to little-used roads or those closed to public vehicle traffic (Montgomery et al. 2015). Decommissioning short segments of roads that access previously created elk forage enhancement units would limit the potential for disturbance for deer and elk from recreational target shooting that is currently occurring in a number of these areas. The decommissioned roads would allow foot access for hunting and other forms of recreation as well as administrative maintenance of forage conditions.

Recreation management activities would minimize impacts of recreation on local habitats while continuing to provide recreation opportunities. OHV use along the Naches trail is an existing use,
and the extent to which deer and elk have habituated to, or have been affected by, that use is unknown. OHV trailhead improvements could increase trail use by motorized vehicles, which could increase the potential for displacement of animals near the trail. Off-road recreational activity can alter elk behavior such as disrupting feeding and increase movements, especially OHVs and mountain biking (Naylor et al. 2009).

Persistent human disturbance can cause an elevated stress response in elk (Jachowski et al. 2015). Improvements to the proposed shooting areas on FSR 70 and FSR 72 that involve sound abatement would be expected to reduce noise-related disturbance to deer and elk in these areas compared to current levels. The proposed shooting closure of the 7013 road would reduce disturbance related to noise and human presence across approximately 40 acres of elk forage openings that were previously created (“Phase 1”) in Management Area 8E.

Elk and deer that use the area surrounding the proposed Ranger Creek recreational improvements may be impacted by disturbance associated with any increases in recreational use. Deer-vehicle collisions on runways (and roads) may result in injuries to people and damage to property in addition to likely injury or death to the animal (Nelson et al. 2008). The likelihood of potential disturbance of or collisions with deer and elk in or near the airfield and associated recreational sites is somewhat dependent on attractants (i.e., forage) as well as level and type of disturbance present.

**Cumulative Effects**

For a general discussion of activities which may add incremental cumulative effects, see “Cumulative Effects to Wildlife Considered for All Alternatives” and Table 16.

Ongoing thinning related to Upper White River Vegetation Management Project would provide forage enhancement, primarily in the Upper West Fork White River. Previous establishment of approximately 159 acres of forage enhancement (Phase 1) openings in MA 8E are providing improved forage. These areas would continue to provide quality forage in perpetuity, although they require regular maintenance.

Timber harvest on non-federal lands likely provides a greater contribution to forage enhancement through greater scale and intensity of harvest. This alternative would add minimal but positive gains in elk and deer forage enhancement to these other activities.

The Norse Peak Fire created open areas that could be expected to develop valuable forage in coming years. The proposed treatments would complement those gains and distribute forage enhancement across a great proportion of the project area and into subwatersheds not affected by the Fire. Proposed planting would occur in only a fraction of the fire area and would not appreciably impact the amount of remaining early seral habitat.

Elk are believed to be relatively resilient to climate change because they are habitat generalists and can move long distances and tolerate a range of climatic conditions (Lawler et al. 2014). If lower snow packs lead to more invasive species and increased encroachment of trees in alpine meadow areas, forage quantity and quality in the summer ranges for elk and deer may be altered. However, increased frequency and severity of fire under climate change scenarios could improve forage availability in forested areas. Overall, the contribution of Alternatives 2 and 3 to deer and elk resources is not entirely clear in light of climate-induced changes, but proposed activities would likely have longer term positive impacts.
Effects Determination for Alternatives 2 and 3:
- may negatively impact individual deer and elk in the short term, but overall population-level effects are expected to be positive due to increased forage.

Summary

Table 39: Comparison of indicators of potential impacts to deer and elk.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acres of Commercial Thinning</td>
<td>0</td>
<td>12,245</td>
<td>12,245</td>
</tr>
<tr>
<td>Total Acres of Non-Commercial Thinning</td>
<td>0</td>
<td>1,883</td>
<td>1,883</td>
</tr>
<tr>
<td>Acres of Elk Forage Thinning in MA 8E</td>
<td>0</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>Acres of Elk Forage Permanent Openings in MA 8E</td>
<td>0</td>
<td>272</td>
<td>272</td>
</tr>
<tr>
<td><strong>Total Acres with Enhanced Forage</strong></td>
<td><strong>0</strong></td>
<td><strong>14,517</strong></td>
<td><strong>14,517</strong></td>
</tr>
<tr>
<td>OPEN Road density in Project Area (Mi/Mi²)</td>
<td>1.8</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**Acres of Treatment by Elevation**

| All Elk Forage Enhancements (MA 8E) <2500 Feet                          | 0             | 31            | 31            |
| All Elk Forage Enhancement (MA 8E) >2500 feet                           | 0             | 358           | 358           |
| Acres of Commercial Thinning < 2500 feet                               | 0             | 2,238         | 2,238         |
| (Winter Range)                                                          |               |               |               |
| Acres of Commercial Thinning > 2500 feet                               | 0             | 10,005        | 10,005        |
| (Summer Range)                                                          |               |               |               |
| Acres of Non-Commercial Thinning <2500 feet                             | 0             | 29            | 29            |
| Acres of Non-Commercial Thinning >2500 feet                             | 0             | 1,854         | 1,854         |

**Acres of Commercial Thinning By Time Period**

| Acres Commercial Thinning 0-5 years                                     | 0             | 6,964         | 6,964         |
| Acres Commercial Thinning 15+ years                                     | 0             | 5,280         | 5,280         |

*Acres of huckleberry enhancement are not included since they would largely overlap with non-commercial thinning.

Effects Determinations Summary

Table 40. Determination Summary by Alternative for Analyzed Species

<table>
<thead>
<tr>
<th>Species or Habitat</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federally-listed Species*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Spotted Owl</td>
<td>NE</td>
<td>NLAA</td>
<td>NLAA</td>
</tr>
<tr>
<td>Northern Spotted Owl CH</td>
<td>NLAA</td>
<td>NLAA</td>
<td>NLAA</td>
</tr>
<tr>
<td>Marbled Murrelet CH</td>
<td>NE</td>
<td>LAA (Disturbance)</td>
<td>LAA (Disturbance)</td>
</tr>
<tr>
<td>Marbled Murrelet</td>
<td>NE</td>
<td>LAA (PCE-2 Removal)</td>
<td>LAA (PCE-2 Removal)</td>
</tr>
<tr>
<td>Grizzly Bear</td>
<td>NE</td>
<td>NLAA</td>
<td>NLAA</td>
</tr>
<tr>
<td>Gray Wolf</td>
<td>NE</td>
<td>NLAA</td>
<td>NLAA</td>
</tr>
<tr>
<td>Sensitive Species**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species or Habitat</td>
<td>Alternative 1</td>
<td>Alternative 2</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>American Peregrine Falcon</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Common Loon</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Harlequin Duck</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Northern Goshawk</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Little Brown Myotis</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Townsend’s big-eared bat</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Mountain Goat</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>California wolverine</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Cascade Red Fox</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Giant Palouse Earthworm</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Broadwhorl Tightcoil</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Shiny Tightcoil</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Western Bumblebee</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Johnson’s Hairstreak</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Melissa Arctic</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Valley Silverspot</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Larch Mountain Salamander</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Van Dyke’s Salamander</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td><strong>Survey and Manage Mollusks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puget Oregonian, Evening Fieldslug</td>
<td>No Impact</td>
<td>No Impact</td>
<td>No Impact</td>
</tr>
<tr>
<td><strong>Management Indicator Species</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern spotted owl, grizzly bear, gray wolf, American peregrine falcon, Pacific bald eagle, mountain goat, Pacific Marten, pileated woodpecker, primary cavity excavators</td>
<td>Would not contribute to a negative trend in the viability of these management indicator species on the Forest</td>
<td>Would not contribute to a negative trend in the viability of these management indicator species on the Forest.</td>
<td>Would not contribute to a negative trend in the viability of these management indicator species on the Forest.</td>
</tr>
<tr>
<td>Neotropical Migratory Birds</td>
<td>No Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elk and Black-tailed Deer</td>
<td>No impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Goat Winter Range (MA-15)</td>
<td>No Impact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Neotropical Migratory Birds: Would not contribute toward the need for additional conservation action
- Elk and Black-tailed Deer: May negatively impact individuals in the short term. Overall impacts are expected to be positive due to increased forage.
- Mountain Goat Winter Range (MA-15): Maintains or improves existing winter range capabilities
<table>
<thead>
<tr>
<th>Species or Habitat</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Federally listed species determinations: NE = No Effect, NLAA = May affect, Likely to Adversely Affect, LAA = Likely to Adversely Affect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensitive Species Determinations: NI = No Impact, BI = Beneficial Impact, MAII = May adversely impact individuals, but not likely to result in a loss of population viability, nor cause a trend toward federal listing, LRLVTFL = Likely to result in a loss of viability on the Forest, or in a trend toward federal listing.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Compliance with law, regulation, policy, and the Forest Plan**

Alternative 1 would not be consistent with Recovery Actions described in the 2011 Revised Recovery Plan for the Northern Spotted Owl, the 2012 Designation of Revised Critical Habitat for the Northern Spotted Owl, the 1997 Marbled Murrelet Recovery Plan or the 2011 Revised Critical Habitat for the Marbled Murrelet. However, Alternatives 2 and 3 would be consistent with these documents. Both Alternatives are consistent with management recommendation for designated critical habitat in the 2011 Revised Recovery Plan for the Northern Spotted Owl, which recommends focusing silvicultural activities in dispersal habitat to increase large patches of contiguous nesting/roosting habitat.

Consultation with the USFWS will be completed for the selected alternative in compliance with Section 7 of the Endangered Species Act.

Both alternatives would comply with the Migratory Bird Treaty Act of 1918 and the Region 6 Peregrine Falcon Policy and would meet the intent of the Migratory Landbird MOU and would not contribute toward the need for additional conservation action for these species.

The project would comply with NWFP Standards and Guidelines regarding the protection of caves, and abandoned mines, wooden bridges and buildings that may be used as roost sites by bats, specifically fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, pallid bat, and Townsend’s big-eared bat.

Vegetation management that maintains mountain goat winter range habitat values and imposes the relevant seasonal restrictions on activities is consistent with LRMP management direction for Management Area 15.

In accordance with the January 2001 ROD standards and guidelines and the December 2003 species list, pre-disturbance surveys were conducted for Larch Mountain Salamanders and Van Dyke’s Salamanders (following protocol standards) within the proposed elk forage enhancement openings, since that activity was not included as one of the 2006 Pechman exemptions. Neither of those salamander species was detected. Habitat for the Puget Oregonian and evening field slug was not present in those areas, therefore pre-disturbance surveys were not required for those two mollusk species.

Thinning activities in stands younger than 80 years old, culvert replacement or removal, and obtaining and placing wood for in-stream improvements are covered under the Pechman exemptions and do not require pre-disturbance surveys. The remaining proposed activities would not occur within or impact suitable habitat for these Survey and Manage species, and therefore pre-disturbance surveys are not required for those remaining activities.

Alternatives 2 and 3 would meet the Forest Plan direction for maintaining snags and down logs on the landscape.
Alternatives 2 and 3 would meet LRMP standards and Guidelines for providing highest levels of deer and elk habitat capability possible while still meeting other primary resource objectives. The project would follow LRMP standards and Guidelines regarding activities in calving, fawning, and kidding areas in order to minimize disturbance to the animals.

Alternatives 2 and 3 would be consistent with the elk and deer forage enhancement objectives set forth in the Huckleberry Land Exchange (USDA 2001).

Aquatic Resources

Affected Environment

General

Most of the activities proposed in the Snoquera Landscape Analysis Project are in the Upper White River watershed, with portions also in the Lower White River watershed and in the Upper and Middle Green River watersheds. The subwatersheds encompassing the project area are shown in Table 1. The White River drainage is a Tier 1 Key Watershed that contributes directly to the conservation of at-risk anadromous salmonids, bull trout and resident fish species, and has a high potential for being restored (USDA FS and USDI BLM 1994). The Upper White and Greenwater Watershed Analysis (USDA FS 2000) characterized the watershed processes and aquatic conditions for the entire Upper White River watershed. Of the 66 square mile watershed, the upper 42 percent is in Mt. Rainier National Park, a small portion in is the Clearwater Wilderness (both are outside the project area), and the lower 14 percent of the basin is privately owned forest land with active management. The middle 44% is National Forest System land, most of which was intensively logged in the past.

Table 41. Project area subwatersheds.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Subwatershed Size (acres)</th>
<th>National Forest Land within Snoquera Boundary (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upper Green River Watershed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headwaters Green River</td>
<td>10,341</td>
<td>7,616</td>
</tr>
<tr>
<td>Twin Camp Creek -- Green River</td>
<td>13,290</td>
<td>6,138</td>
</tr>
<tr>
<td>Sunday Creek -- Green River</td>
<td>15,510</td>
<td>10,309</td>
</tr>
<tr>
<td>Lester Creek -- Green River</td>
<td>21,347</td>
<td>8,447</td>
</tr>
<tr>
<td>Smay Creek</td>
<td>14,213</td>
<td>1,612</td>
</tr>
<tr>
<td>Wolf Creek -- Green River</td>
<td>11,931</td>
<td>2,687</td>
</tr>
<tr>
<td><strong>Middle Green River Watershed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sylvester Creek -- Green River</td>
<td>18,710</td>
<td>678</td>
</tr>
<tr>
<td><strong>Upper White River Watershed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>39,375</td>
<td>908</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>23,955</td>
<td>10,249</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>20,979</td>
<td>1,714</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>21,351</td>
<td>7,398</td>
</tr>
<tr>
<td>Upper Greenwater River</td>
<td>16,081</td>
<td>696</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>32,640</td>
<td>28,513</td>
</tr>
<tr>
<td>Silver Creek -- White River</td>
<td>32,599</td>
<td>27,665</td>
</tr>
</tbody>
</table>
Green River Watershed

The 93-mile Green River is a municipal watershed for the city of Tacoma. Part of the Green/Duwamish sub-basin, the upper Green River lies above two dams—the Tacoma Headworks, a water diversion dam at river mile (RM) 61 constructed by the City of Tacoma to supply drinking water, and the Howard Hanson Dam, constructed by the Army Corps of Engineers at RM 64.5 for flood control. An upstream fish passage facility was constructed in 2005 by Tacoma Public Utilities. In association with a project to increase storage capacity, a juvenile downstream passage facility at Mud Mountain Dam was planned but has not yet been constructed. No anadromous fish are passed above the dams into the upper watershed at this time. Prior to construction of the lower dam in 1911, the upper Green River likely provided habitat for Chinook, steelhead, coho, coastal cutthroat and rainbow trout. The Green River Watershed Analysis (USDA FS 1996) described hydrologic processes, aquatic habitats and species for the Green River watershed upstream of these dams. About one-third of that analysis area is National Forest system land arranged in a checkerboard pattern.

White River Watershed

The 76-mile long White River is part of the Puyallup River sub-basin draining to Commencement Bay in south Puget Sound. A trap-and-haul facility is set up to transport all anadromous fish around the Buckley Diversion Dam (former hydropower dam) at RM 24.3 and Mud Mountain Dam (flood control dam) at RM 29.6. Primary tributaries in the analysis area are the Greenwater River, West Fork White River, and Huckleberry Creek. These streams and the mainstem White River provide habitat for the three fish species federally listed as “threatened”: Puget Sound Chinook salmon, Puget Sound steelhead, and Coastal/Puget Sound bull trout. White River spring Chinook is the only remaining spring Chinook stock in south Puget Sound. Fish species and habitats of interest are described below in the Fish Species section.

Water Quality

**Designated Uses and Impairments**

Beneficial uses of water are designated by Washington State Department of Ecology (DOE) and are part of Washington Administrative Code, Title 173, Chapter 173-201A, Sections 173-201A-600 and 602. For the Snoquera Landscape Analysis Project area, the designated beneficial uses of water for aquatic life are char spawning and rearing in the Green River from its confluence with Sunday Creek to its headwaters, Sunday Creek and tributaries, and Smay Creek and tributaries from the confluence with, and including, West Fork Smay Creek. In the White River, designated beneficial aquatic life uses are char spawning and rearing in the mainstem and all tributaries upstream of, and including, the West Fork White River (and tributaries), and the Greenwater River and tributaries. The White River downstream of the confluence with the West Fork White River is designated as core summer salmonid habitat, which is downstream or downslope of the project area. The designated use for all other surface waters within National Forest System lands are also core summer salmonid habitat.

These waters also have the following designated recreation, water supply and miscellaneous uses: Extraordinary Primary Contact (Recreation Uses), domestic water supply, industrial water supply,
agricultural water supply, stock watering, wildlife habitat, fish harvesting, commerce and navigation, boating, and aesthetic values.

Where water quality parameters for the pertinent beneficial uses have not been met, waterbodies are listed as impaired under Section 303(d) of the Clean Water Act. The upper White and Greenwater Rivers had multiple segments throughout the watershed that exceeded standards for temperature and sediment. In response to the continuous water temperature data collected by Federal and State agencies and the Muckleshoot Tribe between 1995 and 2001, a Total Maximum Daily Load (TMDL) study was developed by the Washington State Department of Ecology and U.S. Forest Service (Ketcheson et al. 2003) and approved by EPA in 2004, with the implementation plan completed in 2006 (Ketcheson and McKee 2006) for water temperature and sediment in the upper White River and Greenwater Rivers. Separate temperature violations are described below. A reach in upper Smay Creek is impaired for Dieldrin (an insecticide), and a reach in the Green River mainstem is shown as impaired for large woody debris.

**Sediment**

Sediment delivery from roads and management-related landslides has changed the natural sediment regime by increasing the amount of sediment that streams must process. Sediment from the road system can be delivered to streams by direct erosion of cut and fillslopes associated with stream crossings, or by surface runoff from roads and ditches that carries sediment-laden water directly or indirectly to streams. Not all sediment production from roadways reaches the aquatic system, because surface runoff from road surfaces and ditches is often directed to unchanneled slopes below the road where runoff has the potential to infiltrate the ground surface or the sediment settles out onto the forest floor before the water enters the streams.

Two factors affecting rates of sediment production from surface erosion on roads are road traffic levels and precipitation. Studies done on the Olympic Peninsula and in southwest Washington found that sediment production was increased by two orders of magnitude when comparing lightly trafficked and heavily trafficked forest roads during periods of runoff (Reid and Dunne 1984, Bilby et al. 1989). These studies also found that when traffic levels remained heavy during a runoff event, sediment concentrations in road drainage waters remained at a relatively high level throughout the storm. Monitoring of previous road closure work within the Suiattle River watershed in the northern part of the Mt. Baker-Snoqualmie National Forest predicted major reductions in plug potential, diversion potential and road fill at stream crossing sites (Cissel et al. 2011). Road stream connectivity was reduced 16% and fine sediment delivery was reduced 9% in the short term (Cissel et al. 2011). Larger reductions in fine sediment delivery were expected over the long term as treated sites revegetate.

In the partial sediment budget developed for the TMDL, Ketcheson et al. (2003) quantified the amount of material generated from glaciers, hillslope processes of creep and rapid mass wasting (debris avalanches), road surface and mass erosion, and channel migration road surfaces within the upper White River watershed. The apparent increases in management-related sediments in the Upper White, West Fork White, and Huckleberry Creek subwatersheds were found to range from 1.7 percent to 7.8 percent. In the Greenwater subwatershed, the apparent increase in management-related sediments was 409 percent.

**Stream Temperature**

In the upper Green River, water temperatures in lower Smay Creek exceeded state water quality standards multiple times in 1992, and was initially listed under Section 303(d) of the Clean Water
Act from its confluence with the Green River to West Fork Smay Creek based on a 1998 assessment. An unnamed tributary to Smay Creek is also currently 303(d) listed.

The upper White and Greenwater Rivers were 303(d) listed for temperature levels exceeding state water quality standards and are under a TMDL Implementation Plan. Huckleberry Creek has unconfirmed violations for temperature in a 1-mile reach upstream and downstream of its confluence with Lost Creek.

Riparian Reserves
Within Riparian Reserves (see Land Allocations at page 8) in the project area, vegetation provides the potential large woody debris and nutrients necessary to maintain diverse aquatic habitat, pool formation, sediment retention, bank stability, and functional interactions between water and the ecosystem.

Road construction alters riparian habitat by disrupting the hydraulic regime through and around the riparian area. Hydraulic regime is altered by the capture and redirecting of flows through riparian areas, removal of shade-producing vegetation, and the exposure of soils resulting in soil temperature increases, increased evaporation from soils, and evapotranspiration from riparian vegetation. The loss of riparian vegetation exposes streambanks to erosional processes that leads to altered stream channel morphology and habitat. Riparian Reserves also act as a buffer to attenuate or deter pollutants from entering the waterway and provide important habitat and nutrients for riparian-dependent species and aquatic biota. Road length within Riparian Reserves is described to demonstrate the relative differences in effects between existing condition and the action alternatives on Riparian Reserves (Table 42). These miles reflect recent decisions to treat hydrologic condition then remove roads from the official database (decommission), though most of these road decisions have not been implemented on the ground yet.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Riparian Reserves, National Forest Only (acres)</th>
<th>Existing Forest Service Road in Riparian Reserves (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters Green River</td>
<td>2,930</td>
<td>4.83</td>
</tr>
<tr>
<td>Twin Camp Creek – Green River</td>
<td>2,139</td>
<td>6.03</td>
</tr>
<tr>
<td>Sunday Creek – Green River</td>
<td>4,402</td>
<td>14.26</td>
</tr>
<tr>
<td>Lester Creek – Green River</td>
<td>3,719</td>
<td>2.36</td>
</tr>
<tr>
<td>Smay Creek</td>
<td>512</td>
<td>0.86</td>
</tr>
<tr>
<td>Wolf Creek – Green River</td>
<td>1,062</td>
<td>0.48</td>
</tr>
<tr>
<td>Sylvester Creek – Green River</td>
<td>334</td>
<td>0</td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>295</td>
<td>1.59</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>3,988</td>
<td>11.00</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>1,140</td>
<td>3.41</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>5,811</td>
<td>12.27</td>
</tr>
<tr>
<td>Upper Greenwater River</td>
<td>5,585</td>
<td>0.17</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>10,788</td>
<td>49.77</td>
</tr>
<tr>
<td>Silver Creek – White River</td>
<td>11,145</td>
<td>17.86</td>
</tr>
<tr>
<td>West Twin Creek – White River</td>
<td>323</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54,173</strong></td>
<td><strong>124.89</strong></td>
</tr>
</tbody>
</table>
Wild and Scenic Rivers

In the Forest Planning process, the Greenwater River was studied for potential designation. Though possessing “outstandingly remarkable values” for fisheries and historical/cultural values, the Greenwater was found to be not suitable for inclusion in the National Wild and Scenic Rivers System due to overall high competing resource values (USDA Forest Service 1990, Appendix E). Neither of the two segments studied (from the headwaters to the Norse Peak Wilderness boundary, and from the wilderness boundary to its confluence with the White River) were recommended for designation.

However, the Forest Plan did recommend that the White River from its headwaters down to its confluence with Huckleberry Creek be included in the National Wild and Scenic Rivers System as Scenic, and the segment from Huckleberry Creek down to the confluence with the Clearwater River be included with a Recreation classification (USDA Forest Service 1990). The values contributing to the proposed classifications are to be protected until a final designation decision is made. The “outstandingly remarkable values” identified for the White River are recreation, fisheries, wildlife, and historical/cultural values (USDA Forest Service 1990, Appendix E).

Fish Habitat Conditions

Watershed Findings

The Upper White and Greenwater Watershed Analysis (USDA Forest Service 2000), the Green River Watershed Analysis (USDA Forest Service 1996), and the more recent Mt. Baker-Snoqualmie National Forest (MBS) subwatershed assessment portion of the whole watershed restoration procedures that applied the methods, tools and techniques of Vacirca et al. (2015) demonstrate that the legacy road network and associated infrastructure and uses are primary drivers of water quality and fisheries habitat functional impairment. This watershed-scale model represents a picture of the cumulative impacts to water quality and fish. Roads were constructed in locations that cut off floodplain processes, altered riparian structure, disrupted aquatic organism passage and natural ranges of flow regimes, increased sedimentation, and artificially increased the length of a watershed’s drainage network. These factors have interacted cumulatively to influence conditions where aquatic resources have become less resilient.

Project-specific Road Condition Assessment

The Snoquera IDT completed a road condition assessment in 2017 to determine how the different intensity of road-caused impairments is predicted to be occurring across the landscape. Each subwatershed in the project boundary in the White River was first divided into smaller catchments, then several metrics displaying causal mechanisms were assessed and scored per catchment. The Green River was not assessed due to the discontinuous ownership pattern. These metrics included overall road density, road density in proximity to streams, road crossings per mile, and riparian road drainage length to stream length (indication of increases in drainage network due to roads). Many of the catchments throughout the Greenwater, West Fork White and Huckleberry Creek subwatersheds rated high to very high in several of these metrics. The distribution and intensity of these were considered in initial proposals for treating roads and hydrologically disconnecting them from their associated stream channels.

Watershed Condition Framework

A Watershed Condition Framework assessment was completed in 2011 for most of the subwatersheds on the Mt. Baker-Snoqualmie National Forest containing NFS lands (USDA Forest Service 2011). The aquatic habitat indicator based on habitat fragmentation, large wood,
and channel conditions was rated impaired for the Huckleberry Creek, Upper and Lower West Fork White River, Lower Greenwater, and Silver Creek-White River subwatersheds in the White River watershed, and also for the Headwaters Green River, Twin Camp Creek-Green River, Sunday Creek, Lester Creek-Green River, and Smay Creek subwatersheds in the Green River watershed. The overall total ratings for Physical Aquatic conditions were tempered to fair or good condition based on good water quality and water quantity conditions.

The riparian vegetation indicator was rated impaired for the Huckleberry Creek, Upper and Lower West Fork White River, and Lower Greenwater subwatersheds in the White River watershed, and also for the Headwaters Green River, Sunday Creek, and Smay Creek subwatersheds in the Green River watershed. The overall total ratings for Biological Aquatic conditions were tempered to a fair condition rating based on overall good ratings for the Aquatic Biota factors.

The roads and trails indicator, which considered changes to the hydrologic and sediment regimes due to the density, location, distribution, and maintenance of the road and trail network, was rated impaired for the Huckleberry Creek, Upper and Lower West Fork White River, Lower Greenwater River, and Silver Creek-White River subwatersheds in the White River watershed, and also for the Headwaters Green River, Twin Camp Creek-Green River, Sunday Creek, and Smay Creek subwatersheds in the Green River watershed. When factoring in the predominantly good soil conditions, the overall Physical Terrestrial rating tempered to a fair rating.

The overall USFS condition rating for the Huckleberry Creek, Upper and Lower West Fork White River, Lower Greenwater River, and Silver Creek-White River subwatersheds in the White River watershed, and the Headwaters Green River, Twin Camp Creek-Green River, Lester Creek-Green River, and Wolf Creek-Green River subwatersheds had overall ratings of good. The Sylvester Creek-Green, West Twin-White and Headwaters White River subwatersheds were not assessed.

### Salmon Habitat Plans

The Green-Duwamish and Central Puget Sound Watershed Salmon Habitat Plan (WRIA 9 Watershed Ecosystem Forum 2005) noted as a Tier 1 activity for the upper Green to protect and restore natural sediment recruitment processes by reducing the amount of slides and road-related sediments from forest roads.

The Salmon Habitat Protection and Restoration Strategy for WRIA 10-Puyallup Watershed and WRIA 12-Chambers/Clover Creek Watershed (Pierce County Lead Entity 2012) stated that lack of road maintenance due to inadequate funding on federal forestlands was a source of resource impacts in the Upper White watershed, and identified the Greenwater River as a high priority area to focus restoration efforts due to low quantities of LWD, poor riparian function, and high sediment load. The Upper White and Greenwater Rivers were also identified as important priority areas to emphasize for protection.

### Aquatics Risk Analysis Findings

The Forest completed a roads analysis in 2002 that included an assessment of the risk and consequences of road failure to aquatic resources (USDA Forest Service 2002). Nine aquatic risk factors were considered, along with six aquatic resource values, and factoring the consequences of failure, road segments were given a numeric value and translated to a high, moderate, or low risk of that road segment to aquatic resources. This assessment was incorporated and updated in
the Mt. Baker-Snoqualmie N.F. Sustainable Roads Strategy (SRS) analysis (USDA Forest Service 2012).

Of the 413 miles of Forest Service-managed roads on NFS land in the Snoquera Project Area, 150 miles were rated as high risk, 136 miles as moderate, 121 miles as low, and 6 miles were not rated (Table 43). Of the 150 miles of High Risk roads, 12.8 miles are within 300 feet (linear GIS-distance) of streams with documented, presumed, or potential presence by any of the three federally listed fish species. These miles do not reflect recent decisions to treat hydrologic condition then store or decommission roads, and most of these road decisions have not been implemented on the ground yet.

### Table 43. Miles of roads by aquatic risk on NFS land by watershed.

<table>
<thead>
<tr>
<th>Aquatic Risk Level</th>
<th>High Risk (miles)</th>
<th>Moderate Risk (miles)</th>
<th>Low Risk (miles)</th>
<th>Not Rated (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper and Lower Green River Watersheds</td>
<td>20</td>
<td>40</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>Upper and Lower White River Watersheds</td>
<td>130</td>
<td>96</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>136</td>
<td>121</td>
<td>6</td>
</tr>
</tbody>
</table>

### Habitat in the Analysis Area

Past timber management activities completely removed large old trees upslope and in the riparian zones of harvest units throughout the project area. In the late 1970s, a stream cleanout practice was employed that systematically removed all instream and floodplain wood with minimum dimensions of 8 inches in diameter and 10 feet long in the Greenwater River, West Fork White River, and Huckleberry Creek (USDA Forest Service 2000, Olson 2010). Loss of this wood decreased channel complexity and reduced the capacity of channels to store sediment. In downstream reaches, sediments accumulated and have led to channel widening. Combined with road construction on unstable soils and streambanks, many rivers and streams in the project area consist mostly of second growth conifers and hardwoods, and streambank erosion, channel down-cutting, and excess bedload have reduced water quality and fish habitat.

Riparian areas, the source of woody material important to create complex instream fish habitat, are still recovering. Existing instream large wood is limited, though restoration projects such as the Greenwater Floodplain Restoration Project (USDA Forest Service 2010) have added large wood complexes to reaches important for spawning, and are reconnecting side channel habitats important for not only spawning and rearing, but to act as refugia during high flows.

### Critical Habitat

The primary constituent elements (PCEs) of critical habitat identified by USFWS for bull trout are: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species. Designated critical habitats for Puget Sound Chinook, Puget Sound steelhead, and bull trout in relation to the project area are listed in Table 44 with the pertinent fish species.
Essential Fish Habitat

The National Marine Fisheries Service released the final rule for essential fish habitat (EFH) for Pacific salmon in 2008 (73 FR 60989). In relation to the project area, they include all streams and other water bodies occupied or historically accessible to Chinook salmon, coho salmon, and Puget Sound pink salmon, which are the species managed by the Pacific Coast Salmon Plan pertinent to the MBS. EFH are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The Duwamish/Green River provides EFH for Chinook and coho salmon, while the Puyallup/White River provides EFH for Chinook, coho, and pink salmon (Table 44).

Fish Species

Anadromous fish are not currently present in the upper Green River due to passage issues at Howard Hanson Dam at RM 64.5. When downstream juvenile passage is constructed, upstream passage of adults will be resumed at the Tacoma Headworks diversion dam at RM 61. In the White River, a trap-and-haul facility is set up to transport all anadromous fish around the Buckley Diversion Dam at RM 24.3 and Mud Mountain Dam at RM 29.6. Table 44 displays the fish species of interest, any special designations, and their utilization of the project area.

Table 44. Fish species and habitats of interest and special designations.

<table>
<thead>
<tr>
<th>Species (Stock)</th>
<th>Status $^3$</th>
<th>Utilization Associated with Project Area$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook (White River Spring; Green River/Duwamish); Oncorhynchus tshawytscha</td>
<td>NMFS—Listed threatened (3/99); Designated critical habitat (9/05); Essential fish habitat FS—MIS SaSI 2002—Unknown</td>
<td>Mainstem White River to and including Silver Springs at RM 60.5. Greenwater River to about RM 9; presumed to use upper mainstem. West Fork White River to about RM 7.2. Huckleberry Creek to about RM 3.2. Critical habitat and EFH in mainstems. Mainstem Green River below water diversion dam at RM 61; potential in mainstem to RM 89; into Sunday Ck to RM 5.5, Snow Ck to RM 0.7, Intake Ck to RM 0.6, Tacoma Ck to RM 0.9; same for critical habitat and EFH.</td>
</tr>
<tr>
<td>Steelhead (White River/ Puyallup Winter; Green River/Duwamish Winter); Oncorhynchus mykiss</td>
<td>NMFS—Listed Threatened (6/07; only anadromous); Designated critical habitat (2/16) FS—MIS (anadromous and resident rainbow) SaSI 2002—Depressed</td>
<td>Mainstem White River to RM 53.1; presumed to RM 59.6. Mainstem Greenwater River to RM 12; Midnight, Twentyeight Mile, Whistler, Pyramid Creeks; residents in mainstem and tributaries. WF White River to about RM 7.2. Huckleberry to RM 2.2. Critical habitat in mainstems and tribs where anadromous known or presumed. Mainstem Green River below water diversion dam at RM 61; potential in mainstem to RM 89; into Sunday Ck to RM 5.5, Snow Ck to RM 0.7, Intake Ck to RM 0.6, Tacoma Ck to RM 0.9; critical habitat where presumed.</td>
</tr>
<tr>
<td>Species (Stock)</td>
<td>Status¹</td>
<td>Utilization Associated with Project Area²</td>
</tr>
<tr>
<td>----------------</td>
<td>---------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Coho (White River/ Puyallup; Duwamish/Soos Creek); Oncorhynchus kisutch</td>
<td>NMFS—Candidate; Not Warranted (7/10); Essential fish habitat FS—MIS SaSI 2002—Healthy</td>
<td>Mainstem White River to and including Silver Springs at RM 60.5. Mainstem Greenwater to RM 12; several named and unnamed tributaries; WF White to RM 7.2 and lower trib; Huckleberry Ck to RM 6.0. Presume same for EFH. Mainstem Green River below water diversion dam at RM 61; potential in mainstem to RM 89; into Sunday Ck to RM 5.5; Snow Ck to RM 0.7; Intake Ck to RM 0.6; Tacoma Ck to RM 0.9. Presume same for EFH after passage.</td>
</tr>
<tr>
<td>Pink (Puyallup); Oncorhynchus gorbuscha</td>
<td>NMFS—Not Warranted (10/95); Essential fish habitat FS—MIS SaSI 2002—Depressed</td>
<td>Mainstem White River to and including Silver Springs at RM 60.5. Mainstem Greenwater at least to RM 7.5. WF White past project area into Park; Huckleberry to 6.2; Eleanor to 0.5. Presume same for EFH. Not present nor potential in Upper Green.</td>
</tr>
<tr>
<td>Chum (Puyallup/Carbon Fall; Duwamish/Green Fall); Oncorhynchus keta</td>
<td>NMFS—Not Warranted (3/99) FS—MIS SaSI 2002—Healthy</td>
<td>Lower mainstem White River to RM 24. Potential: White R to RM 60.5, Greenwater to RM 10, West Fork to RM 7.2, Huckleberry to RM 3.2. Mainstem Green River below water diversion dam at RM 61.</td>
</tr>
<tr>
<td>Coastal cutthroat (Puyallup); Oncorhynchus clarki</td>
<td>NMFS—Not Warranted (4/99) FS—MIS (anadromous and resident) SaSI 2000—Unknown</td>
<td>White River to RM 57.5 throughout Greenwater River, larger tributaries, and in Greenwater Lakes; West Fork to RM 10, Huckleberry to RM 5. Green River past project area, Sunday Ck to and into Snow Ck.</td>
</tr>
<tr>
<td>Sockeye (Baker River stock); Oncorhynchus nerka</td>
<td>NMFS—Not Warranted (Baker River stock in Skagit; 10/95)</td>
<td>Baker River stock not present. Sockeye strays are regularly observed in lower Greenwater and White up to and including Silver Springs Creek as part of other spawner surveys. Mainstem Green River below water diversion dam at RM 61.</td>
</tr>
</tbody>
</table>


Spring Chinook in the White River watershed (captured by the Buckley fish trap) declined to only six fish in 1986, which led the state and Tribes of south Puget Sound to implement a recovery plan involving artificial propagation of wild and captive Chinook (Marks et al. 2017). Two spring Chinook programs and one steelhead program are currently active, as are the use of several acclimation ponds in the project area (including one in the upper Greenwater River, one on lower Huckleberry Creek, and another on Twentyeight Mile Creek). Coho, chum, and steelhead supplementation programs also exist for the lower Puyallup River.

