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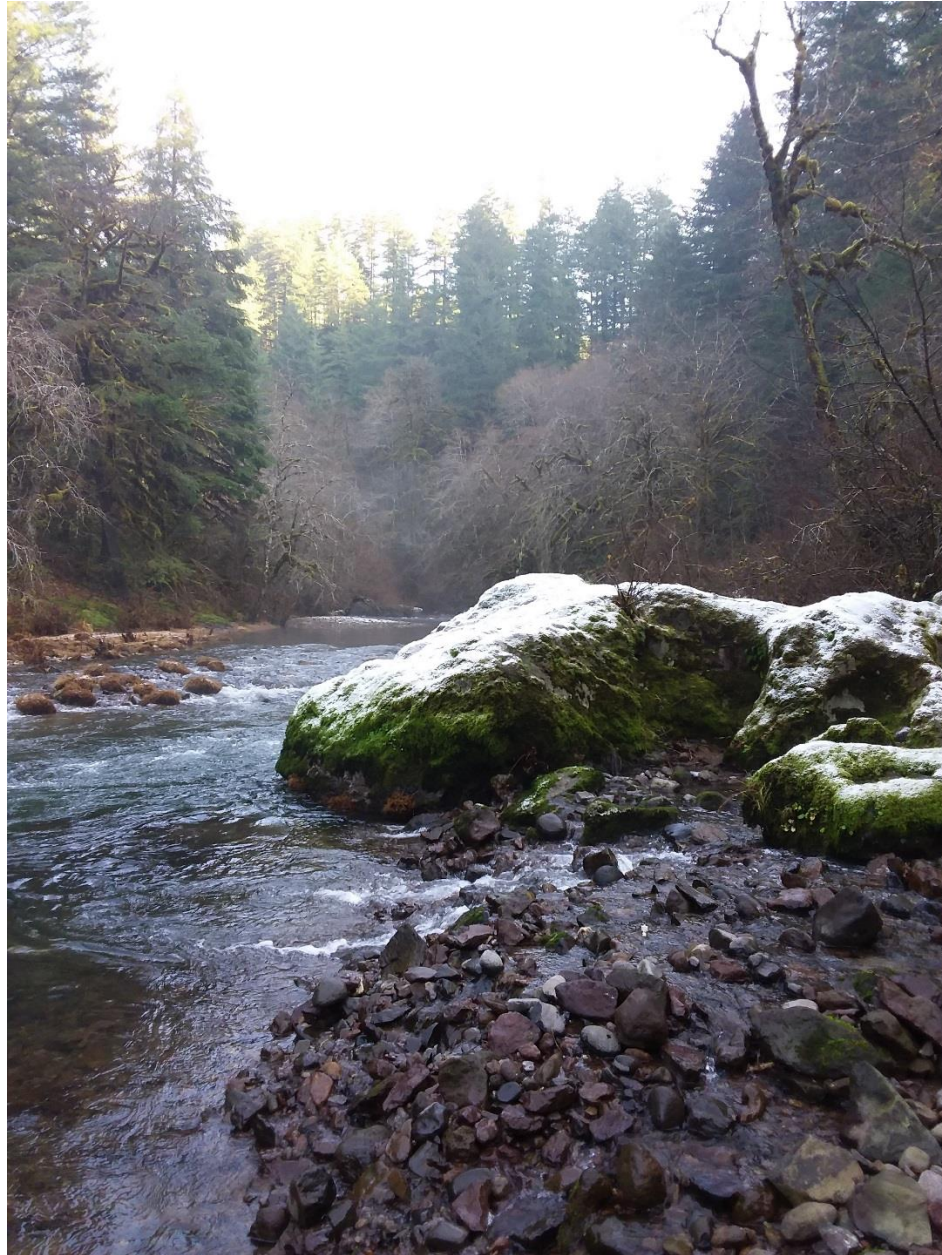
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Trout Creek

Final Environmental Impact Statement

Sweet Home Ranger District, Willamette National Forest
Linn County, Oregon



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Final Environmental Impact Statement

Trout Creek

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Abstract: This Final Environmental Impact Statement (FEIS) contains the Sweet Home Ranger District's proposal to promote forest health, species diversity and complexity, provide a sustainable supply of timber products, mimic historic mixed severity fire at a landscape scale, improve fire resiliency and manage hazardous fuels and enhance hardwood habitat and diversity on 1,670 acres in the Willamette National Forest. The proposed project is located north and south of Highway 20 approximately 22 miles east of Sweet Home, Oregon. Four alternatives were analyzed in this FEIS; a no action alternative (Alternative 1) and three action alternatives (Alternatives 2, 3 and 4). Alternative 2 proposes 1,670 acres of treatment (including skips); Alternative 3 proposes 1,016 acres of treatment (including skips). Alternative 4 proposes 1,670 acres of treatment, but a greater volume of harvest than Alternative 2. Alternative 2 is the Forest Service preferred alternative.

Reader's Guide

The Forest Service has prepared this Final Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Final Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed actions and alternatives. The document is organized as outlined below:

- *Summary*
- *Chapter 1. Purpose and Need:* This chapter describes the scope and objectives of the proposal as well as defines why the proposal is being made at this location and at this time.
- *Chapter 2.* This section describes the alternative methods for achieving the project's purpose. Alternatives are designed to meet the project's purpose and need and to address one or more significant issues related to the proposed actions. This chapter also includes mitigation measures and a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environment that would be affected by the proposed actions as well as the environmental consequences of implementing the alternatives. The analysis is organized by resource area.
- *Chapter 4. List of Preparers:* This section lists the names, together with their qualifications (expertise, experience, professional disciplines), of the persons who were primarily responsible for preparing the environmental impact statement.
- *Chapter 5. List of Agencies, Organizations, and persons to whom copies of the statement are sent*
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the draft environmental impact statement.
- *References*
- *Glossary*
- *Index*

Additional documentation, including more detailed analysis of project area resources, can be found in the project planning record located at the Sweet Home Ranger District Office on the Willamette National Forest.

List of Acronyms

ACS	Aquatic Conservation Strategy
ASCO.....	Aquatic Conservation Strategy Objectives
AMA	Adaptive Management Area
ARP	Aggregate Recovery Percentage
ATP.....	Area to Protect
BA.....	Biological Assessment
B/C Ratio	Benefit / Cost Ratio
BE	Biological Evaluation
BGEA.....	Big Game Emphasis Area
BLM	Bureau Of land Management
BMP	Best Management Practices
BO.....	Biological Opinion
C:N.....	Carbon:Nitrogen ratio
CFR	Code of Federal Regulations
CH.....	Critical Habitat
CWPP.....	Community Wildland Protection Plan
DBH	Diameter Breast Height (4.5 feet above ground)
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DNA	Deoxyribose Nucleic Acid
DTR.....	Dominant Tree Release
EFH	Essential Fish Habitat
EIS.....	Environmental Impact Statement
ESA	Endangered Species Act
FEIS.....	Final Environmental Impact Statement
FL.....	Flame Length
FM	Fuel Model
FR	Fire Regime
FRCC	Fire Regime Condition Class
FS.....	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual

FSVeg.....	Forest Service Vegetation database
FVS.....	Forest Vegetation Simulation
GIS	Geographic Information System
GNN.....	Gradient Nearest Neighbor
GPS	Global Positioning System
HE	Habitat Effectiveness
HH	Harvest Habitat
HUC	Hydrologic Unit Code
IRA.....	Inventoried Roadless Area
LAA	Likely to Adversely Affect
LRMP	Land and Resource Management Plan
LSR.....	Late Successional Reserve
LWM.....	Large Woody Material
MA.....	Management Allocation
MBF.....	Thousand Board Feet
MIS	Management Indicator Species
MMBF.....	Million Board Feet
MSA.....	Magnuson-Stevens Fishery Conservation and Management Act
MSNO	Master Site Number
MVUM.....	Motor Vehicle Use Map
NEPA.....	National Environmental Policy Act
NFF	National Forest Fund
NHPA	National Historic Preservation Act
NLAA.....	Not Likely to Adversely Affect
NMFS.....	National Marine Fisheries Service
NOAA.....	National Oceanic and Atmospheric Administration
NPV.....	Net Present Value
NRHP	National Register of Historic Places
NRIS.....	Natural Resource Information System
NRT.....	National Recreation Trail
NSO	Northern Spotted Owl
NWFP	Northwest Forest Plan
ODF.....	Oregon Department of Forestry
OFRI.....	Oregon Forest Resources Institute
OHV	Off-Highway Vehicle

ORV.....	Off-Road Vehicle
PETS.....	Proposed Endangered Threatened and Sensitive species
PFMC.....	Pacific Fishery Management Council
PNW	Pacific Northwest
PSQ.....	Probable Sale Quantity
Q100.....	100 Year Flood Flows
RDI.....	Relative Density Index
RIS.....	Road Investment Strategy
RMO.....	Road Management Objectives
ROD	Record of Decision
ROS	Rate of Spread (Fire and Fuels)
ROS.....	Recreation Opportunity Spectrum
SDI	Stand Density Index
SDImax	Maximum Stand Density Index
SIA	Special Interest Area
SMS	Scenery Management System
TESP.....	Threatened, Endangered, Sensitive, or Proposed
TL.....	Tolerance Level
TMDL.....	Total Maximum Daily Load
USDA	United States Department of Agriculture
USFWS.....	United States Fish and Wildlife Service
VMS.....	Visual Management System
VQO.....	Visual Quality Objective
WCS.....	West Cascades South
WEPP.....	Watershed Erosion Prediction Project model
WMU.....	Wildlife Management Unit
WQRP.....	Water Quality Restoration Plans

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Summary

The Sweet Home Ranger District is proposing to 1) Encourage stand health, vigor, species diversity and structural complexity in the Matrix, Adaptive Management Area (AMA), and Riparian Reserves; 2) Contribute a variety of sustainable forest products to local markets; 3) Increase spatial heterogeneity, including complex early seral habitat, at a landscape scale by mimicking mixed severity fire; 4) Improve fire resiliency and strategically manage hazardous fuels in high risk areas that could adversely affect the integrity of privately owned lands, Late Successional Reserves (LSR), Matrix, AMA, and Riparian Reserve lands; 5) Enhance and create hardwood habitat and diversity.

The proposed project is located off Highway 20, approximately 22 miles east of the town of Sweet Home, Oregon.

Purpose and Need

Encourage stand health, vigor, species diversity and structural complexity in the Matrix, Adaptive Management Area (AMA), and Riparian Reserves.

The Trout Creek project proposes to treat densely stocked, structurally similar stands with a variety of treatments including commercial thinning, gap creation, aggregate retention harvest and skips. These treatments would result in the development of structural complexity and associated biological diversity contributing to overall forest health. There are two categories of stands proposed for treatments to address this objective: managed stands that are about 40-60 years old and fire-origin stands that are about 100-150 years old.

Contribute a variety of sustainable forest products to local markets.

One of the strategic goals of the Forest Service is to provide and sustain benefits to the American people. To accomplish this goal, one of the objectives is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on National Forest System (NFS) lands and to maintain or create processing capacity and infrastructure in local communities. Through implementation of the proposed actions, the Sweet Home Ranger District would contribute approximately 12 million board feet (MMBF) to the local forest products market over a 3 year period (approximately 2-8 MMBF per year).

Increase spatial heterogeneity, including complex early seral habitat, at a landscape scale by mimicking mixed severity fire.

Over the last several decades, fires in the South Santiam Watershed have been actively suppressed. There are private landholdings adjacent to the project area. Most of the existing early seral habitat in the project area resulted from timber harvest rather than from natural disturbances. These lands do not see mixed severity fire or contain all of the attributes of complex early seral habitat that a disturbance such as a mixed-severity fire might create. Harvest in selected areas would be designed to create structural elements similar to those that would be found in high-severity patches created by a mixed-severity fire or other disturbance.

Improve fire resiliency and strategically manage hazardous fuels in high risk areas to reduce the potential for large-scale fires that could adversely affect the integrity of privately owned lands, Late Successional Reserves (LSR), Matrix, AMA, and Riparian Reserve lands.

This project presents an opportunity to address these concerns by reducing the risk of fires spreading within the checkerboard ownership through strategically-placed fuel treatments. The interface of public and private checkerboard ownership adjacent to the Trout Creek project area has resulted in neighboring parcels of land with differing management objectives and fuels loads. Fuel treatments along ridge tops and road corridors would create defensible areas that can be safely and effectively used during fire suppression. Hardwood fuel breaks and the underplanting of fire and drought tolerant species would increase fire resiliency on the landscape in key areas.

Enhance and create hardwood habitat and diversity.

The Sweet Home Ranger District has few large patches of hardwood trees in its conifer dominated landscape. Treatment of alder areas combined with oak and madrone restoration would help maintain hardwood populations in the project area.

Alternatives

Four alternatives were analyzed in this FEIS; a no action alternative (Alternative 1) and three action alternatives (Alternative 2, 3 and 4). The alternatives vary by the amount of treatment and the specific prescriptions to be implemented (Table 1). Alternative 2 is the proposed action and preferred alternative.

Table 1: Comparison of the Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Timber Harvest Treatments					
Thinning outside Riparian Reserves	Acres	0	624	520	603.5
Thinning in Riparian Reserves	Acres	0	109	109	109
Aggregate Retention (early seral creation)	Acres	0	101	0	101
Gaps	Acres	0	35	43	55.5
Skips	Acres	0	489	344	489
Total	Acres	0	1,358	1,016	1,358
Post-Harvest Fuels Treatments in Timber Harvest Units					
Pile and Burn (mechanical and/ or hand treatments)	Acres	0	157	94	157
Post-Harvest Underburn	Acres	0	278	229	278
Road Activities Associated with Harvest					
New Road Construction	Miles	0	1	1	1
Temporary Road Construction	Miles	0	2.1	1.3	2.1
Temporary Road Re-Open	Miles	0	2.3	2.0	2.3
Roads Maintained	Miles	0	48	46	48
Road Decommissioning	Miles	0	6	10	10
Road Storage	Miles	0	31	29	29
Culvert Replacement	Amount	0	260	248	260

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Rock obtained from expanding existing quarries	Cubic Yards	0	20,000	20,000	20,000
Rock obtained from new quarries	Cubic Yards	0	40,000	0	40,000
Acres by Harvest System					
Skyline Harvest	Acres	0	537	429	537
Ground-based Harvest	Acres	0	328	239	328
Harvest Associated (Non-Commercial Treatments) Planting, Snags, and Down Wood					
Planting in Aggregate Retention Harvest	Acres	0	101	0	101
Planting in Gaps	Acres	0	32	43	55.5
Plant/regenerate Huckleberries	Acres	0	14	6	14
Plant Hazel, camas or other plants for tribal use	Acres	0	8	8	8
Plant Tall Bugbane	Acres	0	5	0	5
Underplant hardwoods	Acres	0	237	154	237
Underplant Incense Cedar and/or Western Redcedar (including in the riparian reserves)	Acres	0	303	0	303
Dry Meadow Restoration	Acres	0	2	2	2
Maple Restoration	Acres	0	3	3	3
Fall and Leave in Areas Unsuitable For Logging	Acres	0	3	3	3
Fall and Leave Conifers in Riparian Reserves	Acres	0	9	7	9
Fall and Leave Alder, underplant with Western Red Cedar and Big Leaf Maple in Riparian Reserves	Acres	0	1	1	1
Underplant Oregon Ash and Western Redcedar in Alder Area of Riparian Reserves	Acres	0	1	1	1
Pre-Commercial Thin (including Riparian Reserves) to favor hardwood trees	Acres	0	7	7	7
Create Snags and Down Wood (occurs in Aggregate Retention units)	Snags or Down Trees per Acre	0	At least 7	At least 7	At least 7
Northern Spotted Owl (NSO) Habitat					
NSO Suitable Habitat in Critical Habitat Treated (including skips)	Acres	0	109	0	109
NSO Dispersal Habitat in Critical Habitat Treated	Acres	0	141	141	141
NSO Non- Habitat in Critical Habitat Treated	Acres	0	77	77	77
NSO Suitable Habitat Treated (including skips)	Acres	0	142	0	142
NSO Dispersal Habitat Treated (including skips)	Acres	0	226	226	226
NSO Non-Habitat Treated (including skips)	Acres	0	103	103	103
Key Issues 1, 2, 3 and 4					

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1. Harvest treatments in stands over 80 years of age	Acres	0	647	0	647
2. No Aggregate Retention harvest	Acres	0	101	0	101
3. More early seral creation and larger gap cuts	Acres	0	136	43	156.5
4. Increase harvest intensity for thinning units	MMBF	0	12.7	8.4	15.8

Summary of Environmental Consequences

Table 2: Summary of Direct Environmental Consequences

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forest and Stand Structure	Competition for sunlight, water and nutrients would continue to increase. Health and vigor would decrease, resulting in reduced resiliency to disturbances such as drought. There would be a lack of diversity and high level of competition between trees. In fire-origin units, remnant trees would continue to be shaded out and experience mortality. No acres would be planted with hardwoods or drought tolerant species. The hardwood component in the project area would continue to decline.	Thinning would improve stand health and vigor, as well as create conditions for successful hardwood fuelbreaks and understory hardwood tree planting. Tree planting and gaps would increase tree species diversity of drought-tolerant species and conifer bough species. Gaps would improve structural complexity by releasing dominant trees to develop complex crown structure and initiating a second tree cohort. Skips would improve structural complexity by allowing inter-tree competition to occur at levels that continuously creates snags, which become down wood. Aggregate retention harvest would create complex early seral habitat.	Same as Alternative 2 except no landscape-scale areas would be treated, resulting in zero acres of landscape areas mimicking mixed severity fire. Complex early seral habitat and late seral-open habitat would continue to decline as canopy cover increases in these stands. Thinning would improve stand health and vigor, as well as create conditions for successful hardwood fuelbreaks and understory hardwood tree planting.	Same as Alternative 2
Fire and Fuels	No fuels would be treated in the project area. Plantations would remain at their current stocking levels and short-term impacts to fire danger would be avoided as no resulting slash would be created during harvest operations. Over time, these stands would begin to self-thin either through competition,	Overall, risk from wildfire would be reduced through reduction of fuel densities in strategic areas such as roads corridors and areas adjacent to private lands in stands following post-harvest fuel treatments. Immediately following timber harvest activities an increase in potential fire intensity would exist until fuels treatments are completed.	Same as Alternative 2 except in unit 56, no harvest activities would take place and no mixed severity fire underburning would take place. Risk of fire spread outside the Menagerie wilderness to private timber land would continue to increase.	Same as Alternative 2 except the removal of the additional volume from unit 56 would decrease the amount of residual snags left in the unit and the post burn structural complexity.