As effects to the management indicator fish species are only made at the Forest scale, Table 45 shows forestwide presence of these species.
Table 45. Miles of documented presence on the Mt. Baker-Snoqualmie National Forest by fish species of interest.

<table>
<thead>
<tr>
<th>Fish species</th>
<th>Miles of documented presence in the Forest¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook salmon</td>
<td>106</td>
</tr>
<tr>
<td>Bull trout</td>
<td>560</td>
</tr>
<tr>
<td>Steelhead</td>
<td>379</td>
</tr>
<tr>
<td>Steelhead</td>
<td>379</td>
</tr>
<tr>
<td>Steelhead</td>
<td>379</td>
</tr>
<tr>
<td>Coho salmon</td>
<td>524</td>
</tr>
<tr>
<td>Pink salmon</td>
<td>220</td>
</tr>
<tr>
<td>Chum salmon</td>
<td>121</td>
</tr>
<tr>
<td>Sockeye salmon</td>
<td>158</td>
</tr>
<tr>
<td>Cutthroat trout</td>
<td>763</td>
</tr>
<tr>
<td>Rainbow trout</td>
<td>503</td>
</tr>
</tbody>
</table>

¹From WDFW 2002; does not include miles on National Forest System land with “suspected” occupancy, or on other land ownerships

Soils

**Soil Disturbance**

Ground disturbance from activities that commercially remove trees have potential to result in exposed soil that then leads to soil erosion. Such actions that disturb soil such as skidding and yarding of logs, temporary road and landing development, fuels treatment, and connected actions associated with road decommissioning.

Soil erosion can directly affect soil productivity by reducing soil depth and volume, resulting in a loss of nutrients and water holding capacity. An indirect effect from soil erosion is runoff from bare areas carrying soil particles to water bodies where it becomes sediment. Surface compaction or rutting by operation of heavy equipment may exacerbate soil erosional processes by concentrating water on that soil surface. Conversely, erosive soils occurring on very steep slopes in this analysis area may be stable for decades because of sufficient protective cover (tree needles, leaves, wood, rocks, etc.). Elements of proposal that may result in erosion:

- logging activities – primarily skid trails and landings; skyline cable corridors; heavy equipment turns;
- logging system road development, reconstruction, and maintenance – temporary new construction and reconstruction may result in erosion of bare soil areas within the road prism, and potential erosion and subsequent sedimentation into nearby stream courses;
- post-logging fuels treatment – pile burning and other slash treatments may result in bare soil where particles can become detached and erode;
- road decommissioning, closure, aquatic organism passage and dispersed site removal – removal of culverts and fills, varying levels of de-compaction, unstable fill slope sidecast pullback, drainage structure and larger aquatic organism passage road crossing installations all have the potential to result in bare soil within the road prisms, and possible sedimentation into nearby stream courses.

Each proposed stand has not been evaluated as to the degree of soil erosion potential. Therefore, project design criteria have been included in the Snoquera proposed action to address during and
post-harvest unit soil and hydrologic measures to decrease the potential for erosion from exposed soil and related sedimentation to streams.

**Organic Matter and Soil Organisms**

A key part of soil productivity includes organic matter content and organisms inhibiting the soil horizon profiles. Together, organic matter and organisms help increase nutrients and other properties of soil fertility. High soil productivity can support a diversity of plant and tree species that contribute to a host of ecology condition and function. Soil fertility and soil biological systems will properly function if certain components are present, such as appropriate levels of organic matter and coarse woody debris. Poor, non-functioning soil biological systems may lead to difficulties in revegetation efforts, or even decline in existing desirable vegetation.

Soil biology involves complex interactions occurring in between organisms and their soil habitats, including physical and chemical characteristics. The specific composition of fungal, bacterial, and arthropod communities is not known for the project area, although in general, soil organisms include mycorrhizal fungi, soil-dwelling arthropods, nematodes and bacteria all of which are crucial to properly function systems. Mycorrhizae, have been shown to profoundly affect forest growth and productivity. Mycorrhizal fungi have been shown to profoundly affect forest growth and productivity, assisting trees in absorbing water, nutrients and provide protection from pathogen attack.

Direct effects from soil compaction, displacement, lack of vegetation, coarse woody material and lack of plant litter covering the soil surface tends to reduce the number of soil arthropods (Niwa et al 2001). The proposed activities may change soil habitats and the soil food web, and alter soil quality, or the capacity of soil to perform its functions (Tugel Lewandowski 2003). These activities associated with the proposed action include:

- logging activities – associated with activities such as ground-based yarding activities, equipment operation throughout a unit and landing development;
- road development – temporary road development and reconstruction of existing ML1 and unclassified roads.

Soils have not been evaluated for organic content and organism species and density. Therefore, to ensure long-term soil productivity project design criteria have been included in the Snoquera proposed action to conserve such soil properties.

**Landslide Risk**

Large scale hillslope failure processes known as landslides are common in the Cascade Mountain Range. Landslide processes are an extension of millions of years worth of geologic and glacial processes. Landslides represent the continual movement of the land and associated formation of land types, such as valleys and tributary channels. Landslides can reveal the underlying parent material beneath soil profiles, which give further indication as to part of the mechanism or influence that contributed to hillslope destabilization.

The majority of landslides on the Mt. Baker-Snoqualmie National Forest, including within the Snoquera Project area are shallow and rapid in nature. Recent observations of these landslides confirm one or more large pulses of debris (soil, rocks and organic matter such as trees) that form. Debris flows are normally carried by gravity and water (flow) and gain energy, mass and associated scour potential as they travel down the mountain into valleys and tributary channels. Debris flows once started from a slide can further gain in mass and energy when intercepting features such as road prisms. Once a landslide scarp is opened up the potential for future
hillslope failure and debris flows can be high. This is because of the increased slope that gets created and lack of effective soil and hillslope ground cover. Thus, the scarf is opened to rapid precipitation and runoff processes that potentially lead to landslides.

Management activities have potential to accelerate hillslope destabilization if overlapped in areas of landslide hazard terrain. Removal of soil stabilizing vegetation such as trees and increasing compaction rates from skidding, temporary road building or other associated logging mechanisms are examples of actions that could lead to hillslope destabilization on mapped landslide terrain.

Landslides and subsequent debris flows can pose a threat to human health and safety and adjacent communities and related infrastructure. In addition, where debris flows intercept roads, the level of valley and/or channel scour can increase in relation to the added mass bulking. Therefore, knowing where landslide hazards occur is important to avoiding artificial acceleration of such hillslope failure processes. Landslides in Washington have been mapped by the Washington Department of Natural Resources using LiDAR technology combined with other information sources, which includes a portion of the Snoquera Project area in Pierce County. This information can be used in the planning and refinement of commercial treatment units and associated logging systems to avoid working in landslide hazard areas and unnaturally increasing or inducing their hillslope failure processes.

Environmental Consequences

Methodology

The action area for fishery resources for the Snoquera Landscape Analysis Project is the area affected both directly and indirectly by the proposed vegetation, road, instream and riparian treatments, the recreation enhancements, plus their connected actions and mitigations, over both the short-term and the long-term, and is the area for consultation for federally listed fish under the Endangered Species Act. The fisheries action area includes: in the upper Green River—Snow Creek and an unnamed stream (both tributaries to Sunday Creek), and an unnamed tributary to Tacoma Creek; in the White River watershed—White River mainstem and tributaries from its confluence with Slippery Creek at river mile (RM) 45.6 to the boundary with Mt. Rainier National Park at around RM 60.8. Major tributaries to the White River in the action area include: Greenwater River and its tributaries from Midnight Creek at RM 3.8, to George Creek at RM 11.3; West Fork White River and right bank tributaries from mouth to boundary of Mt. Rainier National Park; Huckleberry Creek and its tributaries from mouth to boundary with Mt. Rainier National Park.

The analysis area for hydrology resources includes the 15 subwatersheds comprising the Snoquera Landscape Analysis project area, focusing on National Forest System lands. Water quality is discussed qualitatively, using road densities, road drainage, and number of stream crossings as surrogates for changes in erosion and sedimentation potential that could be generated by project-related activities or that could reduce future risk, and discussing where streamside shade may be reduced that could affect stream temperature.

The most contiguous areas of National Forest System land within the Snoquera Project area, and the areas where proposed activities would have the most influence, are in the Upper White watershed. A subwatershed assessment was conducted in 2017 for the six primary component subwatersheds to identify the degree of road-related impairments.
Riparian Reserves, as defined by the ROD (USDA Forest Service and USDI BLM 1994), are discussed using the length of road within Riparian Reserves as a surrogate to demonstrate the relative differences in effects between existing condition and the action alternatives.

Effect determinations are made for the fish species and habitats of special interest (those with special designations) in the action area. Effects to viability of Management Indicator Species are made at the Forest scale. Effects of the proposed project activities to Aquatic Conservation Strategy (ACS) objectives are made at various scales, depending on the objective. Projects are evaluated at both the project and watershed (5th field, or HUC10) scales.

The indicators of change used in this analysis for fishery resources is the number of miles of roads determined to be high risk to aquatic resources (using values from the Sustainable Roads Strategy assessment) that are treated and removed from the Forest road system (decommissioned), plus those treated and put into a storage category. The number of miles of roads to be treated was further analyzed for their proximity to presence of listed fish species. The “proximity” used for the analysis was based on a default Riparian Reserve width for a fish-bearing stream of 300 feet, though 300 feet linear distance in GIS is more conservative than the 300 feet slope distance per the description (USDA Forest Service and USDI BLM 1994, p. C-30). While anadromous fish are not generally passing above the dams in the Green River, they may be actively passed by the time all the proposed Snoquera activities are completed, and their presence are included.

Distribution of Chinook, steelhead, and bull trout stocks for this area were taken from the Statewide Washington Integrated Fish Distribution (SWIFD) layers found at http://geography.wa.gov/data-products-services/data/data-catalog, using filters for documented and presumed presence. Fish utilization and river miles were derived from: WDFW websites—SaSI reports at http://wdfw.wa.gov/conservation/fisheries/sasi/; Salmon Conservation Reporting Engine (SCoRE) at https://fortress.wa.gov/dfw/score/score/species/species.jsp; SalmonScape at http://apps.wdfw.wa.gov/salmonscape/; and Williams et al., 1975. Potential habitat restored for fish passage at blocking culverts was estimated from GIS primarily using water typing modeling in WDNR’s stream layer and the SWIFD layer.

Effects to Riparian Reserves are discussed in terms of the acreage of Riparian Reserves altered through project activities, or, where applicable, using the length of road within Riparian Reserves as a surrogate to demonstrate the relative differences in effects between existing condition and the action alternatives.

Spatial and Temporal Bounding of Analysis

The action area for fishery resources is the area affected both directly and indirectly by the proposed vegetation, road, instream and riparian treatments, the recreation enhancements, plus their connected actions and mitigations, over both the short-term and the long-term, and is the area for consultation for federally listed fish under the Endangered Species Act. The fisheries action area includes: in the upper Green River—Snow Creek and an unnamed stream (both tributaries to Sunday Creek), and an unnamed tributary to Tacoma Creek; in the White River watershed—White River mainstem and tributaries from its confluence with Slippery Creek at river mile (RM) 45.6 to the boundary with Mt. Rainier National Park at around RM 60.8. Major tributaries to the White River in the action area include: Greenwater River and its tributaries from Midnight Creek at RM 3.8, to George Creek at RM 11.3; West Fork White River and right bank tributaries from mouth to boundary of Mt. Rainier National Park; Huckleberry Creek and its tributaries from mouth to boundary with Mt. Rainier National Park.
The analysis area for direct and indirect effects on water quality are the subwatershed streams within the project area containing vegetation treatment, and road or instream work associated with the action alternatives, which have the greatest potential to affect water quality. The analysis area for direct and indirect effects to the Riparian Reserves includes the Riparian Reserves within project area watershed and subwatersheds where proposed vegetation treatments or road work would occur. Determinations of consistency with Aquatic Conservation Strategy (ACS) objectives are made at various scales, depending on the objective. Activities are evaluated at both the project and watershed (5th field, or HUC10) scales. Effect determinations are made for the fish species and habitats of special interest (those with special designations) in the action area. Effects to viability of Management Indicator Species are made at the Forest scale.

**Alternative 1—No Action, Direct and Indirect Effects**

**Water Quality: Sediment, Stream Temperature, Riparian Reserves**

Current conditions would be maintained. In general, National Forest System lands in the project area are maturing at a faster rate than harvest activities occur and has reached a level where past vegetation disturbance from harvest management is assumed to no longer have an effect on peak flow increases at the watershed scale in the project area watersheds. Over time the hydrologic maturity of Forest stands will continue to improve across the analysis area where vegetation has sufficient canopy to fully intercept precipitation in the rain-on-snow zone and the landscape is less susceptible to rapid runoff and increased erosion potential.

This alternative would have no direct effect on Riparian Reserves, sedimentation or water temperature within or downstream of the project area. Since no vegetation, road, instream or other riparian treatments would be done, stream temperature reductions would continue into the future as vegetation reaches maturity, but these reductions would occur at a slower rate than the proposed action. Growth of trees would continue to be limited in the densely stocked second growth stands where competition limits development of large trees and riparian function. Streams would remain depleted of large wood and pool-forming habitat. Inputs of road-related sediment would continue to influence channel dimensions in some portions of the project area.

Riparian Reserves would continue to recover from past harvesting activities. In areas of the Norse Peak Fire where areas with high tree mortality removed nearly all the riparian trees and streamside cover, recovery of riparian area function to filter sediments, stabilize streambanks, and provide shade and woody debris, could take several decades to re-establish.

The existing mechanisms for sediment delivery to streams would continue unchanged, including existing rilling of road surfaces, imminent or future culvert failures, and other road-related sediment inputs. Existing road densities and erosion from Forest Roads would be reduced as previous road decisions are implemented, but additional road treatments to address hydrologic concerns and decommissioning 23.83 miles of system road, storing 5.68 miles, and targeted stormproofing of 54.11 miles would not occur, nor would treatment of up to 37.5 miles of mapped, unclassified routes.

**Fish Habitat and Fish**

There would be no direct effects to fish or fish habitat. There would be no vegetation treatments in various management allocations to attain various objectives, including in Riparian Reserves to improve existing and future instream and riparian function, no transportation system adjustments and restoration activities along roads to address fish passage, drainage, and sediment issues, no
instream and riparian treatments to increase wood and wood recruitment, and improve populations of fish (particularly those that are federally listed under the Endangered Species Act), and no variety of recreation enhancements that include addressing effects to riparian conditions by dispersed users.

Current and future instream wood would continue to limit channel function and fish habitat diversity. Maintenance of the existing 487 miles of system roads would continue as funds allow and as pertinent for their maintenance level. Where culverts remain in unneeded roads, downstream routing of wood would continue to be delayed at road-stream intersections. Potential for road failure and related impacts to fishery resources would remain unchanged, particularly along the 11 miles of roads determined to have high aquatic risk that were not part of a previous decision (e.g., Greenwater ATM) to treat. Road-related sediments associated with scouring of road surfacing or with road failures at culverts are beyond natural inputs in excess of these streams’ ability to transport them through the system, and could settle in fish-bearing waters. As a result, both the quality and quantity of spawning and rearing habitats would continue to be reduced by excess sediments embedding spawning gravels, burying or scouring redds, filling pools, decreasing the food base and growth of rearing fish, and damaging the gills of juvenile fish that combine to reduce fish survival. Further, access to up to 16 miles of habitat upstream of blocking culverts would not be restored. Sedimentation and loss of streamside shade would continue where dispersed campsites are not rehabilitated. Acclimation pond intake adjustments would not be made, and recovery of listed Chinook and steelhead would be delayed.

Soil Disturbance, Soil Erosion, Organic Matter and Soil Organisms

There would be no new detrimental soil disturbances and losses to soil productivity, since no new ground disturbing management activities are proposed in this alternative. There would be no change in soil productivity due to logging-related compaction, puddling and displacement. Existing features of temporary roads, landings and other related past disturbances would not be used or restored, and would likely remain in a detrimental condition for the foreseeable future. Amelioration of these DSCs would progress slowly.

Current extent of compacted areas in the project area, including roads and dispersed recreation sites would not change. No road decommissioning that rehabilitates soil infiltration and re-establishes effective ground cover on such compacted surfaces would occur. No removal and restoration of dispersed sites from riparian areas would occur. Thus, compacted surfaces of dispersed sites and associated hydrologic impairment and lack of riparian vegetation in those areas would remain.

Table 46. Existing NFS system road network and acres of compacted area.

<table>
<thead>
<tr>
<th>Maintenance Level (ML)</th>
<th>ML Type</th>
<th>Miles</th>
<th>Acres of Compacted Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>High degree of user comfort and convenience</td>
<td>14.3</td>
<td>41.6</td>
</tr>
<tr>
<td>4</td>
<td>Moderate degree of user comfort and convenience at moderate travel speeds</td>
<td>2.7</td>
<td>7.9</td>
</tr>
<tr>
<td>3</td>
<td>Maintained for travel by prudent driver in standard passenger car</td>
<td>250.3</td>
<td>728.1</td>
</tr>
<tr>
<td>2</td>
<td>High clearance vehicle use</td>
<td>187.6</td>
<td>545.7</td>
</tr>
<tr>
<td>1</td>
<td>Intermittent use road while placed in storage</td>
<td>31.7</td>
<td>92.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>486.6</strong></td>
<td><strong>1,415.6</strong></td>
</tr>
</tbody>
</table>
Increases in soil erosion would most likely be from new unauthorized off-road activities and dispersed camp sites that could develop over time. Soil erosion may also increase where wildfire occurs resulting in greater than 75% consumption of surface organic cover. Soil erosion of fluvial related land forms (stream channels and floodplains) is also expected to occur where flood and landslide debris flows intercept road prisms or other infrastructure resulting in exacerbation of scouring processes.

At the watershed and larger landscape scale, surface organic material is expected to increase as coniferous and deciduous tree leave and woody litter are deposited on soil surfaces. Soil organisms are expected to continue to populate and perform ecological functions that enhance soil fertility.

**Landslide Risk**

The frequency and extent of landslides would be unchanged in plantations where overcrowded trees would continue to grow slowly. Landslides in areas of high instability would likely continue when triggered by intense precipitation events. Existing shallow landslide scars within the project area would slowly stabilize and revegetate.

No new temporary road construction or reconstruction would occur, so there would be no increased landslide risk from road development. Within the project area (activity areas and haul routes), there would be no change in current maintenance of system roads.

Landslide risk may increase under no action alternatives on roads within the project and planning area under current and anticipated road maintenance funding levels, and deteriorating infrastructure (such as where roads unnaturally concentrate surface flows). Road fill slope failures and potential for culvert washouts or diversions has the potential to increase landslides in such hill slope failure prone areas.

**Effects Common to Alternatives 2 and 3**

**Water Quality**

Timber harvest and road-related activities have the potential to result in increased water temperatures or changes in nutrient or sediment inputs. Road-related activities include temporary construction or reconstruction, log/equipment haul, treatments for closure, decommissioning, and stormproofing, and aquatic organism passage sites. Although this project would entail log haul and heavy equipment hauling, the effects of these activities on stream temperature and erosion or sediment delivery to streams are considered negligible and within the normal range of background levels.

Water flow patterns refer to the temporal and spatial distribution of water across the landscape. While changes in flows can affect runoff rates and lead to increases in erosion, neither action alternative would result in a measurable change in flows sufficient to affect runoff rates leading to increased sedimentation. Additionally, treatments would be spread out over an estimated 20-year period. Local, site-scale effects on hydrology and snow interactions as a result of the proposed vegetation treatments are likely as additional snow is expected to accumulate on the ground due to decreased interception in the forest canopy. Snowmelt may also be more rapid in heavily thinned areas, as snowpacks have greater exposure to wind and other elements that cause snowmelt. Thinned areas (up to 12,245 acres spread out over an estimated 20-year period) would quickly recover to a hydrologically mature condition since only smaller, secondary trees would be removed as part of the thinning prescription. The remaining trees in the thinned stands would
provide interception at a reduced rate for several years until openings in the canopy are filled in by additional limbs and branches that would have an increased access to sunlight. These characteristics of thinning treatments would reduce the effect of the openings on peak and base flows even at the local scale compared to clearcut-type treatments. The timing and magnitude of runoff processes can be altered by the presence and orientation of roads. Road-stream crossings and road ditches are unnatural extensions of a stream system’s natural drainage network. With the extended network, roads can increase the total volume of water available for rapid transport and consequent erosion with sediment delivery to stream channels. Changes to flow patterns are described using road density, road crossings per mile, and riparian road drainage length to stream length (indication of increases in drainage network due to roads).

Up to 272 acres of elk forage enhancement openings are expected to be left in a hydrologically immature state permanently or nearly permanently. These cleared areas are mostly in the lower Greenwater subwatershed with a few in the Silver Creek-White River subwatershed. With full Riparian Reserve no-treatment buffers applied, BMPs such as seeding of disturbed ground, and with the distribution of these openings across the landscape, these permanent openings ranging in size from 0.5-27 acres are not expected to result in measurable changes to runoff rates and to increased sedimentation in the Greenwater or White Rivers.

**Sediment**

Sediment delivery from roads and management-related landslides has changed the natural sediment regime by increasing the amount of sediment that streams must process. Sediment from the road system can be delivered to streams by direct erosion of cut and fillslopes associated with stream crossings, or by surface runoff from roads and ditches that carries sediment-laden water directly or indirectly to streams. Not all sediment production from roadways reaches the aquatic system where runoff from road surfaces and ditches is directed to unchanneled slopes below the road where runoff has the potential to infiltrate the ground surface or the sediment settles out onto the forest floor before the water enters the streams.

Maintenance levels are assigned to road segments identified in the official FS roads database. Definitions of these maintenance levels and work associated with those levels are described in detail in the Engineering Report. About 487 miles of roads in our system are in the project area and were considered in the analysis, with maintenance levels evaluated and assessed based on access needs and level of risk to aquatic resources. While placing roads into storage or decommissioning them often will entail ground-disturbing activities first, some roads may already be in a self-maintaining condition and minimal work is needed. Decommissioned roads would receive no further maintenance once removed from the official road system.

Reduction of road miles and stabilization of the remaining miles is important for reducing stream channel network extension and sediment delivery. Interception of shallow lateral soil water flow by road cuts and subsequent routing of that water into streams and rivers effectively increases drainage network density and peak flows and sediment delivery (Washington Forest Practices Board 1997). Additionally, roads that are no longer maintained may be at higher risk of more episodic failure due to inadequately maintained drainage structures. Sediment delivery from active channel migration is expected to naturally decrease as vegetation disturbances recover and as a result of vegetation activities proposed in Riparian Reserves, removal of road prism within and along the West Fork White River floodplain, as well as the proposed instream wood and riparian restoration/dispersed site corridor activities proposed along the Greenwater River mainstem, Midnight Creek, Whistler Creek, Pyramid Creek, and Huckleberry Creek.
**Roads and Road Treatments**

Of the 486.6 miles in the project area, which includes both NFS and private land, alternatives 2 and 3 would close 5.68 miles, decommission 23.83 miles, and target stormproofing along 54.11 miles of roads (Table 47). Decommissioning treatments can nearly eliminate risk of road-related failure and surface erosion in the long term, and treatments for closure can greatly reduce surface erosion and failure risk through culvert removal and other treatments to allow a more natural drainage pattern. While sedimentation associated with roadwork is possible in the short-term and until the disturbed areas have stabilized, implementation of best management practices such as timing of the work and erosion control measures would minimize project-related sediments reaching streams, and the quantity of sediments in larger streams would be further diluted by flows or background sediments. Roads were identified for targeted stormproofing activities because they would remain open yet have several indicators of road-related impairments and high aquatic risk. Addressing hydrologic function along these roads would reduce road-related sedimentation associated with roads not closed or decommissioned.

Table 47. Proposed miles of decommissioning, storage, and targeted stormproofing treatments of NFS roads by subwatershed.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Decommissioning miles</th>
<th>Storage miles</th>
<th>Targeted Stormproofing miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters Green River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Twin Camp Creek – Green River</td>
<td>0.70</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sunday Creek</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lester Creek – Green River</td>
<td>0.20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Smay Creek</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wolf Creek – Green River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sylvester Creek – Green River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>2.66</td>
<td>0</td>
<td>17.65</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>0.50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>7.32</td>
<td>1.80</td>
<td>22.65</td>
</tr>
<tr>
<td>Upper Greenwater River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>10.12</td>
<td>3.88</td>
<td>0</td>
</tr>
<tr>
<td>Silver Creek – White River</td>
<td>2.33</td>
<td>0</td>
<td>13.81</td>
</tr>
<tr>
<td>West Twin Creek – White River</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>23.83</strong></td>
<td><strong>5.68</strong></td>
<td><strong>54.11</strong></td>
</tr>
</tbody>
</table>

Additionally, approximately 37.5 miles of apparently unclassified routes in the project area within the White River watershed were mapped using LiDAR, and are not in the official roads database. It is unknown if these routes have already received some level of treatment to address concerns for erosion and flow patterns. Additional routes were seen in the field but not mapped. Table 47 displays the mapped routes by subwatershed. As other road treatments are occurring in the proximity of these roads, these would be inventoried for treatments to address hydrologic concerns and treated as appropriate. The 6.75 miles used to access vegetation stands (see Temporary Roads section below) would be treated through the associated timber sale upon completion of activities.
Table 48. Summary of miles of unclassified routes mapped using LiDAR, displayed by subwatershed.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huckleberry Creek</td>
<td>9.24</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>1.68</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>9.14</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>11.41</td>
</tr>
<tr>
<td>Silver Creek-White River</td>
<td>5.99</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37.46</strong></td>
</tr>
</tbody>
</table>

Road Density—Road densities in the project area subwatersheds (the miles of system roads on National Forest System lands per square mile of National Forest within the Snoquera Project area in that subwatershed) would be reduced under both Alternatives 2 and 3. Current road densities in the seven Green River subwatersheds range between 0 and 2.15 miles per square mile, with an overall road density of 1.40 for NFS lands in the Middle and Upper Green River watersheds (Table 49). The Sylvester Creek-Green River subwatershed had just over a square mile of NFS land in the project area, with no roads in these parcels, while Sunday Creek had 34.61 miles of open roads across 16.11 square miles of NFS land. Overall, these values are underestimated due to the limited amount of NFS land (42% in the Upper Green watershed) and the network of existing roads on private lands in most of the subwatersheds in this drainage. A density of greater than 2.4 miles per square mile was used by USDA FS (2011) as a threshold indicating a likely impaired watershed function where the probability is high that the hydrologic regime (timing, magnitude, duration, and spatial distribution of runoff flows) is substantially altered. A density of 1-2.4 indicates a moderate probability where watershed is functioning at risk.

In the White River subwatershed, road densities range from less than 0.03 in the West Twin Creek-White River subwatershed due to the very small amount of roads and NFS land within the project area (0.04 mi in 1.57 square miles), up to 4.63 miles per square mile in the Headwaters White River subwatershed, and are displayed in Table 49. While the Headwaters White River subwatershed also has just 1.42 miles of NFS land in the project area, this piece of the subwatershed includes portions of Hwy 410, Crystal Mountain Boulevard, roads accessing recreation residences, plus the Silver Springs Campground loop roads.

Table 49. Road density before and after treatments.

<table>
<thead>
<tr>
<th>Watershed or Subwatershed Name</th>
<th>Existing¹ FS Road Density (open FS roads and FS lands in Snoquera only) (mi/mi²)</th>
<th>FS Road Density Reflecting Decisions² Prior to Snoquera (mi/mi²)</th>
<th>Alternative 2 and 3 Road Treatments (Storage and Decommission) (miles)</th>
<th>FS Road Density After All³ Treatments (FS roads and FS lands) (mi/mi²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters Green River</td>
<td>1.36</td>
<td>1.36</td>
<td>0.00</td>
<td>1.35</td>
</tr>
<tr>
<td>Twin Camp Creek – Green River</td>
<td>1.87</td>
<td>1.87</td>
<td>0.70</td>
<td>1.81</td>
</tr>
<tr>
<td>Sunday Creek – Green River</td>
<td>2.15</td>
<td>2.15</td>
<td>0.00</td>
<td>2.15</td>
</tr>
<tr>
<td>Lester Creek – Green River</td>
<td>0.65</td>
<td>0.62</td>
<td>0.20</td>
<td>0.60</td>
</tr>
</tbody>
</table>
Results of the road condition assessment pertaining to road densities (Table 50) showed a high percentage of catchments with both high road densities in the subwatershed as well as near streams. While road density is more appropriately analyzed at the subwatershed scale, density within 300 feet is shown as an indicator of roads proximate to streams, where sediment delivery is more likely to occur. This assessment shows that at scales finer than the subwatershed level, road-related impairments become more evident. After road treatments have been implemented, the number of catchments with high road densities hopefully has been reduced.

Table 50. Summary of catchments with road density metrics exceeding thresholds in Upper White River subwatersheds.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Number of Catchments</th>
<th>Number of Catchments with Road Density &gt;2.4 mi/mi²</th>
<th>Number of Catchments with Riparian Road Density &gt;2.4 mi/mi²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Before²</td>
<td>After³</td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>1</td>
<td>1 (100%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>9</td>
<td>7 (78%)</td>
<td>6 (67%)</td>
</tr>
</tbody>
</table>
### Road Drainage

Road-stream crossings and road ditches extend a stream system’s natural drainage network and can increase the total volume of water transported, potentially leading to erosion and sediment delivery to stream channels. Changes to flow patterns looking at road crossings per mile and riparian road drainage length to stream length as an indication of increases in drainage network due to roads is shown for selected subwatersheds in Table 51. Roads in the Snoquera Project area are increasing the effective drainage network by up to 67.4% and up to 4.19 crossings per mile. After all road treatments have been completed, the modeled drainage network would be increased by up to 60.8% and with no more than 3.11 crossings per mile.

#### Table 51. Summary of catchments with road-impairment metrics exceeding thresholds by subwatershed in Upper White River.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Number of Catchments</th>
<th>Number of Catchments with Riparian Drainage Length per Stream Length Ratio &gt;30%</th>
<th>Number of Catchments with &gt;3 Road Crossings per Stream Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Before</td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>1</td>
<td>1 (100%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>9</td>
<td>5 (56%)</td>
<td>4 (44%)</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>3</td>
<td>1 (33%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>8</td>
<td>4 (50%)</td>
<td>2 (25%)</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>23</td>
<td>18 (78%)</td>
<td>8 (35%)</td>
</tr>
<tr>
<td>Silver Creek -- White River</td>
<td>23</td>
<td>5 (22%)</td>
<td>2 (9%)</td>
</tr>
</tbody>
</table>

1 Catchments are those wholly or mostly on NFS land, and entirely or mostly within the Snoquera Project Area. They are basically HUC14 subwatersheds. Catchments off NFS land and outside the project area were excluded due to incomplete data or limited ability to improve.

2 “Before” reflects the roads as classified in the official FS roads database. While decisions such as the Greenwater Access and Travel Management Project had already been made, most of the treatments had not yet occurred, and the expected effect of their treatments are not reflected.

3 “After” reflects multiple decisions, as if they have been implemented on the ground, and what conditions might be like after everything has been completed.

### Temporary Roads

An estimated 34.8 miles of temporary roads are needed to access stands proposed for treatment by this project in both Alternatives 2 and 3, with 3.2 miles estimated to be new construction (Table 2). New temporary road construction within Riparian Reserve has the...
greatest potential to affect sediment production and potential delivery to streams, and is discussed further in the Riparian Reserve section. New construction would consist of less than one mile, and occur in the Headwaters Green River, Sunday Creek, and Huckleberry Creek subwatersheds. Erosion associated with temporary roads is expected to be negligible, and within the range of natural variability for project area waters.

**Log Haul**—An estimated 319 miles of NFS roads would be used for haul under Alternatives 2 and 3. Actual use of roads would vary by year depending on location of sales active at the time. Primary haul routes for this project would be Forest Roads 5200, 5400, 7000, 7200, 7300, and 7500, along with some combination of arterial and local roads. Upon leaving Forest Service roads, haul routes are expected to include WA State Highway 410 and Interstate 90. Hauling on roads with little or no surfacing, that are steep, or cross many streams, can increase surface erosion and sedimentation to streams. Hauling of logs and heavy equipment typically occur during the drier seasons. While haul is likely to increase sedimentation to streams, these sediments would be dispersed across several subwatersheds and diluted by flows from other streams. Combined with high natural background sediments and haul from private industrial timberlands, these sediments would not likely be measurably attributable to proposed project activities, and are considered to be within rates of natural variability.

**Instream Wood**—Instream wood projects (tree tipping) may result in a short-term increase in turbidity during implementation as trees are felled into the channel, but in the long-term would not measurably affect suspended sediments. At some sites falling individual trees into the channel would help retain bedload and reduce channel downcutting and associated bank erosion, and at other sites they would help to create pools.

**Naches Motorized Trail Reroute**—Where portions of the Naches Trail #1175 tread follows straight up the fall line and/or is unsustainable in its current condition, accelerated erosion occurs, with sedimentation eventually reaching streams. Where the trail is rerouted, and abandoned segments would be rehabilitated, an estimated one mile in length, erosion and subsequent sedimentation to streams is expected to be reduced.

**Other Activities**—Planting in areas of the Norse Peak Fire with high tree mortality would speed recovery of those riparian areas and provide bank stability faster than with natural regeneration. Cutting of danger trees or limbs along streams would be limited to those closest to the road. Removing limbs would not affect sedimentation, and removal of some individual streamside trees would not be ground-disturbing, and are not expected to destabilize banks and lead to erosion into streams. Rehabilitation of dispersed sites may result in short-term delivery of sediments to streams during implementation and for the next year or two until initial vegetation becomes re-established, and in the long-term would reduce on-site erosion. Acclimation pond intake adjustments would create short-term sedimentation during implementation. The effects of remaining project activities on erosion or sediment delivery to streams are considered negligible and within the normal range of background levels.

**Stream Temperature**
Water temperatures would not be directly affected by this project because while individual trees might be felled, overall shade-producing vegetation would not be cut on streams, and sediment delivery is not anticipated to have an effect on channel geomorphology. Sediments generated from proposed activities would not increase stream width, which can have the potential to increase stream temperatures by decreasing water depth. No effects are expected to the 303(d) listed water courses, as no activities are proposed in the Smay Creek subwatershed.
of project design criteria and mitigation measures as part of project activities would minimize potential to affect stream temperatures.

Vegetation Treatments

Alternatives 2 and 3 include “no-cut” buffers for all streams, ponds, and wet areas including wetlands to protect existing shade-producing trees from being cut (Table 11). The following minimum no cut buffers are proposed based on site specific conditions including flood prone area, hillslope stability, and stream type (see Table 11), they include:

- For commercial and non-commercial treatments in elk forage enhancement units, 300 feet along fish-bearing streams, 150 feet along perennial non-fish bearing streams, and 100 feet along intermittent non-fish bearing streams
- For other commercial treatments, a minimum 100 feet from all fish-bearing streams (including the Green River, Sunday Creek, White River, Greenwater River, West Fork White River, and Huckleberry Creek) measured from the outer edge of the channel migration zone or floodprone area on either side of channel, to the top of the inner gorge slope break, whichever is greater
- For other commercial treatments, a minimum of 50 or 100 feet from all non-fish bearing perennial streams, depending on site condition, as measured from the outer edge of the streambank or floodprone area to the top of the inner gorge slope break, whichever is greater
- For other commercial treatments, a minimum of 25 or 50 feet from all non-fish bearing intermittent streams, depending on site condition, as measured from the outer edge of the streambank or floodprone area to the top of the inner gorge slope break, whichever is greater.
- 30 feet from all non-fen wetlands, ponds, wet areas, or seeps, measured from the edge of the water, the outer edge of the riparian vegetation or the extent of seasonally saturated soil, whichever is greatest.