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	insect damage, disease, or a combination of environmental factors. Fuel loadings and fire danger would increase as a result of this self-thinning, similar to that following commercial harvest, but without any mitigating fuels treatments.			
Soil Productivity	No effect	Nutrient availability and compaction would remain within the limits outlined in the standard and guidelines of the Forest Plan	Same as Alternative 2	Same as Alternative 2
Water Quality	No effect	Reduction in risk of sedimentation and road failures post-treatment. Benefit to long-term large woody debris and water temperatures. No measurable adverse effects to water quality	Same as Alternative 2	Same as Alternative 2
Rare Plants	No effect	No effect	No effect	No effect
Rare Fungi	No effect	Commercial harvest, burning, gaps, and aggregate retention harvest may impact sensitive fungi individuals or habitat, but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.	Same as Alternative 2 except there would be no effects from aggregate retention harvest as that treatment was eliminated from this Alternative.	Same as Alternative 2
Special Habitats	No effect	No effect	No effect	No effect
Invasive Plants	No effect	The project has a high risk of introducing or spreading known populations of invasive weeds due to harvest activities and temporary road construction.	The project has a low to moderate risk of introducing or spreading known populations of invasive weeds due to harvest activity and temporary road construction.	Same as Alternative 2
Roads	No change in the use pattern of roads or correction of existing road maintenance problems. Brush and tree re-growth and associated reduced visibility, debris on road, and surface irregularities from OHV and other traffic could	The project would reverse declining road conditions on about 48 miles of road. The project would reduce the open road density by 36.8 miles leaving stored and decommissioned roads in a hydrologically stable condition reducing the miles of road	Same as Alternative 2	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	eventually result in unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage associated with localized erosion.	maintenance and reducing the risk of sediment.		
Air Quality	No effect	Effects on air quality from smoke emissions would not exceed state mandated policy.	Same as Alternative 2	Same as Alternative 2
Heritage	No effect	There are no effects to heritage resources. Any new or existing heritage sites would be avoided and protected. See Appendix A for consistency and compliance with heritage direction.	Same as Alternative 2	Same as Alternative 2
Recreation	No effect. No road maintenance activities would take place in the project area and could negatively impact access and dispersed recreation opportunities.	Short-term noise, dust or smoke disturbances from logging and fuels activities. Access to wilderness and trailheads would remain open. Road maintenance due to harvest activity may benefit conditions for scenic driving and dispersed recreation opportunities.	Same as Alternative 2	Same as Alternative 2
Economics	No contribution to local economy or forest sector jobs would occur. If not replaced by another project, Alternative 1 could contribute to a continued decline in forestry and milling related jobs.	Approximately 12.7 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.	Approximately 8.4 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.	Approximately 15.8 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.
Inventoried Roadless Area	No effect	No effect	No effect	No effect
Wilderness (Untrammelled Character)	No effect	No effect	No effect	No effect
Wilderness (Natural Character)	No effect	No effect to rare botanical species. High risk of indirect long term adverse effects from invasive botanical	Same as Alternative 2. Indirect beneficial long term effect to biodiversity, but less than Alternative 2 or 4.	Same as Alternative 2. Indirect beneficial long term effect to biodiversity, but less than Alternative 2.

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		species. Direct short term noise disturbance effects possible to the northern spotted owl and peregrine falcon. Indirect long term habitat disturbance effects possible to the northern spotted owl. Direct beneficial long term effects to aquatic organism passage. No effect to in stream large wood. Indirect beneficial long term effect to biodiversity.		
Wilderness (Undeveloped Character)	No effect	No effect	No effect	No effect
Wilderness (Solitude or Primitive Character)	No effect	Direct medium to long term adverse effects resulting from visible human activity. Direct medium term (about 5 years) adverse effects resulting from sounds of human activity. No effect to recreational access.	Same as Alternative 2	Same as Alternative 2
Wild and Scenic Rivers	No effect	There are no effects to ORVs, water quality, or the free flowing status of the South Santiam River; and therefore, no effects to its continued eligibility for inclusion in the national Wild and Scenic Rivers system.	Same as Alternative 2	Same as Alternative 2
Northern Spotted Owl (Threatened and Management Indicator Species)	No effect	Likely to Adversely Affect due to suitable habitat removal.	May Affect, Not Likely to Adversely Affect due to removal of dispersal habitat.	Likely to Adversely Affect due to suitable and removal of dispersal habitat.
Northern Spotted Owl (Critical Habitat)	No effect	Likely to Adversely Affect due to suitable and dispersal habitat removal within designated critical habitat subunit WCS3.	May Affect, Not Likely to Adversely Affect due to removal of dispersal habitat.	Same as Alternative 2
American Peregrine Falcon (R6 Sensitive and Management Indicator Species)	No effect	May impact individuals due to harvest activities proposed in peregrine habitat/management zones. However, activities would not likely result in a loss of viability in the planning area, nor cause a trend toward federal listing.	Same as Alternative 2	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Harlequin Duck (R6 Sensitive)	No effect	No effect with seasonal restrictions applied	Same as Alternative 2.	Same as Alternative 2.
Lewis Woodpecker (R6 Sensitive)	No effect	May adversely impact individuals due to treatments proposed in managed and natural stands with potential foraging habitat. Harvest would degrade habitat by reducing future snags. Prescribed burning would likely provide some benefit to this species by creating snags and open areas that would attract insects that this species would forage on. Treatments would not likely result in a loss of viability in the planning area.	May adversely impact individuals due to harvest proposed in managed stands with potential marginal foraging habitat. Treatments would not likely result in a loss of viability in the planning area.	Same as Alternative 2
Fringed Myotis and Townsend's Big-eared Bat (R6 Sensitive)	No effect	May adversely impact individuals due to the removal of potential foraging and roosting habitat, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.	Same as Alternative 2
Johnson's Hairstreak (R6 Sensitive)	No effect	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing. A negligible amount of western hemlock habitat would be affected by proposed project activities. In addition, the project area is considered low-quality habitat.	No effect. Harvest is proposed on young managed stands under 80 years old. The chances of these younger stands having any dwarf mistletoe are very low.	Same as Alternative 2
Sierra Nevada Red Fox (R6 Sensitive)	No effect	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing. A negligible amount of the species potential habitat would be affected and some proposed treatments may be beneficial.	Same as Alternative 2	Same as Alternative 2
Crater Lake Tightcoil (R6 Sensitive and Survey and	No effect	Protection buffers would be placed around perennial wetland areas. Therefore, no impacts	Same as Alternative 2	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Manage Species)		are expected to occur to this species.		
Oregon Megomphix (Survey and Manage Species)	No effect	A one acre no-harvest buffer has been placed around sites in units 170 and 190 following management recommendations. Therefore, no impacts are expected to occur to this species.	A one acre no-harvest buffer has been placed around sites in unit 170 following management recommendations. Therefore, no impacts are expected to occur to this species.	Same as Alternative 2
Red Tree Vole (Survey and Manage Species)	No effect	Proposed activities are expected to occur outside of known red tree vole active sites and such proposed activities may impact individuals of the population by reducing canopy cover, connectivity and canopy complexity. In the active red tree vole areas, dispersal would be difficult and suitable habitat would be restricted to riparian and suitable habitat corridors until the area recovers to mature stand conditions. Therefore, the proposed project may impact individuals or their habitat temporarily, but the actions would maintain species persistence and viability. There are no other reasonably foreseeable or ongoing projects that would impact red tree voles or their habitat.	Same as Alternative 2	Same as Alternative 2
Great Gray Owl (Survey and Manage Species)	No effect	There are no known great grey owl nest sites in the project area. This alternative proposes 101 acres of early seral creation and 35 acres of gaps which may enhance opportunities for great grey owl foraging. The proposed actions would maintain species persistence and viability.	There are no known great grey owl nest sites in the project area. This alternative proposes 43 acres of gaps which may enhance opportunities for great grey owl foraging. The proposed actions would maintain species persistence and viability.	There are no known great grey owl nest sites in the project area. This alternative proposes 101 acres of early seral creation and 55 acres of gaps which may enhance opportunities for great grey owl foraging. The proposed actions would maintain species persistence and viability.
Cavity Excavators (Management Indicator Species)	No effect	Snag abundance may initially decline on 1,359 acres but may increase with post-harvest mitigation and enhancement. This	Snag abundance may initially decline on 1,016 acres but may increase with post-harvest mitigation and enhancement.	Same as Alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		alternative would degrade 218 acres, or less than 1%, of this habitat in the Trout Creek project area.		
Elk and Deer (Management Indicator Species)	No effect	Regeneration harvest and small gaps may increase elk forage quality from “poor” to “higher-marginal” for about 20 years on approximately 127 acres. Thinning would improve forage on approximately 733 acres.	Small gaps should increase elk forage quality from “poor” to “higher-marginal” for about 20 years on approximately 43 acres. Thinning would improve forage on approximately 629 acres.	Regeneration harvest and small gaps should increase elk forage quality from “poor” to “higher-marginal” for about 20 years on approximately 156 acres. Thinning would improve forage on approximately 712 acres.
Spring Chinook Salmon -- Upper Willamette River (UWR)	No effect	Likely to Adversely Affect (LAA)	Same as Alternative 2	Same as Alternative 2
Critical Habitat – UWR Spring Chinook Salmon	No effect	Likely to Adversely Affect (LAA)	Same as Alternative 2	Same as Alternative 2
Essential Fish Habitat – Chinook Salmon	No effect	May Adversely Affect	Same as Alternative 2	Same as Alternative 2
Winter Steelhead – Upper Willamette River (UWR)	No effect	Likely to Adversely Affect (LAA)	Same as Alternative 2	Same as Alternative 2
Critical Habitat – UWR Winter Steelhead	No effect	Likely to Adversely Affect (LAA)	Same as Alternative 2	Same as Alternative 2

Chapter 1 – Purpose and Need

1.01 Introduction

The Sweet Home Ranger District is proposing to use a combination of non-commercial treatments and commercial timber sales to encourage forest health, species diversity and structural complexity. These actions would contribute a variety of sustainable forest products to local markets and increase spatial heterogeneity, including complex early seral habitat at a landscape scale by mimicking mixed severity fire. These treatments would also improve fire resiliency and strategically manage hazardous fuels in high risk areas that could adversely affect the integrity of privately owned lands and National Forest System (NFS) lands. Additionally, the proposed commercial and non-commercial treatments would enhance hardwood habitat and diversity. Treatments would occur on about 1,670 acres on the Willamette National Forest.

The project area encompasses approximately 37,344 acres, including 29,142 acres of NFS lands and 8,202 acres of private lands, and is located roughly 22 miles east of Sweet Home, Oregon in Linn County (Figure 1). Highway 20 snakes through the center of the project area and units are located both on the north and south side of the highway (Figure 2). The project is located primarily in the South Santiam 5th field watershed and contains portions of the Bear Creek-Middle Santiam, Soda Fork, Moose Creek, Trout Creek, and Lower Canyon Creek 6th field watersheds (Figure 3). The legal description of the area is T12S, R4E, Section 34, T13S, R3E, Sections 11-15, 22-27, 34-36, T13S, R4E, Sections 2-11, 14-36, T14S, R3E, Sections 1-3, 12. T14S, R4E, Sections 1-20.

The project area is composed mostly of a Douglas-fir and western hemlock overstory with an understory shrub component of vine maple, dwarf Oregon grape, sword fern and Pacific rhododendron. Many of the forested stands in the project area are overstocked from a silvicultural perspective. Additionally, the project area includes a portion of the Menagerie Wilderness, is bisected by the South Santiam River and is in close proximity to a large swath of private land. This interface of public and private ownership has resulted in neighboring parcels of land with differing management objectives, forest structure, and fuels loads.

Fire has historically been the dominant natural disturbance in the project area. There is evidence that the project area was historically subject to mixed severity fire disturbance with a frequency of 50 to 200 years depending on topography. High severity-stand replacing fire would occur less frequently. Most of the fire-origin stands in the project area originated from a stand-replacing fire that burned in the late 1800s. Records indicate 65 naturally occurring (lightning strike) fires in the South Santiam watershed from 1970-2013. Given the close proximity to private timber lands, all fires were suppressed with the average fire being 0.7 acres in size. Timber harvest, including thinning, partial cut, and regeneration harvest has been the dominant disturbance in the project area since the 1950s.

The Trout Creek project area is a popular destination for a wide range of both developed and dispersed recreation activities. The most popular activities include camping, hiking, hunting, fishing, whitewater boating, rock climbing, and scenic driving. There is also limited equestrian and winter recreation use.

There is a small network of official and user created trails accessing the Menagerie Wilderness and the area is popular with day-use hikers and rock climbers. Several developed campgrounds sit adjacent to Highway 20 that provide access to the South Santiam River. Scenic views of the South Santiam River and

the adjacent forest are a significant recreational attraction. The South Santiam River runs through the project area and is designated as eligible for inclusion in the National Wild and Scenic River System.

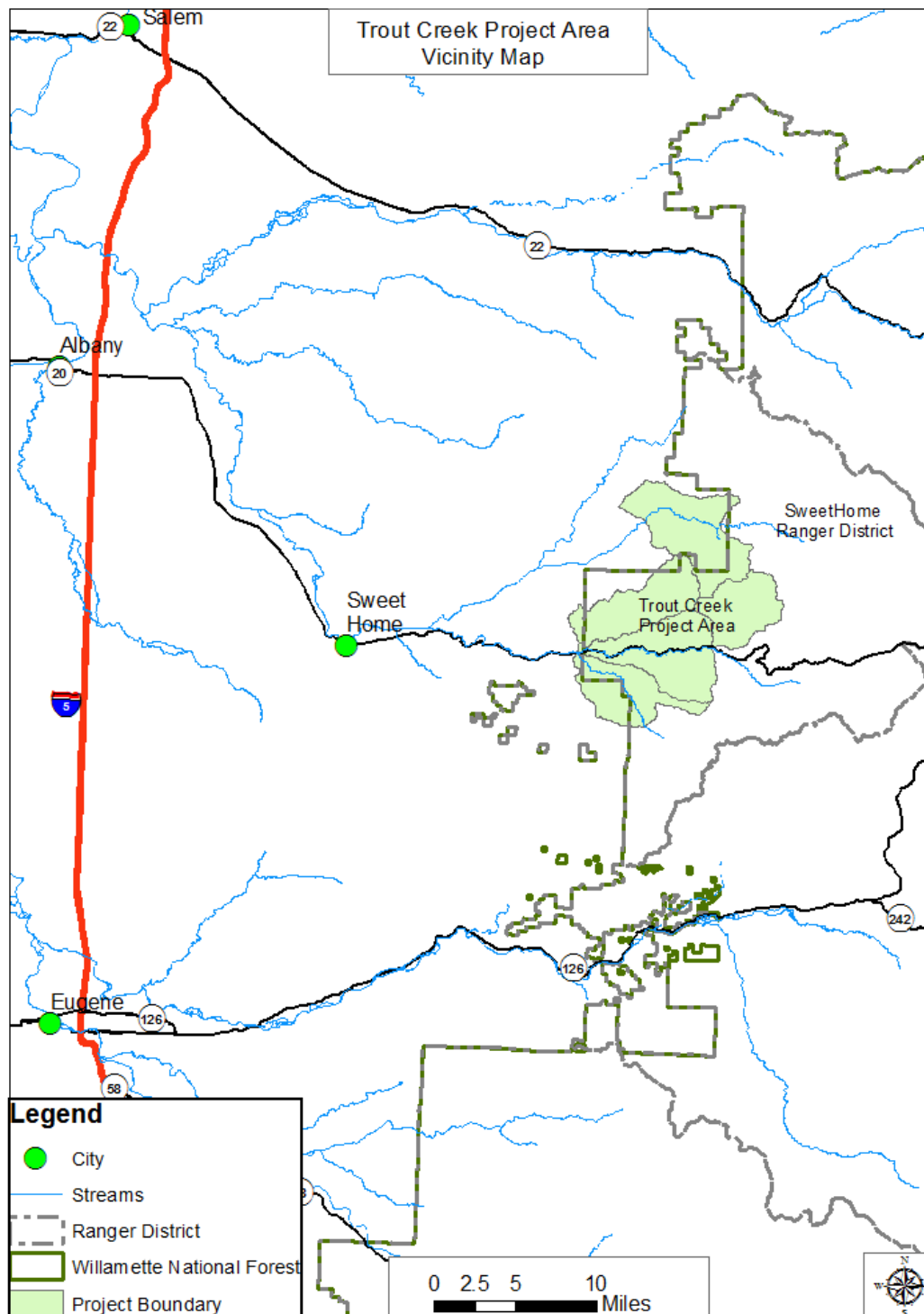


Figure 1: Trout Creek Vicinity Map

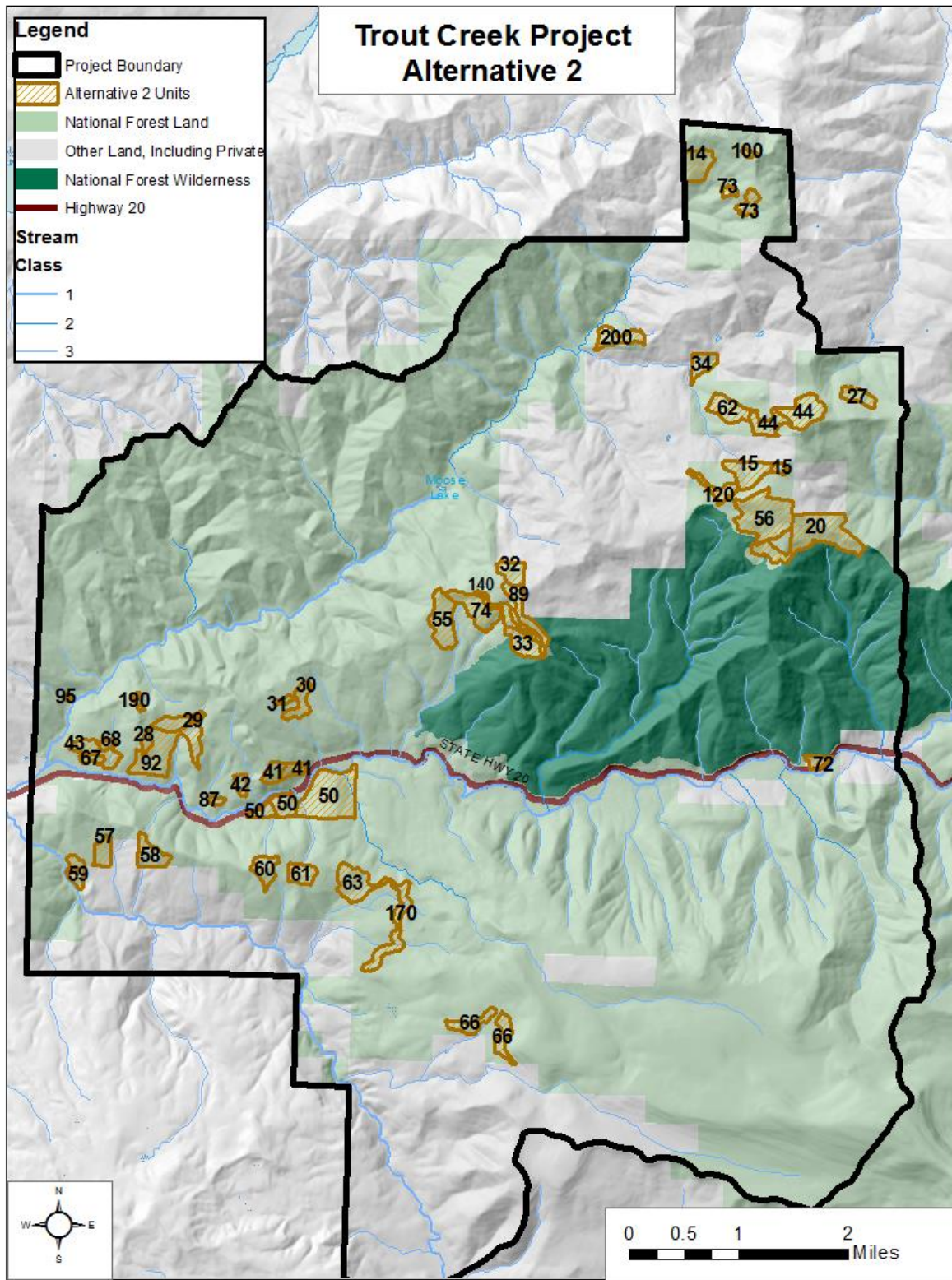


Figure 2: Map of the Proposed Action in the Trout Creek Project Area

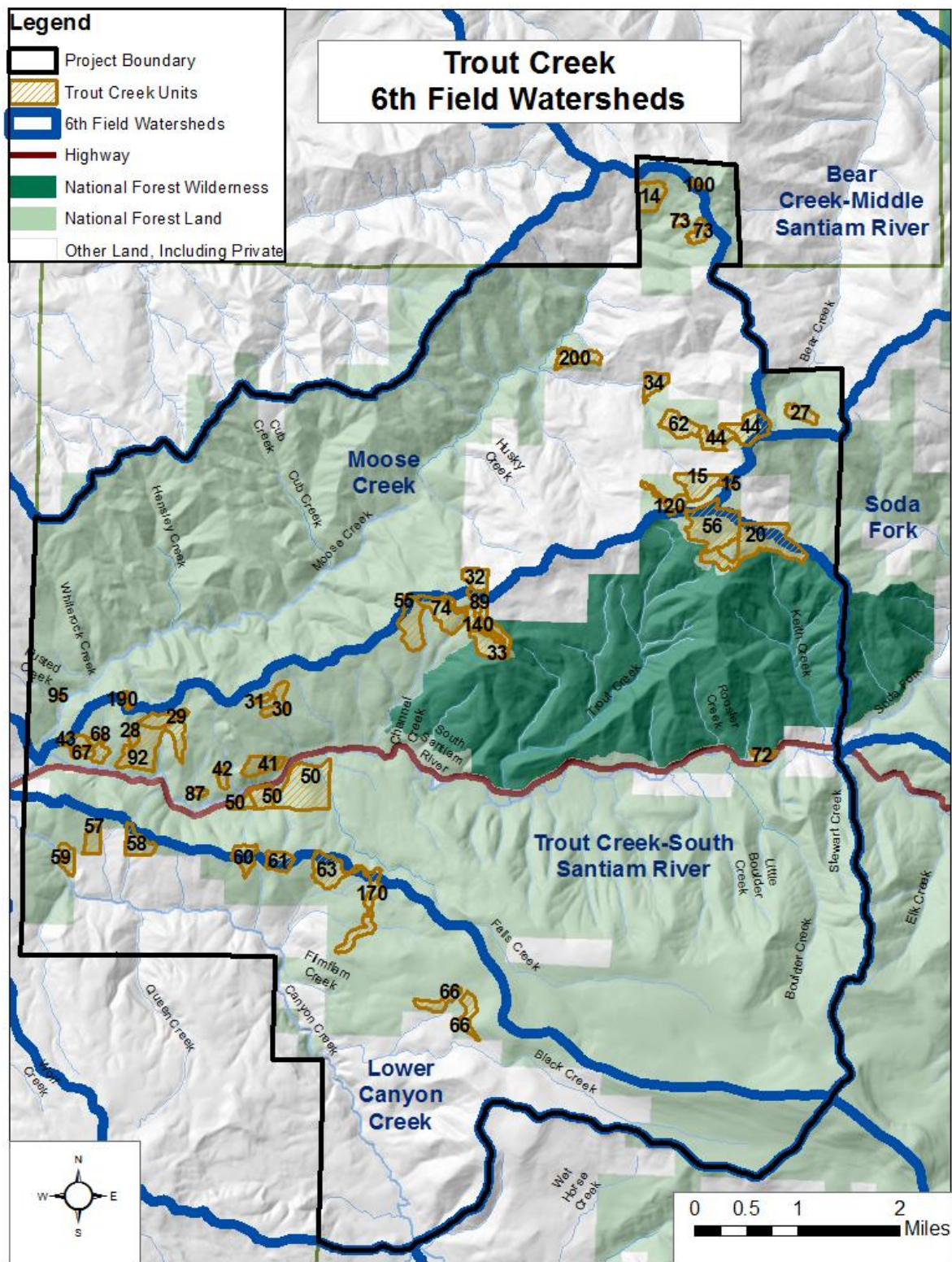


Figure 3: 6th field watersheds in the Trout Creek project area

1.02 Forest Plan and Management Direction

This Final Environmental Impact Statement (FEIS) is tiered to the following environmental impact statements and plans, which are incorporated by reference:

- The Willamette National Forest Land and Resource Management Plan Final Environmental Impact Statement, as amended (USDA Forest Service, 1990; referred to as the “Forest Plan” or “LRMP”).
- The Forest Plan, as amended by the Northwest Forest Plan and Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species with the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management, 1994a; referred to as the “Northwest Forest Plan”).
- The Forest Plan as amended by the 2001 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 Final Environmental Impact Statement and Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service, 2005).

The Forest Plan “guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resources management” (Forest Plan, I-1). The Forest Plan provides management direction through the designation of specific management areas and standards and guidelines specific to these designations.

The Forest Plan was amended by the Northwest Forest Plan (1994), which established additional management areas, standards, and guidelines associated with Matrix, Riparian Reserves, Adaptive Management Areas, and Late-Successional Reserves. When there is overlap of management areas, the more restrictive standards and guidelines apply (Northwest Forest Plan, 1994a, p. A-6). Figure 4 and Figure 5 illustrate the Forest Plan and Northwest Forest Plan management areas. Table 3 displays Forest Plan management areas, Northwest Forest Plan land management areas and acres of each within the project area.

The following management direction is relevant to management allocations with proposed treatments in the project area.

Forest Plan

Special Interest Areas (5a) within the project area include the Shelter Falls, Camas Prairie, Santiam Wagon Road, and Cougar Rock Special Interest Areas (SIA). Treatments are proposed within the Cougar Rock SIA and adjacent to the Camas Prairie SIA. The purpose of Special Interest Area is to preserve lands that contain exceptional scenic, cultural, biological, geological, or other unusual characteristics. Timber management may not be implemented for the purpose of programmed harvests, but it may be implemented for treatments that maintain or enhance the values identified in the Implementation Guides for these areas.

Wildlife Habitat-Special Areas (9d) are areas allocated with the goal of protecting or enhancing unique wildlife habitats and botanical sites which are important components of healthy, biologically diverse ecosystems. Timber management may not be implemented for the purpose of programmed harvests, but it may be implemented for treatments if necessary to meet established wildlife objectives.

Semiprimitive Nonmotorized (10e) are areas characterized by predominately or natural appearing environment of moderate to large size. The interaction between users is low and the area is managed with minimum on-site control and limited to signage, sanitary and safety needs. There is the high probability of experiencing solitude, closeness to nature, tranquility, challenge and risk. Access and travel is non-motorized. Vegetative alterations would be small and widely dispersed.

Dispersed Recreation- Lakeside habitats (10f) this management area provides of the management of forest lakeside areas for their wildlife habitat and scenic values.

Scenic-Modification Middleground (11a) are areas have the goal to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a modest level of scenic quality. These areas are also managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic-Partial Retention Middleground (11c) are areas that have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a moderate level of scenic quality. This area would also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic-Partial Retention Foreground (11d) are areas that have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a moderate level of scenic quality. This area would also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic Retention Foreground (11f) are areas that have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a high level of scenic quality. This area would also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

General Forest (14a) consists of areas outside of other Land Management Allocation categories where most of the timber treatments occur to produce an optimum and sustainable yield of timber production that is compatible with multiple use objectives.

Riparian Areas (15) this management area applies to rivers, streams, small wetlands, lakes and the adjacent riparian areas. The emphasis in this area is to maintain the role and function of riparian areas in the overall landscape ecology.

Northwest Forest Plan

General Forest-Matrix Lands (MA 14a) consist of areas outside of other Northwest Forest Plan land allocation categories where most of the timber treatments occur to produce an optimum and sustainable yield of timber production that is compatible with multiple use objectives.

Riparian Reserves (MA 15) are areas where the conservation of aquatic and riparian-dependent, terrestrial resources receives primary emphasis. In these areas all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas are included and managed for the purpose of protecting the health of the aquatic system and its dependent species.

Late Successional Reserves (MA 16A and 16B) are managed to protect and enhance conditions of late-successional and old-growth forest ecosystems. The purpose of silvicultural treatments is to benefit the creations and maintenance of late-successional forest conditions.

Adaptive Management Areas (MA 17) are areas designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives.

Table 3: Land Management Allocations within the Trout Creek project area

1990 Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres
Wilderness (1)		4,319
Special Interest Areas (5a)	Administratively Withdrawn	46
Special Interest Areas (5a)	Late Successional Reserve (16a/16b)	114
Special Interest Areas (5a)	Adaptive Management Area (17)	126
Wildlife Habitat- Marten (9c)	Administratively Withdrawn	58
Wildlife Habitat – Marten (9c)	Adaptive Management Area (17)	112
Wildlife Habitat – Special Areas (9d)	Late Successional Reserve (16a/16b)	524
Semiprimitive Nonmotorized-(MA 10e)	Late Successional Reserve (16a/16b)	638
Dispersed Recreation – Lakeside Setting (10f)	Adaptive Management Area (17)	115
Scenic Modification Middleground (11a)	Late Successional Reserve (16a/16b)	4,214
Scenic Modification Middleground (11a)	Adaptive Management Area (17)	749
Scenic Partial Retention Middleground (11c)	Late Successional Reserve (16a/16b)	608
Scenic Retention Middleground (11d)	Late Successional Reserve (16A/16b)	171
Scenic Retention Middleground (11d)	Adaptive Management Area (17)	364
Scenic Retention Foreground (11f)	Late Successional Reserve (16a/16b)	852
Scenic Retention Foreground (11f)	Adaptive Management Area (17)	3,665
General Forest (14a)	Late Successional Reserve (16a/16b)	1,979
General Forest (14a)	Adaptive Management Area (17)	8,712
General Forest (14a)	Matrix (14a)	1,749
Riparian Areas (15)	Riparian Reserves (15)	16,431
Critical Habitat		16,520
Inventoried Roadless Areas		10,054
Private Land (not a land allocation)		8,202
Total*		37,344

*Does not include Riparian Reserves or Critical Habitat which overlay other allocations. Does not include Proposed Wild and Scenic Corridor (approximately 15 river miles in the project area). Refer to Section 3.13, Proposed Wild and Scenic River in Chapter 3 for further analysis. Refer to the 1990 Forest Plan. FEIS, LRMP, Appendix E (E-66) for information concerning The Proposed Wild and Scenic designation of Segment 3 of the South Santiam River.

The Proposed Action includes about 1,670 acres (4% of the project area) of commercial timber harvest treatments and non-commercial treatments with associated design features on NFS lands within the Trout Creek project area. A detailed description of proposed treatments for each unit is located in the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District. Table 4 summarizes the acres of proposed commercial timber harvest and non-commercial treatments by land management allocation. No treatments are proposed within Wilderness or Inventoried Roadless Areas.

Table 4: Acres of proposed commercial timber harvest treatments and non-commercial treatments by Management Area (MA)

Forest Plan MA	Northwest Forest Plan MA	CTH	NCT	Total
Special Interest Areas (5a)	Adaptive Management Area (17)	4	0	4
Scenic Modification Middleground (11a)	Adaptive Management Area (17)	115	3	118
Scenic Retention Middleground (11d)	Adaptive Management Area (17)	83	0	83
Scenic Retention Foreground (11f)	Late Successional Reserve (16a/16b)	14	7	21
Scenic Retention Foreground (11f)	Adaptive Management Area (17)	363	247	610
General Forest (14a)	Adaptive Management Area (17)	216	79	295
General Forest (14a)	Matrix (14a)	522	17	539
Riparian Areas (15)	Riparian Reserves (15)	109	0	73
Critical Habitat		471	2	473
Total*		1,317	352	1,670

CTH = commercial timber harvest; NCT = non-commercial treatments

*Does not include Riparian Reserves or Critical Habitat which overlay other allocations

Roads Analysis

In 2015, to comply with Subpart A of the Travel Management Rule (66 Fed. Reg. 3206 (2001); 36 C.F.R. part 212), the Willamette National Forest analyzed the benefits, risks and costs of the entire road system, incorporated stakeholder input and developed a Travel Analysis Report (TAR). This analysis is called the “Willamette National Forest Road Investment Strategy” (RIS, 2015) and provides recommendations that should be implemented in order to protect resources, provide reliable access for administrative and public use, and reduce fiscal costs over the long term. Another obligation of the rule is to identify the minimum road system needed for safe and efficient travel and for the protection, management, and use of National Forest system lands. National and regional direction instructs Forests to complete this next step through NEPA analysis and also further analyze the [RIS] recommendations at the project level and incorporate into decisions. Please refer to Appendix D for more detailed information concerning the Road Investment Strategy and anticipated road activities in this project area.”

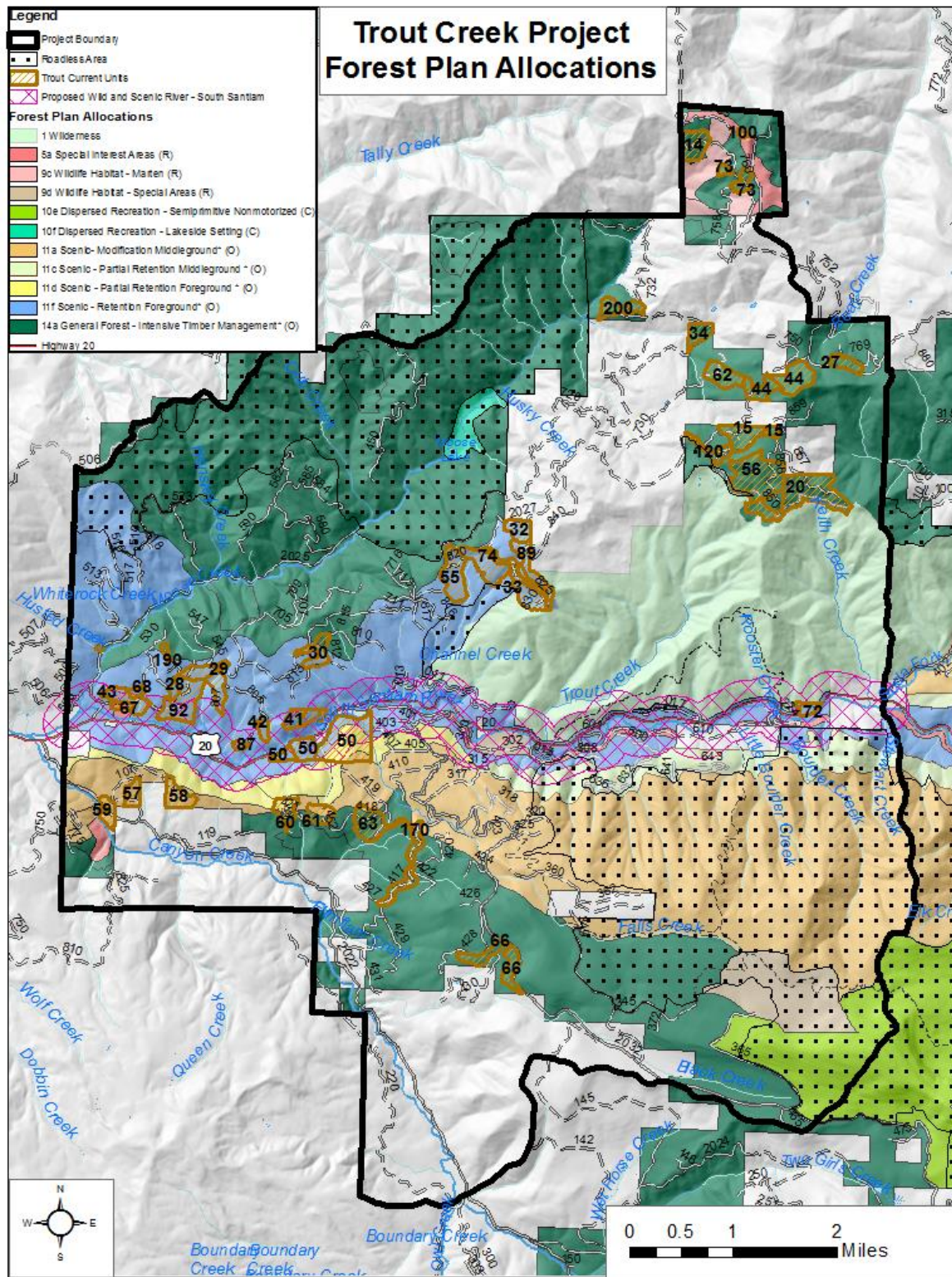


Figure 4: Willamette National Forest Plan management allocations in the Trout Creek Project area

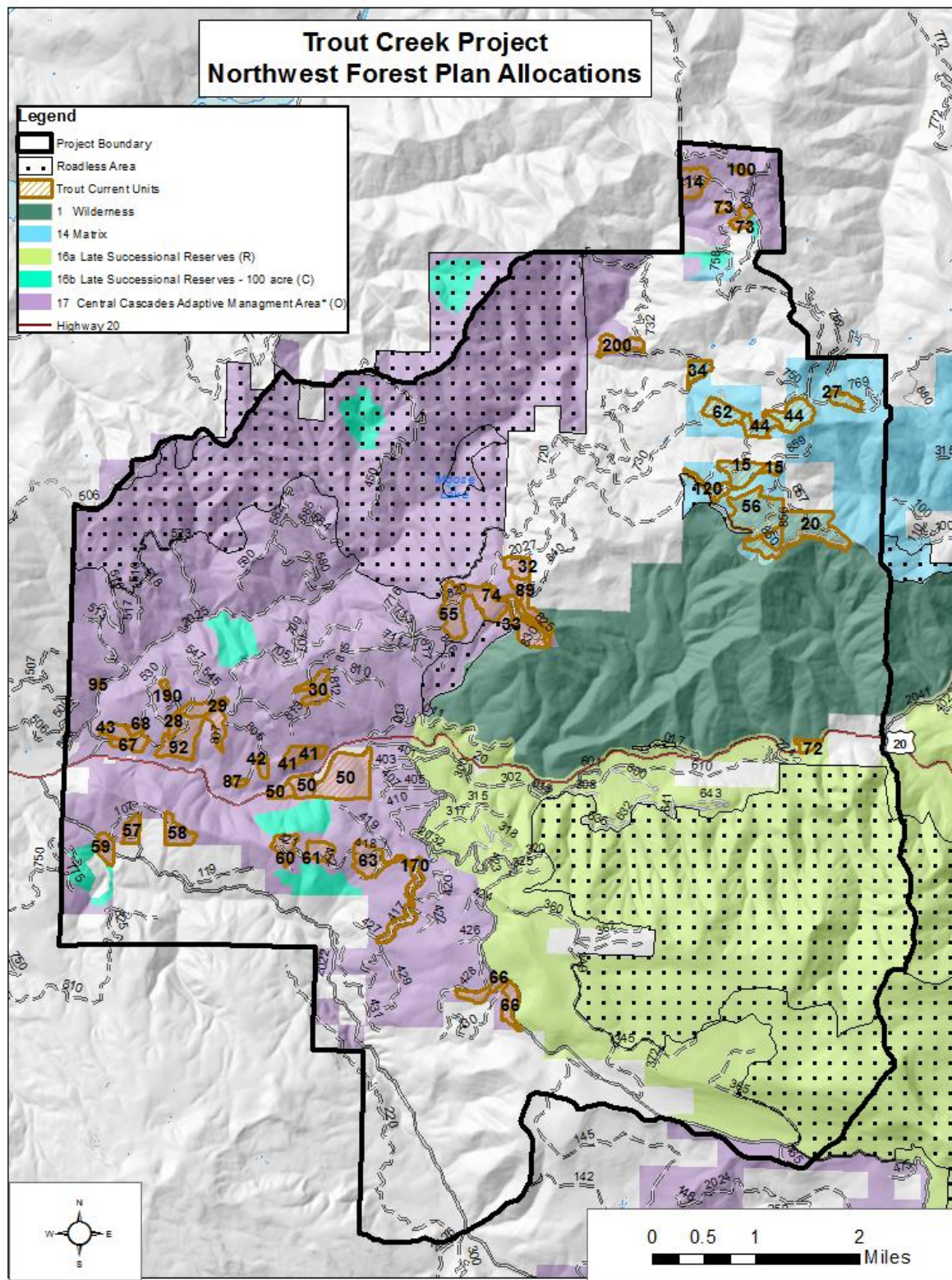


Figure 5: Northwest Forest Plan management allocation in the Trout Creek project area

1.03 Purpose and Need for Action

1. Encourage stand health, vigor, species diversity and structural complexity in the Matrix, Adaptive Management Area (AMA), and Riparian Reserves.