Canopy cover over streams would not be affected, and while Riparian Reserve treatments would reduce adjacent canopy cover for several years, the expected increase in growth of remaining trees would eventually fill in the space.

The intent of these no-cut zones is to protect all vegetation on hillslopes adjacent to streams, including all understory and tree species, and to retain sufficient shade to prevent solar heating of the stream. Wilkerson et al. (2006) found that 75-foot buffers with 60% canopy closure on both sides of the stream resulted in no detectable water temperature change. Groom et al. (2011) detected no difference in pre- and post-harvest stream temperatures on Oregon state forests using a 100 foot riparian management zone limited to thinning, with a 25-foot no-cut buffer. Anderson and Poage (2014) studied variable buffer widths associated with harvesting timber with implementation of the Northwest Forest Plan and the effects of these buffers on stream temperature in western Washington and Oregon. They found that with a minimum 50-foot variable buffer width, slight air temperature increases were measured in the microclimate over streams, but these increases were not sufficient to have an effect on stream temperatures.

The minimum no-cut distances to be used on perennial streams in this project are also consistent with discussions leading to the Northwest Forest Plan TMDL for Western Washington National
Forests that is still in development with the EPA (2015). This “Westside TMDL” will define minimum no-cut distances to ensure that no trees are cut within the current primary shade zones, which vary in size or width from the stream based on stream width, riparian tree height, slope of the adjacent hillslope, and solar aspect or stream orientation in relation to the sun.

Other Activities—Planting in areas of the Norse Peak Fire with high tree mortality would speed recovery of these riparian areas and provide shade faster than with natural regeneration. Cutting of danger trees or limbs along streams would be limited to those closest to the road, and removing some limbs or trees are not expected to result in measurable changes to stream temperatures. Instream wood projects (tree tipping) may result in a slight reduction to on-site shading, but would not measurably affect stream temperatures, and would create pools that help to provide thermal refugia for fish. Rehabilitation of dispersed sites in the long-term would increase streamside shade as vegetation becomes re-established. The small hardwoods that would be cut during implementation of acclimation pond intake adjustments are not providing much thermal cover and would not result in a measurable change to stream temperatures. Road treatments would reduce the potential for sedimentation from road failures to enter stream channels in sufficient quantities to lead to channel widening consequent increases in stream temperature. The effects of remaining project activities on stream temperatures would be neutral.

Riparian Reserves

Ground-disturbing work associated with timber harvesting activities may result in alteration of surface and subsurface hydrology. Approximately 5,057 acres of Riparian Reserves are mapped within or adjacent to proposed commercial harvest stands, with another 571 acres of Riparian Reserves within or adjacent to proposed non-commercial stands. Applying the relevant minimum Riparian Reserve no-cut buffer based on stream type, a conservative estimate for acres to be treated amount to about 3,953 acres of commercial stands, and 485 acres of non-commercial stands. Based on Forest experience and an informal assessment, 50-70% of the acres planned for treatments get dropped from implementation due to several factors, including the need for previously unidentified buffers, geomorphic constraints (e.g., slope breaks, rocky outcrops) or other logging system obstacles, and amount of non-merchantable material (O’Connor, pers. comm. 2018). Ground would not generally be disturbed with non-commercial treatments, as these stands would mostly be accomplished with hand-thinning. These thinning activities all have mitigation measures and best management practices to minimize adverse effects to soils and from erosion to protect nearby aquatic resources. No cut buffers as discussed in the water quality section provide the necessary protection for maintaining the microclimate and stream temperature along stream corridors. Pile burning would be done outside all no-cut buffers, with prescribed burns or under-burning outside full Riparian Reserve buffers.

Many roads in the project cross or were constructed adjacent to streams. They have altered or affected riparian conditions, limiting ecosystem function. The reduction of road-related influences on Riparian Reserves would allow the recovery of riparian vegetation and function, and overall ecosystem health in these areas. Table 52 shows the amount of Riparian Reserve that would be allowed to recover due to proposed decommissioning and storage treatments with Alternatives 2 and 3. While treatments done on a road being decommissioned would allow for more complete recovery, improving drainage prior to placing roads into a storage condition would allow these areas to improve until the road is opened and utilized again, after which it would then either be placed back into storage or possibly decommissioned at that time. While decommissioning activities would not likely involve full recontour, overall net gain from proposed decommissioning treatments amount to 0.32 acre in the Green River watersheds and 27.77 acres in the White River watersheds, with an additional 6.95 acres improving in the White due to
storage treatments. While 35 acres across 54,000 acres of Riparian Reserve in the Green and White drainages reflects a relatively small area, the effect is still incrementally beneficial and supports Aquatic Conservation Strategy objectives to restore conditions in Riparian Reserves.

Table 52. Acres of Riparian Reserve by subwatershed reclaimed.

<table>
<thead>
<tr>
<th>Subwatershed Name</th>
<th>Riparian Reserves¹, acres</th>
<th>Alt. 1—FS Roads in Riparian Reserves², miles</th>
<th>Alt. 2 and 3—FS Roads to be Treated³ in Riparian Reserves, miles</th>
<th>Treated³ Roads in Riparian Reserve, acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters Green River</td>
<td>2,930</td>
<td>4.83</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Twin Camp Creek – Green River</td>
<td>2,139</td>
<td>6.03</td>
<td>0.06</td>
<td>0.175</td>
</tr>
<tr>
<td>Sunday Creek – Green River</td>
<td>4,402</td>
<td>14.26</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lester Creek – Green River</td>
<td>3,719</td>
<td>2.36</td>
<td>0.05</td>
<td>0.145</td>
</tr>
<tr>
<td>Smay Creek</td>
<td>512</td>
<td>0.86</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wolf Creek – Green River</td>
<td>1,062</td>
<td>0.48</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sylvester Creek – Green River</td>
<td>334</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal Green</td>
<td>15,098</td>
<td>28.82</td>
<td>0.11</td>
<td>0.32</td>
</tr>
<tr>
<td>Headwaters White River</td>
<td>295</td>
<td>1.59</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>3,988</td>
<td>11.00</td>
<td>0.80</td>
<td>2.33</td>
</tr>
<tr>
<td>Upper West Fork White River</td>
<td>1,140</td>
<td>3.41</td>
<td>1.25</td>
<td>3.64</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>5,811</td>
<td>12.27</td>
<td>4.45</td>
<td>12.95</td>
</tr>
<tr>
<td>Upper Greenwater River</td>
<td>5,585</td>
<td>0.17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>10,788</td>
<td>49.77</td>
<td>4.62</td>
<td>13.44</td>
</tr>
<tr>
<td>Silver Creek – White River</td>
<td>11,145</td>
<td>17.86</td>
<td>0.81</td>
<td>2.36</td>
</tr>
<tr>
<td>West Twin Creek – White River</td>
<td>323</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal White</td>
<td>39,075</td>
<td>96.07</td>
<td>11.93</td>
<td>34.72</td>
</tr>
<tr>
<td>Total</td>
<td>54,173</td>
<td>124.89</td>
<td>12.04</td>
<td>35.04</td>
</tr>
</tbody>
</table>

¹ Total for entire subwatershed, including outside project area, but only on National Forest System lands
² Reflects decisions made prior to proposed action, even though implementation is ongoing
³ Includes roads proposed for storage and decommissioning, and uses 24 ft average width

New temporary road construction within Riparian Reserve would create the most disturbance associated with temporary roads, with short-term effects lasting during construction and decommissioning afterwards, with longer-term effects lasting until the area revegetates. Of the 34.8 miles of temporary roads estimated to be needed, 11.15 miles would be in Riparian Reserves. Table 53 displays the lengths and estimated acreage of temporary roads in Riparian Reserves by type and by subwatershed, using an 18-foot clearing limit for new construction, and applying it to roads previously decommissioned as well as to unclassified prisms. New construction would consist of less than one mile, and occur in three subwatersheds. While an
estimated 1.9 acres of new construction in Riparian Reserves would be needed across the Snoquera project area, because temporary roads would be decommissioned after use, both action alternatives would result in a net decrease in 22.42 acres of road prism in Riparian Reserves. The effect of decommissioning treatments in Riparian Reserves would be to decompact road surfaces and allow vegetation to become re-established, while also restoring the hydrologic integrity at road-stream crossings.

**Table 53. Temporary roads in Riparian Reserves for Alternative 2 and 3, displayed by type and subwatershed.**

<table>
<thead>
<tr>
<th>Temporary Roads in Riparian Reserves</th>
<th>Previously Decommissioned(^1), miles (acres)</th>
<th>Existing Unclassified Prism(^2), miles (acres)</th>
<th>New Construction, miles (acres)</th>
<th>Total by Subwatershed, miles (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters Green River</td>
<td>0.24 (0.52)</td>
<td>1.88 (4.10)</td>
<td>0 (0)</td>
<td>2.12 (4.62)</td>
</tr>
<tr>
<td>Sunday Creek</td>
<td>1.52 (3.32)</td>
<td>1.1 (2.40)</td>
<td>0 (0)</td>
<td>2.62 (5.72)</td>
</tr>
<tr>
<td>Huckleberry Creek</td>
<td>0.19 (0.41)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0.19 (0.41)</td>
</tr>
<tr>
<td>Lower West Fork White River</td>
<td>1.25 (2.73)</td>
<td>0.94 (2.05)</td>
<td>0.03 (0.07)</td>
<td>2.22 (4.85)</td>
</tr>
<tr>
<td>Lower Greenwater River</td>
<td>0 (0)</td>
<td>2.39 (5.21)</td>
<td>0.67 (1.46)</td>
<td>3.06 (6.67)</td>
</tr>
<tr>
<td>Silver Creek-White River</td>
<td>0.33 (0.72)</td>
<td>0.44 (0.96)</td>
<td>0.17 (0.37)</td>
<td>0.94 (2.05)</td>
</tr>
<tr>
<td><strong>Total by type</strong></td>
<td><strong>3.53 (7.70)</strong></td>
<td><strong>6.75 (14.72)</strong></td>
<td><strong>0.87 (1.90)</strong></td>
<td><strong>11.15 (24.32)</strong></td>
</tr>
</tbody>
</table>

\(^1\) these roads include many with a decision from the Greenwater ATM project to decommission, but where work to physically treat them has not yet occurred, as well as roads that were already removed from the database of record where some level of treatment is assumed to have occurred.

\(^2\) these prisms were identified and mapped using LiDAR

Approximately 3508 acres of the Dispersed Site Corridor are within Riparian Reserves. While not all of these acres would have adjustments made, any of the sites being rehabilitated or reduced in size would improve the function of Riparian Reserves, allowing vegetation to become re-established, and reducing erosion.

At Corral Pass, day-use sites would be established but no individual campsites. Vegetation would be reestablished to rehabilitate the pre-fire campground footprint, and function of the Riparian Reserve through the area would eventually be restored, providing shade and bank stability. Planting areas heavily burned by the Norse Peak Fire, which include parts of the Corral Pass area, would accelerate recovery of Riparian Reserve function.

**Wild and Scenic Rivers**

Fisheries values for the recommended White River segments would be enhanced by Alternatives 2 and 3 through several project components. Tributary instream wood projects would improve habitat conditions for multiple fish species in the short term by creating pools and enhancing off-channel rearing areas, sorting gravels, and detaining mobile wood, while variable density thinning in Riparian Reserves improves the quality of future, long-term wood recruitment. Fish passage projects in the White River would increase available habitat for multiple fish species. Spring Chinook, identified as a “rare” fisheries value for the MBS (USDA Forest Service 1990, Appendix E-4), plus steelhead, would particularly benefit by the acclimation pond enhancements, as they are part of the recovery efforts for these listed species. Road storage and decommissioning
treatments in the White River watershed would reduce existing and potential road-related sedimentation to fish habitats in these segments. There are no instream activities proposed in the White River that would affect its free-flowing condition in recommended segments.

**Fish Habitat**

**Instream Wood**

Instream wood projects that would add wood directly to both fish-bearing and non-fish bearing streams would help reduce channel down-cutting and streambank erosion resulting from past removal of riparian and instream wood. Instream habitat would become more diverse as wood helps to scour pools and sort spawning gravels. Where side channel habitats become activated, both spawning and rearing habitats are opened, and become refugia from high flow events. In a recent study, Hall et al. (2018) found strong correlations in channel floodplain complexity in large rivers with productivity of juvenile Chinook. Side channel and main channel braids, particularly formed by woody debris, were particularly important in the Puyallup/White River basin. Tree-tipping in select reaches of Greenwater River, Huckleberry Creek, and Whistler Creek (see Table 7) would improve Chinook habitat, and would also improve habitat for the other salmonid species in these streams.

Variable density thinning in Riparian Reserves would accelerate tree growth in existing riparian stands, benefitting up to 11.7 miles of fish-bearing streams. Minimum no-cut buffers (see Table 11) would protect existing shade-producing trees from being cut. Thinning of upslope and riparian areas allow for the remaining trees to grow larger and potentially provide larger woody debris to streams in the future than would occur otherwise in a densely stocked stand. The reduction in stand density would encourage stem diameter growth, leading to diameter sizes adequate for creating and maintaining pool habitat (Beechie et al. 2000). Depending on the condition of Riparian Reserves, overstocked riparian stands adjacent to up to an additional 106.5 miles of nonfish-bearing streams might also be treated, resulting in wood added to fish habitat downstream in the future. Reeves et al. (2003) found that over half the large wood in a stream was recruited from upslope. Upslope wood recruitment would be protected by prohibiting harvest on inner gorge slope breaks and unstable ground. Though not intentional, windthrow as a side effect of thinning (Roberts et al. 2007) may lead to additional trees that fall, and are considered natural recruitment into the channel.

Treating Riparian Reserves would have the intended benefit of improving the health of remaining trees, while increasing the diversity and quantity of desired tree species that could eventually recruit to their respective streams. Large conifers create stable spawning and rearing habitats for fish, as well as increase the stability of nonfish-bearing channels.

Where roads crossing streams are proposed for decommissioning, trees would become reestablished, and over the long-term could potentially fall into stream channels, helping provide stability and creating habitat. Removal of a portion of FS Road 74 in the West Fork White River floodplain would help to restore channel processes and riparian habitat.

Additional instream wood is expected to naturally recruit in areas with high and moderate-intensity burn from the recent Norse Peak Fire. As much of this was along ridgetops, transport through the affected drainages to fish-bearing waters may take several years, however.

Danger trees generally would not have otherwise recruited to streams and would not result in a measurable loss of habitat. Planting in heavily burned areas would accelerate recovery of
vegetation and would lead to recruitment of trees to streams faster than if left to revegetate naturally, though would take many decades.

**Sediment**

Several life history stages important to fish are affected by inputs of sediment. Kondolf (2000) showed that the percent of fine sediment in spawning gravels affects the ability of salmonids to reproduce effectively, and fine sediments in spawning gravels is closely related to roads within a watershed (Reid and Dunne 1984). Pool habitats are used by rearing juvenile fish and by adults. Pool area and residual pool depth are responsive to changes in sediment input, which affects the quality of this habitat (Lisle 1982; Lisle 1987).

To measure road-related risk to aquatic habitats, the expected reduction in the miles of roads with high aquatic risk is compared by alternative. Reduction in the amount of high risk road is expected to lead to reductions in fine sediment delivered to stream channels through reductions in road surface erosion and failure rate. Because road failure rate and volume are not easily predicted, and because sediments can enter aquatic systems in many places at various times under different conditions, changes in aquatic habitat are also hard to quantify and can be difficult to connect to project activities. Reducing the amount of high risk road is likely to reduce road-related impacts to aquatic habitat and allow natural recovery to occur. Decommissioning treatments can nearly eliminate risk of road-related failure and surface erosion in the long term, and treatments for closure can greatly reduce surface erosion and failure risk through culvert removal and other treatments to allow a more natural drainage pattern. While sedimentation associated with roadwork is possible in the short-term and until the disturbed areas have stabilized, implementation of best management practices such as timing of the work and erosion control measures would minimize project-related sediments reaching fish-bearing waters, and the quantity of sediments would be diluted by flows or background sediments. Benefits to aquatic habitats through improved quality (and quantity) of spawning and rearing habitats is assumed to occur, but difficult to measurably attribute to project activities, particularly when spread out over space and time.

Of the around 487 miles of Forest Service-managed roads in the project area, which includes both NFS and private land, there are 413 miles of Forest Service-managed roads on NFS land. Of these 413 miles, 150 miles were rated as high risk, 136 miles as moderate risk, 121 miles as low risk, and 6 miles were not rated. Both action alternatives would treat just over 11 miles, resulting in an overall reduction of 10% of high risk roads in the project area (Table 54), which would be expected to reduce the risk of sedimentation to fish-bearing streams and help restore the timing and quantity of flow patterns along these roads. Of the 12.8 miles of roads determined to be a high risk to aquatic resources that are within 300 feet of streams documented, presumed or potentially used by federally listed fish, these alternatives would treat 1.6 miles (leaving about 11.2 miles of high risk roads remaining). The amount of reduced sediments would be greatest in the West Fork White River subwatersheds, where up to 57 percent of the high risk FS-managed roads would be reduced on NFS land, though effects would be masked by the high natural sediment load carried by the river. Short-term sedimentation to fish-bearing streams might occur during project implementation and after the first season of storm events before vegetation becomes more established, but after treatment these roads would have a reduced likelihood of failing, and subsequently a reduced magnitude of sediments that could deliver to fish-bearing waters. The distinct contribution of project activities under this alternative to improved spawning or rearing habitats, or to the number or health of fish is not easily measured, however.
Addressing hydrologic function and routing of water by increasing the size or frequency of drainage structures along the 54.11 miles of roads targeted for stormproofing would reduce road-related sedimentation associated with these roads. The incremental benefits are not known and are not quantified.

Rehabilitation of dispersed sites could also deliver sediments in the short-term until vegetation becomes re-established, while reducing long-term erosion from these sites as streamside shade increases and the riparian area recovers. Rehabilitation of portions of the abandoned segments of the Naches Trail #1175 are expected to incrementally reduce sedimentation to Pyramid Creek and the Greenwater River.

**Table 54. Comparison in number of miles of roads by aquatic risk before and after treatments; FS-managed roads on NFS land within project area only.**

<table>
<thead>
<tr>
<th>Aquatic Risk Level</th>
<th>Existing1 High Risk Roads, miles</th>
<th>High Risk Roads, Reflecting Decisions2 Prior to Snoquera, miles</th>
<th>Alternative 2 and 3, High Risk Road Treatments (Storage and Decommission), miles</th>
<th>Additional Change due to Action Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper and Lower Green River Watersheds</td>
<td>20</td>
<td>20</td>
<td>0.71</td>
<td>-3.6%</td>
</tr>
<tr>
<td>Upper and Lower White River Watersheds</td>
<td>130</td>
<td>89</td>
<td>10.34</td>
<td>-11.6%</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>109</td>
<td>11.05</td>
<td>-10.1%</td>
</tr>
</tbody>
</table>

1 “Existing” represents the roads as classified in the official FS roads database now. While decisions such as the Greenwater Access and Travel Management Project had already been made, most of the treatments have not yet occurred. Also includes stored roads, as these were found in the ATM to need more work to reduce the risk.

2 Reflects multiple decisions; excludes roads that would be stored and decommissioned.

**Fish Passage**

Within the project area, there are 53 fish passage barriers identified within federal management that are partial or complete barriers. Some had been previously identified, while others had not. Many were field-verified during summer 2018. Using GIS layers from the Statewide Washington Integrated Fish Distribution, WA Department of Natural Resources water type modeling, and Forest Service distribution layers, 16 miles of habitat are estimated would be opened. Sites would be further assessed to prioritize for implementation based on available habitat and species utilization. Short-term sedimentation would occur during replacement or removal of barriers, lasting during construction and within a year of completion after the first couple flushing flows of the season. BMPs and timing windows would minimize inputs of sediments and contaminants, and habitat would be available immediately upon completion and over the long-term.

**Acclimation Ponds**

Acclimation pond intake adjustments, while eliminating potential spawning habitats in Twentyeight Mile Creek (95-foot long reach) and in Huckleberry Creek (75-foot long reach) where they are proposed to be hardened, is expected to maintain some rearing habitat. Providing a stable source of flow for the ponds are expected to provide a positive contribution to the recovery of listed Chinook and steelhead despite the removal of the estimated 0.18 ac of habitat.

**Recreation Enhancements**
Other proposed recreation enhancement activities are away from streams and would be neutral to fish habitat with implementation of mitigation measures and pertinent BMPs to address indirect effects such as sedimentation.

**Fish**

Direct effects to fish could occur during implementation of fish passage and other road projects in fish-bearing streams, as well as work for the acclimation pond intakes. De-watering of the work areas may entail fish to be handled during capture-removal from the sites, including where federally listed fish may be present. Indirect effects of improving riparian, instream habitat quality and quantity, and acclimation conditions, would benefit fish health, growth, and survival. Quantifying such benefits in relation to proposed project activities is not feasible, however.

While the Forest Service is not a co-manager of the fisheries in the state of Washington, project activities such as the passage projects, instream wood projects, and riparian thinning and dispersed site treatments would improve existing and future habitat conditions for fish. Acclimation pond adjustments are expected to lead to increases in numbers of Chinook and steelhead, and the acclimation ponds are part of the recovery plan for these species. Fish are an important treaty resource for area tribes.

Where explosives are used to remove culverts on roads proposed for decommissioning that are not accessible by heavy equipment, Forest blasting guidelines and mitigations would be employed to minimize potential effects of overpressure on fish. Explosives have the potential to injure fish due to overpressure from the vibrations associated with a blast, which can rupture a fish’s swim bladder. Vibrations are most easily translated from a bedrock-to-water interface, and have been found to quickly dissipate when translated from air to water.

Mitigations for drafting water would prevent entrainment of fish. Other proposed activities are away from streams and would be neutral to fish with implementation of mitigation measures and pertinent BMPs to address indirect effects such as sedimentation.

**Soil Disturbance, Soil Erosion, Organic Matter and Soil Organisms**

There are 304 commercial treatment stands totaling 12,632.2 acres in Alternative 2. Commercial treatment is composed of thinning to create conditions that would eventually attain late old structure and elk forage where stands are thinned to achieve early serial conditions. Current levels of DSCs sourced from NFS system roads identified for log haul activities include 258.8 miles (890.6 acres). Under Alternative 2, approximately 3.2 miles (9.3 acres) of new soil disturbance would be expected in the form of new temporary roads. Landings and skid trails typical of ground based logging methods also represent new soil disturbance (compaction and displacement). The majority of the additional new areas in a detrimental soil condition (compaction and displacement) would be associated with new temporary roads, skid trails and landings within ground-based harvest units. Based on previous monitoring of ground based units using similar design criteria and mitigations, especially using historic skid trails and landings where possible, new skid trails comprise approximately 10 percent of the activity area (assuming 110 foot spacing between trails).

Burning to treat post-harvest activity fuels (slash) throughout a unit and maintenance burning that may occur in elk forage treatment areas could result in soil exposure and therefore some surface erosion. Effects to soils from treating thinning slash with prescribed fire can have both positive and negative effects. Prescribed burning that does not result in high severity type conditions (i.e. not effective ground cover left, high degrees soils hydrophobicity, etc.) can achieve positive
effects related to soil nutrient cycling and increased availability (Feller 1989). However, the reverse can also occur when nutrients such as nitrogen become lost to the atmosphere when burn intensities are higher (Feller 1989). The later is not expected to be case as the Snoquera Project area exists in a western Cascade Mountain ecosystem with very high precipitation bands making high fire resonance time on soil surfaces unlikely.

Table 55. Project area wide soil disturbance estimates for Alternative 2.

<table>
<thead>
<tr>
<th>Type of Soil Disturbance (estimated acres)</th>
<th>Alternative 2 Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legacy compaction and displacement (acres)</td>
<td>1,276.8</td>
</tr>
<tr>
<td>New compaction - permanent roads (acres)</td>
<td>0.0</td>
</tr>
<tr>
<td>New compaction- temporary roads (acres)</td>
<td>9.3</td>
</tr>
<tr>
<td>New compaction- ground based thinning, skyline corridors, landings, (acres)</td>
<td>348.8</td>
</tr>
<tr>
<td>Slash treatments - burning (acres)</td>
<td>1,216.0</td>
</tr>
<tr>
<td>Net soil disturbance (acres)</td>
<td>2,850.9</td>
</tr>
</tbody>
</table>

1Legacy compaction is compaction and displacement that already exists, and includes unclassified roads, skid trails, landings, and OHV and other trails. Assumes 10 percent per proposed stand.
2Assumes 10 percent per proposed stand will need new temporary skid trails and landing development.
3Severely burned soil is a condition where soil has been heated to a point that alters soil structure, resulting in increased soil erosion potential, decreased soil organisms, and decreased nutrient holding capacity. Severely burned soil often occurs in the immediate area of concentrated pile burning. Assumes 10 percent exposed soil per commercial treatment stand.

Project design criteria have been included in the Snoquera proposed action to address pre-harvest unit evaluation of existing DSCs and if needed, prescribe soil remediation actions. This type of soil mitigation will keep commercial treatment unit DSCs to levels below 20%. In addition, soil remediation actions would improve micro-site water infiltration and provide effective ground cover. In doing so, it’s expected that natural processes leading to improved soil fertility and limiting loss of A horizon via surface erosion would occur over time.

Included in Alternative 2 are elk forage treatments which have goals of creating larger openings in the forest and maintaining their newly established early serial vegetation conditions. Elk forage units could be up to 389 acres in size. Creating and maintaining such conditions is intended to promote elk forage habitat conditions where an understory of native grass and shrubs will managed for. Long-term maintenance includes cutting pioneering conifers, moving or cutting thicker shrubbery and burning. Because of the long-term (>50 years) loss of coniferous tree development related development of organics on the soil surface and lack of over story tree crowns that intercept rain and snow, it’s expected that soil productivity and fertility will be limited in these units. In addition, heavier amounts of compaction and displacement from logging systems is expected occur at higher rates due to the clear-cut nature of silviculture prescriptions. Therefore, there’s higher potential for longer term surface erosion rates and decreased productivity and fertility in these units.

Alternative 2 would decommission and hydrologically close (store) NFS system and unclassified roads. A number of these road management actions are not associated nor dependent on commercial thinning treatments being concluded prior to their implementation. Such road related watershed restoration is expected to occur within the next 5 years on roads not associated with commercial treatment access needs. As commercial treatment get implemented and cycles through the Snoquera Project area (5-20 years out), road decommissioning and closure will then
commence after such access need is complete. Road treatments will decrease compacted soil conditions and surface erosion rates as a result of implementing those actions.

**Table 56. Soil area moved from detrimental to improved conditions due to road decommissioning and closure area.**

<table>
<thead>
<tr>
<th>Proposed Road Treatment</th>
<th>Length (mi)</th>
<th>Soil area improved – based on 24 foot average road prism (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Closures</td>
<td>5.7</td>
<td>16.6</td>
</tr>
<tr>
<td>Road Decommissioning</td>
<td>1.6</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7.3</strong></td>
<td><strong>21.3</strong></td>
</tr>
</tbody>
</table>

Road decommissioning includes removing the road footprint from the landscape and may involve different methods to do so. The rates at which de-compaction would occur is dependent on the method and design utilized to remove the road and disconnect it from the hydrologic system. Regardless, road decommissioning is expected to result in establishment of vegetation in the previous roadway with development of soil function and fertility characteristics occurring over the long-term (> 20 years).

Road closure (ML 1 status) may only scarify the road surface over part of its length, remove culverts on perennial and intermittent streams and provide surface drainage features. Such measures are part of disconnecting ML 1 roads from the hydrologic system while they are in a stored condition. Road closure would decrease levels of soil erosion during the period of storage. Levels of deeper seeded compaction through a given road route in ML1 status are expected to occur over the long term (>100 years).

Connected to road treatments include storm proofing, restoring aquatic organism passage at road crossings and dispersed recreation site restoration. Storm proofing implements road surface and ditch line treatments that function to frequently and effectively move water off and away from roads. Doing so is an effective way to not only decrease sedimentation, but limits hydrologic impairment associated with gully formation on hill slopes or other erosion processes. These actions can limit soil loss from that hydrologic impairment sourced where roads interact with streams and water.

Aquatic organism passage, improves hydrologic and geomorphic processes at road/perennial-fish bearing stream crossings and restores upstream passage for fish and other organisms. These actions employ methods of Forest Service Stream Simulation (US Forest Service 2008), which restores stream fluvial function over an array of discharges. By doing so, unnatural flow energy (sheer stress) resulting from undersized crossings is greatly decreased and therefore decrease exacerbated stream bank erosion that often times occurs downstream of the road. Restoring fluvial function allows riparian vegetation along stream banks to gain a stable foot hold across related soil surfaces.

Alternative 2 would institute camping corridors, which in part include moving or eliminating dispersed camping sites from river and stream flood plains and associated riparian areas. There are numerous dispersed recreation sites within lower-mid reaches of Greenwater River and Huckleberry Creek. Overtime the public has pioneered unauthorized access roads and created areas where dispersed recreation (mostly camping and firearm shooting) occur. Varying degrees of soil compaction and surface erosion has occurred as a result. Moving dispersed recreation
activities out of sensitive riparian areas in favor of alternate sites may move related soil disturbance to new locations, however those new locations would me more upland in nature. While soil remediation (de-compaction, re-introduction of soil organic layers, etc.) that occurs in flood plains and along stream channels where water and related hydrologic processes occur will have more effective benefits in conserving soil. In addition, there will be dispersed sites that get eliminated with no alternative location provided. Therefore, it’s expected that there will be an overall long-term (>20 years) net decrease in levels of DSCs from implementing these dispersed site actions.

Both pre-commercial thinning and tree tipping actions are expected to have neutral effects on existing soil conditions at the discrete project site scale. This is due to the lack of soil disturbance that tree tipping will have. Pre-commercial thinning will maintain vigorous live conifers that will positively respond post-treatment in both growth and crown size over the long-term (> 20 years). Therefore, elements that cause new DSCs are not present while forest-soil ecological interaction will continue without interruption of ground disturbing impacts.

**Landslide Risk**
Increasing landslide risk is related to proposed actions that de-stabilize soil surfaces. Commercial thinning and elk forage units and associated logging systems are actions under Alternative 2 that have the highest potential to increase landslide risk. However, by utilizing the Washington DNR geologist derived mapping regime for existing landslide and potential landslide terrain the likelihood of de-stabilizing such features greatly decreases.

Commercial treatment, road development, and associated activities are not expected to contribute to any new landslides within or adjacent to the activity areas. Harvest activities would thin areas that are considered to be stable by a Soils Scientist and/or Hydrologist. Additional unstable areas identified during commercial treatment unit layout would be designated as “skips” or otherwise excluded from treatment. Thinning would not significantly affect hillslope stability in the short term because the roots of the remaining trees already intermingle with those trees that would be cut, and new root growth would result before the roots of cut trees decay and lose their strength. Over the long term, the thinning would enhance tree growth and tree root development, restoring hillslope stability to original levels. Existing shallow landslide and small rotational failures within the activity area would be protected and would continue to slowly stabilize and revegetate. Existing system roads that would be used for haul would be maintained and repaired as needed. These actions would reduce risk associated with the proposed action, as well as some of the risk of future resource damage from road-related landslides.

**Alternative 3**
Effects of implementing Alternative 3 are very similar to those described above for Alternative 2. With Alternative 3, work would include improvements at Silver Creek Guard Station Visitor Center, re-establish campsites at Corral Pass, and would not expand the Naches Trailhead. With Alternative 3, the same number of miles of roads would be closed or decommissioned as with Alternative 2, but no miles would be placed into a Maintenance Level 3 condition.

Proposed activities would revegetate a smaller area of the Riparian Reserve at the Corral Pass campground. Proposed activities associated with Alternative 3 are not instream or away from fish habitat, and would be neutral to fishery resources.
Effect Determinations
Timing of project activities will be spread over many years. While an implementation plan for sequencing has yet to be developed, project activities and their effects would not occur all at once.

_Federally listed fish and critical and essential habitats_
While both action alternatives treat a minimal amount of roads within 300 feet of stream reaches documented, presumed, or potentially to be used by federally listed fish, both would store or decommission roads farther upslope but in close proximity of federally listed fish habitats in the Greenwater River, Twentyeight Mile Creek, Pyramid Creek, West Fork White River, and Huckleberry Creek. Incremental benefits are expected.

For federally listed fish, the effect determinations are *May Affect, Likely to Adversely Affect* for Chinook salmon, steelhead, and bull trout due to possible handling of fish/fish removal for fish passage and acclimation pond projects. For critical habitat, the effect determinations for proposed activities are *May Affect, Likely to Adversely Affect* for designated Chinook, steelhead and bull trout critical habitats due to acclimation pond projects and sedimentation. For essential fish habitats (EFH), proposed activities *Would Adversely Affect* Chinook, coho, and pink salmon EFH due to instream work and sedimentation. Overall, project activities are expected to have a long-term benefit to Chinook salmon, steelhead, and bull trout, to their designated critical habitats, and to Chinook, coho and pink salmon EFH from: reduced potential for road failures and road-related sedimentation of spawning and rearing habitats; increased habitat complexity, stability and accessibility due to instream and future wood recruitment, improved riparian area function, and increased accessibility of habitats past barriers; increased survival due to acclimation pond improvements.

_Sensitive fish_
Per the most recent Regional Forester’s Special Status Species List dated July 21, 2015, the MBS no longer has fish species designated as sensitive.

_Viability of management indicator species_
The MBS management indicator species are Chinook salmon, steelhead, bull trout, coho, pink, chum, sea-run cutthroat, rainbow, and resident cutthroat. While there are no specific “effect calls” for management indicator species, proposed activities would not affect the Forestwide viability of these populations, nor would they have a measurable negative effect to the quality or quantity of their habitats in the mainstems of the upper Green or upper White Rivers, their tributaries or in the (generally) low-gradient fish-bearing reaches of the small distributary tributaries in the project area. While the risk of potential future negative effects to fish and habitats would be reduced, quantifying such benefits to fish or to their habitats would be difficult.

ESA Consultation
Consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the effects of the Snoqualma Landscape Analysis Project on federally listed fish species, designated critical habitats, and essential fish habitats, is covered through standalone and programmatic consultation documents:

The Snoqualma Landscape Analysis project “may affect, likely to adversely affect” Puget Sound Chinook salmon, Puget Sound steelhead and bull trout. The project “may affect, not likely to adversely affect” critical habitat for Puget Sound Chinook salmon, Puget Sound steelhead, and
Coastal/Puget Sound bull trout. Project activities “would not adversely affect” essential fish habitats for Chinook, coho, or pink salmon.

Cumulative Effects

In order for the effects from implementing either of the proposed action alternatives can be cumulative to the lingering effects from past projects, from incremental effects of concurrent projects, or from effects of projects being planned for the near future, they must overlap in both space and time (and in type of effect). The analysis area for cumulative effects to water quantity, water quality, and Riparian Reserves are the project area subwatersheds where vegetation disturbance or roadwork may affect flows, erosion and sedimentation to streams, stream temperature, or function of Riparian Reserves.