Existing Condition: There are two categories of stands proposed for treatments to address this objective: plantations or managed stands that are about 40-60 years old and fire-origin stands that are about 100-150 years old.

The 40-60 year old, plantations proposed for treatment with this project are typically densely-stocked with limited understory development and structural complexity. Figure 6 shows unit 28, a 40-60 year old over stocked managed stand with a single layer canopy and limited understory development. These plantations are located in Matrix, Matrix-Scenic, Adaptive Management Area (AMA) and Riparian Reserve management allocations.



Figure 6: Unit 28

The fire-origin stands proposed for treatment are generally between 100 and 150 years old and are located in Matrix, Matrix-Scenic and AMA. Many of these stands have received light thinning treatments in the past, when they were about 80-90 years old. These treatments removed some intermediate and suppressed trees, but did little to reduce competition in the overstory or increase structural complexity.

Why Consider Taking Action: The 40-60 year old plantations are considered to be in the stem-exclusion stage of development (Oliver and Larson, 1990). As inter-tree competition for light, water, and nutrients increases, growth rates slow and the stands become less vigorous and more susceptible to insects, diseases, and drought.

Despite some of the older fire-origin stands receiving previous thinning treatments, many are densely stocked with limited structural complexity and low tree species diversity. Due to the level of competition and lack of species diversity, they are highly susceptible to insects and disease, as well as drought. Structural complexity in many stands is lacking due to an absence of abundant gaps, dead wood, secondary canopy layers, and dominant trees with full crowns and large branches.

There are some fire-origin stands proposed for non-commercial diversity under-planting of trees. The conditions in these stands are variable, but generally some received a moderate thin at about 80-90 years of age. These stands have developed a limited secondary canopy layer, consisting primarily of western hemlock and occasionally bigleaf maple. Due to the lack of species diversity they are also susceptible to insects, disease and drought. In the fire-origin stands proposed for harvest and under-planting, the plantings would take place after all harvest activities have been complete. These fire-origin stands are located in Matrix, Adaptive Management Area and Riparian Reserve management allocations.

Desired Condition: The desired condition for the 40-60 year old plantations, as stated in the Willamette National Forest Plan, is: “Young stands would be managed to maintain vigor and growth” using various stand treatments such as “pre-commercial and commercial thinning and protection from insects, diseases, and damage” (Forest Plan, MA14a Desired Future Condition, p. IV-227). “Stands of various conifer species would predominate depending on growing sites; although the natural variety of hardwoods, shrubs, and forbs will continue to be components of the ecosystem with fluctuations occurring as stands progress through the seral stages.” (Forest Plan, MA14a Desired Future Condition, p. IV-227).



Figure 7: A recent commercial thinning unit in a different project area

Stands would retain moderate levels of ecologically-valuable structural components such as snags, logs and relatively large green trees and increase ecological diversity by providing early-successional habitat (Northwest Forest Plan, pp. B-5 and B-6). The young, uniform stands can be diversified by early thinning (DeBell et al., 1997; Hayes et al., 1997). Early commercial thinning has been shown to be beneficial to the future development of understories, the promotion of natural regeneration, and in enhancing biodiversity (Muir et al., 2002). Structural complexity and biological diversity would be enhanced in dense, even-aged, single-storied stands. Figure 7 shows an example of a recent commercial thinning unit in a different project on the Willamette National Forest.

The desired condition of the stands in the 100-150 year old age range is decreased competition of overstory trees, increased structural complexity, and increased species diversity. One goal of the Northwest Forest Plan is to maintain biological diversity associated with native species and ecosystems (Northwest Forest Plan, p. B-1). Treatments in these stands would result in the development of structural complexity and associated biological diversity through gap creation, dominant-tree-release gaps, and the planting of another tree cohort focusing on drought- and fire-tolerant tree species. No-harvest skips would provide areas where future snags would occur due to competition, primarily in Riparian Reserves. This would be achieved primarily through variable density thinning with some aggregate retention harvest.

2. Contribute a variety of sustainable forest products to local markets.

Existing Condition: Commercial timber products such as sawlogs are an important component of the local and regional economy. In recent years, the sale target of the Willamette National Forest has been 70 to 80 MMBF. The majority of timber sales are purchased and harvested by mills or timber companies within a 50 mile radius of the Willamette National Forest.

Why Consider Taking Action: Several laws direct and allow the Forest Service to provide the sustainable harvest of trees from the Nation's forests including Multiple-Use Sustained-Yield Act of 1960 and the National Forest Management Act of 1976. One of the strategic goals of the Forest Service is to provide and sustain benefits to the people of the United States and the world. To accomplish this goal, one of the objectives is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on NFS lands and to maintain or create processing capacity and infrastructure in local communities ([USDA Strategic Plan FY 2014-2018](#)). Additionally, the Willamette National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan, includes goals to produce an optimum and sustainable yield of timber that helps maintain the stability of local and regional economies, and contribute valuable resources to the national economy on a predictable and long-term basis.

Probable Sale Quantity (PSQ) is an estimate of probable harvest levels that could be maintained on a forest annually (Northwest Forest Plan, 1994). PSQs represent neither minimum levels that must be met nor maximum levels that cannot be exceeded. Rather, PSQs represent the best assessment of the average annual amount of timber harvest that could occur on a forest without decline, over the long term, if the schedule of harvests and regeneration are followed (Northwest Forest Plan, 1994). PSQ can vary and change over time depending on acres available for harvest, expected acre yields and Forest direction.

Desired Condition: Through implementation of the proposed actions, the Sweet Home Ranger District would contribute approximately 12 MMBF to the Willamette National Forest PSQ target over a 3 year period (approximately 2-8 MMBF per year).

3. Increase spatial heterogeneity, including complex early seral habitat, at a landscape scale by mimicking mixed severity fire.

Existing Condition: Since 1970 there have been 65 lightning fires in the South Santiam watershed (an average of about 1.5 per year). Those fires were all suppressed, with the average fire being 0.7 acres in size. In that timespan, 47 acres total burned. While not all of those lightning fires would have become larger fire events, some likely would have without suppression. Historically in the central west Cascades, the most common disturbance to create spatial heterogeneity was mixed-severity fire (Tepley, 2013). Historic mixed severity fire burned at a scale of hundreds to thousands of acres (Morrison and Swanson, 1990; Cissel et al., 1998). Mixed severity fires have been suppressed in the last 50 to 100 years due to a multitude of resources-at-risk on the Sweet Home Ranger District as well as to protect adjacent private land.

A 2012 Gradient Nearest Neighbor analysis of all ownerships shows that about 5% of the South Santiam fifth-field watershed is quality early seral habitat. This includes private land. Most of the existing early seral habitat in the project area resulted from timber harvest rather than from natural disturbances. Early seral habitat exists on the landscape, but on land that is intensively managed as industrial forestland. These lands do not see mixed severity fire or contain all of the attributes of complex early seral habitat that a disturbance such as a mixed-severity fire might create.

Why Consider Taking Action: One goal of the Northwest Forest Plan is to maintain biological diversity associated with native species and ecosystems (Northwest Forest Plan, p. B-1). Within Matrix management areas, ecological diversity can be improved through providing high-quality, long-lasting, and more diverse early-successional habitat (Northwest Forest Plan, p. B-2).

In the absence of fire suppression, more than 47 acres would have burned since 1970 in the Trout Creek area, creating more of a mosaic across the landscape. Mixed severity fires contribute to habitat creation and variety on the landscape, from high severity patches where most trees are killed to low severity patches where few trees are killed. Due to fire suppression, this landscape-scale disturbance is becoming rare, resulting in a loss of larger-scale spatial heterogeneity (Tepley, 2013). In particular, high severity patches of mixed severity fire would leave behind complex early seral habitat. Within the project area there is a lack of diversity in early seral habitats such as legacy trees (large, stand dominating trees), snags, down wood, shrubs, grasses, and herbs.

Desired Condition: The desired condition is a landscape with a variety of habitats ranging from very open areas with herb and grass cover; to shrub-covered openings; to open areas with low tree densities that provide structural components such as legacy trees, snags and down wood; to areas with moderate amounts of legacy trees, snags, and down wood; to areas with very little disturbance. It is also desirable to operate as close to the scale of a mixed severity fire event as possible (at least hundreds of acres).

According to Swanson et al. (2011) attributes of complex early seral habitat include:

- Greater variety of environmental conditions (light, temperature and moisture).
- Increased diversity of surviving organisms in the soil (also including organic matter, seeds, rootstock, etc.)
- Structural complexity (surviving live trees, snags, downed wood, perennial shrubs, annual forbs).
- Spatial heterogeneity (for example, a wildfire burns at different intensities, resulting in different levels of surviving trees from no survivors to many survivors).

To increase spatial heterogeneity, the desire is to not only design treatments that create complex early seral habitat similar to that described by Swanson et al. (2011), but to also move the proportion of

complex early seral habitat in the watershed to within the range of natural conditions. LANDFIRE Bio-Physical Setting (BpS) models provide an estimate of landscape forest structure that occurred historically based on the vegetation and disturbance regime that existed prior to European settlement (LANDFIRE, 2009). In the South Santiam fifth-field watershed, analysis of LANDFIRE BpS models shows that the historic average of complex early seral habitat was 8% (compared to the existing condition of 5%, of which most is non-complex early seral habitat on intensively managed land). Complex early seral habitat is important to many animals (such as elk, small mammals, and their associated predators), birds (such as woodpeckers and bluebirds), and insects (especially butterflies and moths) that benefit from the combination of diverse plant communities and surviving structures characteristic of this habitat (Swanson et al., 2011).

Figure 8 shows unit 56, a 100-150 year-old fire origin unit in the Matrix that is in close proximity to the Menagerie Wilderness. The current proposal would retain over half of the unit in no-harvest skips to mimic a low-severity/unburned patch. Treated areas would be commercially thinned, followed by a prescribed underburn, and snag creation to mimic a high-severity fire patch.



Figure 8: Unit 56, a fire origin unit

4. Improve fire resiliency and strategically manage hazardous fuels in high risk areas to reduce the potential for large-scale fires that could adversely affect the integrity of privately owned lands, Late Successional Reserves (LSR), Matrix, AMA, and Riparian Reserve lands.

Existing Condition: The Trout Creek project area is directly adjacent to private lands and contains portions of the Menagerie Wilderness. This interface of public and private checkerboard ownership has resulted in neighboring parcels of land with differing management objectives and fuels loads.

Why Consider Taking Action: The public has raised concerns about fire moving across ownership boundaries due to high fuel loading on NFS lands, including the Menagerie Wilderness. This project presents an opportunity to address these concerns by reducing the risk of fires spreading within the checkerboard ownership through strategically-placed fuel treatments.

Desired Condition: Fuel treatments along ridge tops and road corridors would create defensible areas that can be utilized during fire suppression. The reduced fuel loadings and altered fuel profiles in treatment areas can moderate fire behavior, improve the effectiveness of ground and aerial fire suppression resources, and provide a safer area for personnel to operate in.

One proposed treatment is hardwood fuel breaks. The treatment would commercially remove all merchantable understory trees to remove ladder fuels and thin the overstory to reduce crown fire behavior and create sufficient light in the understory to underplant hardwood species such as red alder and big leaf maple. These hardwood species are less flammable than conifer species and would moderate fire behavior. Once the hardwood trees are established, the fuel break would be effective with no maintenance for the lifespan of the trees (approximately 60 to 70 years for red alder and 100 to 200 years for big leaf maple). The patchy, aggregate retention treatment in followed by a prescribed underburn in unit 56 would also enhance a fuel break along the 850 road in-between private timberlands and the Menagerie Wilderness.



Figure 9: A "before" picture of a fuels treatment area on the Willamette National Forest

Figure 9 and Figure 10 were taken on the Willamette National Forest in an area with similar fuel loading as the areas proposed for fuel breaks in the Trout Creek project. The “before” and “after” images are representative of current conditions and expected outcomes (before hardwood tree establishment) for the Trout Creek project.



Figure 10: An "after" photo of a fuels treatment area on the Willamette National Forest

5. Enhance and create hardwood habitat.

Existing Condition: The Sweet Home Ranger District has few large patches of hardwood trees in its conifer dominated landscape. Two of the largest patches are in the project area, with only one of these being accessible for treatment. Red alder is the dominant species and is currently about 50 years old.

Hardwood patches occupy an important but uncommon niche in the Trout Creek project area. Hardwoods are significant components of forest diversity and habitat (Eskelson et al., 2009). Hardwoods are important to a variety of songbird species, bats, and small mammals and provides key sources of food and cover for bird habitat (Ellis and Betts, 2011).

Why Consider Taking Action: Red alder is a short lived hardwood species and the stands of hardwood in the project area would start experiencing mortality in the next ten to twenty years. In the future, as the red alder dies these areas would likely convert to conifer species. Figure 11 shows a stand where alder would be cut and replanted to stimulate a new cohort of growth and contribute to overall forest health.

Tall bugbane, a formerly sensitive species, is a perennial herbaceous plant that is in general decline on the Sweet Home Ranger District. Tall bugbane prefers the cool, moist habitat found in the vicinity of hardwood trees such as bigleaf maple.

Oak and madrone dominated stands, historically maintained by fire disturbance, are rare on the landscape of the western Cascades. A lack of fire disturbance has resulted in existing patches of oak and madrone becoming overtopped by conifer tree species.

Desired Condition: One goal of the Northwest Forest Plan is to maintain biological diversity associated with native species and ecosystems (Northwest Forest Plan, p. B-1). Generally, it is desirable to maintain and increase the biological diversity represented by hardwood habitats.

The desired condition for the accessible large hardwood stand in the project area is to provide a range of age classes of hardwood trees and prevent a loss of hardwood habitat in the stand. This would provide current and future habitat for some species of birds as well as other wildlife species that rely on this habitat (Betts et al., 2010; Hagar, 2007).

The desired condition for tall bugbane is to maintain and increase its presence in the project area. Treatments that favor or establish bigleaf maple would provide conditions favorable to tall bugbane.

It is desired to maintain existing oak and madrone patches on the landscape, as well as establish more oak in the vicinity of Camas Prairie. Treatments that release oak and madrone from existing conifer competition would maintain existing patches, and aggregate retention treatment would be used to establish more oak trees around Camas Prairie.



Figure 11: A stand where Alder would be treated

1.04 Proposed Action

The proposed action (Alternative 2) would treat approximately 1,670 acres (or approximately 4% of the project area) in the Trout Creek Project. Harvest treatments proposed include commercial thinning,

variable density thinning, aggregate retention, gap creation, hazardous fuels treatments, and skips. The numbers and qualities shown in this section reflect the proposed action, unless otherwise noted. A detailed description of the actions proposed under each Alternatives and maps are included in Chapter 2.

The different commercial timber harvest treatments and non-commercial treatments are briefly described here. Depending on the existing and desired conditions of a particular stand, a variety of treatment combinations may be proposed. Treatment combinations could range from only underplanting to a combination of several commercial and non-commercial treatments. For example, thinning with skips and no gaps may be proposed in one stand, while thinning, aggregate retention, gaps and skips followed by prescribed underburning and underplanting may be proposed in another stand. Refer to Appendix E for the specific combination of treatments proposed in each treatment unit.

Commercial Timber Harvest Treatments

Commercial timber harvest treatments would use a combination of ground and skyline harvest systems. Ground-based harvest systems include a combination of hand and mechanical tree falling and rubber tired grapple skidders to yard trees to landings for processing. Skyline harvest systems would fall trees by hand and yard trees to a landing using a suspended cable system. Depending on the current stand age and other existing conditions, one or a combination of the following timber harvest treatments would be used in each stand to achieve desired conditions. Refer to the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District for detailed treatment descriptions for each unit. In general, the goal of using a combination of the following treatments is to mimic mixed-severity fire on a landscape scale, increase residual tree vigor and resilience to disturbance such a drought, reduce ladder and canopy fuels, influence species composition, and increase structural complexity. The following treatments are prescribed for all Alternatives, however, acres are noted for only Alternative 2 (the proposed action) in the following descriptions.

Commercial Thinning

Commercial thinning treatments are proposed on 733 acres, 109 of which are in the Riparian Reserves. This treatment would focus on removing intermediate and suppressed trees to improve the growth and vigor of the larger, more dominant leave trees. Leave trees would be selected using a variety of spacing criteria to create stands with variable densities (i.e., variable density thinning). Residual tree species composition would also be a factor that influences which trees are selected for harvest.

Aggregate Retention Harvest

Aggregate retention harvest (101 acres) is a form of regeneration harvest designed to create structural elements similar to those that would be found in high-severity patches created by a mixed-severity fire or other disturbance. Unlike traditional regeneration harvest systems such as clearcutting, aggregate retention harvest creates comparatively smaller regeneration openings of irregular shape, retains groups of trees (or aggregates) of $\frac{1}{2}$ acre and larger in size, and retains up to 9 trees per acre in the openings. Some retention trees may then be killed during prescribed underburning or girdled to provide structural elements characteristic of complex early seral habitat. Aggregate retention harvest is proposed in 4 plantations and 2 fire-origin stands. The proportion of aggregate retention harvest would vary by unit, impacting no more than a total of 9 to 42% of a single stand.

Gaps

Gaps (35 acres total) are created by cutting most trees in a small area ranging from a quarter-acre to one acre in size. Species such as pine, cedar, and hardwoods would be retained in order to maintain species diversity. Proposed gaps would comprise 26 acres in plantations and 9 acres in the fire-origin stands. Depending on the desired condition in a particular stand and the size of the gap, up to three large trees may be retained in a single gap in addition to the retained species mentioned above. These large trees would be expected to use the increased access to light to build large crowns and branches, increasing their likelihood of becoming future nest/den trees for wildlife. Gaps would be planted primarily with pine and cedar species in order to further increase tree species diversity, especially of drought-tolerant species. The total area of gaps within any given stand would not exceed 15% of the stand area, but would increase structural complexity, increase species diversity, reduce crown continuity, and provide more areas suitable for sun-loving plants and animals.

Skips

Skips (489 acres) are areas within a stand where no harvest activities take place. This serves to mimic unburned or low-severity patches of a mixed-severity fire. With the exception of a single 5-acre stand that is prescribed for thinning, skips are prescribed in all stands proposed for timber harvest. In total, proposed skips would comprise 362 acres in plantations and 127 acres in the fire-origin stands. In addition to mimicking low-severity areas where tree density remains high, skips are often used to help buffer and protect streams, cultural sites, sensitive areas or other special features (e.g., clumps of legacy trees, snags and down wood). Skips are areas where high levels of tree competition would result in snag and down wood creation.