The spatial scale of the Snoquera Landscape Analysis Project considered for cumulative effects to fisheries resources is the same as the action area: in the upper Green River—Snow Creek and an unnamed stream (both tributaries to Sunday Creek), and an unnamed tributary to Tacoma Creek; in the White River watershed—White River mainstem and tributaries from its confluence with Slippery Creek at river mile (RM) 45.6 to the boundary with Mt. Rainier National Park at around RM 60.8. Major tributaries to the White River in the action area include: Greenwater River and its tributaries from Midnight Creek at RM 3.8, to George Creek at RM 11.3; West Fork White River and right bank tributaries from mouth to boundary of Mt. Rainier National Park; Huckleberry Creek and its tributaries from mouth to boundary with Mt. Rainier National Park. The temporal scale is during and immediately after implementation of the various project components, after the next flushing flows, until disturbed ground has stabilized and vegetation has reestablished either naturally or from plantings, and also the several decades it may take for riparian trees to recruit to stream channels. The types of effects considered are those that affect existing or potential habitat, or fish distribution, health, or population size. Generally, if there is a cumulative effect to water quantity, water quality, or Riparian Reserves, it can affect fish habitat and fish, primarily associated with sediments.

The Snoquera Landscape Analysis Project contributes cumulative effects to the projects in Table 57. For water quality, the cumulative effect is with activities that are instream, that remove vegetation in Riparian Reserves, that may result in indirect sedimentation, and that affect drainage. The cumulative effects of sedimentation from instream activities would cease shortly after the activities are completed and sediments wash downstream and mix with background sediments. Once vegetation recovers, both sediments and any incremental effects to stream temperatures would cease. With drainage patterns, the overlap is primarily additive with an overall reduction in drainage network. A short-term counteracting effect is expected, with a long-term reduction in sediments and potential sedimentation, primarily through road treatments. For Riparian Reserves, the overlap is related to vegetation removal, with a short-term negative additive effect, with a long-term counteractive, beneficial effect as the function of these areas improve.

For fish habitat and fish, there would be an additive effect of increased fish habitat through removal of barriers or instream habitat improvement projects that have lingering benefits. Generally, where sediments were cumulative, they also were cumulative for fish habitat, with an assumed cumulative effect on fish as well.

<table>
<thead>
<tr>
<th>Table 57. Cumulative Effects table for hydrology, and fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Activity</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Past Actions</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Past Timber Harvest</strong></td>
</tr>
<tr>
<td><strong>Greenwater Floodplain Restoration Project</strong></td>
</tr>
<tr>
<td><strong>Blockage of dispersed sites to vehicular access</strong></td>
</tr>
<tr>
<td><strong>Private Timber Harvest</strong></td>
</tr>
<tr>
<td><strong>Crystal Mtn Boulevard Improvement Project</strong></td>
</tr>
</tbody>
</table>

<p>| Present and Reasonably Foreseeable Future Actions                            |                                                                      |                                                                      |                                                                          |
| Upper White River Vegetation and Restoration Project                          | Disturbed soils, disturbed vegetation, road-related sediments and drainage, fish passage, incl Rip’n Res | Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes                  | Additive for soil and veg disturbance incl in RR until recovery. Additive with increased fish habitat and net reduction in road drainage/sediments and delivery to fish habitats. |
| Forestwide invasive plant treatment                                           | Herbicide treatment, includes Riparian Reserves                     | Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes                  | Cumulative net benefit to restoring trees and native vegetation, reducing sedimentation and flows and improve Rip’n Res function in long term; indirect lingering benefits to fish hab/fish |
| Road maintenance                                                             | Road-related sediments and drainage; no effect to Riparian Reserve function | Water Qual-Yes; Rip’n Res-No; Fish Hab-Yes; Fish-Yes                   | Additive for reducing drainage network/road-sediments and delivery to fish habitats |
| Recreation uses                                                              | Dispersed site-related and motorized compaction, sediments; rock dams; consumptive fishing; includes Riparian | Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes                  | Additive for compaction during implementation, net counteractive; additive for sediments until reveg, net counteractive; counter for |</p>
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Type of Effect</th>
<th>Overlap</th>
<th>Cumulative Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation maintenance</td>
<td>Trail-related sediments and drainage, hazard tree abatement; includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for reducing sediments/drainage network and delivery to fish habitats; counteractive for Rip’n Res function (net improvement)</td>
</tr>
<tr>
<td>Annual Ungulate Winter Range Road Closures</td>
<td>Road-related sediments, no effect to Riparian Reserve function</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for reducing road-related sediments, incremental cumulative benefit to fish habitat/fish.</td>
</tr>
<tr>
<td>Puget Sound Energy/Century Link</td>
<td>Vegetation removal, herbicide application, road-related sediments/drainage, includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for veg disturbance until recovery; additive for reducing sediments/drainage to fish habitat, and for Rip’n Res function</td>
</tr>
<tr>
<td>Harvest from WA State DNR lands</td>
<td>Disturbed soils, disturbed vegetation, road-related sediments/drainage; Riparian Reserves not designated</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for soil and veg disturbance until recovery, and counteracting with net reduction in road sediments/drainage and delivery to fish habitats.</td>
</tr>
<tr>
<td>Greenwater ATM</td>
<td>Road-related sediments and drainage, includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for reducing drainage/sediments to fish habitat, and for helping restore Rip’n Res function</td>
</tr>
<tr>
<td>7222 Connector Road</td>
<td>Vegetation removal, road-related sediments and drainage, includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for veg disturbance until recovery, additive for reducing drainage/sediments to fish habitat, and for helping restore Rip’n Res function</td>
</tr>
<tr>
<td>West Fork White River Bridge</td>
<td>Channel migration, fish habitat, road-related sediments, includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for floodplain function, instream hab and RR function, and reducing road sediments/drainage and delivery.</td>
</tr>
<tr>
<td>Ranger Creek State Airstrip Phase 1</td>
<td>Vegetation removal, includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for veg disturbance, incl in Rip’n Reserves until recovery, with net benefit</td>
</tr>
<tr>
<td>Special Use Authorizations</td>
<td>Increase in impervious area; water removal for consumption; includes Riparian Reserves</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive for veg disturbance/flows until recovery; additive for RR until recovery, with net benefit</td>
</tr>
<tr>
<td>Norse Peak BAER (Burned Area Emergency)</td>
<td>Road/trail-related sediments and drainage, barrier culvert removal, herbicide application,</td>
<td>Water Qual-Yes; Rip’n Res-Yes; Fish Hab-Yes; Fish-Yes</td>
<td>Additive effect of reducing sediments to streams, increasing available fish habitat, improving RR</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Type of Effect</td>
<td>Overlap</td>
<td>Cumulative Effect</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------</td>
<td>---------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>

**Soils**

Cumulative effects on the soil resource include effects of all past, present, and foreseeable actions that cause soil disturbance within the project area. The action alternatives, in combination with past or reasonably foreseeable future actions on nearby federal lands, would not likely increase the amount of detrimental soil conditions caused by past actions, and are not considered to be significant for the soil resource, because they do not overlap in time, space and type of effect with other projects. The contribution of soil disturbing impacts by the action alternative would not cumulatively degrade soil productivity or the soil resource.

Past actions of timber harvest created soil disturbance features. Some of those features have had legacy impacts since the 1930’s – 1980’s when such units were last harvested. Somewhat unique to the Snoquera landscape was the Huckleberry Land Exchange (2001). These lands had multiple logging entries prior to being brought over to the National Forest System. Today, they include high density smaller diameter conifer stands with a network of roads with legacy culverts and other logging system features remaining in place. Thus, soils remain in varying compacted and displaced states. The majority of these areas where overlap occurs with proposed stand treatments fall into either pre-commercial thinning or commercially thin 15 years or greater out-year. Project design criteria that evaluates pre-harvest DSCs and if needed implements soil remediation to meet Forest Plan direction is essential to improving overall soil productivity and fertility within these areas.

By implementing actions that restore soil function and productivity it’s expected that overall soil conditions will improve over the long term (>20 years). Such actions are found in ongoing road decommissioning, closure and storm proofing linked to past NEPA decisions such as Upper White EA and Greenwater ATM EA and will continue to occur over the next 5-8 years. Actions linked to Snoquera Restoration Project EA that restore soil function and productivity are also expected to commence over the next 5-10 years. These would be actions not directly tied to commercial treatment road access needs.

**Compliance with law, regulation, policy, and the Forest Plan**

**Wild and Scenic Rivers**

As discussed above, fisheries values for the recommended White River segments would be enhanced by Alternatives 2 and 3 through several project components.

**Forestwide Standards and Guidelines**

Project activities would apply BMPs to maintain water quality from sediments and contaminants during implementation, and would not impair beneficial uses. In the long-term, water quality would be improved by removing road fill and culverts, improving drainage, re-establishing a more natural bank configuration at streams, and decompacting road surfaces that would increase the stability of these channels and reduce the erosion potential to fish habitats downstream. The
Upper White TMDL (Ketcheson et. al. 2003) and Implementation Plan (Ketcheson and McKee 2006) call for similar actions to meet state water quality standards. Wetlands would be maintained through design criteria and avoidance via buffers around all wet areas. Fish passage would not be obstructed during implementation and would be restored at the 53 identified passage barriers upon replacement or removal.

**1994 ROD**

**Key Watersheds**

The project would reduce system and nonsystem road mileage outside Roadless Areas. Alternative 2 and 3 would both reduce system road mileage in the project area Key Watershed by 23.8 miles. Up to an additional 37.5 miles of nonsystem road mileage could also be reduced.

**Riparian Reserves**

Riparian Reserves proposed for treatment in the Snoquera Landscape Analysis Project are dense and will not maintain long-term tree health and vigor. Silvicultural treatments would be applied to improve stand health and increase the diversity of species. The remaining trees, when recruited to streams, would be larger and increase channel stability for fish and other aquatic species.

The Snoquera Landscape Analysis project considers transportation and access needs while helping to reduce the effects of roads on Aquatic Conservation Strategy (ACS) Objectives. Risk to aquatic resources was one consideration in proposing roads for treatments. A total of about 59 acres of roads in Riparian Reserves is proposed for treatment in both Alternatives 2 and 3. Fish passage would be restored to up to 16 miles of habitat. Dispersed recreational practices would be adjusted or rehabilitated where retarding ACS objectives. Fuel treatment activities would minimize disturbance to riparian vegetation through design and mitigations. Mitigations regarding use of herbicides and other chemicals would not retard or prevent attainment of ACS objectives. Mitigations for drafting water would maintain flows and prevent entrainment of fish. Project activities would improve the long-term ecological integrity of these areas of the Green and White River subwatersheds, conserve the genetic integrity of native vegetation through BMPs and mitigations, and meet ACS objectives.

**Botanical Resources**

Direct effects to botanical resources from implementation of this project may include damage and/or mortality to undocumented occurrences of Sensitive plants and/or their habitat from ground disturbing activities associated with various aspects of proposed actions. This may include, but is not limited to, 1) heavy equipment used in timber harvest, road and trail construction, maintenance, and/or decommissioning, 2) removal of colonized substrate (lichen/fungi), 3) foot traffic (trampling), 4) prescribed fire, and 5) noxious weed treatments. Indirect effects include potential introduction and/or spread of noxious weeds, sediment deposition, alteration of hydrologic regimes, and other habitat-altering results not associated with direct effects.

**Affected Environment**

**Table 58. Vegetation zones in the project area.**

<table>
<thead>
<tr>
<th>Veg Zone</th>
<th>Acres</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas-fir Zone (DFZ)</td>
<td>198</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
### Methodology

Pre-field review included analysis of the Natural Resource Information System (NRIS) TES-Invasives database, the national database containing TES (Threatened, Endangered, Sensitive) and invasive plant information. NRIS data provided locations of past survey areas for botanical resources, sensitive plant occurrence information, and survey/location information concerning invasive plant species. Data was also provided by an existing fen inventory (Dewey 2017) which included portions of the project area. Analysis included the review of Geographic Information System (GIS) spatial layers of the vegetative plant associations and stand ages in which the project occurs, as well as professional knowledge of Sensitive species habitat and distribution on the Forest.

20 plant species categorized as regionally sensitive (R6), Survey & Manage (S&M), or state sensitive are documented as occurring within the project area (Table 59).

### Table 59. Survey and Manage (S&M) and Sensitive plant species known to occur within the project area.

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th># of Sites</th>
<th>Taxonomic Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Botrychium ascendens</em></td>
<td>R6 Sensitive</td>
<td>2</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Botrychium hesperium</em></td>
<td>R6 Sensitive</td>
<td>1</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Botrychium montanum</em></td>
<td>S&amp;M Category A</td>
<td>3</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Carex macrochaeta</em></td>
<td>R6 Sensitive</td>
<td>5</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Carex proposita</em></td>
<td>WA Sensitive</td>
<td>4</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Chaenactis thompsonii</em></td>
<td>WA Sensitive</td>
<td>4</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Collema nigrescens</em></td>
<td>S&amp;M Category F</td>
<td>1</td>
<td>Lichen</td>
</tr>
<tr>
<td><em>Cortinarius olympianus</em></td>
<td>S&amp;M Category B</td>
<td>1</td>
<td>Fungi</td>
</tr>
<tr>
<td><em>Dichostereum boreale</em></td>
<td>S&amp;M Category B</td>
<td>1</td>
<td>Fungi</td>
</tr>
<tr>
<td><em>Leptogium teretiusculum</em></td>
<td>S&amp;M Category E</td>
<td>2</td>
<td>Lichen</td>
</tr>
<tr>
<td><em>Lobaria linita var. tenuoir</em></td>
<td>S&amp;M Category A</td>
<td>2</td>
<td>Lichen</td>
</tr>
<tr>
<td><em>Pedicularis rainierensis</em></td>
<td>WA Sensitive</td>
<td>9</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Peltigera pacifica</em></td>
<td>S&amp;M Category E</td>
<td>7</td>
<td>Lichen</td>
</tr>
<tr>
<td><em>Pinus albicaulis</em></td>
<td>R6 Sensitive</td>
<td>4</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Platanthera orbiculata var. orbiculata</em></td>
<td>S&amp;M Category C</td>
<td>4</td>
<td>Vascular</td>
</tr>
<tr>
<td><em>Pseudocyphellaria rainierensis</em></td>
<td>S&amp;M Category A</td>
<td>5</td>
<td>Lichen</td>
</tr>
</tbody>
</table>
Rhizopogon evadens var. subalpinus | S&M Category B | 1 | Fungi
---|---|---|---
Rhizopogon exigius | S&M Category B | 1 | Fungi
Tholurna dissimilis | WA Sensitive | 1 | Lichen
Usnea longissima | S&M Category F | 2 | Lichen

An additional review searched data records not only within the project area but within 2 miles of the project area boundary. The search produced 3 species which were not represented within the project area, along with several additional sites of species which were documented in the project area (Table 60). Survey and Manage (S&M) and Sensitive plants occurring outside, but within 2 miles of, the project area. The purpose of searching adjacent to the project area was to consider the potential for any additional occurrences to be located but undocumented in the project area, and also to consider whether mitigations are required to avoid potential impacts from the project on surrounding species.

### Table 60. Survey and Manage (S&M) and Sensitive plants occurring outside, but within 2 miles of, the project area.

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th># of Sites Outside Project Area (2 miles)</th>
<th>Also Located Within Project Area?</th>
<th>Taxonomic Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carex proposita</td>
<td>WA Sensitive</td>
<td>3</td>
<td>Yes</td>
<td>Vascular</td>
</tr>
<tr>
<td>Cypripedium fasciculatum</td>
<td>S&amp;M Category C</td>
<td>1</td>
<td>No</td>
<td>Vascular</td>
</tr>
<tr>
<td>Peltigera pacifica</td>
<td>S&amp;M Category E</td>
<td>2</td>
<td>Yes</td>
<td>Lichen</td>
</tr>
<tr>
<td>Platanthera orbiculata</td>
<td>S&amp;M Category C</td>
<td>1</td>
<td>Yes</td>
<td>Vascular</td>
</tr>
<tr>
<td>Schistostega pennata</td>
<td>S&amp;M Category A</td>
<td>1</td>
<td>No</td>
<td>Bryophyte</td>
</tr>
<tr>
<td>Scribneria bolanderi</td>
<td>WA Sensitive</td>
<td>1</td>
<td>No</td>
<td>Vascular</td>
</tr>
</tbody>
</table>

The US Fish and Wildlife Service (USFWS) list of Threatened and Endangered species for Washington was accessed on September 20, 2018. Using the USFWS Information for Planning and Consultation (IPaC) tool, the project area was searched for current Threatened, Endangered, and Candidate plant species. One Candidate species, *Pinus albicaulis* (whitebark pine), was documented as occurring within the project area boundary at three sites. Candidate species are those which are under consideration for official listing as either Threatened or Endangered, and for which there is sufficient information to support listing. No other species were documented within the vicinity of the project area.

A total of 9 Sensitive and 14 Survey and Manage plant species are documented within, or within close proximity to, the project area. 10 of the survey and manage species require management of known sites (Cat. A, B, E), 2 require management of high priority sites (Cat. C), and 2 require no management (Cat. F). Of the 2 Category C species, 1 site within 2 miles of the project area is considered a high priority site (*Cypripedium fasciculatum*) due to the limited distribution of the species on the Forest.
Invasive Plants

Pre-field review of invasive plants produced a list of 16 species of concern documented in the project area (Table 61). More than 16 species are known to occur within the project area, however those presented here represent Forest Service Priority species which are treated when observed, or mapped to be treated at a later date. A total of 288 sites are shown, however it is common for invasive species sites to contain more than one species, and a single site may be counted more than once depending on how many species are present. Representation of Total Acres on Table 61 also contains overlapping acres when more than one species is present. After removing overlapping mapped sites, actual total area equaled 863 acres. The same exercise was performed to determine actual acreage of invasive species within 100 feet of roads, since roads are a known vector for invasives. A total of 761 acres was produced, indicating approximately 88% of known invasive infestations occur within 100 feet of roads in the project area.

Table 61. Documented Invasive Species of Concern.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th># of Sites</th>
<th>Total Acres</th>
<th>FS Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centaurea diffusa</td>
<td>knapweed, diffuse</td>
<td>2</td>
<td>132.72</td>
<td>5</td>
</tr>
<tr>
<td>Centaurea jacea</td>
<td>knapweed, brown</td>
<td>2</td>
<td>10.63</td>
<td>5</td>
</tr>
<tr>
<td>Centaurea stoebe</td>
<td>knapweed, spotted</td>
<td>16</td>
<td>236.33</td>
<td>5</td>
</tr>
<tr>
<td>Cirsium arvense</td>
<td>thistle, Canada</td>
<td>91</td>
<td>264.09</td>
<td>18</td>
</tr>
<tr>
<td>Cirsium vulgare</td>
<td>thistle, bull</td>
<td>56</td>
<td>204.96</td>
<td>16</td>
</tr>
<tr>
<td>Cytisus scoparius</td>
<td>Scotch broom</td>
<td>39</td>
<td>337.63</td>
<td>13</td>
</tr>
<tr>
<td>Hieracium lachenalii</td>
<td>hawkweed, common</td>
<td>33</td>
<td>264.91</td>
<td>3</td>
</tr>
<tr>
<td>Hieracium laevigatum</td>
<td>hawkweed, smooth</td>
<td>1</td>
<td>25.00</td>
<td>3</td>
</tr>
<tr>
<td>Hypochaeris radicata</td>
<td>cat's ear, common</td>
<td>1</td>
<td>160.02</td>
<td>40+</td>
</tr>
<tr>
<td>Polygonum bohemicum</td>
<td>knotweed, bohemian</td>
<td>2</td>
<td>0.08</td>
<td>1</td>
</tr>
<tr>
<td>Potentilla recta</td>
<td>sulfur cinquefoil</td>
<td>1</td>
<td>0.26</td>
<td>11</td>
</tr>
<tr>
<td>Rubus armeniacus</td>
<td>blackberry, Himalayan</td>
<td>1</td>
<td>0.01</td>
<td>34</td>
</tr>
<tr>
<td>Rubus laciniatus</td>
<td>blackberry, evergreen</td>
<td>1</td>
<td>0.01</td>
<td>35</td>
</tr>
<tr>
<td>Senecio jacobaea</td>
<td>tansy ragwort</td>
<td>36</td>
<td>641.45</td>
<td>6</td>
</tr>
<tr>
<td>Senecio vulgaris</td>
<td>common groundsel</td>
<td>4</td>
<td>0.13</td>
<td>40+</td>
</tr>
<tr>
<td>Tanacetum vulgare</td>
<td>common tansy</td>
<td>2</td>
<td>0.02</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>288</td>
<td>2278.24</td>
<td>(863 actual)</td>
</tr>
</tbody>
</table>

Surveys

Data considered in the analysis of this project has been provided by past general and focused botanical surveys, as well as field surveys (2018) specific to the Snoquera project. Existing botany survey coverage within the project area totaled nearly 16,000 acres, approximately 14% of the total acreage of the project area on National Forest System lands. In some cases, records of
sensitive plant occurrences were not connected to mapped survey areas, indicating more survey has been performed than what is represented in the database.

Field surveys were conducted in 2018 with a focus on areas where existing survey coverage was limited and where activities were proposed to occur. 2018 surveys did not record any new or additional occurrences of special status plant species to be considered in management decisions. Table 62 summarizes special status plant species in relation to activities proposed to occur under the action alternatives (Alternatives 2 & 3).

Table 62. Summary of Special Status Species by Proposed Action.

<table>
<thead>
<tr>
<th>Species</th>
<th>Type of Activity</th>
<th>Location</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium ascendens</td>
<td>LSR Thin</td>
<td>1 site within potential unit</td>
<td>R6 Sensitive</td>
</tr>
<tr>
<td>Botrychium montanum</td>
<td>LSR Thin / Developed</td>
<td>1 site within and 1 site adjacent to</td>
<td>S&amp;M Category A</td>
</tr>
<tr>
<td></td>
<td>Recreation</td>
<td>potential units, 1 site adjacent to proposed rec thinning</td>
<td></td>
</tr>
<tr>
<td>Carex macrochaeta</td>
<td>LSR Thin</td>
<td>2 sites within and 2 sites adjacent to</td>
<td>R6 Sensitive</td>
</tr>
<tr>
<td></td>
<td>potential units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cortinarius olympianus</td>
<td>Matrix Thin</td>
<td>1 site within potential unit</td>
<td>S&amp;M Category B</td>
</tr>
<tr>
<td>Lobaria linita var. tenuoir</td>
<td>LSR Thin</td>
<td>2 sites within and 1 site adjacent to</td>
<td>S&amp;M Category A</td>
</tr>
<tr>
<td></td>
<td>potential units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peltigera pacifica</td>
<td>LSR Thin</td>
<td>2 sites within and 2 sites adjacent to</td>
<td>S&amp;M Category E</td>
</tr>
<tr>
<td></td>
<td>potential units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudocyphellaria rainierensis</td>
<td>LSR Thin</td>
<td>1 site within and 1 site adjacent to potential units</td>
<td>S&amp;M Category A</td>
</tr>
<tr>
<td>Rhizopogon evadens var. subalpinus</td>
<td>LSR Thin</td>
<td>1 site adjacent to potential unit</td>
<td>S&amp;M Category B</td>
</tr>
</tbody>
</table>

Species Assessments

Sensitive plant species documented within the project area will be managed and protected by applying appropriate design criteria outlined in Table 11 of this document. Individual assessments for 23 species known to occur in the project area are provided in the Snoquera Botany Specialist Report. Also included are assessments for an additional 20 species not known, but having potential, to occur in the project area. Table 63 in this document summarizes effects determinations for regional and state sensitive species known, and having potential, to occur in the project area.

Spatial and Temporal Bounding of Analysis Area

The spatial scope of this analysis includes all NFS lands within the Project area boundary. To consider potential impacts resulting from proposed actions which may have effects beyond the project area boundary, an additional 2 mile buffer around the project area creates the spatial scope of this analysis for Direct, Indirect, and Cumulative effects. Cumulative effects are bound in time by thirty years (fifteen years prior and fifteen years into the future), as this encompasses the impacts related to the most recent planning efforts and any foreseeable impact to botanical resources from the Snoquera project.
Environmental Consequences

Direct and Indirect Effects
Direct effects to botanical resources from implementation of this project may include damage and/or mortality to undocumented occurrences of Sensitive plants and/or their habitat from ground disturbing activities associated with various aspects of proposed actions. This may include, but is not limited to, 1) heavy equipment used in timber harvest, road and trail construction, maintenance, and/or decommissioning, 2) removal of colonized substrate (lichen/fungi), 3) foot traffic (trampling), 4) prescribed fire, and 5) noxious weed treatments. Indirect effects might include introduction and/or spread of noxious weeds, sediment deposition, alteration of hydrologic regimes, and other habitat-altering results not associated with direct effects. Direct and indirect effects will be analyzed further by each proposed action.

Alternative 1 - No action
Under Alternative 1 there would be no direct effects to Sensitive, Survey & Manage, USFWS Candidate plant species, or fens beyond what is currently occurring. Design criteria are in place to mitigate impacts from ongoing actions, such as noxious weed treatments (USDA FS 2015).

Indirect effects may be expected to Sensitive plants due to a decision to not implement restoration aspects of the project. Impacts currently occurring on the landscape, particularly within riparian areas, would not be addressed and further degradation of these habitats could result in damage to, or loss of, Sensitive plants due to stream bank head-cutting and other types of stream bank erosion. Instream wood activities proposed in the action alternatives would contain components which would be beneficial to Sensitive plants. Roads identified for decommission or stormproofing which are causing (or are expected to cause) resource damage, such as excessive sediment movement, could also result in indirect negative effects to Sensitive plants if action is not taken.

Under the No Action alternative there would be no planting of Pinus albicaulis (whitebark pine) in the Norse Peak burned area. No impacts, beneficial nor detrimental, would occur to the species beyond what it is currently experiencing. Across its range, Pinus albicaulis is expected to be negatively impacted by habitat alterations associated with climate change. The USFWS identified threats to the species to include “habitat loss and mortality from white pine blister rust, mountain pine beetle, catastrophic fire and fire suppression, and environmental effects resulting from climate change”. The species appears to be in a downward trend within much of its range and may be in danger of extinction, potentially within as few as two to three generations. The generation time of whitebark pine is approximately 60 years (USDI FWS 2010).

Alternative 2
A total of 9 Sensitive and 14 survey and manage plant species are documented within, or in close proximity to, the project area (see Tables 3 & 4 of Botany Specialist Report for list). Eight of these species are located within or adjacent to proposed LSR thinning units, and one is located within a proposed Matrix thinning unit. One species (Botrychium montanum) is located within a LSR proposed unit, with a separate occurrence located in a proposed Developed Recreation area (Ranger Creek).

Variable Density Thinning
All Terrestrial Restoration projects (including all proposed thinning) would occur in stands younger than 80 years. These are generally stands that have regenerated following some past
timber harvest. Suitability for supporting sensitive species is variable in stands which have been harvested in the past, depending on the method of, and time since, harvest. Areas which have been clear-cut and burned, then replanted, are not expected to retain the pre-disturbance characteristics which may have supported sensitive species previously, resulting in loss or fragmentation of habitat. Sensitive species may still occupy pockets of undisturbed areas, or may have survived and/or re-established following the historic disturbance. These considerations have been incorporated in the analysis of effects for all three alternatives.

Variable density thinning would be achieved via mechanical means, generally using heavy equipment. Heavy equipment associated with mechanical treatments can directly impact understory plants by crushing or uprooting, or by compacting soil or otherwise altering the forest floor. The equipment can also loosen and displace soil, which can then collect in drainages and other low-lying areas. Microsite hydrology and fungal communities can be affected by heavy equipment to a point where Sensitive species could be lost or inhibited from establishing. Seven fens are identified within the project area boundary and there is potential for more (undocumented) to occur. The nature of these systems would result in avoidance from project activities, as they are wet areas and often connected to larger wetland ecosystems. Sites which may be fens but have not been documented as such would at least be recognized as wetlands, for which BMPs are in place to protect.

Heavy thinning would be achieved by similar means to variable density thinning, but would result in more open canopies and likely more ground disturbance from heavy equipment. However, heavily thinned areas would not cover large areas, approximately ½ acre to 3 acres in size and across 3-10 percent of the stand area. Skipped areas would remain densely stocked and would be largely avoided, covering at least 10 percent of a stand area. Skipped areas would include riparian no-cut buffers, hardwoods and minor species areas, and plant protection buffers.

Dense timber stands are often found to have a rather depauperate understory, limited number and diversity of plant species. Thinning in these stands would reduce canopy cover and provide opportunity for more species’ establishment, though non-vascular and shade tolerant vascular plants have potential to be impacted by the change in conditions and increased competition for resources. Invasive plant species also have the potential to migrate into stands with these more open conditions.

Supporting actions associated with Terrestrial Restoration activities include road construction, reconstruction and/or maintenance for use of temporary roads on existing templates, road conversion, and creation of skid trails and slash piles. Roads and skid trails have the potential to alter ground surface by crushing and/or uprooting vegetation, compacting or otherwise altering soil, exposing bare soil, and introducing non-native and/or invasive plant species to an area.

Multiple passings to slash piles by heavy equipment can compact soil and de-vegetate pathways. Piles have the potential to be placed upon, or near, undocumented occurrences of Sensitive plants. Piling of unused forest materials results in alteration of the site below via increased temperatures, blocking of sunlight and other resources, and general surface disturbance. Piles planned for burning result in high temperatures below and surrounding piles, and further surface disturbance. Although an approved seed mix is distributed across the affected area, non-native and/or invasive plant species commonly colonize these areas after burning (Haskins & Gehring 2004).

Potential indirect effects may result from greater use of existing roads for hauling, resulting in an increase in erosion and dust pollution. Undocumented Sensitive species which may occur along roads could experience reduced photosynthetic capacity due to a coating of dust on the leaves. In
some cases, thinning dense stands may open access to areas previously protected from unauthorized motor vehicle or ATV use. New use in areas increases not only the potential for unauthorized collecting, trampling, and other losses of individuals, but also increases the susceptibility of non-native or invasive plant species invasion.

A summarized list of species known or having potential to occur within areas proposed for project activities are listed by project type. Each plant species is analyzed individually in the Snoquera Botany Specialist Report to describe in more detail the potential effects of proposed actions on specific habitats and species. Sensitive plant species known to occur in, or within close proximity to, thinning areas are *Botrychium ascendens* and *Carex macrochaeta*. Both species have potential to occur elsewhere in the project area.

Sensitive plant species known from the project area with potential for undocumented occurrences to be located in or near thinning areas are *Botrychium ascendens*, *Botrychium hesperium*, *Carex macrochaeta*, *Carex proposita*, *Pedicularis rainierensis*, *Pinus albicaulis*, and *Tholurna dissimilis*.

Sensitive plant species not known from the project area but analyzed as having potential to occur there, and with potential to occur in or near thinning areas are *Botrychium pedunculosum*, *Campanula lasiocarpa*, *Carex magellanica* ssp. *irrigua*, *Carex pauciflora*, *Carex stylosa*, *Fritillaria camschatcensis*, *Gentiana douglasiana*, *Leptogium cyanescens*, *Lycopodium dendroides*, *Lycopodiella inundata*, *Ophioglossum pusillum*, *Pellaeas breviores*, *Platanthera chorisiana*, *Platanthera obtusata*, *Ramalina thrausta*, *Scribneria bolanderi*, and *Swertia perennis*.

Effects in riparian reserve variable density thinning areas would be similar to those described above, since the actions would be implemented similarly. The additional actions of felling several larger diameter trees into stream channels would be expected to promote an increase in future Sensitive plant habitat by rehabilitating the areas to more natural conditions and by addressing current erosion and floodplain concerns, though potential remains for undocumented sensitive plants to be displaced, damaged, or destroyed by the action.

Sensitive species known from the project area with potential to occur in these areas area *Botrychium ascendens*, *Botrychium hesperium*, *Carex macrochaeta*, *Carex proposita*, *Pedicularis rainierensis*, and *Tholurna dissimilis*.

Sensitive plant species not known from the project area but analyzed as having potential to occur there, and with potential to occur in or near riparian reserve thinning areas are *Botrychium pedunculosum*, *Carex magellanica* ssp. *irrigua*, *Carex pauciflora*, *Carex stylosa*, *Fritillaria camschatcensis*, *Gentiana douglasiana*, *Leptogium cyanescens*, *Lycopodium dendroides*, *Lycopodiella inundata*, *Ophioglossum pusillum*, *Platanthera chorisiana*, *Platanthera obtusata*, *Ramalina thrausta*, *Scribneria bolanderi*, and *Swertia perennis*.

Non-Commercial Thinning
Non-commercial thinning would occur following commercial harvest and would remove trees up to 7” DBH. These treatments would be primarily accomplished by hand thinning, with possible exceptions for Huckleberry and/or Elk Forage treatments if approved by botany, wildlife, and aquatic resource specialists. Slash would be piled and burned, or scattered where appropriate. The effects from slash piling and burning described in variable density thinning apply here as well to the same list of species.
Planting – *Pinus albicaulis* (whitebark pine)

The proposed action would include planting of *Pinus albicaulis* in appropriate areas within the perimeter of the Norse Peak fire burned area. The action would contribute to maintaining and improving the viability of this Candidate species on the MBS, which is in observed decline across much of its range.

Elk Forage Habitat Management

The proposed action would convert up to 272 acres of forested stands to shrub/grass/forb types and an additional 117 acres would occur as pre-commercial or commercial thinning. Effects from the use of heavy equipment would be similar to what has been previously discussed in thinning units, though no forest cover would remain within the elk forage openings. This would result in a permanent loss of the habitat type within the openings, ranging in size from 0.5 to 27 acres and averaging less than 10 acres each. Lands where the action would occur were acquired from Weyerhaeuser Timber Company and were harvested prior to the acquisition. Areas where the action would occur are not considered to be highly suitable for supporting Sensitive plant species and no occurrences of Sensitive species are documented within the vicinity of Elk Forage units. Sensitive plant species would not be expected to establish in these areas in the future, unless connected to other open areas where undocumented occurrences exist. If this were the case, there could be potential for generating habitat for *Botrychium ascendens*, or *Botrychium hesperium*. More likely, the sites will create opportunities for pollinators, which could be encouraged by an appropriate seed mix.

Huckleberry Enhancement

Huckleberry enhancement would occur on up to 400 acres in the project area to promote the health and production of harvestable berry fields. Implementation would largely be performed concurrently with non-commercial thinning treatments, so effects would be similar. Areas identified for huckleberry enhancement may currently be utilized for harvesting berries, and would be available after implementation for that use. Sites would not be accessible during implementation. Selected sites would contain an element of huckleberry in the shrub layer and would likely be situated under fairly open canopies or on the edge of more forested stands. Sensitive plant species with potential to occur in these areas include *Botrychium ascendens*, *Botrychium hesperium*, *Carex macrochaeta*, and *Carex proposita*.

Recreation Enhancement

Dispersed camping management would involve removing some existing areas from authorized use and rehabilitating disturbed areas, improving existing areas to align with resource objectives and user access, and no action in some areas to remain in their current state. Areas to be rehabilitated could require recontouring, decompacting, and seeding or planting to re-establish vegetation. Improving existing areas could involve leveling of parking areas and installation of fire rings, picnic tables, and possible vault toilets. Rehabilitation of sites would not be likely to affect Sensitive plants, as these areas have been trampled and de-vegetated by past and current use. Decompacting would be beneficial for the plant communities to re-establish, and would provide a more suitable foundation for seeding or planting after. Improvement activities would not be expected to impact Sensitive plants, as these actions would most likely occur within areas already impacted by past activities (devegetated, compacted). Parking areas are often situated adjacent to system roads in the road right of way. These areas are not generally considered suitable Sensitive plant habitat. With any proposed ground disturbance, a concern of noxious weed introduction and/or spread exists, particularly in high use areas where foot traffic has the possibility to further spread seeds.
Proposed activities at Naches, Corral Pass, and Noble Knob, would have minimal effect on botanical resources. These sites were surveyed in 2018 and no sensitive plants were observed. Trail maintenance on Naches trail would include some short-term ground disturbance which could result in damage or mortality to undocumented sensitive plant occurrences located near the trail but would be beneficial in the long-term by addressing erosion concerns which can alter suitable habitats by either removal or deposition of soils. Corral Pass campground would not be re-established under this alternative and revegetation efforts would occur as needed, focusing on areas which are not naturally revegetating. Closing the campground may result in less foot traffic in the area, reducing potential for user-created trails and devegetation. However, the campground is situated near several trailheads and trails which would continue to receive use. Potential impacts to botanical resources such as trampling, devegetation, or unauthorized plant collection would be fewer under this decision, but they would not be eliminated. No Sensitive plants are documented from the vicinity of Corral Pass, though *Botrychium ascendens*, *Botrychium hesperium*, *Botrychium pedunculosum*, *Carex macrochaeta*, and *Scribneria bolanderi* have the potential to occur.