Non-Commercial Treatments

Non-commercial treatments typically focus on reducing or rearranging surface and ladder fuels, influencing species composition with planting, or improving the transportation system. In some instances these treatments are prescribed as a stand-alone treatment to achieve a desired condition, a post-harvest treatment, or an action connected with commercial harvest treatments.

Post-harvest Fuels Treatments

Post-harvest fuels treatments mitigate activity fuels created during harvest operations.

Pile and burn treatments (157 acres) would primarily follow commercial thinning treatments where prescribed underburning may result in high mortality of residual trees or may be difficult to control. Surface fuels would be piled by hand or machine and then burned. Large down wood would not be piled to ensure it remains on site following pile burning to meet wildlife and soils objectives.

Prescribed underburning (278 acres) would primarily be used following aggregate retention harvest. This fuels treatment is the intentional burning of vegetation and surface fuels under favorable conditions, to reduce the fire hazard and also mimic ground conditions that would be present following a mixed severity fire. Prescribed underburning would also serve to prepare sites for planting tree seedlings by reducing competing vegetation and exposing patches of mineral soil.

Dry Meadow Restoration

There is a 2-acre dry meadow in Unit 20 that was the result of the original timber harvest. This area has slowly been filling in with trees. To maintain this rare habitat, merchantable trees would be harvested as

part of an aggregate retention treatment. Sub-merchantable trees would be cut and piled. The piles and the meadow area would be burned as part of the aggregate retention underburning. The dry meadow would then be excluded from tree planting. This would result in maintaining this area as a dry meadow for the next 20 to 30 years

Maple Restoration

There is a 3-acre portion of Unit 30 that was stocked primarily with bigleaf maple prior to the original harvest. These trees were cut in the original harvest, resulting in a vigorous stump sprouting. This treatment would thin the maple sprouts to release the dominant maple stems. This would be a fall and leave treatment which may result in firewood opportunities if the cut sprouts are of a suitable size.

Underplanting

Underplanting is proposed for 704 acres throughout the Trout Creek project for a variety of reasons and purposes. On 101 acres of aggregate retention and 32 gap acres, underplanting would follow a treatment such as timber harvest, or prescribed underburn. These treatments prepare the site for planting by disturbing the soil, increasing available light, and reducing other vegetation (e.g., shrubs and grass) that would compete with the seedlings for nutrients and water. Planting trees in aggregate retention openings and gaps helps to establish a new cohort of trees, while also increasing species diversity and promoting species that are well suited to future climate conditions such as increased and more intense droughts. No herbicide treatments are proposed. On the remaining 642 acres, a variety of different conifer, hardwood and shrub species are proposed for planting to achieve different objectives. In some stands, underplanting would not follow commercial timber harvest, but is proposed to increase species diversity. Western Redcedar and Incense Cedar is proposed for underplanting both in and outside of Riparian Reserves across 303 acres. Species, such as huckleberry, camas, and hazel, are proposed for planting because they are culturally important species to local Tribes. Tall bugbane, a rare plant, would be planted in a 5 acre unit where it is present, but declining. Underplanting of hardwoods is prescribed across 237 acres to maintain hardwood habitat, create low maintenance fuel breaks, increase the variability of a stand and provide for forest health in the Riparian Reserves.

Fall and Leave Treatments

Fall and leave treatments are proposed for 16 acres in the Trout Creek project. On 1 acre, the planting of Western Redcedar and Big Leaf Maple is proposed following a fall and leave Alder treatment to promote long-lived species for stream shading. Another 6 acre unit has proposed fall and leave thinning in 2 acres of Douglas-fir plantation that is not feasible to log. Another three acre fall and leave thinning treatment is prescribed for a 3 acre area below a cliff band that is unreachable by logging equipment. Fall and leave of conifers in Riparian Areas is proposed for an additional 10 acres across the project area. All of the trees would be left on site.

Transportation

Temporary Road Construction: In Alternative 2, approximately 2 miles of new temporary spur road would be built and just over 2 miles of existing temporary spur roads would be open. Temporary roads would be created in all action alternatives (see Appendix D for detailed numbers and quantities of transportation related activities in all alternatives). These roads would be placed in areas to minimize impacts to resources and impacted areas would be repaired and rehabilitated after use. Previously disturbed sites would be utilized where possible. The initial effects of the construction would be compacted soils; however those effects would be offset by decommissioning. The effects of the repair

and rehabilitation work would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction, so increased growth is possible along skid trails and landings that have treatment.

Temporary Road Re-open: These are temporary roads that involve the re-opening of an existing non-system road bed. The same repair and rehabilitation requirements as Temporary Road Construction apply.

Maintenance: About 48 miles (Alternatives 2 and 4) and 46 miles (Alternative 3) of forest roads would be repaired and maintained to improve structural strength and road surfaces to a level that would support commercial timber haul, safely accommodate mixed commercial and noncommercial use, and meet the desired condition.

Road maintenance associated with haul routes would result in decreased maintenance cost, improved safety, and reduced potential for resource damage related to degraded roads that would be needed for current and future resource management. Road maintenance activities may include felling danger trees, clearing and grubbing, replacing drainage structures, asphalt pavement patching, repairing holes in the roadbed, reconstructing ditches, application of dust abatement material, and placement of aggregate surfacing. Alternatives 2 and 4 would include the installation or replacement of approximately 260 culverts and Alternative would include the installation or replacement of approximately 248 culverts.

Storage (Maintenance Level 1): About 31 miles of unused roads would be stored. Storing a road involves physically closing a route to all motor vehicle traffic using barriers such as boulders, water bars or berms, but leaving the road in the National Forest Transportation System. These roads are expected to be used intermittently when needed for project or fire access, but kept closed for periods of years between uses. During the storage process, actions (e.g., removing all or some culverts and fills from stream channels) and construction of durable drainage features (e.g., water bars) would be performed to prevent erosion during long periods without maintenance and to make the road hydrologically neutral. While closed to all motor vehicle traffic, system roads would be categorized as being in Maintenance Level 1 (ML1).

Decommission: About 6 miles under Alternative 2 and about 10 miles under Alternatives 3 and 4 of existing unused forest roads would be decommissioned. These roads are determined to be no longer needed for management activities, closed to all vehicle traffic, and taken off the Forest's road inventory. Decommissioning involves restoring an unneeded route to a more natural state. Motor vehicle traffic would be eliminated by construction of barriers and the route would be stabilized, much like roads being closed for storage (i.e., Maintenance Level 1). Unlike road storage, however, decommissioned routes are not expected to be reopened in the future. In addition to blocking with barriers, removing culverts and constructing water bars, other actions may be taken to further reduce hydrological impacts, such as subsoiling, outsliping, recontouring and mulching. The barriers may be augmented with techniques such as camouflaging with brush or slash and recontouring the segment of road or trail visible from its entrance. A route that is on the National Forest Transportation System would be removed from that system when decommissioned.

Rock Quarry: Gaps of two acres in size are prescribed in two fire-origin units, one where a rock quarry would be created and one where an existing rock quarry would be expanded. The rock quarry creation and expansion would include stripping, blasting, and site and access improvement. All trees would be cut in these gaps to facilitate rock removal. For each pit, development and use would impact approximately 3 acres or less.

1.05 Tribal Consultation

Tribal consultation for the Trout Creek project began in 2014, where it was presented at several annual and individual Tribal meetings. Tribes involved included the Klamath Tribes, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of Warm Springs. Updates to the timeline of planning were identified every year at annual meetings through 2017. On November 22, 2016, the Tribes listed above received a consultation package that included information about the proposed project location, proposed actions, and the purpose and need for the project. One letter from the Warm Springs Tribe was received. The Tribe expressed support for the project as long as impacts to cultural sites are mitigated. The Tribe was especially supportive of the huckleberry planting in the Cougar Rock area.

1.06 Public Involvement Efforts

Public involvement efforts during the development of the FEIS included public meetings, open-houses, scoping letters, and publication of the project in the Federal Register, Willamette National Forest Schedule of Proposed Actions and Willamette National Forest website. Below is a timeline illustrating public involvement efforts for the Trout Creek project:

- May 2014: A Knowledge Transfer was held over three non-consecutive days to share educational information and enable various groups and the public to share their opinions concerning the project. Groups that participated were the Sweet Home Ranger District staff, US Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Oregon Woodlands Coop, Guistina, Cascade Timber Company, Rosboro, South Santiam Watershed Council, Linn County Parks, Oregon State University, the Siletz Tribe and the Grand Ronde tribe.
- July 17, 2014; September 4, 2014; September 9, 2016: Public field trips held in the Trout Creek project area to view and discuss the project.
- February 5, 2015; December 11, 2015, August 4, 2016: public meetings in Sweet Home, Oregon
- April 1, 2015: Project published in the Willamette National Forest Schedule of Proposed Actions
- January 23, 2017: Notice of Intent (NOI) to prepare an EIS published in the Federal Register
- January 23, 2017: Scoping letter and background information mailed to members of the public, organizations, and state and federal agencies that have expressed interest in receiving information on District projects.
- December 29, 2017: Notice of Availability (NOA) and initiation of 45-day comment period for Draft Environmental Impact Statement (DEIS) published in the Federal Register
- December 29, 2017: Notice of Availability (NOA) and initiation of 45-day comment period for DEIS published in the Register Guard.

Members of the public, organizations, and state and federal agencies were invited to provide comments and concerns about the Trout Creek project during the public scoping comment period from January 23rd through February 14th, 2017. Seven scoping letters were received. Three of these letters were in support of the project, two letters were opposed or partially opposed to the project, and two letters provided general comments. Scoping comments received varied from those that wanted more clarification on proposed activities to specific suggestions for project implementation. Scoping comments were used to help develop planning issues, alternatives, and effects analyses for the DEIS. A complete record of all letters, including names and addresses of individuals, agencies, and organizations

that submitted a letter during the scoping period, is available online in the Trout Creek Public Reading Room at (<https://cara.ecosystem-management.org/Public/ReadingRoom?Project=46279>).

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Members of the public, various organizations, and state and federal agencies were invited to provide comment on the DEIS during the 45-day comment period from December 29th, 2017 through February 12th, 2018. Seven letters were received from members of the public, federal officials, and public interest organizations. Comments received varied from general statements of support or opposition to requests for additional analysis. A complete record of all letters, including names and addresses of individuals, agencies, and organizations that submitted a letter during the 45-day comment period, is available online in the Trout Creek EIS Public Reading Room at (<https://cara.ecosystem-management.org/Public/ReadingRoom?Project=46279>).

All correspondence and comments are also available in the Project Record at the Sweet Home Ranger District office.

While preparing the DEIS for publication, the Forest Service was made aware that interested individuals were conducting red tree vole surveys in proposed treatment units located above 3,500 feet in elevation. Pre-disturbance surveys were not required or conducted by the Forest Service in units above 3,500 feet (Forest Plan, 2001). Forest Service specialists used the data provided by the interested individuals to confirm the location of additional red tree vole nests above 3,500 feet. The deciding official took them into consideration when making the decision as described in the Draft Record of Decision (DROD). Changes to the project will be tracked, updated, and reflected in the publication of the DROD.

1.07 Consultation with other Agencies

United States Fish and Wildlife Service and National Marine Fisheries Service

Upper Willamette River Chinook salmon and Upper Willamette River Steelhead

Endangered Species Act (ESA) formal consultation with the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon Upper Willamette River winter steelhead is complete. The Biological Assessment prepared for the Trout Creek project found that the project “may affect, and is likely to adversely affect” Upper Willamette spring Chinook salmon and winter Steelhead. This analysis also found that there would not be any adverse modification of designated critical habitat for either species. On February 14, 2017, the Trout Creek project was presented to the NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” Consultation was formally initiated on February 17, 2017 by Forest Supervisor Tracy Beck. The Biological Opinion was issued to Tracy Beck on January 9, 2018 (NMFS no. WCR-2017-6494). The Forest

Service is required to comply with the terms and conditions provided by the NMFS in the Biological Opinion.

Northern Spotted Owl

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was initiated in 2016 and final evaluation by the USFWS and a Biological Opinion was received in August of 2017. Effects of the various proposed actions for the Trout Creek project were addressed by the Willamette Planning Province Level I Terrestrial Team (2017) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the FY2018 Biological Opinion (BO) (FWS Reference Number 01EOW00-2017-F-0555). This BO fulfills the Forest Service's legal requirement with respect to Section 7 of ESA for the Trout Creek Project. This EIS incorporates by reference this BO, as well as the Biological Assessment.

U.S. Environmental Protection Agency (EPA)

During project scoping, the EPA submitted a list of recommendations for analysis and project design. This letter was reviewed and recommendations incorporated as appropriate. The EPA received a copy of the DEIS and rated the project "Lack of Objectives (LO) identified no potential environmental impacts requiring substantive changes to the project. Per Forest Service regulations, this FEIS will be filed with the EPA's Office of Federal Activities in Washington, DC, who will publish a notice of availability in the Federal Register. The EPA's findings are included in Appendix F, Response to Comments on the Draft EIS.

Oregon State Historic Preservation Office

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project. In accordance with this PA, an appropriate inventory was conducted in 2014 to 2016. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of "Historic Properties Avoided" on (June 7, 2017). SHPO had no comments regarding the Forest Service finding. Documentation has been retained in the Willamette National Forest and Sweet Home Ranger District Heritage files.

1.08 Issues Derived from Public Comments

A standardized content analysis process was conducted to analyze the letters received during the public scoping comment period. Content analysis was designed to extract comments from each letter received, evaluate similar comments from different letters, and identify topics or issues of concern. During content analysis, the Interdisciplinary Team (IDT), with involvement and approval from the Responsible Official, identified issues and separated them into three categories: "key" issues, "other" issues, and "out of scope" issues.

Key Issues

Key issues represent an unresolved conflict associated with potential environmental effects of the proposed actions that cannot be resolved simply with mitigation or design features. Key issues are used to formulate alternatives and focus the analysis of environmental effects.

During the public scoping process, four key issues were identified from comments and questions:

Key Issue #1: Harvest treatments should not occur in stands over 80 years of age

Key Issue #2: No regeneration harvest should occur and no early seral creation is necessary

Key Issue #3: Increase harvest intensity for thinning units

Key Issue #4: More creation of early seral and larger gap cuts

Alternative 3 was developed in response to Key Issues 1 and 2. Alternative 3 eliminates harvest treatments in stands over 80 years of age and eliminates regeneration harvest. Alternative 4 was developed in response to issues 3 and 4. This alternative increases gap creation and harvest intensities in several units.

Other Issues and Out of Scope Issues

Other issues are minor issues that do not result in development of alternatives or focus the analysis of environmental effects. In most cases, the IDT is able to address these issues by refining the design of a project (i.e., dropping a unit from the project) or applying a design feature (i.e., requiring buffers around streams).

Out of Scope issues are those identified as being “out of scope” of this environmental analysis. These issues include those that are not or cannot be addressed or solved in this project-level analysis; issues already decided by law, regulation, or other higher level decisions; issues irrelevant to the decision being made; and/or issues that are conjectural or not supported by scientific evidence.

1.09 Decision Framework

The Responsible Official for this proposal is the District Ranger on the Sweet Home Ranger District of the Willamette National Forest. The District Ranger will review the proposed actions, alternatives, and the environmental consequences in order to make the following decisions:

- Whether to implement the proposed actions or another alternative
- What specific design features are needed
- What specific project monitoring requirements are needed to ensure design features are implemented and effective
- What if any modifications would be made to the proposed actions and alternatives

The decision will be based on:

- How well the selected alternative achieves the project purpose and need
- How well the selected alternative responds to analysis issues

Chapter 2 – Alternatives

This chapter describes and compares the alternatives considered for the Trout Creek project. It includes a description and map of each alternative considered. This chapter also presents the alternatives in comparative form, defining the differences between each alternative in order to provide a clear basis for choice by the decision maker.

Four alternatives have been analyzed in detail for this project: Alternative 1 - No-Action; Alternative 2 – Proposed Action and Preferred Alternative; Alternative 3 - No regeneration harvest and no treatment in stands over 80 years old; and Alternative 4 – Additional gap creation and increased thinning intensity in Unit 56. Chapter 2.05 describes another alternative considered, but eliminated from detailed study. Appendix E provides detailed information related to the specific treatment units in each action alternative.

2.01 Alternative 1 – No Action

Alternative 1, the No Action Alternative, assesses the current condition and expected future condition of the affected environment should an action or action alternatives not be implemented (73 Federal Register 143, July 24, 2008; p. 43084-43099). Under Alternative 1, commercial timber harvest and non-commercial treatments would not be implemented. The No Action Alternative should not be confused with a baseline. Whereas a baseline is essentially a description of the affected environment at a fixed point in time, the No Action Alternative considers what effects would occur to forest ecosystems and resources in the project area if no action is taken. The purpose and need of the proposed actions would not be met under Alternative 1, as none of the proposed actions would be implemented.

2.02 Alternative 2 – Proposed Action and Preferred Alternative

Alternative 2 is the preferred alternative and was developed to fully meet the purpose and need for this project. Alternative 2 proposes to treat approximately 1,670 acres in the project area (Figure 12).

Alternative 2 would thin roughly 733 acres (about 2% of the project area) and approximately 101 acres (less than 1% of the project area) would undergo aggregate retention harvest. Some thinning treatments would incorporate some untreated areas (skips) and create gaps from ¼ acre to one acre in size (2-acre gaps for rock quarries) with variable spacing of remaining trees. The aggregate retention harvest would be designed to create complex early seral habitat, increase forest-age diversity and increase structural complexity across the project area.

Approximately 576 acres of thinning and 52 acres of aggregate retention is proposed in plantations (about 40-60 years of age). About 157 acres of thinning and 49 acres of aggregate retention harvest is proposed in fire origin stands over 80 years old (about 100-150 years of age). These actions would provide roughly 12.7 MMBF of timber products to the local economy. A total of 109 acres of Riparian Reserves are proposed for thinning in plantations to increase in-stream productivity by increasing hardwood species, increased conifer growth and light availability. No thinning is proposed in the Riparian Reserves in the fire origin stands. About 3 acres of fall and leave treatments are also proposed to improve hardwood diversity and structure in the Riparian Reserves in the fire-origin stands.

Alternative 2 also aims to increase spatial heterogeneity and complex early seral habitat by mimicking mixed severity fire on a landscape scale. On 309 acres of plantations a combination of thinning,

aggregate retention harvest, gap creation and controlled burn would result in a diverse landscape of green trees and openings. The treatments would vary by unit, but in total there would be 52 acres of openings with individual tree retention, 12.5 acres of gaps, 132 acres of thinning to various spacing and densities, and 112 acres of no-harvest skips.

Aggregate retention harvest is proposed in two fire-origin stands. In unit 67 (9 acres), aggregate retention is proposed to enhance oak habitat. Treatments would include harvesting all merchantable trees except Oregon white oak in 2 acres, planting the harvested area with oak, and leaving 7 acres in untreated skips. Unit 56 is proposed for aggregate retention harvest to mimic mixed severity fire and plant drought resistant species (e.g., incense cedar and pine) on dryer south and west facing slopes. Unit 56 is 112 acres, but high severity fire patches would be replicated on only 47 acres using a combination of commercial thinning, underburning and varying levels of tree girdling. Unburned areas or low severity fire patches would be simulated by leaving 65 acres of untreated skips. Unit 56 is located to the north of the Menagerie Wilderness (Figure 12). Situated in a relatively isolated portion of designated Matrix between the wilderness boundary and private timber land, unit 56 provides an opportunity to create conditions where wildfire could be controlled and stopped from spreading onto private land should a fire start in the Menagerie Wilderness. Fire suppression tactics in designated Wilderness are limited and often require special permissions to implement. Given the relatively small size of the Menagerie Wilderness, a high intensity fire burning under severe wildfire weather conditions could potentially spread to adjacent lands before suppression efforts could effectively slow fire progression, putting private land at risk. Aggregate retention harvest is intended to create open areas where crown fire could effectively be controlled and, in conjunction with a proposed fuelbreak along the adjacent 850 road, increase the probability of fire suppression efforts successfully preventing fire from spreading from the wilderness onto private land. Additionally, the regeneration openings would be located on south and west-facing slopes where high-severity fire would likely occur in the absence of fire suppression. The south and west-facing slopes are also dryer than north-facing slopes, so drought tolerant conifer species would be planted. Refer to the Chapter 3.01, Forest and Stand Structure for further details and Appendix E and the Integrated Prescriptions for detailed prescriptions.

Hardwood fuel breaks, where conifers would be thinned heavily and hardwood species would be under-planted, are proposed on about 35 acres of plantations and 76 acres of fire origin stands. This would help curb the volume of hazardous fuels in these stands, provide a long term option for managing wildfires in the area, and further improve fire resiliency in and adjacent to the project area. A 14 acre plantation (unit 72) in Late Successional Reserve is also proposed to be treated in this way to help protect an Oregon Department of Transportation facility.

Additionally, approximately 370 acres of non-commercial treatments are proposed across the project area. These include the fall and leave treatments; snag creation of conifers for oak and madrone restoration; the planting of special forest products and plants important for tribal use; and the restoration of a 2-acre meadow.

Native conifers such as western redcedar, incense cedar, sugar pine, noble fir and other minor species such as hazel, huckleberries and bugbane would be planted on about 400 acres. Plantings would take place after harvest in gaps and in aggregate retention openings, and additionally as underplanting in units that are not proposed for commercial harvest. About 38 acres would be planted with desirable conifer bough species for future bough harvest. Hardwood trees would be under-planted on 237 acres as part of variable density thinning in existing hardwood stands, fuelbreak treatments, and creation of habitat for tall bugbane or Oregon white oak. While not adding commercial value, these actions would restore and maintain hardwood populations, increase forest diversity and structure, and contribute to overall landscape health in the project area.

The removal of forest products would include associated road work across the project area. Alternative 2 would require 48 miles of road maintenance or reconstruction that would include the installation of approximately 260 culverts (primarily replacements). There would be less than 1 mile of new road construction. Construction or reopening of non-system temporary road access would be approximately 4.4 miles. These temporary roads would be decommissioned and returned to their original condition at the conclusion of project activities.

Alternative 2 also proposes to decommission and hydrologically stabilize approximately 6 miles of road and the storage of approximately 32 miles of road. The impacted roads would be existing Forest Service roads 2000-011, 017, 2000-632, 636, 641, and 643, 2032-308 and 419 and 2027-539, 541 and 830. Most of these roads or sections thereof are currently inaccessible to vehicle traffic. A rock pit would be developed near the 2027-825 road junction and an existing rock pit would be expanded on the 2027 road. A detailed description of road work including decommissioning and mile posts is available in Appendix D.

Table 5 includes a summary of treatments and connected actions proposed under Alternative 2. A detailed description of proposed treatments and project activities is included in Appendix E. A detailed list of treatments for individual units is listed in the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Table 5: Summary of Proposed Treatments and Connected Actions – Alternative 2

Proposed Activity	Unit of Measure	Alternative 2	Purpose – Need Addressed ¹
Timber Harvest Treatments (commercial)			
Thinning outside Riparian Reserves	Acres	624	1, 2, 3, 4, 5
Thinning in Riparian Reserves	Acres	109	1, 2, 5
Aggregate Retention (early seral creation)	Acres	101	1, 2, 3
Gaps	Acres	35	1, 2, 3
Skips	Acres	489	1,3
Total	Acres	1,358	1, 2, 3, 4, 5
Estimated Gross Volume	MMBF	12.7	2
Connected Actions			
Post-Harvest Fuels Treatments in Timber Harvest Units^{2,3}			
Pile and Burn (mechanical and/or hand treatments)	Acres	157	4
Post-Harvest Underburn	Acres	278	4
Transportation			
New Road Construction	Miles	1	-
Temporary Road Construction	Miles	2.1	-
Temporary Road Re-Open	Miles	2.3	-
Roads Maintained	Miles	48	-
Road Decommissioning	Miles	6	-
Road Storage	Miles	31	-
Culvert Replacement	Amount	260	-
Rock Obtained From Existing Quarries	Cubic Yards	20,000	-
Rock Obtained From New Quarries	Cubic Yards	40,000	-
Harvest System			
Skyline	Acres	537	-
Ground-based	Acres	328	-

Proposed Activity	Unit of Measure	Alternative 2	Purpose – Need Addressed ¹
Harvest Associated (Non-Commercial Treatments) Planting, Snags, and Down Wood ^{2, 4, 5}			
Planting in Aggregate Retention Harvest	Acres	101	1
Planting in Gaps	Acres	32	1
Plant/regenerate Huckleberries	Acres	14	1
Plant Hazel, camas or other plants for tribal use	Acres	8	1
Plant Tall Bugbane	Acres	5	1
Underplant hardwoods	Acres	237	1, 4, 5
Underplant Incense Cedar and/or Western Redcedar (including in the riparian reserves)	Acres	303	1
Dry Meadow Restoration	Acres	2	1
Maple Restoration	Acres	3	1, 5
Fall and Leave in Areas Unsuitable for Logging	Acres	3	1
Fall and Leave Conifers in Riparian Reserves	Acres	9	1, 5
Fall and Leave Alder, underplant with Western Redcedar and Big Leaf Maple in Riparian Reserves	Acres	1	1, 5
Underplant Oregon Ash and Western Redcedar in Alder Area of Riparian Reserves	Acres	1	1, 5
Pre-Commercial Thin (including Riparian Reserves) to favor hardwood trees	Acres	7	1, 5
Create Snags and Down Wood (occurs in aggregate retention units)	Snags or Down Trees per Acre	At least 7	1
Northern Spotted Owl (NSO) Habitat			
NSO Suitable Habitat in Critical Habitat Treated (including skips)	Acres	109	1
NSO Dispersal Habitat in Critical Habitat Treated	Acres	141	1
NSO Non-Habitat in Critical Habitat Treated	Acres	77	1
NSO Suitable Habitat Treated (including skips)	Acres	142	1
NSO Dispersal Habitat Treated (including skips)	Acres	226	1
NSO Non-Habitat Treated (including skips)	Acres	103	1

¹ 1 – Encourage stand health, vigor, species diversity and structural complexity; 2 – Contribute a variety of sustainable forest products to local markets; 3 – Increase spatial heterogeneity and complex early seral habitat by mimicking mixed severity fire; 4 – Improve fire resiliency and manage hazardous fuels to reduce the potential for spread of large scale fires; 5 – Enhance and create hardwood habitat and diversity.

² Some of these acres are not included in the total because they are accounted for under “Timber Harvest Treatments”.

³ Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device. Post-harvest fuels treatments methods may change depending on feasibility and funding.

⁴ Many of these actions are non-commercial and are subject to funding availability and may be dependent on Knudson-Vandenberg (KV) revenue generated by timber sales from the Trout Creek project.

⁵ For specific planting prescriptions, please see the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Commercial harvest and non-commercial treatments would occur in stands ranging from 32-150 years old. Approximately 647 acres proposed for commercial harvest and non-commercial treatments are in stands over 80 years old and 1,016 acres proposed for treatments are in stands under 80 years old. Table 6 provides a summary of forest age classes and treatment acres for Alternative 2.

Table 6: Summary of Forest Age Classes and Treatment Acres– Alternative 2

Item	<80 years old	>80 years old	Total
Unit Acres (including skips)	1016	647	1,663
Acres Proposed for Commercial Treatment (excluding skips)	654	215	869
Acres Proposed for Non-Commercial Treatment (including overlap with commercial treatment acres in some units)	49	311	360
Average Age	44	126	-

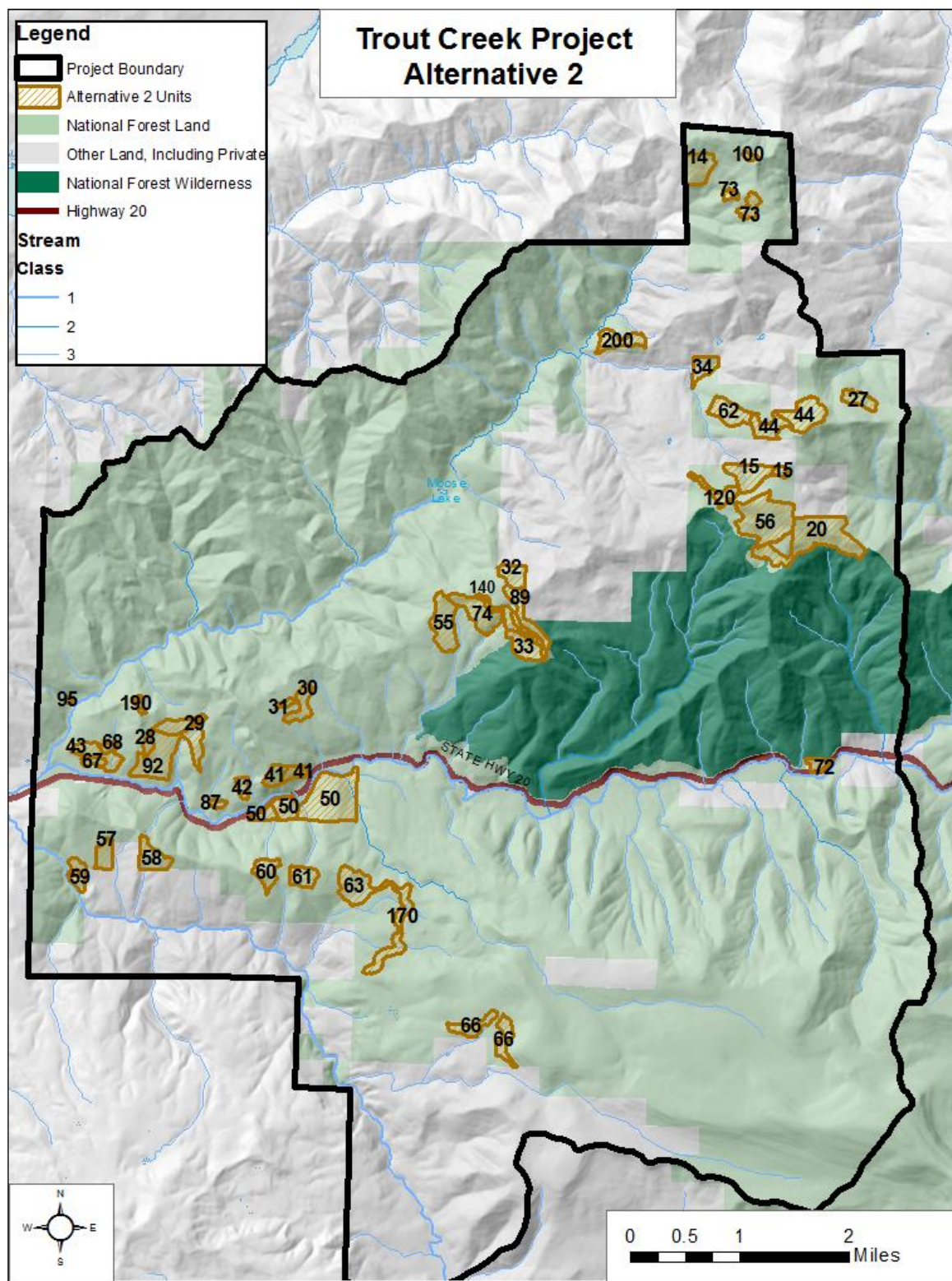


Figure 12: Map of Alternative 2

2.03 Alternative 3 – No Regeneration Harvest and No Treatment in Stands Over 80 Years Old

During the public scoping process, four key issues were identified from comments and two of these issues are addressed in Alternative 3:

Key Issue #1: Harvest treatments should not occur in stands over 80 years of age

Key Issue #2: No regeneration harvest should occur and no early seral creation is necessary

Alternative 3 was developed in response to Key Issues 1 and 2. Alternative 3 eliminates harvest treatments in stands over 80 years of age. Any non-commercial treatments in stands over 80 were also eliminated. Additionally, Alternative 3 differs from Alternative 2 in that any aggregate retention harvest proposed in stands under 80 years of age was altered to thinning treatments with gaps; therefore, Alternative 3 has fewer acres of commercial harvest, but more acres of thinning in managed stands and gap creation when compared to Alternative 2.

Alternative 3 proposes to treat approximately 1,016 acres in the project area (Figure 13). Harvest treatments proposed include thinning, gap creation, and skips. Harvest treatments would yield an estimated gross 8.4 million board feet of timber. Post-harvest fuels treatments would include pile and burn and post-harvest underburn.

Alternative 3 would require about 3.3 miles of temporary road construction or reconstruction, 46 miles of existing road maintenance and would replace approximately 248 culverts. Temporary roads would be decommissioned and returned to their original condition at the conclusion of project activities. There would be no rock quarry creation in Alternative 3.

This alternative proposes to decommission and hydrologically stabilize an additional 4 miles of NFTS road for a total of 10 miles of road decommissioning. The impacted roads would be existing Forest Service roads 2000-013, 2032-315, 317, 410, 452, 456, 2027-707, 709, 801, and 817. Most of these roads or sections of road are currently inaccessible to vehicle traffic. Some roads only have a portion proposed for decommissioning. A detailed description of road work including decommissioning and mile posts is available in Appendix D.

Table 7 includes a summary of treatments and connected actions proposed under Alternative 3. A detailed description of proposed treatments and project activities is included in Appendix E. A detailed list of treatments for individual units is listed in the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Table 7: Summary of Proposed Treatments and Connected Actions – Alternative 3

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed ¹
Timber Harvest Treatments (commercial)			
Thinning outside Riparian Reserves	Acres	520	1, 2, 3, 4, 5
Thinning in Riparian Reserves	Acres	109	1, 2, 5
Aggregate Retention (early seral creation)	Acres	0	1, 2, 3
Gaps	Acres	43	1, 2, 3
Skips	Acres	344	1, 3
Total	Acres	1,016	1, 2, 3, 4, 5
Estimated Gross Volume	MMBF	8.4	2

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed ¹
Connected Actions			
Post-Harvest Fuels Treatments in Timber Harvest Units^{2,3}			
Pile and Burn (mechanical and/or hand treatments)	Acres	94	4
Post-Harvest Underburn	Acres	229	4
Transportation			
New Road Construction	Miles	1	-
Temporary Road Construction	Miles	1.3	-
Temporary Road Re-Open	Miles	2.0	-
Roads Maintained	Miles	46	-
Road Decommissioning	Miles	10	-
Culvert Replacements	Amount	248	-
Road Storage	Miles	29	-
Rock Obtained From Existing Quarries	Cubic Yards	20,000	-
Rock Obtained From New Quarries	Cubic Yards	0	-
Harvest System			
Skyline	Acres	429	-
Ground-based	Acres	239	-
Harvest Associated (Non-Commercial Treatments) Planting, Snags, and Down Wood^{2, 4, 5}			
Planting in Aggregate Retention Harvest	Acres	0	1
Planting in Gaps	Acres	43	1
Plant/regenerate Huckleberries	Acres	6	1
Plant Hazel, camas or other plants for tribal use	Acres	8	1
Plant Tall Bugbane	Acres	0	1
Underplant hardwoods	Acres	154	1, 4, 5
Underplant Incense Cedar and/or Western Redcedar (including in the riparian reserves)	Acres	0	1
Dry Meadow Restoration	Acres	2	1
Maple Restoration	Acres	3	1, 5
Fall and Leave in Areas Unsuitable for Logging	Acres	3	1
Fall and Leave Conifers in Riparian Reserves	Acres	7	1, 5
Fall and Leave Alder, underplant with Western Redcedar and Big Leaf Maple in Riparian Reserves	Acres	1	1, 5
Underplant Oregon Ash and Western Redcedar in Alder Area of Riparian Reserves	Acres	1	1, 5
Pre-Commercial Thin (including Riparian Reserves) to favor hardwood trees	Acres	7	1, 5
Northern Spotted Owl (NSO) Habitat			
NSO Suitable Habitat in Critical Habitat Treated (including skips)	Acres	0	1
NSO Dispersal Habitat in Critical Habitat Treated	Acres	141	1
NSO Non-Habitat in Critical Habitat Treated	Acres	77	1
NSO Suitable Habitat Treated (including skips)	Acres	0	1
NSO Dispersal Habitat Treated (including skips)	Acres	226	1
NSO Non-Habitat Treated (including skips)	Acres	103	1

¹ 1 – Encourage stand health, vigor, species diversity and structural complexity; 2 – Contribute a variety of sustainable forest products to local markets; 3 – Increase spatial heterogeneity and complex early seral habitat by mimicking mixed severity fire; 4 – Improve fire resiliency and manage hazardous fuels to reduce the potential for spread of large scale fires; 5 – Enhance and create hardwood habitat and diversity.

² Some of these acres are not included in the total because they are accounted for in under "Timber Harvest Treatments".

³ Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device. Post-harvest fuels treatments methods may change depending on feasibility and funding.

⁴ Many of these actions are non-commercial and are subject to funding availability and may be dependent on Knudson-Vandenberg (KV) revenue generated by timber sales from the Trout Creek project

⁵ For specific planting prescriptions, please see the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Harvest treatments would occur in stands ranging from about 32-65 years old. No harvest would occur in stands over 80 years old. Table 8 provides a summary of forest age classes and treatment acres for Alternative 3.