Ranger Creek Airstrip was visited during 2018 botany field surveys and determined to provide minimal suitable Sensitive plant habitat due to historic and ongoing disturbance and maintenance. The area experiences general maintenance throughout each year to ensure the safety of the airstrip, including mowing and cutting small diameter trees as permitted. *Botrychium montanum* (Survey & Manage Category A) is documented near a campground adjacent to the airstrip where campground improvements are proposed. The area has potential to support *Botrychium ascendens*, *Botrychium hesperium*, and *Botrychium pedunculosum* as well.

**Alternative 3**

Naches Trailhead access along FSR 7065 would not be expanded under Alternative 3. This would result in no action taking place, which would have no impact on Sensitive plants since there are currently no erosion concerns or needs for action.

Up to five sites would be re-established at Corral Pass campground within the existing footprint of the campground. As this area has been used in the past as a campground and Norse Peak fire burned it over, it is unlikely that Sensitive plants would be impacted from the action of re-establishing sites. The action would result in more use in the area and could result in user-created trails among campsites. Some devegetation would be expected. *Botrychium ascendens* and *Botrychium hesperium* may have potential to occur in the vicinity of proposed campsites, but are not documented and were not observed during 2018 field surveys.

Silver Creek Guard Station improvements would occur only under Alternative 3. The site was visited during 2018 botany surveys and no Sensitive species were observed. The surrounding area has been developed to varying extents, with intact forest beyond the footprint of disturbance. Impacts to Sensitive plants would not be expected to occur.

**Invasive Plants**

**Alternative 1**

Under Alternative 1, there would be no impacts to or from invasive plants beyond what is currently occurring. Ongoing invasive treatments would continue within the project area, similar to in the past.
Alternative 2

Alternative 2 would minimize the spread of existing noxious weeds and avoid introducing new weeds where possible, but some increase in noxious weed cover is expected in the short term. Noxious weeds have the ability to outcompete native vegetation, including Sensitive species, for resources such as sunlight, water, nutrients, and space.

Ground disturbing activities associated with timber harvest, road construction / maintenance / decommissioning, and other proposed projects have the potential to create areas of new noxious weed infestations. Of particular concern are areas where ground disturbing activities are proposed and noxious weeds are currently present, facilitating further spread of these existing infestations.

Invasive species in the project area are generally located near roads (88% of mapped infestations), but can be found in other settings as well. Thinning operations have the potential to transport invasive plant seeds from roadsides or other sites further into forested stands which may be relatively free from weeds.

Activities associated with dispersed camping sites and trails/trailheads also pose a higher risk of spreading noxious weed seeds, as these areas are often known to contain concentrated populations of weeds.

Proposed recreational target shooting areas have been heavily impacted and devegetated in the past. Noxious weeds are a concern at some shooting areas and have been treated annually. Shooting areas proposed for improvements or closure would require continued noxious weed treatments to address the concern.

Project design criteria requires pre-implementation treatment of noxious weeds in areas of known infestations as an effort to eradicate weeds prior to machinery or other disturbances entering the area and spreading invasive plants and/or seeds beyond their existing footprint. Of particular concern is the transfer of invasive plant seeds from roadsides (where they commonly occur and are accessible to treat) into forested areas where the species may have not otherwise invaded and treatment is more challenging. Seeds may be unknowingly transported on tires or machinery, in organic material or slash movement, and by many other actions. Recently exposed/disturbed soils are susceptible to the establishment of noxious weeds. If pre-implementation treatments are not feasible or cannot be conducted due to other restraints, post-implementation treatments will occur and sites would be surveyed to map the extent of any spread.

Alternative 3

As only minor changes are proposed between Alternative 2 and 3, effects of invasive species on the landscape would be nearly identical between the two action alternatives. Projects proposed at Naches Trailhead, Corral Pass Campground, and Silver Creek Guard Station under Alternative 3 would slightly increase ground disturbance on the landscape and would require additional monitoring and potential invasive species treatments at those locations. Cumulative Effects

The extent of the Snoquera project area serves as the cumulative effects analysis area (see project file for a list of projects being considered for this cumulative effects analysis). Since the location of all project activities and rare and invasive plant sites are not currently known (potentially undocumented occurrences), this cumulative effects analysis will be broad and based on current information.
Cumulative effects are the accumulation of direct and indirect effects, due to the repetition and interaction over time by other actions in the past, present, and foreseeable future, in addition to the proposed action. For this analysis, a cumulative effect is the result of the accumulation of impacts that may affect Special Status plants or cause the introduction or spread of invasive plants within the project area.

**Alternative 1**

Indirect effects to botanical resources associated with not implementing restoration and rehabilitation aspects of the project were identified for Alternative 1. Cumulative effects would include the continued degradation of these areas, largely through various forms of erosion, resulting in habitat degradation, and potentially loss of individuals or populations of Sensitive plant species.

No cumulative effects to invasive plants under this alternative, as no direct or indirect effects were identified.

**Alternative 2**

Within the Snoquera project area, activities causing disturbance to vegetation in the past, present, and future are largely a result of 1) timber harvest, 2) road construction, reconstruction, and maintenance, 3) special uses, 4) recreation, and 5) fish and wildlife habitat enhancement projects. The accumulation of direct and indirect impacts from these activities has resulted in vegetation and soil alteration, modification, and invasive plant spread.

Disturbance can be a temporary or long-term change in environmental conditions that may result in changes to vegetation composition. Some plant species favor disturbances and early-successional stages, while other plant species favor late-successional stages without disturbance. Habitat alteration can occur when vegetation is impacted beyond immediate or short-term recovery to an extent where conditions are no longer suitable to support particular plant species. Loss of habitat may occur when vegetation is unable to recover over time.

Vegetation modification can decrease the available suitable habitat for rare plants, while increasing the suitable habitat for invasive plants. An altered habitat can result from, but is not limited to, the accumulation of changes in solar exposure, hydrologic patterns, soil microbial and fungal activities, air quality, water quality, microclimate, ground cover, competition, organic litter, mineral soil compaction, and/or sediment movement.

Cumulative effects to botanical resources have the potential to increase with all new or recurring actions on the Forest. Actions associated with the use of heavy equipment have the potential to increase the presence of invasive plants in the project area and may result in these species spreading into areas where they would not have otherwise been as likely to reach.

**Alternative 3**

Cumulative effects for Alternative 3 would be the same as those described in Alternative 2, since only minor changes are proposed between the two alternatives and the differences do not change expected effects to botanical resources.
Compliance with law, regulation, policy, and the Forest Plan

Effects Determination
As required by the Forest Plan, as amended, the Specialist Report and the EA documents all federally-listed threatened and endangered species, Forest Service Region 6 Sensitive species, and Survey & Manage species and evaluates potential impacts to these species (USDA Forest Service 1990, page 4-127). Habitats for sensitive plants will be managed to ensure that management activities do not contribute to these species becoming threatened or endangered (USDA Forest Service 1990, page 4-127). The design of this project insures that appropriate actions are taken to protect listed and Sensitive species, areas, and habitats (USDA Forest Service 1990, page 4-127). This project is consistent with Survey & Manage standards and guidelines; it provides for the persistence of species at the project level, the watershed level, and in the planning area at the site level (i.e. the Mt Baker-Snoqualmie National Forest), and it maintains viable populations of survey and manage species within the project area.

The determination of effects on Sensitive plant species were made as a result of the information gathered in the pre-field review, field reconnaissance, survey results, and effects analysis for the action alternatives. The determinations were based on effects of proposed activities on known populations and impacts to populations that could occur in areas that are unsurveyed for all Sensitive plants. The determination language is set forth in Forest Service Manual 2670. A complete analysis of each species is available in the Snoquera Botany Specialist Report.

Determinations consider the extent of each plant species’ distribution on the Forest and within the project area. Species may be limited in documented occurrences, located within a restricted range, have highly specific habitat requirements, or have a significant percentage of known sites located within, or within close proximity to, areas identified for potential treatment in the action alternatives.

Objectives, standards, and guidelines have been established to conserve Sensitive plants located on the Mt. Baker-Snoqualmie National Forest. This project would follow the objectives, standards, and guidelines applicable to those species and habitats found in the project area.

Four Sensitive plants located in the project area are ranked either apparently or demonstrably globally secure (G4/G5) (NatureServe 2015). This, in combination with the rangewide presence of these species, can be interpreted to mean that if all of the occurrences of these species in the project area were extirpated, the species would most likely survive and most likely not cause a trend to Federal listing. The four globally secure species are: Botrychium hesperium, Carex macrochaeta, Carex proposita, and Tholurna dissimilis.

Sixteen sensitive plants not known to occur in the project area but analyzed as having potential to occur there, and ranked either apparently or demonstrably secure are: Campanula lasiocarpa, Carex magellanica ssp. irrigua, Carex pauciflora, Fritillaria camschatcensis, Gentiana douglasiana, Lycopodium dendroideum, Lycopodiella inundata, Ophioglossum pusillum, Pellaea brevifolia, Platanthera chorisiana, Platanthera obtussata, Ramalina thrausta, Scribneria bolanderi, and Swertia perennis.

Three Sensitive plants located in the project area are ranked globally vulnerable (G3). These species are: Botrychium ascendens, Chaenactis thompsonii, and Pinus albicaulis. If project activities were expected to impact the species, each would most likely survive and most likely not cause a trend to Federal listing due to the global range and abundance of the species. Additionally,
Botrychium pedunculosum is not known to occur but was analyzed as having potential to occur, and is ranked globally vulnerable.

One Sensitive plant located in the project area (Pedicularis rainierensis) is ranked globally imperiled (G2). The species is considered a local endemic to Mt. Rainier and the majority of documented occurrences are located within Mt. Rainier National Park. P. rainierensis is documented in one general area on the MBS and also occurs on the Forest outside of the project area. It is documented near the base of Mt. Rainier on all sides except possibly the southeast. Project design criteria would mitigate impacts to all known P. rainierensis sites in the project area, though potential remains for undocumented individuals to be impacted. If project activities were to impact individuals of the species, it would not likely result in a trend toward Federal listing due to the extent of occurrences located outside of the project area. No aspects of either action alternative are proposed within known occupied sites of P. rainierensis. Proposed LSR thinning treatments are possible within approximately 0.65 miles from documented sites, and are separated by additional features such as roads, rivers, and mountainous topography.

With mitigation measures (see Table 11) fully implemented, a determination of “May adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range-wide” is made for 25 MBS Sensitive plant species for each of the alternatives (Table 63).

Table 63. Determination Summary by Alternative for Analyzed Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Alternative 1 (no action)</th>
<th>Alternative 2 (proposed action)</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium ascendens</td>
<td>triangular-lobed moonwort</td>
<td>NI¹</td>
<td>MAII³</td>
<td>MAII</td>
</tr>
<tr>
<td>Botrychium hesperium</td>
<td>western moonwort</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Botrychium pedunculosum</td>
<td>stalked moonwort</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Campanula lasiocarpa</td>
<td>mountain harebell</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Carex macrochaeta</td>
<td>long-awn sedge</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Carex magellanic a ssp. irrigua</td>
<td>boreal bog sedge</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Carex pauciflora</td>
<td>fewflower sedge</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Carex proposita</td>
<td>Great Smoky Mountain sedge</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Carex stylosa</td>
<td>variegated sedge</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Chaenactis thompsonii</td>
<td>Thompson’s pincushion</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Fritillaria camschatensis</td>
<td>Kamchatka fritillary</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Gentiana douglasiana</td>
<td>swamp gentian</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Leptogium cyanescens</td>
<td>blue jellyskin</td>
<td>NI</td>
<td>MAII</td>
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<td>Lycopodium dendroidatum</td>
<td>tree groundpine</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Lycopodiella inundata</td>
<td>inundated clubmoss</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Ophioglossum pusillum</td>
<td>northern adderstongue</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
<tr>
<td>Pedicularis rainierensis</td>
<td>Mt. Rainier</td>
<td>NI</td>
<td>MAII</td>
<td>MAII</td>
</tr>
</tbody>
</table>
Recreation

Affected Environment

The project area is located in both King and Pierce Counties. King County shares its southern border, delineated by the White River, with Pierce County. Pierce County is bordered to the east by the Pacific Crest trail.

Highway 410 bisects the project area and provides access to recreational opportunities within the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests as well as Mount Rainier National Park. The analysis area offers many developed recreation outdoor activities including two developed (fee) campgrounds: Dalles and Silver Springs; and one primitive (no drinking water or garbage pickup, no fee) campground: Ranger Cr. Corral Pass campground was also a primitive campground, but was destroyed by the Norse Peak Fire and is not currently available. There are two fire lookouts: Kelly Butte and Sun Top that are staffed by volunteers in the summer months and when staffed, are open for public visitation. There is a back country airstrip with public facilities and day use picnic sites, and numerous opportunities for dispersed recreation activities including dispersed camping, recreational target shooting, undeveloped picnic areas, and scenic viewpoints.

The project area provides numerous miles of roads and roughly 250 miles of multiple use trails, offering opportunities to the hiker, equestrian, mountain bikers, and motorized (motorcycle, ATV/UTV, recreational and passenger vehicle) public. Opportunities along these roads and trails include, but are not limited to: hunting, fishing, berry picking, sightseeing, along with cultural ceremonies and collection of medicinal and other plants opportunities by local Tribes. Two highlights of this area’s trail system include portions of the Pacific Crest National Scenic Trail and the Historic Naches trail system.

The area provides winter groomed snowmobile trails and cross country ski opportunities in partnership with Washington State Sno-Parks Program. These winter trail opportunities on NFS managed lands include approximately 65 miles of groomed snowmobile trails, and an estimated 6,000 acres of ungroomed terrain for cross country skiing and snowshoeing. Crystal Mountain ski resort is also a part of the project area offering downhill skiing on groomed trails and in ungroomed and backcountry areas. No activities proposed by the Snoquera project are located within the area operated by Crystal Mountain ski resort.
According to data released by the U.S. Census Bureau, from April 2016 through April 2017, the population of the Seattle-Tacoma-Bellevue area grew by more than 64,000 people. The Census Bureau states that the three-county area was the sixth-fastest growing metro area in the country, topped only by Dallas, Houston, Atlanta, Phoenix and Washington D.C. The overall population rose to nearly 3.9 million residents for the three counties with King County accounting for more than half of the increase, with nearly 33,000 more people living there than the previous year. According to the Office of Financial Management, from the April 1, 2010 decennial census to April 1, 2018, King County is the main contributor, with total growth of 259,000 persons over eight years, compared to 194,200 persons between 2000 and 2010. Pierce County’s growth was 26th nationally, with a little over 17,000 more people in 2017 than the prior year.

Environmental Consequences

Direct and Indirect Effects

Proposed project activities with direct and indirect effects on recreation include: commercial thinning, temporary road construction or closures, road management changes, enhancement of fish and wildlife habitats, huckleberry and dispersed/developed camping, recreational target shooting, trails, trailheads, and facility improvements. The effects of this landscape analysis project are designed to improve the natural environment of forest communities, while improving recreation opportunities across this project area. With the proposed actions contained in this project, effects would include temporary disruption to recreation activities, setting and opportunities.

Alternative 1-No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. Project area facilities and roads would continue to be managed based on the Forest Plan and already approved road decisions made in the Greenwater ATM (2017). The public using or frequenting various recreation facilities and sites in the analysis area would continue to experience similar situations and conditions commonly encountered in the past with some road access issues due to storm damage repairs, or other unforeseeable circumstances that require temporary closures.

There would be no commercial thinning, enhancement of fish and wildlife habitats, huckleberry enhancements, or planting. Current conditions (i.e. recreation experiences, Public Safety, Recreational Opportunity Spectrum (ROS) characteristics) at dispersed sites, facilities, trailheads, and trails would not change under this alternative. Trailhead expansions or improvements in high use recreation areas, or improvements to trails, recreation facilities and dispersed opportunities within the corridors as a result of vegetation management activities would not occur. These sites would continue to be crowded with limited availability of parking and visitor amenities. There are safety issues, recreation conflicts, human waste, increased trash dumping and other illegal activities found along many of these corridors within the project boundary that would continue to be problematic. Under this alternative, the analysis area would continue to be managed under the Forest Plan, as amended, with the area being consistent with current laws, regulations, policy, and guidelines.

Developed and Dispersed Recreation

The current facilities, configurations, and level of development would remain the same. Visitor Safety and Facility/Site Protection Standards and Guidelines that were established in the Mt.
Baker-Snoqualmie Land and Resource Management Plan, as amended, would continue to not be met fully with the types and number of recreational users on the landscape that is occurring today.

Negative effects from dispersed recreation throughout the analysis area would likely increase under the no action alternative. Dispersed camping and recreational target shooting, popular along the lower corridors of Forest Service Roads #7000, #7010, #7030, #7300, and #7160-210 would continue in the short term with ongoing monitoring to determine if sites should remain open for the long term. Lack of proper sanitation facilities areas where sites are concentrated would continue, and health and safety concerns would be monitored. Short term ambient noise from recreational target shooting would continue at current levels with no mitigation measures put in place, with long term conflicts continuing to occur for the non-recreational target shooting public and habitat for threatened and endangered that exists in proximity to these target shooting dispersed sites. Other dispersed recreation activities such as hunting, fishing, picnicking and driving for pleasure in and around the analysis area would not change.

Corral Pass access would continue to be restricted due to the current road and area developed facilities, designs, and configurations that were severely damaged during the 2017 Norse Peak Fire, leaving the area unsafe for public access. The Corral Pass campground would not be rebuilt, and reconstruction of day use sites and pit toilet facilities would also not occur. Recreation facilities and opportunities in the Ranger Cr campground area and backcountry airstrip would remain the same.

**Trails and Trailheads**

Under the no action alternative, the current trail system and trailhead facilities would remain the same. As described above for the Corral Pass area, there would be little to no change to the design or condition of the three non-motorized, single track trails accessed in this area: Noble Knob Tr. #1184, Rainier View Tr. #1155, and the Greenwater Lakes Tr. #1176. Access to these three system trails would be limited as the gate at the bottom of Corral Pass would remain shut, until post-fire mitigations can be implemented for public safety, currently approximately six miles without vehicle access.

Forest Service Road (FSR) #7065 would not be converted to a trail, trailhead parking for ATV/UTV riders would continue to be overcrowded and/or limited to two to three vehicles with trailers, and FSR #7065 would continue to be passenger vehicle only, resulting in negative impacts to the ATV/UTV trail rider by not providing a legal route to access the motorized section of the Historic Naches Tr. #1175. Ongoing annual trail maintenance and operations on the Naches Tr. #1175 would continue as maintenance schedules allow, but these current maintenance levels would likely not be enough to bring the designated dual track trail up to standard. Currently segments of this trail go straight up the fall line of the landscape, user created routes are being created to avoid these difficult and sometimes impassable areas. This current trail condition is creating a large source of sediment deposits in area streams and roadways. Erosion to the trail tread is accumulating rapidly to the point that sections of this trail could be permanently lost which could result in the potential closure of this trail system to the motorized community.

**Alternatives 2 and 3**

Both action alternatives include project design criteria and mitigation measures to help address required standards and guidelines in Forest Plan. The long-term direct and indirect effects from both alternatives would bring the most heavily impacted recreation conditions in the analysis area, into compliance with the standards and guidelines through improvements, redesign, reconstruction, rehabilitation and revegetation, user education and participation. During
Implementation, some of these activities may cause short-term access restrictions. See the Proposed Action and Alternatives section of this EA for details of the proposed activities, project design criteria and mitigation measures.

Effects common to Alternatives 2 and 3

For both alternatives 2 and 3, the effects from the proposed activities described in following sections of the proposed action are essentially the same for recreation: Terrestrial Restoration, Transportation, and Watershed Restoration.

The terrestrial and watershed restoration activities will have minimal impacts on recreation. The vast majority of recreation activities would continue with no long-term shifts, disruptions, or changes in use. Access to some trailheads may be impacted through temporary closures or disruptions during active thinning and hauling of vegetation, and while implementing road and watershed improvement projects, in the project area. Recreational use of dispersed sites near some of the more common and popular areas would likely be temporarily impacted in certain locations along those roads when active logging and hauling occurs along the road.

Action alternatives, as mitigated, would reduce potential exposure and risk to public safety from active harvest related activities. Public access would be temporarily suspended and access roads would be temporarily closed during active thinning activities. Traffic signs along roads being used for timber haul and associated road work would be utilized to inform the public of road and traffic hazards. In addition, timber harvest activities generally require that roads be brought up to better maintenance standards to facilitate safe and efficient logging operations. Once activities are concluded, the roads are often left in better shape than before making the driving experience for visitors safer and more enjoyable.

Maintenance level road changes

The proposed road maintenance level changes would close approximately 6%, or 30 miles of Forest System roads, the majority of these being spur roads, within the project area. Short and long term effects would change the access to these roads from motorized public access to non-motorized access. Currently the majority of these spur roads are short, dead end roads that have limited recreational value and are being used primarily for unsafe target shooting and illegal garbage dumping. Impacts of these spur road closures would be largely positive in the reduction of opportunities for these illegal acts and could provide future recreational opportunities such as, but not limited to, non-motorized dispersed camping, hiking, and hunting.

Dispersed and Developed Recreation

Dispersed Camping – Designated Sites

Alternatives 2 and 3 would alter the dispersed camping recreation opportunity experience in the project area. Implementation of developing these specific sites would be incremental and phased. Designated site development would result in the following:

- reduction of overall dispersed sites while reducing overcrowding for camping experience within the established corridors.
- improved facility amenities and visitor safety;
- reduction in overcrowding and congestion as well as user conflicts;
more under-utilized and suitable areas within the project area would receive more use due
to displacement of recreationists in these managed corridors.

The effects to the dispersed recreation experience from this action would be:

- Camper capacity for the “managed dispersed” camping sites would decrease within the
  specified corridors, which would address concerns for overcrowding and dispersed
  overnight use into developed camping areas and/or other unaffected areas on and off
  forest that can absorb the future use.

- Solitude of dispersed camping would increase. Improved camper satisfaction should
  result from this reduction of overcapacity dispersed campsites.

- Dispersed campsite parking slots along the forest road corridor would be redesigned to
  accommodate parking for each associated campsite without interfering with normal
  traffic flow on forest service system roads. This would reduce current roadside parking
  congestion and improve driving safety for public traveling through these road corridors.

- Camper movement and travel (ingress and egress) to each managed dispersed site would
  be improved by establishing one “Walk in Only” trail from parking area, minimizing the
  current spider web network of user trails in the areas.

- Facility landscape and natural vegetation would be better protected and sustained in the
  future by the installation of picnic tables and fire rings at each designated camp site.

- Human health and safety would be improved through addition of pit toilets to the area
  which would reduce the overall impact of scattered human waste in these overly used
  areas.

- Information distribution would be improved by upgrading and installing appropriate
  signage at designated parking area for these dispersed sites to educate users of the rules
  and assist law enforcement in obtaining compliance with dispersed camping and area
  regulations.

- Dispersed camping opportunities outside of the “managed” corridors would have
  minimum change. Only areas that impacted a sensitive riparian area could result in the
  loss of dispersed camping opportunity.

- All illegal motorized routes that access any of the dispersed sites would be
  decommissioned with “walk in” paths created to provide access to the site. This would
  have a slight effect on availability of dispersed recreation, however, the majority of
  changes are occurring on roads that are already closed to motor vehicle use or roads that
  are not suitable for passenger vehicles.

Short-term impacts to recreation during designated site implementation are expected but would be
minimized to the extent possible through application of design criteria and mitigation measures
(Table 11). Closures and construction activities would be schedule during midweek and/or in the
shoulder seasons when camping is minimal to minimize the impact on users seeking camping
opportunities. Visitors would be provided information about the closures and construction
activities and alternate camping opportunities and signs would be posted at road entrances, in the
affected areas, to aid in notifying users prior to and during closures. Short and long-term effects
would be a reduction of dispersed sites within these corridors, primarily on and around stream
banks and riparian areas, which would promote better wildlife, vegetative, steam and fisheries health. Recreationally, the effects would promote more isolated dispersed camping opportunities (reduction in overcrowding) while also reducing the amount of trash, human waste, and overall vegetative disturbance that is currently happening within these corridors. Other effects would be more restrictions for dispersed camping within the corridors. Camping in these corridors would be limited to designated, established sites only. Camping in areas within the corridors that are not designated would be prohibited.

Recreational Target Shooting

70 & 72 Target Shooting area improvements
Two areas currently used for recreational target shooting (70 and 72 rock pits) would be improved (see Description of Proposed Action – Recreational Target Shooting). These areas would be temporarily closed during construction and improvement activities resulting in short-term displacement of users of these sites as some of the traditional users would likely be redirected to other areas for target shooting. To mitigate this displacement effect closures and construction activities would be scheduled during midweek and/or in the shoulder seasons when target shooting in these rock pits are minimal and would have the least impact on users seeking this recreational activity (see Table 11 for mitigation measures). The Forest would also provide information to the public regarding alternative opportunities for target shooting that meet the legal descriptions for target shooting on public land.

Recreational users would benefit in the long term. With more development of these two sites, heavier public use would be expected at both sites, but facilitates would be in place to accommodate that use. Parking congestion and ingress and egress would be improved. Recreational shooters would benefit from increased shooting opportunities for both long and short range firearms. Enhancements would benefit users by creating a safer target shooting environment, reduce “trigger trash” with more established targets on site, and minimize the destruction of vegetation currently being used as backstops for targets, which would help create a more positive public image for this type of recreation use to the non-target shooting public. With consolidation of use at these two sites, other dispersed sites would be less attractive for use reducing potential shooting impacts from trigger trash and natural resource destruction. With the incorporation of sound mitigation measures by adding earth mounds and vegetation to the overall design of the parking area, this would have a positive effect at reducing surrounding ambient noise that could affect wildlife and the non-target shooting public in the area.

7013 Pit Target Shooting Closure
The 7013 recreational target shooting pit would be closed to target shooting. This area is currently under a one year closure order (ORDER NO. 06-05-18-05) prohibiting target shooting. The temporary, one year Special Closure Order was issued in July 2018 and preliminary information indicates the closure has been effective at starting to address resource and health and safety concerns. The proposed action would issue a closure order for up to five years, the maximum closure length that can be approved from an EA. The longer term closure would help prevent continued resource degradation and ensure protection of public safety in the area continues. The need for the closure would continue to be evaluated and the order rescinded or a new order issued as necessary based on conditions.
Ranger Creek State Airstrip

The Washington State Department of Transportation – Aviation Division (WSDOT Aviation) manages a group of general aviation airstrips in Washington, known as “State-Managed Airports.” Ranger Creek airstrip, consists of just over 22 acres within the NFS Buck Creek Campground complex and is operated by WSDOT Aviation through a Special Use Permit.

This State-Managed airstrip system at Ranger Creek provides unique benefits including: support of forest firefighting activity and emergency medical operations, transportation access to recreational areas, and flight safety enhancement.

Areas within and adjacent to the airstrip could be temporarily closed to public and pilots during construction and improvement activities for health and safety purposes. This would likely redirect some of the traditional users to other areas. Closures and construction activities would be scheduled during midweek and/or in the shoulder seasons where feasible to minimize impacts to recreational users. The public would also be notified of these closures and advised of alternative backcountry airstrip opportunities. These short term impacts are expected to be minimal, but the airstrip is a favored location for fly-ins, military training exercises, search and rescue training, and glider operations, approximately 1800 to 2000 take offs and landings (operations) April through December, weather permitting.

In the long term, recreational users would benefit from the facility improvements. Both alternatives would enhance operations, improve user safety, and bring the airstrip into conformance with acceptable FAA and WSDOT Aviation Airport design standards per the recommendations of the WSDOT Airport Layout Plan (ALP).

Trails and Trailheads

The Corral Pass Trailhead, dispersed campground, day use sites, signs, and five pit toilets along with the adjacent Noble Knob Trailhead, day use sites, and trailhead facilities (picnic table, signs, garbage can) were destroyed in the 2017 Norse Peak fire. These two trailheads are popular destination access points for the Noble Knob Tr. #1184 (Hiking, equestrian, mtn. biking) and two Norse Peak Wilderness trail access points, the Greenwater Lakes Tr. #1176 and the Rainier View Tr. #1155 (Hiking and Equestrian).

Corral Pass Trailhead

During trailhead reconstruction and repair, temporary closures would be put in place. There may be short-term adverse impacts to the surrounding area trailheads from congestion of displaced recreational users. Trailhead reconstruction would likely occur during the summer months when soil conditions are dry. Closure impacts to recreationists would be minimized by scheduling repairs during mid-week when demand is less, potentially opening up the area on weekends for public use. Some displacement of trail users can be anticipated especially during the peak summer months when use rises, but the effect would be minor since access to the specific trails from Corral Pass can be accessed in other areas and other trail systems in the area would be open to handle the temporary increased use coming from the trailhead closure. Signs would be posted at the beginning of the road access to Corral Pass to aid in notifying users prior to and during closures. In the area burned by the Norse Peak fire additional short-term effects related to temporary closures for hazard tree mitigation over the next several years are possible but would be necessary for public health and safety.

Long-term effects would include changing the recreating public’s ability to use the area as a day-use only area instead of an overnight camping opportunity. This change in use patterns from
camping to day-use only would primarily affect fall hunting camp opportunities. Both alternatives would reestablish and improve access for better ingress/egress for public and emergency vehicles, while providing better parking opportunities for vehicles with stock trailers. Facilities for equestrian use would also be improved. The trailhead would be revised to better fit the Wilderness character of the area and meet Forest Service Standards and Guidelines for wilderness trailheads.

**Noble Knob Trailhead**

Effects of actions proposed at this site would be similar to those described for Corral Pass. During trailhead reconstruction and repair, temporary closures would be put in place which could result in short-term adverse impacts to the surrounding area trailheads due to increased congestion of displaced recreational users. Trailhead reconstruction would likely occur during the summer months when soil conditions are dry. Closure impacts to recreational users would be minimized by scheduling repairs during mid-week when demand is less, potentially opening up the area on weekends for public use. Some displacement of trail users can be anticipated especially during the peak summer months when use rises, but the effect would be minor since access to the specific trails from Noble Knob can be accessed via other trailheads. Signs would be posted as needed to notify users prior to and during closures. In the area burned by the Norse Peak fire additional short-term effects related to temporary closures for hazard tree mitigation over the next several years are possible but would be necessary for public health and safety.

In the long term, use at this multiple use trailhead/trail which is a popular destination for hiking, equestrian, and mountain biking, would change to day-use only, affecting mostly fall hunting camp opportunities. Access would be improved for better ingress and egress for public and emergency vehicles more parking would be provided to reduce parking congestion. Facilities for equestrian and mountain bike use would be improved. As with the Corral Pass trailhead actions, there would be no net loss of parking and trail access compared to current conditions following the Norse Peak fire.

**Naches Trailhead Expansion**

During trailhead expansion, temporary closures would be put in place. Trailhead reconstruction would occur when soil conditions are dry. Closure impacts to recreationist would be minimized by scheduling construction during mid-week when demand is less and have the least impact to the users, potentially opening up the area on weekends for public use. During mid-week construction, there would be no ATV/UTV trailhead parking available in the area to access the Naches Tr. #1175. Some displacement of trail users can be anticipated especially during the peak summer months when use rises, but the impact would be minor since the Naches Trail can be accessed in other areas where Forest Service roads intersect with the trail system. Signs would be posted at the Pyramid Sno-Park TRHD and at the existing TRHD at the beginning of FSR #7065 to aid in notifying users prior to, and during closures.

Both alternatives would benefit recreational users in the long-term by expanding and improving facilities associated with the existing Naches trailhead. Additional parking spaces would be added which would better accommodate the overflow of traffic. Ingress and egress for public and emergency vehicles would be improved and the parking area would be better defined to limit creation of user built parking and unauthorized trails. Motorized recreational users would have increased opportunities to be in compliance of Motor Vehicle Use laws and restrictions by not parking off site and riding ATV/UTV’s on system roads that are prohibited to that type of OHV use.
Differences between Alternative 2 and 3
The differences for recreation effects of these two alternatives are summarized below.

Alternative 2 specific effects

Day Use Area: Corral Pass and Noble Knob
Temporary closures would be put in place during construction of these day use sites, and during construction there would be no pit toilet in the area for public use. Impacts would be minimal with access to the two trailheads providing “park and go” trail access.

With the sensitivity to burnt resources, and the expense of rebuilding the original dispersed campground, this proposed action would not rebuild any of the campground facility sites. A gate would be installed at the original site of the campground entrance, changing management of the area as a day use trailhead instead of an overnight trailhead destination.

Road to Trail and Trail Reroute - Naches Trail #1175 motorized trail section
There would be no short-term direct and indirect effect on this proposed road to trail conversion as the Forest Service passenger road system #7065 designation to Forest Service trail #1175 system would occur immediately. There would be short-term effects associated with heavy maintenance and rerouting sections of the entire 5.7 miles stretch of the Naches Tr. #1175 in areas along the trail where trail tread is poorly located and does not meet minimum manual and handbook standards. These areas would be brought up to Forest Service standards by relocating the existing trail tread to a more sustainable route.

During heavy maintenance and construction of reroutes, these sections of trail would be closed temporarily. There may be impacts to the affected trails from additional use but these would be temporary. Trail Reconstruction would likely occur during the summer months when soil conditions are dry. Closure impacts to trail users would be minimized by scheduling repairs during the mid-week when demand is less and have the least impact to the users. Some displacement of trail users can be anticipated especially during the peak summer months when use rises, but the effect would be minor since the remaining trail system capacity should be able to handle the temporary use increase coming from the closures. Signs would be posted at trailhead to aid in notifying users prior to and during closures.

Road to trail conversion and trail maintenance would benefit motorized recreation users in the long-term. Effects of Redesigning/rerouting areas of tread that exceed design width standards and are the result of poor design and improper drainage, would help establish a system trail that is better designed for current and future needs. This would better provide for safety, enhance user experience, and reduce long-term maintenance. Two-way trail traffic modifications would enhance vehicle safety along the route.

Alternative 3 specific effects
Alternative 3 would have effects similar to Alternative 2 except as follows:

Corral Pass Campground
Alternative 3 would reestablish up to five individual sites in the existing footprint of the campground that was burnt over in the 2017 Norse Peak Fire, with parking slots, fire rings, and picnic tables. The remainder of the existing campground footprint would be revegetated. The short term effects of this action would be that access to the campground and the campground itself would be closed to camping, only day use opportunities at the trailheads, until the campsites (up to five) can be reestablished within the existing campground footprint.
In the long-term, this alternative would reestablish pre-fire site conditions by allowing overnight camping at the trailhead compared to day use only under Alternative 2. The ability to camp overnight would bring in more public to the area for longer duration of time, providing more opportunities for backcountry recreational experiences but would also effect the primitive Wilderness solitude experience with potential overcrowding in a Wilderness setting. Developing these overnight campground sites would be more expensive to construct and maintain in the long-term. With declining federal budgets, this action could set the area up for failure on operations and maintenance leaving an undesirable camping opportunity for the recreating public.

**Silver Creek Guard Station Visitor Center Improvements**

Alternative 3 would restore and upgrade the historic Silver Creek Guard Station Visitor Center building to provide for ADA accessibility and security. Short term effects of this action would be the closure of this facility while construction was in progress, temporarily closing a rest stop area along the 410 corridor and displacing recreational visitors to gather Forest and Park Service visitor information elsewhere. In the long-term, this alternative would bring the public building into ADA compliance and would improve ingress/egress access to the facility for individuals with disabilities. Restoration of deteriorating facility would provide the public an opportunity to visit a historic building and would provide a rest stop for the public in an area where there currently is none for several miles around.