Table 8: Summary of Forest Age Classes and Treatment Acres – Alternative 3

Item	<80 years old	>80 years old	Total
Unit Acres (including skips)	1016	0	1,016
Acres Proposed for Commercial Treatment (excluding skips)	672	0	672
Acres Proposed for Non-Commercial Treatment (including overlap with commercial treatment acres in some units)	41	0	41
Average Age	44	-	-

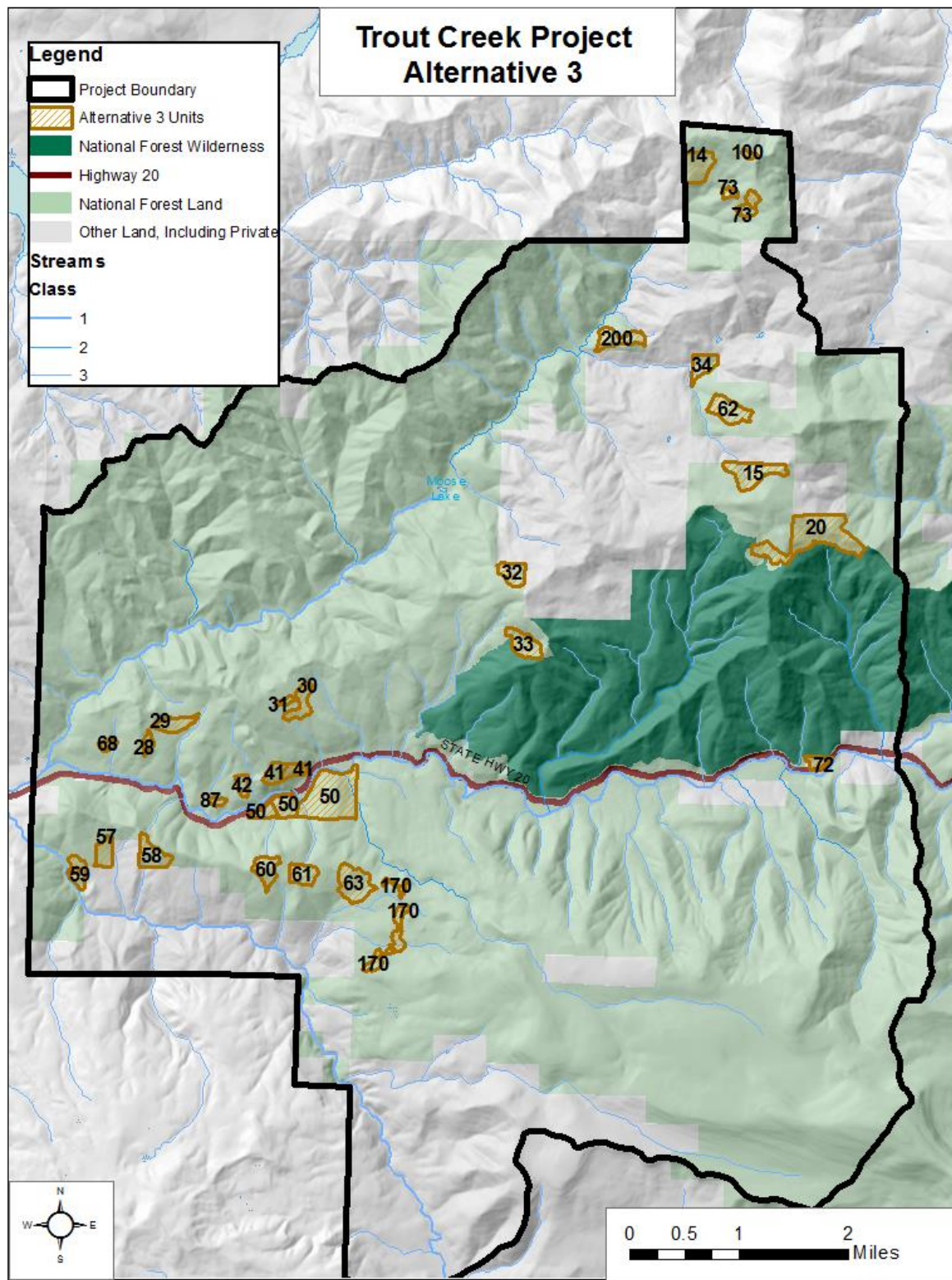


Figure 13: Map of Alternative 3

2.04 Alternative 4 – Additional Gap Creation and Increased Harvest Intensity in Unit 56

Alternative 4 was developed in response to Key Issues 3 and 4:

Key Issue #3: Increase harvest intensity for thinning units

Key Issue #4: More creation of early seral and larger gap cuts

Alternative 4 proposes to treat approximately 1,670 acres in the project area (Figure 14). Harvest treatments proposed include thinning, aggregate retention, gap creation, dominant tree release, and skips. Post-harvest fuels treatments would include pile and burn and post-harvest underburn.

Alternative 4 increases gap cuts in some managed stands and fire-origin units. Approximately 562 acres of thinning and 52 acres of aggregate retention would take place in managed stands. Approximately 151 acres of thinning and 49 acres of regeneration harvest would take place in fire-origin stands.

Alternative 4 increases the harvest intensity in unit 56 compared to Alternative 2. As a result, fewer snags would be created because more trees would be harvested. Alternative 4 has equivalent acres of commercial harvest, but more acres of gap creation and increased harvest intensity when compared to Alternative 2. These actions would provide roughly 15.8 MMBF of timber products to the local community.

Mileage for road maintenance, reconstruction, and temporary road construction and reconstruction would be identical to Alternative 2. Alternative 4 proposes the same increased mileage of road decommissioning as in Alternative 3. Rock pit development is consistent across all Alternatives. A detailed description of road work including decommissioning and mile posts is available in Appendix D.

Table 9 includes a summary of treatments and connected actions proposed under Alternative 4. A detailed description of proposed treatments and project activities is included in Appendix E. A detailed list of treatments for individual units is listed in the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Table 9: Summary of Proposed Treatments and Connected Actions – Alternative 4

Proposed Activity	Unit of Measure	Alternative 4	Purpose – Need Addressed ¹
Timber Harvest Treatments (commercial)			
Thinning outside Riparian Reserves	Acres	603.5	1, 2, 3, 4, 5
Thinning in Riparian Reserves	Acres	109	1, 2, 5
Aggregate Retention (early seral creation)	Acres	101	1, 2, 3
Gaps	Acres	55.5	1, 2, 3
Skips	Acres	489	1, 3
Total	Acres	1,358	1, 2, 3, 4, 5
Estimated Gross Volume	MMBF	15.8	2
Connected Actions			
Post-Harvest Fuels Treatments in Timber Harvest Units^{2,3}			
Pile and Burn (mechanical and/or hand treatments)	Acres	157	4
Post-Harvest Underburn	Acres	278	4
Transportation			
New Road Construction	Miles	1	-
Temporary Road Construction	Miles	2.1	-

Proposed Activity	Unit of Measure	Alternative 4	Purpose – Need Addressed ¹
Temporary Road Re-Open	Miles	2.3	-
Roads Maintained	Miles	48	-
Road Decommissioning	Miles	10	-
Culvert Replacements	Amount	260	-
Road Storage	Miles	29	-
Rock Obtained From Existing Quarries	Cubic Yards	20,000	-
Rock Obtained From New Quarries	Cubic Yards	40,000	-
Harvest System			
Skyline	Acres	537	-
Ground-based	Acres	328	-
Harvest Associated (Non-Commercial Treatments) Planting, Snags, and Down Wood^{2, 4, 5}			
Planting in Aggregate Retention Harvest	Acres	101	1
Planting in Gaps	Acres	55.5	1
Plant/regenerate Huckleberries	Acres	14	1
Plant Hazel, camas or other plants for tribal use	Acres	8	1
Plant Tall Bugbane	Acres	5	1
Underplant Hardwoods	Acres	237	1, 4, 5
Underplant Incense Cedar and/or Western Redcedar (including in the riparian reserves)	Acres	303	1
Dry Meadow Restoration	Acres	2	1
Maple Restoration	Acres	3	1, 5
Fall and Leave in Areas Unsuitable for Logging	Acres	3	1
Fall and Leave Conifers in Riparian Reserves	Acres	9	1, 5
Fall and Leave Alder, underplant with Western Redcedar and Big leaf Maple in Riparian Reserves	Acres	1	1, 5
Underplant Oregon Ash and Western Redcedar in Alder Area of Riparian Reserves	Acres	1	1, 5
Pre-Commercial Thin (including Riparian Reserves) to favor hardwoods	Acres	7	1, 5
Snags and Down Wood (occurs in aggregate retention units)	Snags or Down Trees per Acre	At least 7	1
Northern Spotted Owl (NSO) Habitat			
NSO Suitable Habitat in Critical Habitat Treated (including skips)	Acres	109	1
NSO Dispersal Habitat in Critical Habitat Treated	Acres	141	1
NSO Non-Habitat in Critical Habitat Treated	Acres	77	1
NSO Suitable Habitat Treated (including skips)	Acres	142	1
NSO Dispersal Habitat Treated (including skips)	Acres	226	1
NSO Non-Habitat Treated (including skips)	Acres	103	1

¹ 1 – Encourage stand health, vigor, species diversity and structural complexity; 2 – Contribute a variety of sustainable forest products to local markets; 3 – Increase spatial heterogeneity and complex early seral habitat by mimicking mixed severity fire; 4 – Improve fire resiliency and manage hazardous fuels to reduce the potential for spread of large scale fires; 5 – Enhance and create hardwood habitat and diversity.

² Some of these acres are not included in the total because they are accounted for in under “Timber Harvest Treatments”.

³ Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device. Post-harvest fuels treatments methods may change depending on feasibility and funding.

⁴ Many of these actions are non-commercial and are subject to funding availability and may be dependent on Knudson-Vandenberg (KV) revenue generated by timber sales from the Trout Creek project

⁵ For specific planting prescriptions, please see the Integrated Prescriptions which are a part of the project record kept on file at the Sweet Home Ranger District.

Commercial harvest and non-commercial treatments would occur in stands ranging from 32-150 years old. Approximately 647 acres proposed for commercial harvest and non-commercial treatments are in stands over 80 years old and 1,016 acres proposed for treatments are in stands under 80 years old. Table 10 provides a summary of forest age classes and treatment acres for Alternative 4.

Table 10: Summary of Forest Age Classes and Treatment Acres – Alternative 4

	<80 years old	>80 years old	Total
Unit Acres (including skips)	1016	647	1,663
Acres Proposed for Commercial Treatment (excluding skips)	654	215	869
Acres Proposed for Non-Commercial Treatment (including overlap with commercial treatment in some units)	49	305	354
Average Age	44	126	-

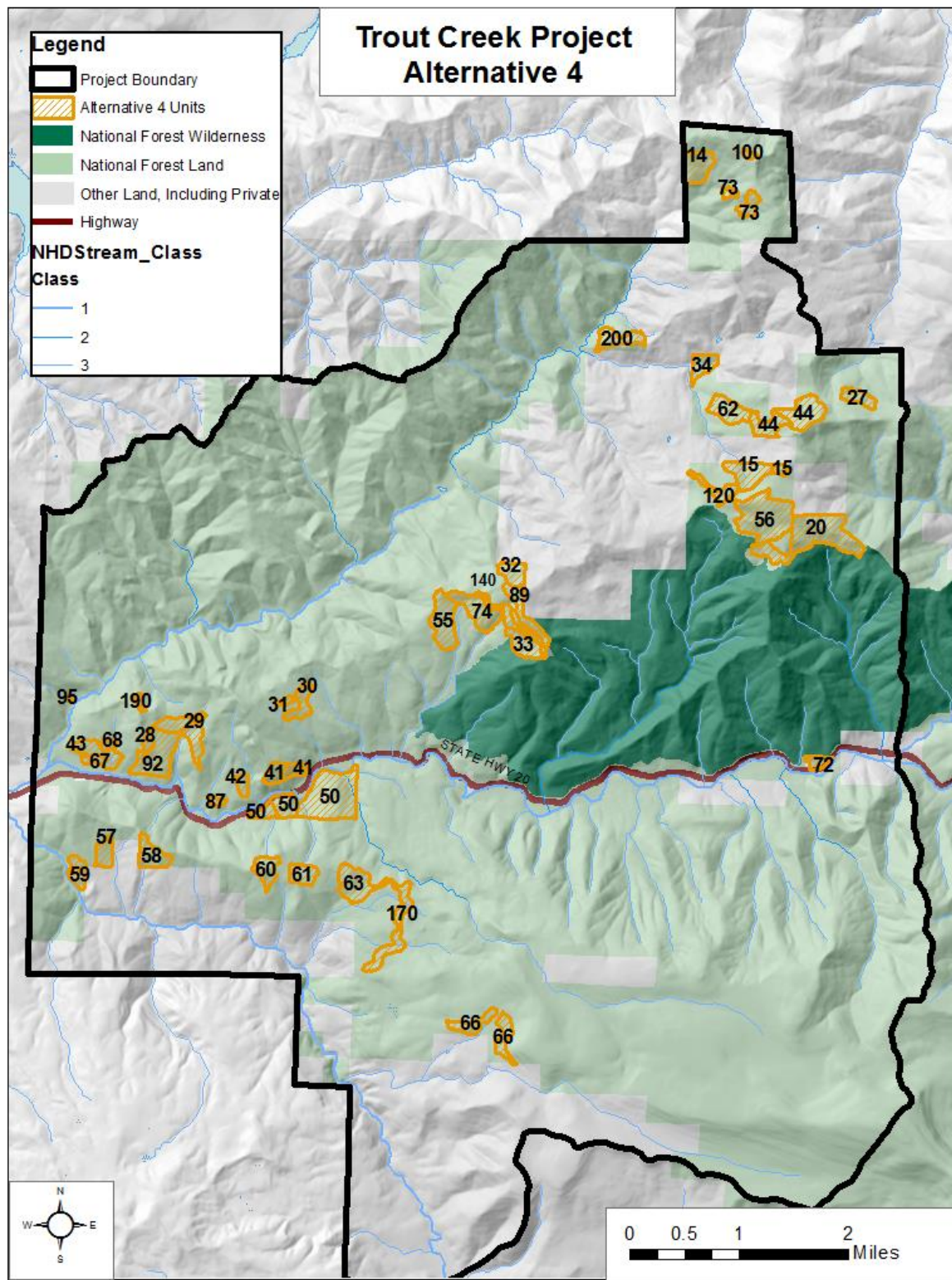


Figure 14: Map of Alternative 4

2.05 Alternatives Considered But Eliminated

Alternative that Includes Increased Acreage and Regeneration Harvest in Fire Origin Stands 100-150 Years Old

The original Proposed Action included an additional 1,416 acres of treatment, both thinning and early seral creation, in fire-origin stands. These acres were dropped from the project due to the presence of red tree voles. The red tree vole (RTV), a small tree dwelling mammal, is a Survey and Manage Species. During the summers of 2014 and 2015, Forest Service employees conducted extensive RTV surveys in any stand proposed for treatment over 80 years of age and that met habitat requirements. Due to the Survey and Manage regulations, a buffer of 10 acres must be established around each active RTV nest. RTV nests were found abundantly in many of the fire-origin stands resulting in a patchwork of buffered and unbuffered areas. Consequently, many of the fire-origin units were not commercially viable.

The original proposed action was modified (see Alternative 2) to include only 324 acres of harvest in the fire-origin stands.

2.06 Comparison of Alternatives

Table 11 summarizes and compares treatments and connected actions that would occur under each alternative.

Table 11: Comparison of Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Timber Harvest Treatments					
Thinning outside Riparian Reserves	Acres	0	624	520	603.5
Thinning in Riparian Reserves	Acres	0	109	109	109
Aggregate Retention (early seral creation)	Acres	0	101	0	101
Gaps	Acres	0	35	43	55.5
Skips	Acres	0	489	344	489
Total	Acres	0	1,358	1,016	1,358
Connected Actions					
Post-Harvest Fuels Treatments in Timber Harvest Units					
Pile and Burn (mechanical and/ or hand treatments)	Acres	0	157	94	157
Post-Harvest Underburn	Acres	0	278	229	278
Road Activities Associated with Harvest					
New Road Construction	Miles	0	1	1	1
Temporary Road Construction	Miles	0	2.1	1.3	2.1
Temporary Road Re-Open	Miles	0	2.3	2.0	2.3
Roads Maintained	Miles	0	50	46	50
Road Decommissioning	Miles	0	6	10	10
Road Storage	Miles	0	31	29	29
Culvert Replacements	Amount	0	260	248	260
Rock obtained from expanding existing quarries	Cubic Yards	0	20,000	20,000	20,000
Rock obtained from new quarries	Cubic Yards	0	40,000	0	40,000
Acres by Harvest System					

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Skyline Harvest	Acres	0	537	429	537
Ground-based Harvest	Acres	0	328	239	328
Harvest Associated (Non-Commercial Treatments) Planting, Snags, and Down Wood					
Planting in Aggregate Retention Harvest	Acres	0	101	0	101
Planting in Gaps	Acres	0	32	43	55.5
Plant/regenerate Huckleberries	Acres	0	14	6	14
Plant Hazel, camas or other plants for tribal use	Acres	0	8	8	8
Plant Tall Bugbane	Acres	0	5	0	5
Underplant hardwoods	Acres	0	237	154	237
Underplant Incense Cedar and/or Western Redcedar (including in the riparian reserves)	Acres	0	303	0	303
Dry Meadow Restoration	Acres	0	2	2	2
Maple Restoration	Acres	0	3	3	3
Fall and Leave in Areas Unsuitable For Logging	Acres	0	3	3	3
Fall and Leave Conifers in Riparian Reserves	Acres	0	9	7	9
Fall and Leave Alder, underplant with Western Red Cedar and Big Leaf Maple in Riparian Reserves	Acres	0	1	1	1
Underplant Oregon Ash and Western Redcedar in Alder Area of Riparian Reserves	Acres	0	1	1	1
Pre-Commercial Thin (including Riparian Reserves) to favor hardwood trees	Acres	0	7	7	7
Snags and Down Wood (occurs in Aggregate Retention units)	Snags or Down Trees per Acre	0	At least 7	At least 7	At least 7
Northern Spotted Owl (NSO) Habitat					
NSO Suitable Habitat in Critical Habitat Treated (including skips)	Acres	0	109	0	109
NSO Dispersal Habitat in Critical Habitat Treated	Acres	0	141	141	141
NSO Non-Habitat in Critical Habitat Treated	Acres	0	77	77	77
NSO Suitable Habitat Treated (including skips)	Acres	0	142	0	142
NSO Dispersal Habitat Treated (including skips)	Acres	0	226	226	226
NSO Non-Habitat Treated (including skips)	Acres	0	103	103	103
Key Issues 1, 2, 3 and 4					
1. Harvest treatments in stands over 80 years of age	Acres	0	647	0	647
2. No Aggregate Retention harvest	Acres	0	101	0	101
3. More early seral creation and larger gap cuts	Acres	0	136	43	156.5
4. Increase harvest intensity for thinning units	MMBF	0	12.7	8.4	15.8

Comparison of Treatments Proposed in Riparian Reserves for Alternatives 2, 3 and 4.

The treatments proposed in Riparian Reserves for Alternatives 2, 3 and 4 are described and displayed below in Table 12 and Table 13. All units were surveyed by fisheries, hydrology, wildlife, and botany specialists.

Alternatives 2, 3 and 4 propose both active and passive management of Riparian Reserves: thinning, down wood augmentation, and no treatment (Table 12). No aggregate retention harvest or gap creation would occur in Riparian Reserve areas, and no commercial harvest would occur in Riparian Reserves in fire-origin stands. In commercial thinning in managed stands there would be no harvest buffers of a minimum of 75 feet on perennial streams. There would generally be a 50 foot buffer on intermittent streams, but there is one exception in unit 73 with only a 25 foot no harvest buffer on intermittent streams that have no riparian vegetation. Within Riparian Reserves, stand-specific treatments were prescribed by the Silviculturist in consultation with the District Hydrologist and Fish Biologist and are consistent with the upland treatments in the remainder of the unit. The Riparian Reserve commercial treatments are intended to meet the same desired future condition as the upland portion of the unit.

Table 12: Riparian Reserve Acres Proposed for Treatment

Activity ¹	Riparian Reserve Acres Proposed for Treatment						
	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
Stand Type ²	N/A	Managed Stands	Fire-Origin	Managed Stands	Fire-Origin	Managed Stands	Fire-Origin
Commercial Thinning ³	0	109	0	109	0	109	0
Non-commercial Treatment ³	0	18	3	18	0	18	3
Total Treatment	0	127	3	127	0	127	3
No Harvest	N/A	362	127	344	0	362	127
Total Riparian Reserves in proposed units	N/A	489	130	471	0	489	130
Percent of Riparian Reserve Treated in Trout Creek Project Area (%) ⁴	N/A	2.9	0.1	2.8	0	2.8	0.1
Percent of Riparian Reserve Treated in South Santiam 5 th Field Watershed (%) ⁵	N/A	2.9	0.1	2.8	0	2.9	0.1

¹ There is no gap creation or aggregate retention (early seral creation) in the Riparian Reserves in the Trout Creek project.

² Managed stands consist of stands that are 40-65 years old. Fire origin stands consist of stands that are 100-150 years of age.

³ Only Riparian Reserve treatments are represented in this table. Underplanting is not included.