**Naches Trailhead Expansion and Trail Reroute**

The proposal for Alternative 3 is as described in Alternative 2, except Alternative 3 would not expand the existing Trailhead footprint at the bottom of FSR #7065. Alternative 3 would designate dual motorized use from the Pyramid SnoPark to FSR #7065, authorizing mixed motorized traffic on FSR#7000 for approx. 1.1 miles allowing ATV’s/UTV’s to travel the same route as passenger vehicles are using currently. Short and long-term effects to recreation would include adding mixed recreational vehicle use to a passenger vehicle road system. This mixed use would change the management and maintenance of the road, likely resulting in the short and long term effects:

- Reduced posted speed limit – Slowing the traveled speed through the area of designated dual use allowing for safer emergency stopping distances for two way traffic but also lengthens travel time through the area.
- Increased road blading – Provides a safer road surface to accommodate the mixed vehicle use. With limited road maintenance budgets this increase of road blading to accommodate the mixed use, this would shift priorities to this road section and ultimately take away maintenance from another area of forest service roads.
- Ability to use an already established TRHD (Pyramid TRHD) that provides access to the Naches trail, giving the forest flexibility to take the funds that would be used to build a second trailhead in the area and redirect those funds into building a trailhead in another area that has no access.

**Cumulative Effects**

Analysis of cumulative effects on recreation considers the effects of past, present, and reasonably foreseeable future activities on the recreation resource. The spatial and temporal scale (area and time of impacts of the Snoquera Landscape Analysis Project) considered for analysis of cumulative effects to the recreation resource is the Middle Green, Upper Green, Lower White and
Upper White watersheds, where effects from this project can be considered with other projects. The temporal bounds for the actions considered in cumulative effects are the same as described for the short and long term effects. In order for effects of the proposed project to be cumulative to effects from existing or planned projects, they must overlap in both space and time. The full list of projects, as identified in the project record, has been considered in this analysis. Other projects include, timber harvesting, prescribed burning, road maintenance and decommissioning, trail and trailhead maintenance/reconstruction, recreational use, and other management activities.

Past development, timber harvesting and road construction, decommissioning, and maintenance contributed to the existing condition of the recreation landscape, creating an area where human activity is evident, and the recreation setting is primarily that of a working landscape. In addition, past road construction has resulted in a positive contribution to the accessibility of recreation activates in the area, such as access to hunting grounds, dispersed campsites, and providing access to many summer and winter trail opportunities. Present and reasonably foreseeable future activities include continued maintenance on open forest roads, including improving road and surface drainage, clearing roadside vegetation, and repairing and maintaining culverts. When combined with the long term positive impact of the action alternatives on a healthy forest setting, present and future activities would have a positive effect on recreation by maintaining the access routes and improving the forest setting.

In summary, the cumulative impact of the projects listed in the project record would be neutral or positive for recreation.

Compliance with law, regulation, policy, and the Forest Plan

The Snoquera Landscape Analysis Project would contribute to the Forest Plan goal of providing a broad spectrum of recreation opportunities and experiences. Existing experiences and opportunities would continue. Public use would continue to be managed to provide for public safety, resource values and a quality experience. The project would not change any class of the Recreation Opportunity Spectrum. All Alternatives would meet Forest Plan Standards and Guidelines related to recreation resources.

Visual Resource Management

Affected Environment

Scenic quality is a fundamental element of recreation experiences. Driving to enjoy the scenery has been the top national recreation activity for over a decade. Viewing scenery has always been a highly valued activity for visitors to the Mt. Baker-Snoqualmie National Forest. In the 2006 National Visitor Use Monitoring (NVUM) survey, Mt. Baker- Snoqualmie National Forest visitors identified viewing natural features as the second leading recreation activity at 56%, following hiking/walking at 64% (National Visitor Use Monitoring, 2006).

Visual Quality Objectives (VQO) are standards and objectives for the visual management of the landscape. The objectives describe a different degree of acceptable alteration (except for Preservation) of the natural landscape which is keyed on the variety of the inherent landscape and the sensitivity of its users. The degree of alteration is measured in terms of visual contrast with the surrounding natural landscape. Within the Project Area the importance of aesthetics and sensitivity of the users is reflected in the predominance of the foreground Retention and Partial Retention VQO’s.
Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action
Under this alternative, none of the proposed improved developments or activates would occur. Visually, no immediate change would occur. The forest stands considered for treatment in this project would continue to grow over the next several decades and the analysis area would maintain its visual condition.

Alternatives 2 and 3
The effects of alternatives 2 and 3 on visual resources are essentially the same. Recreation enhancement projects are the actions that differ between alternatives 2 and 3, and the recreation enhancement projects will have a negligible effect on scenery. In addition proposed road maintenance level changes would have no impact to visual resources.

The forest stands in the project area are typically mixed composition of Douglas-fir, western hemlock, western redcedar, and Pacific silver fir. Forest undergrowth is typically thick in openings consisting of huckleberry, sword fern, vine maple, alder and hemlock regeneration indicating a high potential for regrowth and screening of disturbed areas, therefore the use of natural revegetation augmented with seeding and mulching, and duff, would be a suitable method for mitigating visual impacts in both Retention and Partial Retention VQO areas.

Initially, some evidence of disturbance would be noticeable immediately after treatments in the foreground areas. However, this area has high potential for fast understory regeneration and growth that would shield evidence of any activities within 3-5 years. Recent thinning experience on the MBS has shown stands with retained understory, ground cover, and new growth in treated units have covered stumps and debris. Thinned stands increase the feeling of space and allow views through the stand from the roadway, as well as allowing light to penetrate the Forest floor. This meets standards for Foreground Retention.

Retention and Partial Retention standards would be met through thinning prescriptions in project stands within those prescriptions. Trees would be selected in these zones to maintain large diameter trees, maintain understory vegetation and/or encourage understory development and minimize ground disturbance. Slash treatment would be implemented along roads open to the public and would minimize the appearance of slash concentrations on portions of open roads. Skyline corridors, and temporary roads would be minimized and treated to mitigate short term and longer term effects.

Occasional small openings due to temporary roads and skyline corridors would provide variety to evenly textured stands and are consistent with Retention VQO due to their limited width and number within a single unit. The first 100 feet of temporary roads and the landings would be seeded, mulched or revegetated within 1 year to reduce short term effects of color and textural differences.

Critical viewing areas include the Mather Memorial Parkway (MMP) and the Recommended Wild and Scenic White River. The MMP provides a Roaded Natural Recreation opportunity. Implementation of visual resource design criteria within the MMP, would ensure high visual quality levels would be maintained. Motorists driving the highway or visitors recreating along the White River could not be able to observe the thinning area due to the dense vegetation growing
adjacent to the highway and river. A portion of proposed stands fall within the Recommended Wild and Scenic River corridor. However, terrain and vegetation growing adjacent to the river screen most views of the project area from the White River.

The Northwest Forest Plan, as amended, overlays Late Successional Reserve on the designation of the Mather Memorial Parkway. The Visual Quality Objective (VQO) for the Mather Memorial Parkway is Retention, (USDA Forest Service 1990, p. 4-200) “Human activities are not evident to the casual Forest visitor” (USDA Forest Service 1990, p. Glossary-44). Commercial thinning is not precluded from this area, but shall meet recreation and visual objectives, and reduce the risk of public injury from hazardous trees (USDA Forest Service 1990, p 4-201).

The VQO Retention designation would be met in the Mather Memorial Parkway (MMP) primary viewshed corridor by implementing best management practices that direct management activities to not be visually evident to the casual Forest visitor or remain subordinate to the visual environment. Past experience from similar thinning in the corridor show that thinning treatments are not evident to the casual viewer traveling at highway speeds. Thinning prescriptions would maintain what is viewed as a natural setting and promote characteristics of old growth forest. A consistent canopy would cover the landscape in the foreground and middle ground areas.

Cumulative Effects

The spatial and temporal scale (area and time of impacts of the Snoquera Landscape Analysis Project) considered for analysis of cumulative effects to visual resources is the Middle Green, Upper Green, Lower White and Upper White watersheds, where effects from this project can be considered with other projects. In order for effects of the proposed project to be cumulative to effects from existing or planned projects, they must overlap in both space and time. The full list of projects, as identified in the project record, has been considered in this analysis. Of projects listed in the cumulative effects table, only vegetation management projects would contribute to cumulative effects on visual resources, and these would not have lingering effects that would overlap with the implementation of the Snoquera project.

Wild and Scenic Rivers

Affected Environment

There are no designated Wild and Scenic Rivers in the project area. However there are areas of Recommended Recreation Rivers and Recommended Scenic Rivers within the project area. The section of the White River from the headwaters at Emmons Glacier to Huckleberry Creek (approximately 20 miles) was identified as eligible for future designation under the “Scenic” classification per the Forest Plan (USDA Forest Service 1990, p. 4-33). The section of the White River from Huckleberry Creek to the confluence with the Clearwater River (approximately 17.7 miles) was identified as eligible for future designation under the “Recreation” classification per the Forest Plan (USDA Forest Service 1990, p. 4-33). These classifications were in part because the White River retains outstandingly remarkable values associated with scenic, recreation, wildlife, fisheries, historic/cultural, and ecological resources. The goal of the Forest Plan is to maintain or enhance these outstanding and remarkable values so that the White River’s eligibility status is not compromised (USDA Forest Service 1990, p. 4-189). Portions of the Recommended Recreation Rivers and Recommended Scenic Rivers areas within the project area overlap with the Mather Memorial Parkway designation. The goal of the Forest Plan is to manage the parkway area to maintain and enhance its outstanding scenic and recreation qualities (USDA Forest Service 1990, p. 4-199).
Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action
Under this alternative, none of the proposed improved developments or activates would occur. Visually, no immediate change would occur. The forest stands considered for treatment in this project would continue to grow over the next several decades and the analysis area would maintain the scenic, recreation, wildlife, fisheries, historic/cultural, and ecological resources values so that the White River’s eligibility status is not compromised. This alternative would have no effect on current eligibility of the White River for future designation.

Alternatives 2 and 3
The effects of alternatives 2 and 3 on Wild and Scenic Rivers are essentially the same. Recreation enhancement projects are the actions that differ between alternatives 2 and 3, and the recreation enhancement projects would have a negligible effect on Wild and Scenic Rivers. The exception to this may be removal and restoration of dispersed recreation use sites. Most of the actions proposed under these Alternatives would be located outside of the areas identified as Recommended Recreation Rivers and Recommended Scenic Rivers.

An outstanding value is the recreation and visual quality of the drainage. The Visual Quality Objective (VQO) for Recommended Scenic River is “Retention” within 300 feet to ¼ mile of the areas visible from the river itself and Partial Retention for visible areas beyond the foreground (USDA Forest Service 1990, p. 4-93). For the Retention VQO, “human activities are not evident to the casual Forest visitor” (USDA Forest Service 1990, Glossary p. 44). The VQO for Recommended Recreation River is “Partial Retention” within 300 feet to ¼ mile of the areas visible from the river itself and Partial Retention for visible areas beyond the foreground (USDA Forest Service 1990, p. 4-93). For the Partial Retention VQO, “human activity may be evident, but must remain subordinate to the characteristic landscape” (USDA Forest Service 1990, Glossary p. 44). The project would retain these values through implementation of the aquatic conservation strategy and no cut buffers on both sides of the White River. In some specific locations along the river, removal and restoration of dispersed recreation use sites may be visible from the river during implementation, however this would be minimal, and short-term. In the long-term restoring the riparian vegetation along the river would benefit the VQO. Evidence of project activities would either not be visible from the River or only minimally visible for a short duration. Thus, management activities would meet both Retention and Partial Retention standards. Alternatives 2 and 3 would therefore have no direct or indirect effect on current eligibility of the White River for future designation.

Cumulative Effects
Since project activities would meet both Retention and Partial Retention standards, there would be no direct or indirect effect on current eligibility of the White River for future designation. Therefore, there would be no direct or indirect effects from the activities proposed in the action alternatives that could be added cumulatively to other past, present or foreseeable projects which would impact the current eligibility of the White River for future designation, and thus no cumulative effects.
Compliance with law, regulation, policy, and the Forest Plan

The Snoquera Landscape Analysis Project would be consistent with the Forest-wide Standards and Guidelines. The project establishes project design criteria for visual resources, and mitigations related to aquatic conservation resources which stipulates no cut buffers. Evidence of timber harvest activities would not directly affect or be visible from the river and management activities would meet both Retention and Partial Retention standards. VQO’s for visual resources management would be met.

Transportation

Affected Environment

There are approximately 486.6 miles of existing National Forest system roads, under Forest Service jurisdiction, that access the 115,597 acres of NFS lands within the Snoquera Project area. Not all of these roads are on NFS lands, and cross privately owned land. National Forest system roads are broken down by operational maintenance level, which describes the standard to which the road is currently managed (see Table 5 for miles of road by maintenance level).

The existing road system provides access for fire protection, administration, recreation, timber harvest, firewood gathering and other forest product removal, vegetation management, private land access and other forest management activities.

Environmental Consequences

Methodology

Roads needed for stand treatment operations were surveyed to determine condition, maintenance and reconstruction needs. Road condition surveys with estimated maintenance and reconstruction needs are included in the project record.

The transportation assessment was developed using current road system data and travel planning results. Roads needed to access proposed vegetation treatment areas were analyzed using a variety of information including, Forest transportation atlas, Geographic Information System (GIS), LiDAR, topographic maps, road site visits, road condition surveys, soil surveys, existing and archived White River Ranger District road maps, aerial photographs, wildlife and botanical surveys, staff field knowledge, previous NEPA decisions and heritage surveys. Travel Analysis Report (USDA Forest Service 2015) recommendations were used in evaluating an efficient and cost-effective transportation system in the project area. Route lengths and land areas were calculated using on the ground field verification and GIS software. Distance figures are approximate values based on the Forest transportation atlas (including spatial GIS data and tabular INFRA data) and are limited to the accuracy of those sources which includes measurements from GIS, GPS, field instruments and aerial photography. Drainage structures and improvement needs on surveyed roads were measured with a digital odometer on drivable roads and with a measuring wheel for closed walk-in roads.

Road miles were updated throughout the planning process as better information was made available and could change slightly with additional field verification during project implementation.
Spatial and Temporal Bounding of Analysis Area

Direct/Indirect Effects Boundaries
The spatial boundary for transportation planning includes roads within the project area boundary and National Forest System haul roads outside of the project boundary.

Temporal boundaries for roads and transportation related activity operation would be continued for this decision for about 20 years after this EA is signed. Effects of road improvements, road maintenance, closures and road decommissioning would be long term. With road decommissioning taking the longest time frame for implementation due to timber harvest contract award and operation schedules utilizing roads proposed for decommissioning.

Cumulative Effects Boundaries
Cumulative effects analysis area is the Snoquera project area which includes roads within the project area, and road segments outside of the project boundary that were identified for access for implementation of the project area off the 410 State Highway. These roads included federal, county and private land. This area was chosen because it includes a transportation system that will be used in the implementation of the proposed action in the project area. Traffic to and from the project area also uses many of the roads within this cumulative effects analysis area with similar user needs.

The time period for cumulative effects considered activities currently underway and for the next 20 years, which is the reasonably expected maximum time period for the proposed activities of this project to be completed. As in direct effects, road improvements, road maintenance, closures and road decommissioning and trail improvements would be long term and will continue until completed as funding is made available.

Direct and Indirect Effects

Alternative 1 - No action
Under the No Action Alternative, there would be no vegetation management, project related road improvements and project related road maintenance. Roads would be maintained under the annual road maintenance schedule as funds are available. Additional roads would not be identified for decommissioning.

Implementing Alternative 1 would result in no changes in road status or road maintenance levels. Roads would continue to be maintained under the annual road maintenance schedule as funds are available. Additional roads would not be identified for decommissioning. Any additional road repair or reconstruction of the current roads would happen as funds become available. Any additional decommissioning of existing roads would also depend on the availability of funds for analysis and implementation.

Under the No Action Alternative, annual road maintenance with no project road improvements could lead to infrequently maintained road drainage systems and diminishing user comfort and access for visitor use. The annual road maintenance funding for the project area has consistently been under the levels projected as needed. Therefore, these roads would continue to be maintained on the infrequent basis. Additionally, the roads carry a backlog of deferred maintenance and the backlog would continue until funds are available. Deferred maintenance on Forest Service roads is typically the result of lack of funding and/or lack of access. The longer a road goes without maintenance, the more likely road failures may occur, with the potential for detrimental impacts to both the road system and other resources (fish, water quality). Deferred
maintenance costs would continue to increase for the road system within the project area with no foreseeable additional funding to make the desirable repairs.

With no action, there would be no change in road miles or road maintenance level or density and decisions made in the Greenwater ATM remain unchanged, therefore, there would be no direct or indirect effect on current road miles.

**Alternative 2**

Under Alternative 2, the transportation system would help accomplish the proposed vegetation management objectives that would provide restoration of roads for haul routes, and access to rock and water sources. This proposed action would also assist aquatic organism passage road improvement objectives within the project area. The proposed action would adjust road maintenance levels, decommission roads, and convert roads to trails.

Alternative 2 would contribute to maintaining the open road system by performance of maintenance and reconstruction of open roads used as haul routes, and contribute to a reduction of the maintained road system by storage and decommissioning of additional roads. The proposed changes in road maintenance would save the Forest on deferred road maintenance costs, and with reduced road maintenance needs, allow the Forest to apply limited road maintenance funding to higher priority roads within the affected area. The proposed action would allow the Forest Service to move closer to meeting objectives of the minimum road system necessary to meet public access and administrative needs (FSM 7710.2(3)) as well as protection of the environment (FSM 7730.2(3)).

Short-term traffic from harvest operations and forest product removal would require adequate traffic control, some temporary public road closures, and proper communications to maintain safe and efficient traffic flow. A short-term reduction in public access may occur in some areas to minimize user conflicts during project implementation. Main collector and arterial forest roads would receive the majority of traffic.

Activities proposed would contribute to a well maintained, safer, and more efficient road system which would provide long-term public and administrative access in the project area.

**Travel Analysis and the MBS Sustainable Roads Strategy**

During the Forest Transportation Analysis Process (TAP, 36 CFR Part 261, Subpart A) commonly known as SRS (Sustainable Roads Strategy) or Minimum Roads Analysis, system roads were evaluated and management recommendations were evaluated for each road. Additional site specific analysis was conducted during the Snoquera Project planning, identified and recommended specific road segment changes related to project implementation.

<table>
<thead>
<tr>
<th>Table 64. Proposed Maintenance Level Changes</th>
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<tr>
<td>Maintenance Level</td>
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<tr>
<td>Decommission</td>
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<tr>
<td>Maintenance Level 1 Closed/Storage</td>
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<tr>
<td>Maintenance Level 2 – High Clearance</td>
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<tr>
<td>Maintenance Level 3 – Suitable for Passenger Cars</td>
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Details of the proposed road changes can be found in Table 4 of this EA. The changes propose two types of actions, decommissioning and level 1 road closure, that would lead to field evaluation and determination of the level of treatment needed to accomplish stated road objective.

**Decommissioning**

Decommissioning would involve actions to hydraulically disconnect the road and close to access by motorized vehicles. Some may need little to no treatment, others it may be necessary to perform decompaction, full recontour, and fill removal or a combination of various treatments. Each road would be a site specific treatment. After treatment inventory status would change to decommissioned and it would no longer be managed as a road.

**Level 1 Closure**

Level 1 closure would involve a determination on actions to place the road in a condition that would require little to no maintenance in the timeframe in which it needs to be stored, until needed for future management. This could range from constructing a berm to removal of culverts and installation of water bars.

**Other Road Maintenance Level Changes**

Alternative 2 would also adjust 0.20 miles of National Forest System road in Maintenance Level 3, for use as road to a trailhead and convert 1.75 miles of National Forest System road to a trail.

Alternative 2 would contribute to Travel Management (36 CFR Part 212, Subparts A, B, and C) objective directions for a minimum road system.

**Road to Trail Conversion**

Under alternative 2, there would be approximately 1.75 miles of roads converted to trail. Road 7065 for 1.55 miles and 7065-210 for 0.20 miles – leading to improvements to a trailhead and parking area already located on FSR 7065.

Recreation site improvements would reduce the miles of road needing maintenance, marginally reducing road maintenance costs. Better drainage features to be designed into the parking area and road terminus with the conversion of the road to trail. This work would require adequate traffic control, some temporary public road closures, and proper communications to maintain safe and efficient traffic flow.

**Transportation System and Vegetation Management**

**Haul Routes**

To facilitate commercial thinning, the Proposed Action would require use of open and closed Forest System roads. Under Alternative 2, roads used for vegetation treatment access and product removal would be improved where needed to provide safe use while mitigating resource effects. To provide safe access for harvest equipment and haul vehicles, system road miles would be used (and maintained), with temporary roads used to implement logging system harvest design. Road maintenance accomplished by the proposed project would allow for appropriated road maintenance dollars to be expended on other road projects.

Haul roads that access harvest units have been identified in GIS with segment lengths and proposed work described in the Project Record. Road miles and estimated type of work needed, for use as haul routes are displayed in Table 5 of this analysis.
Use of approximately 249.61 miles of Maintenance Level 2-5 Forest System roads. Actions associated with use of these roads would range from routine road maintenance, spot repair to reconstruction. Timber purchasers would be required to perform road repair and maintenance work as a condition of timber-sale contracts prior to using the roads.

Utilization of approximately 9.19 miles of Maintenance Level 1 Forest System roads. Actions associated with use of these roads would range from routine road maintenance, spot repair to reconstruction. Timber purchasers would be required to perform road repair and maintenance work as a condition of timber-sale contracts prior to using the roads, then stored after use.

Closed roads would be treated for drainage and re-closed through the timber sale contract after harvesting activities. Site specific reconstruction costs for roads proposed for reconstruction are calculated with costs summarized in a spreadsheet located in the project record. A detailed list of roads proposed for use as haul routes can be found in the full Transportation report in the project record.

Road work would be done in accordance with applicable Timber Road Maintenance Specifications, required project design criteria, management requirements and mitigation measures.

**Temporary Roads**

To facilitate harvesting systems of timber stands away from open roads, Alternative 2 would use approximately 34.8 miles of temporary roads. The proposed action would utilize 31.6 miles of existing unclassified roads on a temporary basis and build 3.2 miles of new temporary roads for timber harvest restoration related activity.

Temporary roads would be constructed as necessary to provide for safe project access and removal of forest products.

Temporary roads would be decommissioned following use as per current Forest Service policy which is to decommission temporary roads and monitor effectiveness of decommissioning (Forest Service Manual [FSM] 7703.2; FS BMP pp. 33-35). Standard timber sale contract clauses for temporary roads decommissioning would include removal and obliteration of installed improvements. Including culverts, reestablishment of natural drainages, removal of fills, ripping of road surface, blocking the road to motorized access, and revegetation as necessary.

**Road Maintenance**

National Forest System and temporary roads used for hauling would receive road maintenance commensurate with use during operations to preserve road function. Maintenance activities would include: blading; brushing; removing roadside Danger trees; repair road surface; cleaning, repairing drainage structures such as culverts, ditches and cross drains; dust abatement; removal and installing closure barriers; and installing or repairing signs. Maintenance activities generally do not disturb ground outside the existing roadway (toe of fill to top of cut) other than removing material around culvert inlets. Road maintenance for haul routes would include maintenance or development of truck turnarounds as needed.

Under alternative 2, maintenance would be done on all roads utilized for hauling. Maintenance would comply with Timber Road Maintenance Specification requirements and would provide a transportation system for long-term safe efficient travel and improved hydraulic function. Road
maintenance proposed under Alternative 2 would have minimum adverse effect on resources and would likely have beneficial effect.

**Rock Source**

Available rock material sources within and adjacent to the project area would be used to support project road work. Roads providing access to and from these sites would be maintained. Rock source sites have been located in the project area, these sites would be used to acquire rock material for road reconstruction and maintenance. Material source operations would follow project design features. Rock source site locations would need to be verified for quality and quantity for each site. Additional rock source site information is located in the project record. Several known sites are on or adjacent to these roads:

7000000, 7012210, 7012240, 7013110, 7031000, 7200000, 7200210, 7200214, 7230130, 7250000, 7500000, 7500510, 7510300

Rock sources within the road prism may be utilized as rock sources and use of any additional rock sources located during the project layout would be assessed for use at that time with resources specialists from the Forest. The development of local rock source in the proposed action would reduce haul costs for weed-free sources of rocks, would reduce wear on road systems with shorter haul routes (and reduced truck emissions), and provide the Forest with reworked rock pits for use in road maintenance. Reworked local rock sources are expected to contribute to economically maintaining roads to standards, providing for safe travel routes and lessening resources impacts resulting from poorly maintained roads.

**Water Drafting Sites**

Water drafting sites would be identified during project implementation. For the use of road reconstruction and maintenance. Operations at the sites would follow project design features and meet BMPs.

**Road Costs (associated with commercial thinning)**

Road maintenance costs are broken down into three parts Pre-Haul, During Haul, and Post Haul

Pre-Haul: can be anywhere from light timber sale maintenance via Timber Sale Specifications to Heavy Specified Reconstruction so the cost can vary greatly from road to road.

During Haul: This work is work performed to maintain the road commensurate to the traffic associated with the project. The cost are calculated by established road use rates developed by the forest. Rates are inflation adjusted annually.

Post-Haul: This work is what is required after a particular road is no longer used for the sale activity and includes drainage, spot rocking and road surface cleanup work as required in the sale contract.

Roadbed stabilization/excavation, addition of drainage structures, and placement of pit-run and crushed aggregate surfacing would be required to achieve an extended season of haul over these routes that are integral to the harvest and post-sale operations. Reconstruction costs for this project area are estimated average of $75,000 per mile depending upon the level of intensity of the proposed reconstruction.
It is estimated that the road maintenance costs would be about $3000 per mile dependent on road work needs for Pre-Haul and Post-Haul work. If spot rocking is required, these costs would increase. Haul and placement costs for spot rocking are estimated to be approximately $30/cubic yard and would vary depending on haul distances, Forest provided or private source, and the type of material being used.

During Haul maintenance cost are calculated utilizing a per MBF commensurate use rate calculation and would be determined at the time of contract preparation. All costs are subject to inflation.

**Other Road Related Costs (not associated with commercial thinning)**

Road work costs vary depending on the level of decommissioning and other logistics (i.e. hauling and disposal of fill away from perennial streams, roads with existing failures causing access issues for heavy equipment, etc.).

Decommission System Roads: Estimates for decommissioning of roads not needed for future management access would include costs to obliterate, remove culverts and restore draw crossings, recontour slope, seed, and place woody debris on disturbed areas. An average road decommissioning cost of about $10,000 to $25,000/mile depending on the applied treatment and need to hydraulically disconnect and obliterate the road, but could be higher (or lower) depending on site and conditions.

Convert Road to Trail: Estimates of the cost to convert road 7065 & 7065-210 to trail includes closing road to general public use. The road to trail conversions costs are similar to decommissioning depending on design and needs.

Road work would be accomplished to avoid, reduce, eliminate, rectify, or compensate for potential undesirable effects from proposed activities. All road work and infrastructure improvements would be conducted in accordance with management requirements and mitigations included in the project design criteria. Forest Plan management requirements are standard operating procedures that would be followed for proposed activities.

**Alternative 3**

Effects for Alternative 3 would essentially be the same as those described in Alternative 2, since only minor changes are proposed and the difference is a negligible effect to the transportation system.

Alternative 3 would designate dual motorized use from the Pyramid SnoPark to FSR #7065, authorizing mixed motorized traffic on FSR#7000 for approx. 1.1 miles allowing ATV’s/UTV’s to travel the same route as passenger vehicles are using currently. This would eliminate the 0.20 miles proposed for changing to ML-3 in Alternative 2.

**Required Monitoring**

The transportation system would be monitored for maintenance and reconstruction, closures and decommissioning effectiveness.

**Cumulative Effects**

A list of projects considered for this cumulative effects analysis is in the project record.
**Alternative 1**

There are no direct or indirect effects for Alternative 1, therefore there are no cumulative effects.

**Alternatives 2 and 3**

Cumulative effects for transportation would be the same for all action alternatives, since only minor changes are proposed between the two alternatives and the differences do not change expected effects to transportation.

**Previous Restoration Decisions**

The effects of most projects proposed in the foreseeable future are negligible from year to year. The overall effect over time is that the road system as a whole is being reduced as the Forest Service implements previous restoration decisions such as the Upper White EA and Greenwater ATM EA as budget and scheduling allows.

**Haul Road Use**

The effects of timber haul on the roads may have an adverse effect due to wear on the road surface; however, this would be mitigated by the road maintenance requirements of pre-haul, during-haul, and post-haul operations. In addition, the surface rock replacement deposits by the timber purchaser would provide a means to maintain/repair/replace the crushed aggregate, should it wear out due to the timber haul. Timber Sale road maintenance should provide a beneficial effect to the road system beyond the close of the project.

**Cumulative Effects Summary**

The cumulative effects of this project (road repairs, upgrades of culverts, and other crossings to current standard, decommissioning, and closing roads for storage, etc.) would be a road system better able to serve recreation traffic, administrative needs, emergency response, fire management, and other forest management needs. Overall, the cumulative effects of past, present, and reasonably foreseeable future projects would be a positive effect on road facilities due to the following results:

- Improvement of safe access and resiliency of road system
- Reduced road maintenance needs would allow the Forest to apply limited funding to higher priority roads within the affected area.
- Moves the Forest Service closer to meeting objectives of the minimum road system (by miles of roads reductions) necessary to meet access needs (FSM 7710.2(3)) as well as protection of the environment (FSM 7730.2(3)).

**Post Implementation Road Levels**

After implementation of this EA there will approximately 463.92 miles of managed Nation Forest system roads, under Forest Service jurisdiction, that access the 115,597 NFS acres within the Snoquera Project area.

**Table 65. Post implementation transportation system road miles within the project area by maintenance level.**

<table>
<thead>
<tr>
<th>Maintenance Level</th>
<th>ML Type</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>High degree of user comfort and convenience</td>
<td>14.3</td>
<td>12.51</td>
<td>12.51</td>
</tr>
</tbody>
</table>
### Maintenance Level

<table>
<thead>
<tr>
<th>Maintenance Level</th>
<th>ML Type</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Moderate degree of user comfort and convenience</td>
<td>2.7</td>
<td>2.70</td>
<td>2.70</td>
</tr>
<tr>
<td>3</td>
<td>Maintained for travel by prudent driver in standard passenger car</td>
<td>250.3</td>
<td>244.64</td>
<td>244.44</td>
</tr>
<tr>
<td>2</td>
<td>High clearance vehicle use</td>
<td>187.6</td>
<td>176.43</td>
<td>176.43</td>
</tr>
<tr>
<td>1</td>
<td>Intermittent use road while placed in storage</td>
<td>31.7</td>
<td>27.64</td>
<td>27.64</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>486.6</td>
<td>463.92</td>
<td>463.70</td>
</tr>
</tbody>
</table>

### Forest Plan Consistency

All Alternatives would be consistent with the standards and guidelines for roads in the Forest Plan, as amended.

### Fire, Fuels, and Air Quality

#### Methodology

Fire Intensity Level analysis was accomplished utilizing stand exam data gathered in 2010 and 2011 for the stands included in the vegetation management portion of the Snoquera project. Stand plot data was generated from the stand exam data by the Forest Vegetation Simulator (FVS). The stand plot data was produced in a tree list (.trl) format.

Median Weather Data was generated from 10 years of weather data collected at Lester Remote Automated Weather Station (RAWS) in the Green River drainage of the Snoqualmie Ranger District. Lester RAWS has provided the most consistent weather data for the Snoqualmie Ranger Districts and is the driest of the available RAWS locations.

The USFS Pacific Northwest Region Wildfire Risk Assessment (PNRA) provides foundational information about wildfire hazard and risk to highly valued resources and assets across the geographic area. A wildfire risk assessment is a quantitative analysis of the assets and resources across a specific landscape and how they are potentially impacted by wildfire. The PNRA analysis considers several different components, including: likelihood of a fire burning; intensity of a fire if one should occur; exposure of assets and resources based on their locations; and the susceptibility of those assets and resources to wildfire. Assets are human-made features, such as commercial structures, critical facilities, housing, etc., that have a specific importance or value. Resources are natural features, such as wildlife habitat, federally threatened and endangered plant or animal species, etc. Fire risk at the subwatershed scale for was calculated for three types of treatments: commercial thin, commercial thin 15 years, and pre-commercial thin.

#### Spatial and Temporal Bounding of Analysis Area

Direct and indirect effects are those generally occurring within 1 – 20 years of implementation. Temporal effects directly tied to treatments on the ground may last for several years or longer (i.e., mechanical treatments and FRCC), while air quality effects are short duration as smoke generally dissipates in a few days and rarely lasts more than a few weeks.

The spatial extent of the analysis area is the Upper White River drainage, greater Greenwater Area and Mt. Rainier National Park. Mechanical treatment and on the ground prescribed fire effects are usually limited to treatment areas within the unit, stand, and/or fuel model(s). Spatial effects on Fire Regime Condition Class (FRCC) are assessed at a landscape level (in this case the...
project area). Air quality spatial effects are assessed at the air shed level, which would include the project area and the larger surrounding area that smoke could affect.

**Affected Environment**

**Fire History**

Historically, within the project area, fire has been the major agent of disturbance. The project area is in the rain shadow of Mt. Rainier, leading to drier conditions than are found elsewhere on the Forest. Also, the low elevation passes through this portion of the Cascade Crest lead to the increased potential for strong east winds. These east winds are caused by differences in atmospheric pressure between the east and west slopes of the Cascades and the resulting winds are often warm and dry. These conditions lead to a greater potential for large fires in the project area.

Large-scale fires have burned in the analysis area with an approximate interval of 100-200 years with smaller fires occurring between (Henderson unpublished data). Large portions of the project area burned in the 1508 and 1701 fires. Since then, some local natural fires have burned smaller portions of the Project Area, specifically in the 1890’s and the recent Norse Peak fire in 2017. Out of each fire episode, large patches of new forest emerged interspersed with forested areas the fire avoided. The resulting mosaic of forest succession is still present along with the areas of active harvest beginning in the 20th century. Due to the fire history, this area did not usually contain high percentages of old growth or mature forest over long periods of time. The exception to this is found in the Huckleberry watershed, where the last large fire occurred in the 1200’s and there have only been relatively small fires since.

Fire suppression activities since the early 1900’s have interrupted the natural fire cycle by keeping fires small. Since these large burning episodes, known fires within the project area have ranged from relatively small to large, the larger of these fires was the Greenwater 7440 Fire (300 acres, 2006 human caused) in the W. Fork White River, Dalles Ridge Fire (around 1,100 acres 1967 lightening) in the Upper White River, Wrong Creek Fire (440+ acres 2018 lightening) West Fork White River and the Norse Peak Fire (23,265 acres on Snoqualmie RD 2017 lightening), The Sawmill Creek Fire (1,062 acres 2017 human caused) in the Greenwater and Upper White Rivers. With the limited size of fires over the last century, the major agent of disturbance in the project area shifted from fire to timber harvest.

**Fuel Conditions**

Fuel is comprised of living and dead vegetation that can be ignited. It is often classified as dead or alive and as natural fuels or those from logging operations. Fuel components refer to such items as downed dead woody material in various size classes, litter, duff, herbaceous vegetation, live foliage, etc. Fuel conditions have been modified over the past 80 years primarily due to timber harvest.

Fuel Models: The Fire Behavior Prediction System utilizes 13 fuel models to represent fuel conditions. This project has areas represented by four fuel models:

<table>
<thead>
<tr>
<th>Fuel Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Timber</td>
</tr>
<tr>
<td>11</td>
<td>Light Logging Slash</td>
</tr>
<tr>
<td>12</td>
<td>Medium Logging Slash</td>
</tr>
</tbody>
</table>
Early timber production within the project area converted heavy timber fuel model (FM 8 and 10) to a heavy logging slash fuel model (FM 13). Subsequent regeneration in logged areas has resulted in fuel conditions characterized by limited surface fuels in 60 to 80-year old timber stands. Fuel conditions in more recent harvest units vary and are dependent on whether fuels treatments such as prescribed burning were applied. Following timber harvest, any slash left results in a moderate to heavy surface fuel loading, creating a thinning slash to logging slash fuel model (FM 11 or 12). The untreated fuels change over time as the fuel beds compact, fine fuels decay and shading from forest regeneration decreases fire hazard over about a 25 to 35 year period. Treated units are typically characterized as a less volatile brush fuel model and thus do not represent a significant fire hazard.

Surface fuel loadings in the project area have increased due to timber harvest inactivity and the lack of fire occurrence. Existing fuel loadings could range from 17 to 55 tons per acre (USDA Forest Service 1980 - Photo Series 2-DF-2, pages 38-39).

Air quality
Air quality is affected by regional contributors such as urban pollutants, agricultural and forestry burning, and recreational campfires and vehicle driving.

Environmental Consequences

Direct and Indirect Effects

Alternative 1—No Action
The No Action Alternative would not change current trends for surface fuel conditions. Natural accumulation of forest fuels would continue, partially offset by natural decomposition of forest-floor fuel.

Over time, as stands grow to maturity in approximately 130 years, fuel loading would increase gradually, assuming no substantial change in predicted rate of spread and flame length the two fire behavior indicators. Predicted rate of spread and flame length during periods of elevated fire danger (defined as 90th percentile fuel conditions) would generally not exceed initial attack capability; most unplanned ignitions would be suppressed during initial attack. A gradual shift in fuel loading would result in heavier timber conditions as the stand reaches maturity and stand succession occurs, creating more surface fuels. The two fire behavior indicators would gradually increase, resulting in increased resistance to control for initial attack.

Current initial attack and extended attack suppression response would continue. It is anticipated that roads would continue to be under-maintained, and accordingly a degradation of public and suppression access would continue, with a net neutral result. Reduced access for initial attack would be mitigated by lack of access for public and corresponding reduction in potential for human caused fires.

Air quality would continue to be affected by regional contributors such as urban pollutants, agricultural and forestry burning, and recreational campfires and vehicle driving.
Alternatives 2 and 3

Fuels
Short term the timber harvest commercial and non-commercial thinning units, Elk Forage and Huckleberry Enhancement would increase surface fuel loading. Forest Plan standards are exceeded by the post-harvest surface fuel loading. Site specific analysis was conducted and modeled that a fire would exceed FIL3 three years after creation of activity fuels (minus foliage) under median weather conditions for the area.

FVS model runs show that commercial thinning treatments would change surface fuel conditions from primarily Fuel Model 10 (Closed Timber Litter) to some combination of Fuel Model 10, Fuel Model 11 (Light Logging Slash), Fuel Model 12 (Medium Logging Slash), and/or Fuel Model 13 (Heavy Logging Slash) in the years immediately following harvest. This would result in approximately 12,367 acres converted to surface fuel conditions that are more resistant to suppression of fires, and would slightly increase the chance of a large fire in the Snoquera Landscape project area. As the stands mature in the next 20-50 years and beyond, fuels on the ground would decay, and understory would develop. A slow transition would occur from slash fuel conditions back to timber fuel conditions. On this longer timeframe, the effect of altered resistance to suppression and increased chance of a large fire would slowly decline.

Wildfire Risk Assessment
The project may slightly increase the risk of human-caused fires. Opening of timber stands and creation of landings along open roadways may increase public use of the area for recreation, hunting, and firewood cutting. Treatment of activity fuels in areas along these open roads as described in Alternatives 2 and 3 would increase but not guarantee the chance of success of initial attack suppression. Risk of human starts in Snoquera Landscape project area would increase proportionately with potential increased human use.

Timber harvest operations on National Forest System roads could have a negative impact of wildfire suppression response, EMS response or law enforcement response attempting to travel through active timber harvest areas along roads. Managing harvest activities on or along roads to accommodate emergency response in a timely manner would be an adequate mitigation.

Decommissioning of existing national forest system roads would have a negative impact on fire suppression response time. Decommissioned roads can be re-opened and utilized with heavy equipment for fire suppression activities and decommissioned as the final fire suppression rehabilitation activity. Decommissioned roadways are fully usable for foot travel into a reported wildfire location. Ripping road surface creates an extremely uneven ground surface that creates an unsafe walking surface for extensive foot travel to wildfire locations.

Air Quality
Both Alternatives would contribute to air quality impacts in terms of logging vehicle traffic and prescribed slash burning, both of which would be slightly above fluctuating background levels, and temporary and ending upon the completion of post-sale activities. All slash disposal burning would be conducted in accordance with all applicable policy, guidance, and direction. Overall, effects of the proposed action to air quality are expected to be negligible.

Alternatives 2 and 3 would limit air quality impacts where feasible through application of design criteria. Short term smoke impacts may occur during prescribed fire or pile burning. Burning
would be planned so that factors such as wind direction and air mass stability would help limit the effects of smoke on local residents, campers, and the general public.

**Other proposed activities**

Other components proposed in Alternatives 2 & 3: Watershed Restoration and Recreation Enhancement proposed activities would have minimal impacts on fuel loading. Application of fuel treatment standards would eliminate any potential concentrations of fuel from these actions (see project design criteria and “Methods of Fuel Treatment” in fuels specialist report).

**Cumulative Effects**

One project with effects to fire, fuels, and air quality, Elk Forage Phase I, would overlap in time, and space with the proposed project. Smoke emissions of both projects would be regulated daily and concurrently by the Washington DNR (Washington State Smoke Management Plan), therefore Alternative 2 and 3 would not contribute cumulatively to Fire Intensity Level or Air Quality.

**Compliance with law, regulation, policy, and the Forest Plan**

**Forest Plan Consistency**

All Alternatives are consistent with the standards and guidelines for fire in the Forest Plan, as amended, as well as all applicable state laws and regulations.

**Clean Air Act**

All burning would be conducted in compliance with Washington State requirements and applicable agreements. Burns would be registered, planned, accomplishment reported, and monitoring conducted as specified in the Washington State Smoke Management Plan, and would be consistent with the Clean Air Act. Additional restrictions may be necessary to meet air quality standards and such restrictions would be applied as necessary.

**Cultural Resources**

**Methodology**

The analysis is dependent on existing information held in the MBS cultural resource database (Infra), GIS database, project files, and the Washington Department of Archaeology and Historic Preservation (DAHP) cultural resource database (WISAARD.) Site potential was assessed using the WA DAHP predictive model and historical documents on file in the Supervisors Office of the MBS. A general methodology is proposed for inclusion in the project-level programmatic agreement. Phased reporting will require a development of survey methods for the particular areas of potential effect and their respective types of effects.

**Environmental Consequences**

**Alternative 1 – No Action**

Under this alternative, none of the proposed treatments or activities would occur. The densely stocked second growth stands would not be thinned and actions that would improve late seral or old growth attributes, enhance huckleberry, and improve watershed function would not be authorized. This alternative would have no direct effects on significant cultural resources. No mitigation activities would be necessary. Indirect effects may be attributable to areas of known
soil degradation as a result of recent fires and heavy recreational impact, or a combination of both. Certain locations of heavy pre-contact indigenous activity tend to overlap modern recreational areas leading to increased erosion, artifact exposure, and displacement, and increasing potential for looting.

In regards to tribal traditional uses, lack of active forest management poses its own risks. Indigenous forest management has been practiced for countless generations for the purposes of maintaining conditions conducive to food procurement, or for propagation of medical plants. For example, the lack of early seral environment as a consequence of Forest Service fire suppression has reduced the availability of huckleberries in some traditional berry gathering locations (as described in greater detail in McCullough 1973, Plummer 1900, and Larson and Forsman 2001). Sustaining forest management that results in fire suppression will continue to affect availability of huckleberries and game animals in subalpine environments. However, natural fires (especially the recent Norse Peak fire) accomplished much in restoring the previous open subalpine conditions last seen in 1896. Thus, the consequences of a no-action alternative in this case can be linked to a promulgation and continuation an undesirable condition, while it was eventually reversed by a single act of nature. In this context, it is difficult to ascertain a positive or negative connation to the outcome of no-action, as it may be a matter of time and perspective.

Another aspect of the traditional values interlaced within forest ecology is that old growth conditions serve a valued role in the production of certain medical and ceremonial plants and utilitarian materials. Having lost much of the old growth environment to logging, many important plant species only found in climax forests are becoming increasingly scarce. Left to its own recovery, second growth stands have been demonstrably slow to develop old-growth conditions. While the particulars of the ecological effects of a no-action alternative are beyond the scope of this segment of the environmental review, it is generally accepted that untreated second-growth stands will take longer to develop conditions suitable for these purposes. Again, time and nature may eventually make this point moot; however, the present situation does not suit the contemporary needs of tribal members conducting traditional practices.

Alternatives 2 and 3

Terrestrial Restoration

For purposes of this assessment, the effects can be categorized under two general types of actions, mechanical tree removal and non-mechanical tree removal.

Commercial Timber Harvesting

Commercial thinning of trees would use a variety of mechanical logging systems, which can vary in their degree of impact. Some impacts could result from felling of trees, but most impacts are derived from the removal of timber from the cutting unit. Past studies on effects to archaeological sites from logging systems have verified the obvious disturbances of breakage, exposure, and displacement. With tree felling, the affect is fairly direct, such as a tree falling on a standing structure. However, there are too many variables to consider to attempt to derive specific impacts given any and all situations when it comes to yarding.

In logged units from the 1980s within the project area, cable yarding in clear cuts concentrated impacts where logs were dragged to landings along set skid paths. Thinning as opposed to clear cutting can have a similar effect when skid trails concentrate paths around the remaining trees. With skyline yarding, ground impacts are minimized when logs are not dragged. Thus, the degree
of impacts resulting from skidding can vary from method to method, and are further dependent on slope, soil conditions, erosion potential, equipment used, etc.

The simplest assumption is that artifacts (if present) can be dislodged, broken, and displaced. Lithic materials generally fare better in preservation but can suffer more impact breakage from hard strikes and pressure from skidding, vehicle tracks, and tires. Organic materials such as bark netting, baskets, mats, etc. are less effected by compaction from vehicle weight, but are less resistant to weather once exposed on the surface. Displacement affects the context in which artifacts are located and can reduce or destroy the scientific value of any particular site. A broken artifact in context is worth more than a whole artifact in another location. How great the effect of displacement is thus dependent on the aforementioned conditions and treatment methods, as well as the site’s extant integrity.

Stable, stratified buried sites are rare in any case; therefore, the impact from equipment may not do more than what natural post-depositional processes have done already. However, should a rare stable buried site be churned up by repeated passes of tracked harvesters, or subjected to deep incisions by repeated log skidding, the site may lose all scientific value through the destruction of its archaeological matrix. To a lesser extent, compaction by heavy vehicles may not churn soil, but could distort strata within the soil matrix. It would be difficult to predict with any reasonable certainty just how much information loss would result from a singular vehicle track across a site given the unknown particulars of any potential feature or site context. Guessing at that level becomes a futile exercise akin to site divination. Suffice to say, direct effects to archaeological sites from mechanical logging activities can range from non-existent to total loss.

The prescription for cable logging would be designed so as to minimize the potential adverse impacts to the soil surface. Where cable-harvesting systems are used, logs would be yarded with either full or single-end suspension. Where cable corridors cross no-cut riparian buffers, full suspension of the logs would preclude any surface affect. Any trees felled for corridors within riparian no-cut buffers would be left on the ground, also precluding the displacing/dislodging effects of skidding. Additionally, where ground-based logging systems are used, felling would be accomplished in a single pass of equipment, thus avoiding the deep trenching that has occurred in previous harvesting events.

Indirect effects can range in scope from site-specific to broadly regional. Should artifacts be exposed by vegetation removal or soil displacement, they are more likely to be picked up by the public, or the loggers themselves (Bryant, Gehr, & Flenniken, 1982). Exposure also subjects the site to erosion, which further displaces and destroys the archaeological matrix. Increased exposure to weathering also poses a risk as organic materials such as woven fibers, wood, bark, and bone implements often deteriorate quickly once exposed to the surface. A less obvious indirect effect is that of destruction to site integrity by altering the viewshed or other nearby conditions. Sites are evaluated under certain criteria for their eligibility to the National Register of Historic Places (NRHP); however, they also must retain integrity to convey that significance. There are seven aspects per National Register Bulletin 15; location, design, setting, materials, workmanship, feeling, and association. Removal of vegetation can affect the setting and feeling of a site to a degree that it would constitute an adverse effect. With most archaeological sites, this is unlikely. This is more likely to affect historical sites with standing features that rely on the environmental setting to convey its place in history. It is most likely to affect certain indigenous “traditional cultural properties” where conditions within the site require a degree of wildness and/or solitude. Indirect effects of integrity are generally ascertained through consultation and not through the direct identification of sites within the project area.
Non-commercial Thinning

Non-commercial thinning stands would be generally be accessed by foot, treated by chainsaws, and would not require skidding. Direct effects are negligible among low-profile site such as lithic scatters or other non-architectural sites. Standing architecture would be at risk from tree felling but also easily avoided. Indirect effects resulting from erosion and artifact exposure are also less due to the retention of woody material on the surface. Conversely, the debris would protect unobtrusive sites from visibility, access, and erosion.

Non-mechanical non-commercial thinning is a low risk activity exempt from review per the Programmatic Agreement, Appendix A, Ecology, Range & Watersheds, section 2.f, and Timber, section 1. If logging equipment were employed for this prescription, the effects would be included with the commercial thinning context.

Planting in the Norse Peak Fire area

Replanting could involve the use of a hoedad to open a slit in the soil for insertion of a seedling. The direct effect is a negligible possibility of minor artifact displacement via tool insertion into the soil surface.

Indirect effects resulting from planting can vary widely by species, environmental conditions, and type of archaeological sites or features. Effects can include the slow displacement of buried artifacts or destruction of archaeological features resulting from root growth. The resulting latticework of roots can destroy the information potential of buried features only visible as subtle soil changes (e.g., living surfaces, post-holes, etc.) by permeating stratified formations, and in some cases proliferating within organic deposits that provide higher nutrients to the root system (Crow 2004). However, this lattice also resists the shear forces leading to erosion (Crow 2004). Displacement or damage to archaeological sites can all also occur violently through eventual uprooting via wind throw events or wildfire once a replanted stand has matured. Changes can also occur to the hydrological response of soil, composition of ground vegetation, and soil chemistry through root exudates. These potential effects would not be considered undertakings if a forest were allowed to revegetate naturally; however, the act of replanting would be an undertaking and the consequential guidance of a stand to meet a future condition should be taken into account should they be allowed to adversely affect known significant sites.

In relation to traditional uses, the guidance of a forest to support a particular species (via replanting) could result in conditions no longer conducive to traditional activities, or supportive of native plant species important for a specific location. Replanting can also be a means to restore a stand to those desired conditions, and assist in the propagation of traditional plant resources.

In both action alternatives, replanting is proposed in the Corral Pass area. Replanting is generally regarded as a low risk activity exempt from review per the Programmatic Agreement, Appendix A, Ecology, Range & Watersheds, section 2.c, and Timber, section 2. Any replanting would be done in careful consideration of the long-term effects to known cultural sites.

Transportation System

Road Construction and Road Closures

Direct effects for the construction of new roads varies depending on the existing condition. New construction of a road prism suitable for a large vehicle would employ heavy equipment and displace a substantial amount of soil. Where heavy equipment is employed, the consequence is the displacement of artifacts, destruction of buried features, and the total disturbance of
archaeological matrix. If rock faces are to be cut, there is the potential for damaging or destroying rock art sites or rock shelter features.

In the instance of road reconstruction on previously decommissioned roads, the effects would be negligible in regards to cultural resources. Former system road construction and subsequent decommissioning would have resulted in a total disturbance of potential sites within the extant road prism. Thus, reconstruction within these parameters generally does not pose a threat to significant sites.

In some cases, temporary roads may be constructed on unclassified roads with existing prisms. The potential effects would be the same as road construction of decommissioned roads or upgrading the maintenance level of a system road.

Road decommissioning is proposed for some roads after access is no longer needed. If the road is an engineered feature with a defined prism, there is a fair chance that any sites in its path suffered a total disturbance during the initial construction. Thus decommissioning after a road has been constructed/reconstructed for project access would not pose a threat greater than the roads initial construction. In some cases, the road is itself a site and may be individually significant or contribute to a significant historical district. Alteration of historic route, fabric, or features (i.e., culverts, bridges, retaining walls, etc.), may affect the integrity of the road as a historic site.

Alterations of maintenance levels are generally low impact as they occur within existing road prisms. Site-specific effects may result from excavation of features such as culverts, short realignments, or bridge replacements. The closure of a road (change to maintenance level 1,) is the most impactful as it requires the removal of aquatic barriers and construction of additional drainage features. The potential effects are essentially the same as road decommissioning, sans ripping and recontouring.

Road construction and decommissioning has the potential to provide or remove access to cultural resources. This can be both to the benefit and detriment of a site or traditional use area. If a cultural resource is at risk from looting or vandalism, the lack of access provides added protection. If a site is part of a shared cultural heritage and requires access by either tribal members or the public for its use and/or enjoyment, then providing access is a benefit.

Decommissioning of roadway surfaces is generally regarded as a low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range & Watersheds, section 4.

**Danger Tree Removal**

Individual hazard tree removal by non-mechanical methods and does not involve skidding typically does not pose a threat to cultural resources. Mechanical removal of individual trees or small groups of trees has limited potential to affect cultural resources in a similar capacity as tree harvesting methods described above. However, old-growth trees may exhibit cultural modification or hold cultural significance or other utilitarian value to tribal members. Large hollow cedars have been known to store ceremonial items, and can run the risk of being identified as a hazard tree.

Specific hazard tree identification is an ongoing process. Trees are identified during normal operations and proposed for removal. Consequently, it is not possible to identify specific concerns on all hazard trees at this time. Design criteria would be included for old growth trees that exhibit cultural modification or use.
Watershed Restoration

Road Decommissioning, Storage, Stormproofing, and Aquatic Organism Passage

Road decommissioning in the context of watershed restoration can vary from the aforementioned decommissioning of constructed roads. This proposal may include the removal of user-created non-system roads that lack a formal prism or template. These roads often originate by illegal incursions through forested areas through natural openings. Some are spurs formed through repeated vehicle use; some are shortcuts between system roads. Consequently, user-created roads lack hardened surfaces and, most importantly, lack legal environmental review in their construction. In this instance, surface and shallow sites may have been bisected or exposed by repeated vehicle traffic but retain enough integrity to be considered significant. Vehicles may upturn or compress surface soil causing nominal displacement, or expose artifacts by damaging and impeding vegetation growth. Like dispersed camping, the public actions are not undertakings for the sake of Section 106 compliance, yet the process of rehabilitation is. The effect of decommissioning may be considered as destructive as new road construction. (The evaluation of sites damaged by illegal road creation is a Section 110 or ARPA issue.) Ripping or blading of native or non-native roadways is exempt from case-by-case review and may subject to inspection or monitoring per the Programmatic Agreement, Appendix B.

Aquatic organism passages and stormproofing are projects implemented within existing roads. The effects are the mostly the same as any road construction, maintenance, or decommissioning actions described above, except that they may be isolated to specific locations as opposed to running the length of a road. In some instances, removal of aquatic organism barriers on roads that are already being reclaimed naturally may involve the use of blasting at stream crossings. This would limit the scope of potential effects to the stream crossings and the associated features and fill being removed, without having to reconstruct the road.

Water features such as culverts generally exist within a disturbed context. It is possible that cultural resources could be affected by ground disturbance if components are buried below the existing feature, or outside of the lateral footprint of disturbance. It is also possible that existing passages are themselves historical features. Stormproofing activities are generally regarded as a low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range & Watersheds, section 4.

Instream enhancements

Various instream enhancements are proposed such as tipping trees into streams, and existing instream structure maintenance/enhancement. Most work instream does not have the potential to affect significant archaeological sites as the stream channels are periodically scoured by floods. River terraces, however, can retain important sites and features. Depending on the approach to instream work, heavy equipment may affect the stability of terrace sites directly by tipping (uprooting) trees for instream wood, or by constructing temporary access routes. The installation of wooden structures for promoting side stream channeling may damage sites by successfully creating side streams that erode older terraces.

Acclimation Ponds

The project includes the reissue of a 30-year permit for the operation and maintenance of the existing acclimation ponds. The continued use of the existing features does not have the potential to adversely affect cultural resources and is exempt from further review per 36CFR800.3(a)(1).
However, repairs and upgrades to the Twenty-eight Mile Creek and Huckleberry Creek intakes and ponds would require heavy equipment and ground disturbance. The use of heavy machinery to construct and harden new channels has the potential to disturb buried archaeological materials. Additional field inventory would be required to ascertain the effects of the project outside of the previously analyzed project areas.

Recreational Enhancement

Designated Dispersed Camping/Riparian Restoration

Dispersed campsites are user-created campsites that typically include a stone fire ring surrounded by a relatively flat cleared area and a driveway spur from the main access road. Ground visibility is often exceptional compared to the surrounding forest as these areas are typically cleared of duff and small branches and woody debris. Increased erosion can be seen at riverside camps, especially on paths used to access water. Sites can exhibit tree vandalism, remnant stacks of firewood, trash, makeshift camp toilets, and hunting features such as field-dressing racks or makeshift tables.

Dispersed camping is not in itself an undertaking thus not subject to Section 106 review or clearance. However, the designation of dispersed campsites is an undertaking and presents a possible adverse effect to significant cultural resources. The impact of dispersed camping results mostly from exposure of shallow cultural deposits, consequential increased erosion, and the casual looting of diagnostic artifacts. Vehicle access in wet conditions can also affect soil integrity at shallow depths. A possible but less likely occurrence is the alteration of the physical properties of artifacts and buried hearth features through long-duration high intensity campfires. This is more probable in rock shelters where the placement of fire rings has a higher chance of overlapping a previous pre-contact site due to spatial constraints.

Direct effects of designating an existing dispersed camp would occur from the increased intensity of use, thus continuing loss from erosion or looting. Establishment of fire rings and hardening of eroding surfaces can further displace or damage artifacts and features. Designating new locations could subject otherwise intact cultural sites to new impacts. The proposal to close specific sites could include recontouring, decompacting, and replanting. This could damage or destroy shallow or surface cultural sites.

Designation of sites often comes with a suite of stabilization or protective actions. When done to improve stability of soils, or protect the surrounding environment, it can provide a positive effect for nearby archaeological or historic resources by preventing erosion or escaped campfires. Designation can also be used to direct activity away from known sensitive sites. In the case of the Snoquera analysis, the designation of sites is proposed in addition to a closure of other areas to dispersed camping. This would allow the protection of culturally sensitive areas by directing camping to areas cleared through the environmental review process. Although not specifically named in the context of dispersed camping, decompaction and reseeding is generally regarded as a low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range & Watersheds, section 4.

Pit Toilets

Installation of pit toilets would accompany the designation of campsites. Although the pit toilets are proposed for installation in areas of previous disturbance, the depth of the disturbance should be taken into consideration. The horizontal extent and depth of excavation required for
installation of a toilet often poses risks to buried cultural deposits. In regards to traditional uses, it is important to consider the proximity of toilets to areas of cultural value, sources of medicinal plants, or plants of other traditional function.

Recreational Target Shooting
Designation of target shooting typically occurs in areas already opened to and impacted by shooting or other disturbances such as quarries and gravel pits. Thus, there are normally few direct effects. The designation of the FSR 70 rock pit and FSR 72 rock pit for shooting would limit the proposed enhancements to places already have total disturbance by quarrying activities. There is no potential for these locations to retain significant cultural resources.

The 7013 shooting pit is within a former clear-cut created as an Elk Forage unit. The area was surveyed in 2008 for the creation of the forage units, and 2014 for road maintenance projects. The site was revisited in 2018 by the Forest Archaeologist, verifying the heavily degraded condition. No cultural resources were identified at the base of the shooting area.

Road to Trail Conversions and/or Reroutes
Trailhead alterations, heavy maintenance, reroutes, reclamation and rehabilitation are proposed for the Naches Trail #1175. The trail is a culturally significant historic district and includes numerous contributing features and sites. The trail proposals pose a high risk for adverse effects to significant cultural resources. Any alterations to the trail or ground disturbance along its corridor has the potential to damage the integrity of the historic feature, and damage or destroy contributing pre-contact and historic indigenous sites along the route. Specific activities would be carefully devised in consultation with SHPO and affected tribes to prevent adverse effects to historic properties.

Corral Pass Campground/Day Use Sites
Corral Pass is a uniquely sensitive area for cultural resources; information regarding the location is left deliberately vague in this analysis. Proposals for the rehabilitation of the area have been devised in consideration of the extenuating circumstances presented by this location. Although the Section 106 process is incomplete, the developments are being planned in a manner that is intended to balance both the contemporary public need with the protection of cultural resources. Differences between Alternative 2 and Alternative 3 involve the elimination of the campground versus the establishment of a smaller campground footprint at the site of the old campground. Alternative 2 offers a substantially higher degree of protection for cultural resources by eliminating long-term occupation of the pass. Reestablishing campsites increases the duration of people in proximity to significant cultural resources that may be adversely affected by human presence.

Ranger Creek State Airstrip
Washington State Department of Transportation has proposed a suite of campground and airstrip improvements to the Ranger Creek airstrip. The facility is within an area identified as a traditional cultural property. The length of traditional use by default creates a high probability of archaeological sites in conjunction with a contemporary interest in the location’s continued use for traditional activities. Any improvements would require cultural resource inventory in addition to consultation in regards to protecting cultural practices. The agency would seek resolution of adverse effects that would result from the decision in accordance with the process described in 36 CFR 800.6.
Silver Creek Visitor Center
Upgrades to the Silver Creek Visitor Center is included as part of Alternative 3. The visitor center is listed on the National Register of Historic Places. Any alteration to the building would require consultation with the Advisory Council on Historic Preservation (ACHP) and the Washington DAHP. The agency would seek resolution of adverse effects that would result from the decision in accordance with the process described in 36 CFR 800.6.

Summary
For some proposed undertakings, the details remain deliberately incomplete as part of the aforementioned condition-based management. Consequently, section 106 review is incomplete. While a generalized analysis of the types of effects is possible, specific risks to cultural resources remain mostly unknown or assumed, or the field review and consultation is in progress. This was not an unexpected outcome for the NEPA timeline, nor does it prohibit a decision. In accordance with 36 CFR 800.1c regarding timing:

*The agency official must complete the section 106 process “prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license.” This does not prohibit agency official from conducting or authorizing nondestructive project planning activities before completing compliance with section 106, provided that such actions do not restrict the subsequent consideration of alternatives to avoid, minimize or mitigate the undertaking's adverse effects on historic properties.*

Consequently, the alternatives retain enough flexibility to accommodate site-specific changes needed to avoid adverse effects. As most of the proposed actions are within a condition-based management framework, this consideration is widely applicable. In addition, the agency is in the process of developing a project-level programmatic agreement for the phased completion of Section 106, in accordance with 36 CFR 800.4(b)(2) Undertakings derived from the decision will be considered separately for compliance under the terms of the PA as actions are refined.

Table 66. Summary of effects to cultural resources.

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Effects Analysis Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Density Thinning- Mechanical Tree Removal</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement. Will result in multiple Section 106 projects.</td>
</tr>
<tr>
<td>Elk Forage Habitat (MA 8E) Permanent Openings</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Non-commercial Thinning- Non Mechanical</td>
<td>Exempt from case-by-case review per the statewide Programmatic Agreement, Appendix A, Ecology, Range &amp; Watersheds, section 2.f, and Timber, section 1.</td>
</tr>
<tr>
<td>Planting at Corral Pass</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement.</td>
</tr>
<tr>
<td>Planting (all other locations)</td>
<td>Generally exempt from case-by-case review per the statewide Programmatic Agreement, Appendix A, Ecology, Range &amp; Watersheds, section 2.c, and Timber, section 2. May require additional tribal consultation.</td>
</tr>
<tr>
<td>Road Maintenance</td>
<td>No potential to effect significant cultural resources within existing road prism and features.</td>
</tr>
<tr>
<td>Project Component</td>
<td>Effects Analysis Required</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Temporary Road Construction - on existing prism or previously decommissioned road</td>
<td>Low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range &amp; Watersheds, section 4. Additional tribal consultation per terms of project Programmatic Agreement to ensure there are no additional issues.</td>
</tr>
<tr>
<td>Danger Tree Removal</td>
<td>Incorporate design criteria to prevent inadvertent damage to culturally modified or utilized trees.</td>
</tr>
<tr>
<td>Decommission</td>
<td>Decommissioning of non-native roadway surfaces is generally regarded as a low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range &amp; Watersheds, section 4. Additional tribal consultation per terms of project Programmatic Agreement to ensure there are no additional issues.</td>
</tr>
<tr>
<td>Road Closure/Storage, Aquatic Organism Passage, Stormproofing</td>
<td>Decommissioning of non-native roadway surfaces is generally regarded as a low risk activity exempt from case-by-case review, and may be subject to inspection or monitoring per the Programmatic Agreement, Appendix B, Ecology, Range &amp; Watersheds, section 4. Additional tribal consultation per terms of project Programmatic Agreement to ensure there are no additional issues.</td>
</tr>
<tr>
<td>Instream Wood Existing Instream Structure Maintenance/Enhancement</td>
<td>Review access points and methods, potential stream changes in accordance with project Programmatic Agreement</td>
</tr>
<tr>
<td>Acclimation Pond Improvement</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Designated Dispersed Camping/Riparian Restoration</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Pit Toilets</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Recreational Target Shooting Improvements</td>
<td>No sites in proposed locations. Additional consultation with tribes to be completed prior to implementation.</td>
</tr>
<tr>
<td>Shooting area closure</td>
<td>Previous survey adequate. No concerns.</td>
</tr>
<tr>
<td>Naches Trail Trailheads-Expansion/Reestablish</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Road to Trail Conversions and/or Reroutes</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Corral Pass Campground / Day Use Sites</td>
<td>Field review in progress. Consultation and reporting in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Ranger Creek State Airstrip</td>
<td>Survey/consultation in accordance with terms of project Programmatic Agreement</td>
</tr>
<tr>
<td>Silver Creek Visitor Center</td>
<td>SHPO consultation on potential adverse effects to historic property. Mitigation of adverse effects negotiation.</td>
</tr>
</tbody>
</table>

**Compliance with law, regulation, policy, and the Forest Plan**

The project is being developed in accordance with the regulations promulgated in 36 CFR 800. A project-level Programmatic Agreement is currently being negotiated in consultation with the ACHP, affected tribes, and SHPO. Although the process of Section 106 review would not be completed for the decision, the framework would be formalized for the continued review.
throughout each undertaking. Completing the Section 106 process for undertakings resulting from
the decision prior to implementation, the project will be in legal compliance.

Treaty Rights

The Forest Service, through the Secretary of Agriculture, is vested with statutory authority and
responsibility for managing resources of the National Forests. Commensurate with the authority
and responsibility to manage is the obligation to consult, (National Historic Preservation Act,
Executive Orders 13084 and 13175), cooperate, and coordinate with Indian tribes in developing
and planning management decisions regarding resources on NFS lands that may affect tribal
rights.

Elements of respective American Indian cultures and tribal welfare, lands, and resources, were
sometimes entrusted to the United States government as a result of treaties. These treaties resulted
in cession by the Tribes to the United States of a large territory that includes the entirety of what
is now the Mt. Baker-Snoqualmie National Forest. Federal trust responsibilities resulting in part
from the ratification of the 1855 treaties to which the United States is a party, require that the
United States government facilitates the execution of treaty rights and traditional cultural
practices of the tribes by working with them on a government-to-government basis in a manner
that attempts a reasonable accommodation of their needs without compromising the legal
positions of the respective tribes or the federal government. Specific treaty rights applicable to the
land base managed by the Mt. Baker-Snoqualmie National Forest are generally articulated in
Article V of the Treaty of Point Elliott, 1855, as further articulated by federal courts.

“The right of taking fish at usual and accustomed grounds and stations is further secured
to said Indians in common with all citizens of the Territory, and of erecting temporary
houses for the purpose of curing, together with the privilege of hunting and gathering
roots and berries on open and unclaimed lands.”

Treaty rights include rights specifically reserved in treaties signed by American Indian groups
with the federal government (i.e., the Treaty of Point Elliott) as well as other rights not
specifically taken away by treaty. They include the reserved right to “fish at usual and
accustomed grounds and stations” as well as the “privilege of hunting on open and unclaimed
lands.” Although “open and unclaimed lands” is not clearly defined, federal courts have ruled that
certain federal public lands not set aside for uses incompatible with hunting, such as National
Forest lands, are considered open and unclaimed for these purposes.

These reserved rights reflect the subsistence, medicinal and spiritual aspects of the traditional
lifestyle of Northwest Indian people. They are as important to Indian Tribes today as they were
when their ancestors reserved these rights in the Treaty. The MBS includes ancestral lands of
many treaty tribes with reserved rights to hunt, fish, and gather. Tribes use the Forest road system
to access fish, wildlife, and plant materials throughout the project area. Roads heavily used for
recreation, in conjunction with high visitor use and increasing populations, may not provide
suitable access for Tribes to exercise their rights to these resources.

Proposed activities would be expected to improve long term habitat conditions for a variety of
fish and wildlife species. In particular, proposed terrestrial habitat restoration would improve
forage conditions for elk and deer in the project area, while minimizing the potential for short
term impacts to important elk calving areas. Additional effects to the quality of Tribal hunting,
gathering, and fishing experiences would be related to changes in access and effects to fish,
wildlife, and plant or other forest product resources. See individual resource sections for a
discussion about effects of the project to those resources. Both Alternatives 2 and 3 would reduce the amount of open road miles, and the remaining open roads would receive more improvement and maintenance, thereby ensuring better access to Tribal members along remaining roads.

Climate Change

Rationale for Project-Scale Effects on Climate Change

This proposed action would affect 12,245 acres of forest by commercially thinning smaller trees from the stand, retaining a residual stand of about 70 percent of the original stand area. This scope and degree of change would be minor relative to the amount of forested land being 115,597 acres within the project area as a whole. Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet’s lower atmosphere (IPCC 2013). Considering emissions of GHG in 2010 was estimated at $49 \pm 4.5$ gigatonnes$^5$ globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, this proposed action’s direct and indirect contribution to greenhouse gasses and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the contribution to cumulative effects on global greenhouse gasses and climate change would also be negligible under all alternatives.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41 percent
- Energy production – 35 percent
- Agriculture – 12 percent
- Forestry and other land uses – 12 percent

There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014; Smith et al., 2014; FAOSTAT, 2013). The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

Summary of Project-scale Impacts from Predicted Climate Change

Ongoing and predicted regional climate changes have the potential to affect the hydrologic regime in the upper Cascade Mountains, such as increased year-round temperatures, changes in the precipitation patterns (including rain on snow events), and greater magnitude and frequency of storm flows. Predicted changes would impact access and travel, distribution of plant and wildlife species, fire frequency, invasive species, and forest pests. Measures have been developed and incorporated into the design of the Proposed Action which would address climate sensitivity consistent with strategies from the Forest’s Climate Change Vulnerability Assessment (USDA Forest Service, 2014). This information reflects the current status and predicted changes for the subwatersheds of the Project Area.

$^5$ A gigatonne is one billion metric tons of CO$_2$; equal to about 2.2 trillion pounds.
The global climate has changed through time and will continue to change. Scientific models and methodologies project an increasing rate of climate change in upcoming years. Applying regional climate models to site-specific Project Areas makes the conclusions less certain. However, some general projections are possible for the purpose of environmental analysis.

The following projections for the Pacific Northwest are derived from the Climate Impacts Group of the University of Washington, Seattle. Models developed by the Climate Impacts Group project temperature increases during the 21st century along with large year-to-year and decade-to-decade variation in precipitation (Mauger, 2015). The 2015 State of Knowledge: Climate Change in Puget Sound report highlights the following climate changes and how they may alter the water cycle in the land area of the Puget Sound region:

- **Snowpack and Streamflow**: Warming will cause a greater proportion of winter precipitation to fall as rain rather than snow. Snowpack is projected to decline, causing the spring peak in streamflow to occur earlier in the year. Winter streamflow is projected to increase in snow-influenced watersheds, while most locations are projected to experience a decline in summer streamflow.

- **Landslides and Sediment Transport**: Changes in rainfall, snowpack, and streamflow may lead to an increase in landslide risk, erosion, and sediment transport in fall, winter, and spring, while reducing the rates of these processes in summer. Quantitative projections of the likely changes in sediment transport and landslides are limited, in part because it is challenging to distinguish climate change effects from non-climatic factors such as development patterns and forest management.

- **Flooding**: Both the extent and the frequency of flooding is projected to increase. Heavy rain events are projected to intensify, increasing flood risk in all Puget Sound watersheds. Continued sea level rise will extend the reach of storm surge, putting coastal areas at greater risk of inundation. In snow-accumulating watersheds, winter flood risk will increase as the snowline recedes, shifting precipitation from snow to rain.

Proposed actions incorporate adaptation strategies to help reduce impacts and increase landscape resiliency. Strategies for vegetation, fish and wildlife habitat and access include:

- Thinning to accelerate the development of late successional forest conditions
- Increasing stand-level biodiversity
- Early detection and rapid response to invasive species
- Increase habitat connectivity and diversity of habitat types
- Restore stream and flood-plain complexity
- Remove infrastructure from flood plains
- Increase off-channel habitat and protect refugia in side channels

Adaption strategies and tactics to address climate sensitivities for hydrology-access, fish and wildlife habitat, and forest health are selected in response to projected climate change for the subwatersheds encompassing the project area. Four sets of climate data are presented for evaluation:
• Precipitation Type - a classification of watersheds into categories of rain-dominant, snowmelt-dominant or mixed-rain-and-snow dominant, current type is presented along with projected changes for the years 2040 and 2080.

• The peak flood statistic - the percent change of the 100-year flood level over historic (1916-2006) levels, for each of the future climate scenarios and aggregated by watershed. Values are based on 2080 climate scenario dataset.

• Soil moisture percent change - used as an indicator for potential landslides and slope failure. Values are based on the winter season 2080 climate scenario dataset.

• Snowmelt date - the number of days earlier that snowmelt is predicted to occur relative to the present, for each of the climate scenarios. Values are based on 2040 climate scenario dataset (2080 scenario data was not available).

Together, these four data sets reflect the drivers of climate change across the Project Area and integrate region wide increases in temperature with changes in precipitation type and early onset of snowmelt. These changes have the potential to impact social, cultural, aquatic and terrestrial aspects of the Project Area.

In terms of dominant precipitation type for subwatersheds of the Project Area, the majority of the area is dominated by snow (Figure 19). A smaller proportion is either mixed rain-and-snow or rain dominated, reflecting the glacial influence of Mt. Rainier (snow) and elevation gradients of the overall area and associated subwatersheds (rain dominated in lower elevation portion of the Project Area). However, projected increases in temperature result in a loss of snow dominated moisture regime (2040) while rain dominated areas increase in area by 2080.
Potential increase in flood risk (increase in 100-year flood events) summarized at the subwatershed scale is projected to increase for the entire area by 2080 (Figure 20). For the Project Area, flood risk was projected to increase between 8 and 49% by 2080. Increases in 100-year flood events will greatly affect fish habitat and roads and those activities that rely on access. As areas shift from snow to mixed dominant precipitation types, the projected change in flood events increases.
Subwatersheds of the Project Area.

Figure 20. Potential Percent Change in Peak Flood Risk Under the 2080 Climate Change Scenario for Subwatersheds of the Project Area. Increasing Percent Values represent greater increase in flood risk from the historic period (1916-2006) under the 2080 scenario.

Changes in soil moisture are used to infer landslide risk. Greater projected changes in soil moisture can influence slope stability as the type and timing of precipitation changes. For nearly half of the Project Area, soil moisture is projected to change by at least 10 percent or more by 2080 (Figure 21).

Increasing winter temperatures will result in decreasing snowpack and result in certain areas to be snow-free earlier in the year. An earlier onset of snowmelt has the potential to lead to increased visitor use of the road systems to access areas historically snow-covered later into the year. Projected changes in the onset of snowmelt by 2040 are presented in Figure 22.
Climate changes across the Project Area have the potential to result in lower water flows which reduce fish habitat, reduced tree vigor, increased susceptibility to forest pests and diseases, increased fire frequency, reduce native plant populations (increased competition from invasive species), road damage/closures leading to loss of access for cultural practices and recreation opportunities. Adaption strategies to help reduce climate impacts have been incorporated in the Proposed Actions and are derived from recommendations in the Forest’s Climate Change Vulnerability Assessment.

Figure 21. Potential Percent Change of Increased Soil Moisture Under the 2080 Climate Change Scenario for the Subwatersheds of the Project Area. Percent Values represent greater increase in land slide potential from the historic period (1916-2006) under the 2080 scenario.
Inventoried Roadless Areas

Affected Environment

Inventoried Roadless Areas comprise 8,428 acres of the Snoquera project area (Table 67). Inventoried Roadless Areas (IRA) in the project area. These IRAs were identified in the 2001 Roadless Area Conservation Rule (36 CFR Part 294). While the IRAs are substantially undeveloped, portions of the areas contain roads or other developments including evidence of prior timber harvest. Some stands within the Suntop, Lonesome Lake, and Norse Peak IRAs were harvested as recently as 1983. However, the majority of the lands that make up IRA in the project area consist of stands 120 years or older and are predominantly unroaded. Several non-motorized trails, including the Palisade Trail, Ranger Creek, Trail, and Norse Peak Trail are located within the Norse Peak IRA boundary. Other IRAs in the project area also have trails including the Crystal Ridge Trail in the Silver Creek IRA.

Table 67. Inventoried Roadless Areas (IRA) in the project area.

<table>
<thead>
<tr>
<th>IRA Name</th>
<th>Acres in Project Area</th>
<th>Total Acres</th>
<th>% of IRA in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norse Peak</td>
<td>4,845</td>
<td>19,336</td>
<td>25.06%</td>
</tr>
<tr>
<td>Suntop</td>
<td>2,058</td>
<td>2,058</td>
<td>100%</td>
</tr>
<tr>
<td>Lonesome Lake</td>
<td>505</td>
<td>505</td>
<td>100%</td>
</tr>
</tbody>
</table>
**IRA Name** | **Acres in Project Area** | **Total Acres** | **% of IRA in Project Area**
--- | --- | --- | ---
Silver Creek | 1,020 | 9,003 | 11.33%
Total | 8,428 | 8,428 | 8,428 |

**Methodology**
The indicator used for assessing effects to inventoried roadless areas is the effects to the resources and features that are often present in and characterize inventoried roadless areas, as described in 36 CFR 294.11.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measure</th>
</tr>
</thead>
</table>
| Impacts to roadless area characteristics (36 CFR 294.11) | - High quality or undisturbed soil, water, and air and sources of public drinking water  
- Diversity of plant and animal communities; Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land  
- Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation  
- Natural appearing landscapes with high scenic quality; Reference landscapes  
- Traditional cultural properties and sacred sites  
- Other locally identified unique characteristics |

**Spatial and Temporal Context for Effects Analysis**
The scale of analysis is the Snoquera project planning area and the extent of the four IRAs identified above in Table 67. The spatial contexts for this analysis is the areas associated with reforestation activities. The temporal context for the effect analysis is long-term, 5 to 50 years.

**Environmental Consequences**

**Direct and Indirect Effects**

Table 68. Acres of activities that occur within Inventoried Roadless Areas in the Snoquera project planning area.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting</td>
<td>0 acres</td>
<td>Up to 225 acres</td>
<td>Up to 225 acres</td>
</tr>
</tbody>
</table>

**Alternative 1**
There would be no direct effects to Inventoried Roadless Areas because no activities would occur. The existing condition would remain unchanged, except by natural processes and ongoing management activities. There would be no thinning, snag creation, down wood creation, or other terrestrial habitat enhancement activities or connected actions. Road decommissioning would not occur. The degraded condition of the second growth stands would persist. Total acreage of the IRAs would remain the same.
Alternatives 2 and 3

Approximately 10% of the high severity burn area within the Norse Peak IRA, up to 225 acres, would be planted with suitable tree species, include whitebark pine (*Pinus albicaulis*) where appropriate. This activity would not change the acres of IRA within the project area, but would affect the characteristics of IRAs as described below. The acres planted would be the same across both alternatives, thus there would be no difference in effects to IRA between Alternatives 2 and 3. None of the other activities included in Alternatives 2 and 3 would be in IRA and therefore those activities would not affect any IRA characteristics. Effects of Reforestation on Characteristics of Inventoried Roadless Areas are described below:

High quality or undisturbed soil, water, and air and sources of public drinking water

The effects to water quality, including effects to the Green River which supplies water to Tacoma, are described in the Aquatic Resources section. The area proposed for planting is in the Upper White River watershed and no portion of the Norse Peak IRA is in the Green River watershed. Planting in areas of the Norse Peak Fire with high tree mortality would speed recovery of riparian areas and provide bank stability faster than with natural regeneration.

Planting activities would have no effect on air quality in the Norse Peak IRA.

Diversity of plant and animal communities; Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land

Planting would benefit habitat for late-successional species in the long term as it would augment conifer tree density and development over a larger area than if burned areas were left to regenerate naturally. As described in the vegetation section, planting would accelerate development of late-successional and old-growth habitat in a late successional reserve that is currently composed of less than 60% functioning late successional old-growth habitat. See landscape restoration context section describing the current condition and need for change.

Planting would also benefit whitebark pine, a candidate species for listing under the Endangered Species Act. Whitebark pine would be planted, where appropriate for the species, in high mortality areas within the perimeter of the Norse Peak Fire, including some areas within the Norse Peak Inventoried Roadless Area. See Description of Alternative 2. Seedlings resistant to white pine blister rust would be planted as part of a restoration strategy for whitebark pine. This action would contribute to maintaining and improving the viability of a species which is currently declining across much of its range. See botany section for additional discussion.

Planting would contribute habitat complexity, would accelerate development of structurally diverse forested habitat, and would improve habitat connectivity for species at risk, while still maintaining areas where early seral habitat would contribute to habitat diversity. See wildlife effects. The diversity of species planted and a variety of abiotic and other factors related to tree planting for the Snoqualma project reforestation efforts are expected to produce variation in the vertical structure and horizontal spatial pattern of the developing stands. Only a relatively small proportion of the high severity burn area will be planted, which would ensure that an ample amount of area is left to regenerate at a natural pace and retain high early seral habitat values for an extended period. See wildlife effects.
**Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation**

As described in the recreation section, the proposed terrestrial and watershed restoration activities, including reforestation, will have minimal impacts on recreation. Planting in the Norse Peak IRA would not disrupt access or opportunities for recreation.

**Natural appearing landscapes with high scenic quality; Reference landscapes**

The species proposed to be planted are native to the area. The planting is proposed within an area that burned at very high severity so will be visible and may affect the natural appearance of the landscape in the short term. Over time the evidence of planting will moderate and the presence of native species will contribute to the high scenic quality of the area. No more than 10% of the high severity burned areas would be planted which would ensure that the majority of the fire-affected landscape would be retained in a largely un-managed condition.

**Traditional cultural properties and sacred sites**

Replanting poses generally low risk to cultural resources. See cultural resources section describing planting as a “low risk activity exempt from review per the Programmatic Agreement, Appendix A, Ecology, Range & Watersheds, section 2.c, and Timber, section 2.” To avoid impacting traditional cultural properties and sacred sites, areas near Corral Pass would be surveyed prior to planting and consultation completed in accordance with the terms of the project Programmatic Agreement. See Table 66.

**Other locally identified unique characteristics**

There are no other locally identified unique characteristics that would be affected by reforestation activities.

**Cumulative Effects**

There are no activities with effects to IRA that would overlap time and space with actions proposed in either Alternative 2 or 3 and therefore there would be no cumulative effects.

**Summary of Effects**

Planting would have a nominal effect on the scenic quality of the affected area in the short term but in the long term would contribute to the biological diversity of the Norse Peak IRA.

**Compliance with law, regulation, policy, and the Forest Plan**

Planting is not prohibited by the 2001 Roadless Rule. No other activities are proposed within IRA.

**Other Undeveloped Lands**

**Affected Environment**

Human influences have already substantially altered the ecological processes throughout much of the project area. Other undeveloped lands are isolated polygons of National Forest System land with no evidence of road, past harvest activities, or other developments such as campgrounds or ski areas. Forest databases for the existing road system, stand age, and past harvest activities were combined with local knowledge of the area, input received during the scoping period, and examination of aerial photography and LiDAR imagery to make this analysis.
Approximately 44,361 acres of undeveloped lands were identified in the project area (polygons of at least one acre in size; see Table 69). These other undeveloped lands areas are not designated wilderness, nor or they Inventoried Roadless Areas. There are no forest-wide or management area standards specific to other undeveloped lands areas in the Mt. Baker-Snoqualmie Forest Plan or the Northwest Forest Plan. Undeveloped lands are managed consistent with forest-wide standards and guidelines and the relevant Forest Plan management area allocations.

### Table 69. Size Class and acres of other undeveloped lands in the project area.

<table>
<thead>
<tr>
<th>Number of Polygons</th>
<th>Size Class</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td>1-20 ac.</td>
<td>1,065</td>
</tr>
<tr>
<td>1113</td>
<td>20.1-100 ac.</td>
<td>5,264</td>
</tr>
<tr>
<td>29</td>
<td>100.1-200 ac.</td>
<td>4,078</td>
</tr>
<tr>
<td>24</td>
<td>200.1-400 ac.</td>
<td>7,105</td>
</tr>
<tr>
<td>21</td>
<td>400.1-1,000 ac.</td>
<td>11,788</td>
</tr>
<tr>
<td>5</td>
<td>&gt;1,000.1</td>
<td>15,061</td>
</tr>
</tbody>
</table>

**Total = 44,361**

### Methodology

The effects to other undeveloped lands were based on existing maps and polygons created utilizing geographic information systems (GIS). The project planning area was evaluated for evidence of roads (open or closed, including a 300-feet buffer on each side of the road), prior timber harvest, and developments such as ski areas and campgrounds.

Information regarding the effects of prior harvest, including previously harvested lands acquired by the Forest Service, were discussed and reviewed with the project silviculturist. Based on field review and professional judgement, these lands still show evidence of past harvest, including stumps and vegetation conditions outside those expected and reflective of historical, pre-harvest conditions. Forest stands younger than 80 years were excluded from analysis as other undeveloped lands because of the high potential for such stands to show evidence of past harvest.

Individual polygons of other undeveloped lands less than 1 acre were eliminated from further study because no special or unique resource values were identified and the description of effects to individual pieces of land less than 1 acre are better disclosed as part of the other resource effects sections in this EA. A majority of the polygons less than 1 acre in size actually represented mapping areas due to the coarse nature and scale of the polygons drawn.

### Spatial and Temporal Context for Effects Analysis

The scale of analysis is the Snoquera project planning area. The spatial contexts for this analysis are unit boundaries and the areas with the associated road building activities, and areas proposed for reforestation. The temporal context for the effect analysis is long-term, 5 to 50 years. Road decommissioning, new road construction, silviculture treatments would have a long-term effect.
Figure 23. Extent of Inventoried Roadless Areas and other undeveloped lands within the Snoquera project area.
and may increase or reduce the amount of land with undeveloped characteristics. Dispersed
camping corridors were not relevant for the analysis because lands were only considered for
undeveloped lands if they were 300 feet or farther from a road. Dispersed camping sites are
primarily on or adjacent to existing roads.

**Environmental Consequences**

**Direct and Indirect Effects**

**Alternative 1**
There would be no direct effects to other undeveloped lands because no activities would occur in
these areas. The environment would remain unchanged, except by natural processes and ongoing
management activities. There would be no thinning, snag creation, down wood creation, or other
terrestrial habitat enhancement activities or connected actions. Road decommissioning would not
occur. Undeveloped areas would remain unchanged, except by natural processes and routine
maintenance on existing roads and trails. The degraded condition of the second growth stands
would persist. Total acreage of the undeveloped areas would remain the same.

**Alternatives 2 and 3**
No thinning or road construction activities are proposed in undeveloped areas. It is anticipated
that approximately 10% of the high severity burn area within the undeveloped lands, up to 105
acres, would be planted with suitable species. This activity would not change the acres of
undeveloped lands within the project area, but would affect the undeveloped character of the
affected area during implementation and shortly thereafter, as described below. No other activities
with the potential to alter the undeveloped nature of these lands are proposed.

Planting could occur in 14 polygons on approximately 1,048 acres of unroaded areas although it
is anticipated that no more than 10 percent of that area would be planted. Planting is not expected
to alter the undeveloped nature of these areas in the long term although there would be some short
term effects. Table 70 and Table 71 show the polygons and acreage of undeveloped areas before
and after implementation of Alternative 2 and 3. Planting would not change the size of
undeveloped polygons. Effects to the physical and biological resources in the project area,
including those in units proposed in unroaded areas, are disclosed in the applicable resource
sections of this EA and are not reiterated here.

**Table 70. Acres of activities and miles of road proposed under Alternatives 2 and 3 that occur within
other undeveloped lands in the Snoquera project planning area.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silviculture treatments</td>
<td>0 acres*</td>
<td>0 acres*</td>
</tr>
<tr>
<td>Reforestation (planting)</td>
<td>Approximately 105 acres</td>
<td>Approximately 105 acres</td>
</tr>
<tr>
<td>Temporary road construction</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Three of the initially proposed LSR stands (185, 285, 286) overlapped with the unraoded areas but have been
determined to be not suitable for treatment, so those acres not included here. Six of the initially proposed LSR stands
overlapped with unaoded areas but they have been excluded from treatment because of stand age so are not included
here. Mapping discrepancies between the stand boundaries and the stand age layer used to identify unroaded parcels
also resulted in small fragments of overlap that are not included here.
Table 71. Changes in other undeveloped lands in the Snoquera project area under action alternatives.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Other unroaded acres after implementation</th>
<th>Acres changed</th>
<th>Percentage of project area* remaining as undeveloped lands</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44,361</td>
<td>0</td>
<td>38%</td>
</tr>
<tr>
<td>2</td>
<td>44,361</td>
<td>0</td>
<td>38%</td>
</tr>
<tr>
<td>3</td>
<td>44,361</td>
<td>0</td>
<td>38%</td>
</tr>
</tbody>
</table>

*Only the portion of the project area made up of NFS land is included here (115,597ac.)

During and shortly after planting, the affected areas could appear nominally managed. However, planting would entail variable spacing and low density to maintain horizontal variability. Subsequent density management would not occur in planted areas. Diversity of plant and animal communities may shift from current patterns but ecological diversity would remain. The effects of planting are not expected to be visible into the future and would not have a lasting effect on the size of undeveloped polygons. The 44,361 acres of undeveloped lands would remain undeveloped.

Cumulative Effects

For undeveloped lands in which project activities would occur the cumulative effects to soil, water quality, plant and animal communities; habitat for threatened, endangered, and sensitive species, recreation, and cultural resources are disclosed in previous sections of this EA and are not reiterated here.

There would be no effect to the size of undeveloped polygons from this project, therefore there would be no cumulative effects.

There are no projects being planned in the area which would provide for potential future effects to other undeveloped lands. Past and current management activities outside of the project would likely continue. Future wildfire management would cumulatively change composition and structure of vegetation which could affect some forest visitor’s sense of naturalness and remoteness. Apparent naturalness and solitude and remoteness would be cumulatively impacted by grazing, dispersed camping, and motorized ATV and vehicle use on roads.

Effects associated with recreational use, including noxious weed spread, hunting, fishing, erosion, litter, and evidence of fire rings are expected to remain cumulatively minor. Ongoing removal of danger trees and fire wood gathering along forest roads changes the vegetation but does not change the overall sense of naturalness or sense of solitude along an existing developed transportation corridor and are outside of other undeveloped lands. Overall, cumulative impacts from these activities on apparent naturalness, solitude and remoteness is very small (not measurable/indistinguishable) in proportion to the changes anticipated from the direct and indirect impacts of the alternatives disclosed above.

Summary of Effects

Neither alternative would reduce the size of undeveloped polygons.
Compliance with law, regulation, policy, and the Forest Plan

Environmental effects to resources in other undeveloped lands due to the implementation of proposed project activities would be consistent with applicable laws, regulations, and Forest Plan management area standards and guidelines.

Figure 24. Planting activities within other undeveloped lands.
Other Required Disclosures

Prime Farmlands, Rangelands, Forestlands, and Parklands
USDA Departmental Regulation 9500-003 describes obligations of USDA agencies with respect to prime farmlands, rangelands, forestlands, and parklands. The alternatives described in this EA do not propose changes in land use as described in the regulation and would not result in the conversion of these lands to other uses.

Floodplains and Wetlands
USDA Departmental Regulation 9500-003 and Executive Orders 11988 and 11990 describes obligations of Federal agencies with respect to floodplains and wetlands. DR 9500-003 advocates that beneficial functions and values of wetlands and floodplains be reserved. The alternatives described in this EA do not propose changes in land use and would not result in the conversion of wetlands to other uses or other encroachment on floodplains. Beneficial functions and values of wetlands and floodplains would be maintained or improved through implementation of the action alternatives. Effects to floodplains and wetlands are described in the Aquatic Resources section of this EA.

EO 11988 directs Federal agencies to restore and preserve the natural and beneficial values served by floodplains. Consist with this EO, the action alternatives and associated design criteria and BMPs have been designed to minimize potential harm to or within floodplains. Implementation activities proposed would improve the physical processes of floodplain connectivity and function. See Need for Proposal description describing the goal to enhance the health of streams and associated aquatic ecosystems by modifying the transportation system to improve floodplain structure. Effects to floodplains are described in the Aquatic Resources section of this EA. The action alternatives would minimize adverse effects to the floodplains, and thus be consistent with Executive Order 11988.

EO 11990 directs Federal agencies to “avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.” The action alternatives do not propose new construction or development within wetlands, some aquatic enhancement actions may have short term adverse impacts during construction activities, but these activities are designed to improve aquatic and wetland habitats in the long term and have been designed to avoid any adverse impacts to the greatest extent feasible. See Aquatic Resources section of this EA for a discussion of effects wetlands.

Environmental Justice and Civil Rights
Executive Order 12898 directs federal agencies to identify and address the problem of adverse environmental effects by agency programs on minority and low income populations. Population demographics for the following census bureau-defined geographic areas in the vicinity of the project were considered: Enumclaw Plateau CCD, King Co, WA; Buckley CCD, Pierce Co, WA; and Mount Rainier CCD, Pierce Co, WA.

The percentages of families or individuals below poverty level in the communities near the project area are similar to those of the Region and less than the percentages reported for the US overall (approximately 9% of individuals for the Enumclaw, Buckley, and Mount Rainier CCD compared to 15% of individuals for the US; Headwaters Economics 2018). The 2016 median
household income is above the national poverty guideline (Headwaters Economics 2018). Based on local knowledge, some low-income populations in the vicinity of the project area and augment incomes through actions such as gathering firewood and other forest products to sell. Long-term access to such areas would be improved through road maintenance activities associated with the proposed action. Some proposed actions in the planning area may provide job opportunities for local residents. None of the proposed actions are expected to affect farms or water quality of municipal or domestic-use water systems.

81-92% of the population self-identifies as White, compared to 73.3% nationally, while 0-6-2% self-identify as American Indian, and 0.7-5% as Asian (Headwaters Economics 2018). No adverse effects from project activities are expected to disproportionately affect members of any racial minority group.

Employment by occupation statistics demonstrate that in the Enumclaw, Buckley, and Mount Rainer CCD, the greatest percentage of employees work in management, professional, and related occupations (27-35%) with only a small percentage employed in farming fishing, and forestry (~0-3%).

In summary, effects of alternatives on the human environment (including minority and low-income populations) are expected to be similar for all human populations regardless of nationality, gender, race, or income. No disproportionately high and adverse human health or environmental effects on minority populations and low-income populations are expected as a result of implementing any alternative.

Effects on civil rights, including those of minorities and women, would be minimal. Activities associated with the proposed action would be governed by Forest Service contracts, which are awarded to qualified purchasers regardless of race, color, sex, religion, etc. Such contracts also contain nondiscrimination requirements. While the proposed activities would create jobs and provide consumer goods, no quantitative output, lack of output, or timing of output associated with these projects would affect the civil rights, privileges, or status quo of consumers, minority groups, or women.

**Conflicts with Plans, Policies, or Other Jurisdictions**

This project would not conflict with any other policies, regulations, or laws. Based on information received during scoping, informal consultation meetings, and analysis in the EA, none of the alternatives under consideration would conflict with the plans or policies of other jurisdictions, including Tribes. This project would not conflict with any other policies and regulations or laws, including the Clean Water Act, Endangered Species Act, National Historic Preservation Act, and Clean Air Act. Refer to the following sections for discussions regarding these laws:

- Fire, Fuels, and Air Quality – Clean Air Act
- Aquatic Resources – Clean Water Act
- Wildlife, Botany, and Aquatic Resources – Endangered Species Act
- Cultural Resources – National Historic Preservation Act
Potential or Unusual Expenditures of Energy

Implementation of the action alternatives would require expenditures of fuel for workers to access the project area and for use of power equipment. Alternative 1 would not require the expenditure of fuel. Overall, the project would not result in any unusual expenditure of fuel.
Glossary

**Activity Center** The core of a northern spotted owl’s territory and the focal point of protection measures. Most frequently located in or near the highest concentration of remaining habitat.

**Anadromous**—migrating from the sea to freshwater to spawn

**A-weighted sound level** The sound pressure level measured using the A-weighting network which approximates the human ear response to sound, and is also typically used for measuring wildlife response to sound.

**Best Management Practice (BMP)** Methods, measures, or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures, and other requirements, scheduling, and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice.

**Closure** Restriction of motor vehicle use on a travel way by means of elimination or prohibition. Closures may be permanent or temporary depending on management objectives.

**Concern species** Species whose populations are of concern to biologists on the Mt. Baker-Snoqualmie National Forest. An informal designation.

**Critical Habitat** (for threatened or endangered species; from the Endangered Species Act, p. 2)—(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. (The USFWS and the NMFS formally designate what is “critical habitat” for their respective species. Critical habitat includes the stream channels with a lateral extent defined by the ordinary high-water line [33 CFR 319.11].)

**DAHP**- Washington Department of Archaeology and Historic Preservation. Synonymous with the WA State Historic Preservation Office (SHPO).

**Danger Tree** A standing tree that presents a hazard to people due to conditions such as deterioration of or damage to the root system, trunk, stem, or limbs or the direction or lean of the tree. Synonymous with hazard tree for purposes of this Project.

**Decommissioning** Activities that result in the stabilization and restoration of unneeded roads or trails to a more natural state.

**Deferred maintenance** is the practice of postponing maintenance activities such as repairs on both real property (i.e. infrastructure) and personal property (i.e. machinery) in order to save costs, meet budget funding levels, or realign available budget monies.

**Designated Critical Habitat** (Endangered Species Act) defined as an area occupied by a species listed as threatened or endangered within which are found physical or geographical features essential to the conservation of the species, or an area not currently occupied by the species, which is itself essential to the conservation of the species. As defined in the ESA “conservation”
means any and all methods and procedures, and the use of those, needed to bring a species to recovery—the point at which the protections of the ESA are no longer needed.

**Designated road, trail, or area** A NFS road, a NFS trail, or an area on NFS lands that is designated for motor vehicle use pursuant to 36 CFR 212.51 on a motor vehicle use map.

**Dispersal habitat** For northern spotted owls, habitat that meets the 50-11-40 (50 year old or greater forest stand with trees 11 inches d.b.h. or greater with a stand average 40% canopy cover) (Thomas, et al 1990). Dispersal habitat that has adequate flying space is considered a travel corridor between blocks of nesting, roosting, and foraging habitat. Dispersal habitat generally does not meet the criteria for nesting, roosting or foraging habitat.

**Early seral** An ecological age class designation. Early successional condition with open canopy generally with less than 60 percent overstory tree cover and less than 2 inches mean diameter breast height. Vegetation is typically some combination of graminoids, forbs, and shrubs, and can have tree seedlings or saplings.

**Eligible or listed** refers to the status of any prehistoric or historic district, site, building, or structure in regards to the NRHP maintained by the Secretary of the Interior. A site may be either not eligible, eligible, or listed in the NRHP. Sites that are unevaluated are treated as eligible until a determination is made. According to the 2004 revised regulations [36 CFR 800.4(d)(1)] for the NHPA, sites considered not eligible for the NRHP may be directly affected once adequately recorded and evaluated, and concurrence is received from the State Historic Preservation Office.

**Endangered species** A threatened species or distinct population segment found by the Secretary of the Interior to be threatened with extinction.

**Essential Fish Habitat**—those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

**Extirpated** Eliminated from a local area.

**Forest road or trail** A road or trail wholly or partly within or adjacent to and serving the NFS that the Forest Service determines is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources.

**Forest transportation atlas** A display of the system of roads, trails, and airfields of an administrative unit.

**Forest transportation system** The system of NFS roads, NFS trails, and airfields on NFS lands.

**Fragmentation** The degree to which the landscape is broken into distinct patch types.

**Functional class** The grouping of roads by the character of service they provide.

  Arterial. An NFS road that provides service to large land areas and usually connects with other arterial roads or public highways.

  Collector. An NFS road that serves smaller areas than an arterial road and that usually connects arterial roads to local roads or terminal facilities. Provides service to smaller land areas than an arterial road. It usually connects forest arterial roads to local forest roads or terminal facilities.
Local. An NFS road that connects a terminal facility with collector roads, arterial roads, or public highways and that usually serves a single purpose involving intermittent use.

**Hazard tree** See Danger tree definition above.

**Hibernacula** Sites where hibernation occurs, generally in reference to bats.

**Historic property** means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria. This term would equate to “significant” archaeological or historic sites in regards to NEPA but does not equate to a determination of a “significant” impact.

**HUC** hydrologic unit code; hydrologic unit is identified by a unique code consisting of a sequence of numbers that identify a hydrological feature like a drainage basin, watershed, river, or catchment. Each hierarchical level is assigned two digits. For example, a HUC 10 drainage is a fifth level watershed, and a HUC12 drainage is a sixth level subwatershed.

**Human influence zone** Areas of human activity (recreation sites, roads, trails, buildings, mines, hydropower operations, etc.) buffered by one-fourth mile around trails and one-half mile around roads and other sites.

**Large woody debris** Pieces of wood larger than 10 feet long and 6 inches in diameter.

**Late seral forest** An ecological age class designation. Late successional condition with a single or multiple canopy structure, including mature, large trees, and old-growth stands. Usually containing snags and down wood structure.

**LSR (Late-Successional Reserve)** mapped or unmapped areas of forest seral stages that include mature and old-growth age classes. These reserves are designed to maintain a functional, interacting late-successional and old-growth ecosystem. (ROD USDA-USDI, Standards and Guidelines 1994, B-1)

**Maintenance** The upkeep of the entire forest transportation facility including surface and shoulders, parking and side areas, structures, and such traffic-control devices as are necessary for its safe and efficient utilization. **Road Maintenance Level Descriptions:**

- Maintenance level 1 roads are closed. Basic custodial maintenance is performed to protect adjacent resources and to protect the road for future management activities. Maintenance emphasis is to ensure drainage facilities are functioning.

- Maintenance level 2 roads are open for use by high clearance vehicles. Maintenance level 2 roads may not be suitable for passenger car travel.

- Maintenance level 3 roads are open and maintained for passenger car travel by a prudent driver, user comfort or convenience are not priorities. Roads are typically low speed, single lane with turnouts and could have spot surfacing. Some roads may be fully surfaced with either native or processed material.
Maintenance Level 4 roads provide a moderate degree of user comfort and convenience at moderate travel speeds.

Maintenance Level 5 roads are designed to provide a high degree of user comfort and convenience. These roads are normally double-lane, paved facilities. Some may be aggregate surfaced and dust abated.

**Motor vehicle** Any vehicle which is self-propelled, other than: (1) A vehicle operated on rails; and (2) Any wheelchair or mobility device, including one that is battery-powered, that is designed solely for use by a mobility-impaired person for locomotion, and that is suitable for use in an indoor pedestrian area.

**Motor vehicle use map** A map reflecting designated roads, trails, and areas on an administrative unit or a Ranger District of the NFS.

**National Forest System road** A forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county, or other local public road authority.

**National Forest System trail** A forest trail other than a trail which has been authorized by a legally documented right-of-way held by a State, county, or other local public road authority.

**Neotropical migrants** Birds that migrate from North America to regions south of the Tropic of Cancer (latitude 23 1/2 degrees north) to winter.

**Objective Maintenance Level** The maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the operational maintenance level. The transition from operational maintenance level to objective maintenance level may depend on reconstruction or disinvestment.

**Omnivore** Animal that feeds on both plants and animals.

**Opening or Regeneration Timber Harvest** A harvest technique that removes all trees, regardless of size, on an area in one operation. Following the timber harvest, new seedlings will be planted in addition to the occurrence of natural regeneration.

**Operational Maintenance Level** The maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained.

**Perennial stream** Permanently present surface water. Flows occur throughout the year except possibly during extreme drought or during extreme cold when ice forms.

**Redd** Fish nest; eggs deposited in stream gravels.

**Rendezvous sites** Temporary resting sites used for several days at a time by a wolf pack during summer months while pups are developing.

**Right-bank** Relative to an observer looking downstream, the bank of the stream or river on the observer's right side.

**Riparian zone** Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water,
associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

**Road Realignment** Activity that results in a new location of an existing road or portions of an existing road and treatment of the old roadway.

**Road Reconstruction** Work that includes, but is not limited to, widening of roads, improving alignment, providing additional turnouts, and improving sight distance - projects that improve upon the standard to which the road was originally constructed. Also undertaken to increase the capacity of the road or to provide greater traffic safety.

**Road** A motor vehicle route over 50 inches wide, unless identified and managed as a trail.

**Road improvement** Activity that results in an increase of an existing road's traffic service level, expands its capacity, or changes its original design function.

**Road Storage** Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed one year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities and runoff patterns. Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open to traffic. However, while being maintained at level 1, they are closed to traffic, but may be open and suitable for non-motorized uses.

**Security habitat** Habitat defined as greater than 0.25 mile from open roads or outside of the human influence zones mountain goats, and at least 0.3 mile for grizzly bear core and wolf security habitat.

**Sensitive Species** (from [http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy](http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy))–For Region 6 of the Forest Service, those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species’ existing distribution (FSM 2670.5).

**Seral** Of or pertaining to the series of stages in the process of ecological succession.

**Suitable habitat** Habitat in which an animal or plant can meet all or some of its life history requirements.

**Surface erosion** The detachment and transport of individual soil particles by wind, water, or gravity.

**Survey and Manage species (S & M)** Species to be protected through survey and management standards and guidelines on federal lands as identified by the Standards and Guidelines for Management of Habitat for Late-successional and Old-growth Forest and Related Species Within the Range of the Spotted Owl (ROD, Appendix J2).

**Temporary road** A road authorized by contract, permit, lease, other written authorization, or emergency operation and not intended to be a part of the forest transportation system and not necessary for long-term resource management.
Threatened species A native species likely to become endangered within the foreseeable future.

Trail A route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail.

Unauthorized Road or Trail A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas.

Unclassified Road A road on National Forest System lands that is not managed as part of the forest transportation system, such as unplanned roads, abandoned travel ways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.

Undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval.

Ungulate For this analysis, includes elk, black-tailed deer, and mountain goat.

Vegetation Management Treatment of forested stands associated with the Snoquera project in this report includes the various thinning treatments, huckleberry enhancement, permanent elk forage openings, or other density management. These harvest activities are primarily proposed for commercial sale and additional sites designated for non-commercial treatment depending on the size of material to be removed.

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