⁴ Percent based on a total of 16,909 acres of Riparian Reserves in the Trout Creek project area.

⁵ Percent based on a total of 16,621 acres in the South Santiam 5th Field Watershed. About 30 acres of the project area are located in the Middle Santiam 5th Field Watershed. No treatments in the Riparian Reserve are proposed in the Middle Santiam Watershed.

Several Riparian Reserve areas were identified during field surveys to have a potential to be thinned to provide in-stream large wood, lack of riparian diversity, and/or opportunity for hardwood release. Selected Riparian Reserves for treatment were chosen for their vegetation characteristics at the stream catchment scale and at the site-specific scale. Riparian Reserve stands along streams in units 30, 33, 34, 67 and 95 are in need of non-commercial treatment and are proposed for fall and leave treatments. In these five units, fall and leave treatment would occur in approximately 20% to 75% of the units' no-

harvest buffers to reduce densities, open the canopies, increase growth and vigor of remaining trees, and add medium to large wood to forest floor and stream channels. These treatments would not result in reduction of canopy cover below 70% in Riparian Reserves. Refer to Table 13 for details.

Table 13: Proposed Riparian Reserve Treatments

Unit ¹	Treatment Description	Estimated Acres
30	Thin maple sprouts to favor dominate maple stems in the Riparian Reserves.	3
33	Fall and leave thinning an alder patch in the Riparian Reserves. This area would be replanted with western redcedar and bigleaf maple to promote stream shading.	1
34	Fall and leave, staying above 70% canopy cover in Riparian Reserves to promote in-stream structure to improve hydrologic function.	5
67	Fall and leave to release existing oak trees from competition. 55 trees would be felled in the Riparian Reserves.	1
87	Fall and leave thinning in a portion of a Douglas-fir plantation cut off by wetland from logging operation (1 acre). Underplant an alder area with Oregon Ash and western redcedar to promote long-lived species (1 acre).	2
95	Snag creation and fall and leave treatments to release existing oak and madrone trees from competition. 5 trees in the Riparian Reserves would be felled.	1
170	Pre-commercial thin by clearing 14 feet around existing hardwood trees. 35 foot buffer on perennial streams and no buffer on intermittent streams.	7

¹ Treatment in units 67 and 95 would drop if Alternative 3 is selected. All other units are treated under all alternatives.

2.07 Design Features

The design features in Table 14 were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices (BMPs).

Table 14: Design Features Common to Alternative 2, Alternative 3 and Alternative 4

Unit #	Reason	Design Feature	Dates
Silviculture			
All units	Retain structural components for wildlife	- Legacy trees would be retained unless removal is required during logging operations to meet safety requirements. Legacy trees are defined as trees left from previous stands that are typically larger than trees in the cohort that currently dominates stocking. Upper limits on the size of tree eligible for harvest would be in place in units that have legacy trees. See Integrated Prescriptions for details in specific units and legacy tree diameter. If cut, legacy trees would remain on site for down wood. - Existing coarse woody debris (≥10-inch diameter snags, ≥6-inch diameter down wood) would be retained and protected from disturbance where operationally feasible. - Logging damaged trees would not be removed without Forest Service approval. These trees offer an opportunity to enhance coarse woody debris development.	
14, 15, 20, 27, 28, 29, 30, 31, 32, 33, 34, 41, 42, 44, 50, 57, 58, 59, 60, 61, 62, 63, 68, 72, 73, 87, 89,	Decrease inter-tree competition while maintaining minor species in stands	Species targeted for release in these units are some combination of western redcedar, bigleaf maple, bitter cherry, and pine species. See Integrated Prescriptions for details in specific units.	

Unit #	Reason	Design Feature	Dates
100, 120, 140, 170, 190, 200			
15, 27, 32, 33, 44, 58, 62, 63, 200	Reduce disturbance to wildlife using gaps	5. If operationally feasible, locate gaps at least 100 feet from system roads. If gaps need to be placed closer than 100 feet due to feasibility, place as far from the road as is feasible.	
	Mimic disturbance patterns of fire and insects/disease	6. Use an irregular gap pattern that mimics a natural pattern across the landscape, unless otherwise noted. Vary gap placement so they are not linear or in a grid-like pattern.	
	Maintain stream shade	7. No gaps would be placed within Riparian Reserves (within 150 or 172 feet of streams).	
	Create complex branch structure in retained trees for future wildlife nesting/denning	8. Designate the center of the gaps by marking and retaining one dominant tree in 0.5-acre gaps and one to three dominant trees in 1-acre gaps. Retained tree(s) would be healthy and have at least 40% live crown ratio to reduce risk of blowdown. Favor selecting pine, Douglas-fir, or western redcedar as the leave tree(s). Avoid selecting true fir as the dominant tree(s) because of their high risk of sunscald and lower fire resiliency.	
	Maintain minor species in gaps for species diversity; Create structural complexity and species diversity	9. Cedar, pine, hardwoods, and Pacific yew would be retained in all harvest gaps.	
44, 57, 89	Maintain road system	10. Gaps to develop a new rock source, expand an existing rock source, and expand an existing waste area to assist in ongoing road maintenance would be located with assistance of Forest Service engineers. See Integrated Prescriptions for details in specific units. 11. All merchantable trees ≥ 7 inches DBH would be cut in these three gaps.	
14, 15, 20, 56	Meet requirements for reforestation as directed by National Forest Management Act and LRMP; increase species diversity	12. These units/portions of units would be reforested to meet required stocking levels of 150 trees per acre. See Integrated Prescriptions for details in specific units. 13. Planting would occur at a rate of 170 to 300 trees per acre. Species planted would be noble fir, western white pine, sugar pine, western redcedar, and incense cedar. Composition varies by unit. See Integrated Prescriptions for details in specific units. Container stock would be preferred, although other stock could be used if necessary. Planted trees would be sheltered from harsh growing conditions by using stumps, slash, and other natural features (microsites) located in the stand.	
14, 15, 20, 56	Maintain stream shade Structural complexity; mimic fire disturbance (apply to the remainder of this list)	14. Early seral creation would not occur in Riparian Reserves. 15. At least 15% of each early seral creation unit, outside of Riparian Reserves, shall meet green tree retention guidelines from the Northwest Forest Plan (about 70% in aggregates of 0.5 acres in size or greater and 30% as dispersed structures such as individual trees or aggregates smaller than 0.5 acres). 16. Areas with large down woody debris or rock outcrops would be priorities for green tree retention. 17. In the harvest areas, the largest Douglas-fir would be retained at the rate of nine to fifteen trees per acre as dispersed structures. 18. Underburn in the spring or fall to reduce fuels, prepare the site for planting, and create snags in the fire-intolerant species retained in the harvest area (such as true fir and hemlock). Pull slash away from the base of retained Douglas-fir if necessary for them to survive the burn.	

Unit #	Reason	Design Feature	Dates
		a. Monitor early seral creation area for snags post-harvest and burn. If burn does not meet Forest Plan Standard and Guidelines, create 2 snags and 5 down trees per treated acre from trees in Green Tree Retention. b. Unit 56 would include additional snag creation for site preparation and to meet objectives of mimicking fire disturbance.	
67	Maintain and increase the Oregon white oak component adjacent to Camas Prairie; increase trees/plants traditionally used by tribes	19. In harvest areas, all existing Oregon white oak would be retained. 20. All other merchantable trees under 35 inches DBH would be cut. 21. Underburn in the spring or fall to reduce fuels and prepare the site for planting. Pull slash away from the base of retained Oregon white oak if necessary for them to survive the burn. 22. Oregon white oak would be planted at 75 trees per acre using a cluster pattern to create an oak savanna. This would enhance the Camas Prairie Special Interest Area. 23. Outside of harvest areas, existing Oregon white oak would be released via fall and leave treatment. See Integrated Prescription for more details.	
43, 55, 66, 74, 92	Increase species diversity	24. These units would be underplanted, as funding allows, with shade tolerant cedar species at low levels. See Integrated Prescription for details in specific units.	
95	Maintain species diversity	25. Existing Oregon white oak and madrone would be released from competition. See Integrated Prescription for details.	
Fuels/Air Quality			
All units	Air Quality	1. Prescribed fire and fuels treatment implementation would be conducted in accordance with the Oregon State Management Plan.	
Wilderness			
20, 56	Protection of Wilderness Character: recreational access; Maintain access for recreating public	1. Maintain recreational access to the Menagerie Wilderness while treatment activities are occurring from August 1 to January 15 or until roads become impassable due to snow.	August 1 through January 15
20, 33, 72, 89	Protection of Wilderness Character: recreational access	2. Maintain recreational access to the Menagerie Wilderness while treatment activities are occurring. 3. Trail guard is necessary to protect public safety crossing treatment units.	Year round
20, 72, 89, 120, 140	Protection of Wilderness Character: mitigate noise impacts from non-commercial units and activities	4. Restrict to weekdays from Memorial Day to Labor Day. 5. Accomplish treatment with non-motorized equipment when feasible. 6. Expedite activities to the extent possible.	Memorial Day to Labor Day
20, 33, 56, 72, 89	Protection of Wilderness Character: mitigate impacts from commercial harvest.	7. Directionally fall trees away from wilderness boundary. 8. Skyline corridors and tailholds shall not enter wilderness area. Yard away from wilderness area.	
15, 20, 33, 44, 56, 72, 120, 140	Protection of Wilderness Character:	9. Expedite harvest activities to the extent practicable.	

Unit #	Reason	Design Feature	Dates
	mitigate noise from Commercial Harvest Units		
44, 57, 89	Protection of Wilderness Character: mitigate noise from blasting	10. Utilize available technologies to minimize sound travel from blasting (i.e., foams, etc.) to the extent possible.	Year round
Recreation and Wild and Scenic Rivers			
20, 56, 72	Maintain access for recreating public	1. Forest road 856 to remain open to public access while harvest activities occur (access to northern boundary of Menagerie Wilderness). 2. Implement traffic control to inform public accessing wilderness from Forest Road 856. 3. Trail guard is necessary to protect public safety crossing unit 20 and 72.	
41, 42, 50, 67, 68 (within ¼ of river), 72, 87	Protection of Wild & Scenic River values (MA-6c-20)	4. Retain at least 10 live green trees per acre in all harvest units. These trees would be dominant or co-dominant conifers within the stand.	
41, 50	Protection of Wild & Scenic River values (MA-6c-11)	5. Do not exceed 3 acres in size of even-aged regeneration harvest units (gaps). Shape and blend harvest units, or gaps, in a manner that would maintain or enhance the area's scenic quality by minimizing contrast in form, line, color, and texture.	
41, 42, 50, 67, 68 (within ¼ mile of river), 72, 87	Protection of Wild & Scenic River values (MA-6c-13)	6. Reshape landings to blend with the landscape and re-established ground cover. Preferred slash disposal methods include chip/disperse, chip/remove, truckload remove, hand pile/burn.	
41, 42, 50, 67, 68 (within ¼ mile of river), 72, 87	Protection of Wild & Scenic River values (MA-6c-15)	7. Maintain the appearance of an old-growth forest condition throughout the corridor, particularly along the river and its immediate environment. Overstory trees maintained in the old-growth seral stage should exhibit diameter, bark texture, color, branching habitat, height, and crown characteristics typical of each species type and growing site.	
50	Reduce impacts to recreating public	8. Keep road 2032 open to vehicle traffic from its origin with highway 20 to the turn off to Longbow group from May 1 through October 31.	
72	Reduce impacts to recreating public	9. Maintain vehicle access and existing parking to Rooster Rock trailhead during all treatment activities to allow for access to the hiking trail. Parking lot and trailhead to remain open for use. Any physical impacts due to harvest activity to the trailhead or parking area would be repaired and returned to pre-harvest activity condition.	
All units	Reduce impacts to recreating public	10. No hauling on Memorial Day, 4th of July, and Labor Day holidays. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	Memorial Day to Labor Day
43, 67, 68, 28, 92, 87, 42, 50, 41, 72	Reduce impacts to recreating public	11. No weekend operations from Memorial Day through Labor Day on Friday 6 pm through Sunday. No operations on Memorial Day, 4th of July, and Labor Day holidays. No operations the week of the 4th of July if the day falls on Tuesday-Thursday.	Memorial Day to Labor Day
All units	Reduce impacts to dispersed site creation and expansion	12. Rehabilitate all landings to prevent site from becoming a new dispersed site. Place natural obstacles such as down wood and rock in a natural arrangement to prevent creation of new dispersed sites where they do not presently exist. Bury boulders 1/3 of the way in the ground where possible.	
All units	Reduce impacts to dispersed site creation and expansion	13. In units where proposed landings are currently dispersed sites, rehabilitation of sites would be necessary to restore site to desired condition for continued use as a dispersed site or to return it to a naturalized state. Consultation with a recreation	

Unit #	Reason	Design Feature	Dates
		specialist would be required in the design phase for units in or adjacent to these areas. Rehabilitation may include: Placing natural obstacles such as down wood and rock in a natural arrangement to prevent expansion of dispersed sites. Burying boulders 1/3 of the way in the ground where possible.	
All units	Reduce impacts to dispersed site creation and expansion	14. Close temporary roads to traffic and rehabilitate to prevent new off road recreation use. Subsoil road surface of temporary roads to prevent new road creation where appropriate. Place natural obstacles such as down wood and rock in a natural arrangement to prevent creation of new dispersed sites where they don't presently exist. Bury boulders 1/3 of the way in the ground where possible.	
All units	Reduce impacts to recreating public	15. No operations on opening weekends of Cascade elk and deer rifle seasons; restriction is limited to the opening weekend of each hunt.	
All units	Reduce impacts to recreating public	16. Commercial hauling on a road open to all vehicles (mixed used, levels 2-5 road), must use a warning sign indicating "Trucks" or "Log Haul", in order to prohibit OHV use on roads beyond those signs. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	
All units	Reduce impacts to recreating public	17. Inform public of mixed use road closures, due to operations, on Forest Service websites, two weeks prior to harvest activity. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	
Scenic Quality			
50, 72	Minimize impacts to scenery along Scenic Byway (Hwy 20)	1. Any regeneration stock protective devices (animal damage protection tubes) would be brown or similar in color to blend with the natural surroundings (avoid white and other bright colors).	
72	Minimize impacts to scenery along Scenic Byway (Hwy 20)	2. Do not cut trees within 30 feet on either side of Rooster Rock Trail. Trees should be marked on the side away from the road or trail. 3. No staging of equipment on the Rooster Rock Trail and avoid the trail when considering the placement of logging systems.	
20, 32, 89, 140, 56	Minimize impacts to scenery viewed from Key Observation Points in the Menagerie Wilderness	4. Unit and gap edges would be feathered and skips would be left in organic, non-geometric shapes in a variety of sizes. 5. Prioritize leave trees that are along unit boundaries that also meet wildlife requirements. 6. Avoid widely spaced trees that are silhouetted along the skyline.	
50, 72	Minimize impacts to scenery along Scenic Byway (Hwy 20)	7. Slash would be chipped, removed, dispersed or piled and burned.	
28, 29, 30, 31, 32, 33, 41, 42, 60, 67, 68, 87, 89, 140	Minimize impacts to scenery in Scenic, Retention, Foreground and Scenic, Partial Retention, Foreground Management Areas	8. Slash would be chipped and dispersed or piled and burned.	
28, 29, 30, 31, 32, 33, 41, 42, 50, 60, 67, 68,	Minimize impacts to scenery in Scenic, Retention, Foreground and	9. Visible landings would be shaped to blend with the landscape and ground cover to be reestablished	

Unit #	Reason	Design Feature	Dates
72, 87, 89, 140	Scenic, Partial Retention, Foreground Management Areas		
33, 42, 50, 68	Minimize impacts to scenery in Scenic, Retention, Foreground Management Areas	10. New temporary haul roads would be designed to blend into the surrounding topography and follow natural patterns to decrease apparentness on the landscape. If significant grade changes are necessary in construction of roads, the area would be returned to original grade when obliterated.	
Wildlife			
All units	Protect Northern Spotted Owl	1. In the event an owl nest is discovered during layout or implementation, no proposed activities shall take place within the 300 meter nest patch. 2. Haul is restricted on roads within 65 yards of all 300 meter owl nest patches.	Year Round
60, 61, 73	Protect Northern Spotted Owl	3. No proposed activities shall take place within the 300 meter nest patch. 4. Consult with wildlife biologist prior to layout.	Year Round
73, 60, 61, 63, 59, 42, 50, 14, 100, 170, 200	Protect Northern Spotted Owl, Great Grey Owl and Migratory Birds	5. No proposed activities, including road maintenance, are to take place during critical nesting bird season this includes aerial activities. 6. No blasting or burning within 0.25 miles of a known 300 meter owl nest patch.	3/1 to 7/15
73, 60, 61, 63, 59, 42, 50, 14, 100, 170, 200	Protect Northern Spotted Owl, Great Grey Owl and Migratory Birds	7. No blasting or burning within 100 yards of a known 300 meter owl nest patch.	7/16 to 9/30
72	Protect Northern Spotted Owl	8. Only the south side of the unit, in unsuitable habitat, shall be harvested.	Year Round
50, 41	Protect Harlequin Duck	9. No proposed activities shall take place during nesting bird season.	03/01 to 07/15
All units	Species of Concern	10. If previously undocumented raptor nests are found during layout or sale administration, project modifications would be made as needed to protect the nest site and reduce harm to birds.	Year Round
170, 190	<i>Megomphix hemphillia</i>	11. A one acre no-harvest or prescribed burning buffer within unit 170 shall be established on 3 MEHE sites north of the unit and on 2 sites on the south side of unit 190.	Year Round
30, 170, 190	<i>Megomphix hemphillia</i>	12. Only cool patchy under burning allowed.	Year Round
20, 56, 120, 15	Peregrine Falcon	13. No proposed activities shall take place during nesting season, including burning, aerial activities, or blasting.	02/01 to 08/15
20, 56, 120, 89, 140, 32, 33, 34, 44, 27, 72, 62, 15	Peregrine Falcon	14. No aerial activities shall take place during falcon nesting season.	02/01 to 08/15
20, 56, 120, 89, 140, 33, 34, 200, 32, 74, 44, 27, 72, 62, 15	Peregrine Falcon	15. No blasting shall take place during falcon nesting season.	02/01 to 08/15
All units	Johnson's Hairstreak	16. During layout retain any Western Hemlock that are identified as having dwarf mistletoe where feasible.	Year Round

Unit #	Reason	Design Feature	Dates
28, 170	Red Tree Vole	17. A 10 acre no-harvest buffer within unit 170 shall be established on 2 RTV sites south of the unit and on one site on the north side of unit 28.	Year Round
All units	Protect Fisher, Fringed Myotis, Pileated Woodpecker and other Cavity Nesters, American Marten	18. Retain all snags, regardless of DBH, unless they must be dropped for safety or operation concerns. If a snag must be dropped, leave snag in the unit. 19. Retain defective trees with cavities or sloughing bark to the greatest extent feasible to serve as wildlife habitat 20. Retain all existing down wood. In addition, ensure that future coarse woody debris habitat is provided for as prescribed.	Year Round
14, 15, 20, 56, 67	Protect Fisher, Fringed Myotis, Pileated Woodpecker and other Cavity Nesters, American Marten	21. An assessment of snag levels shall be conducted post-prescribed burning to ensure that Forest Plan standards of maintaining or creating 2 snags/acre and 240 linear feet of down wood are met. If the assessment concludes that, post-burn, Plan standards were not met, additional dead wood would be created.	Year Round
All units	Protect Fringed Myotis and Townsend's Big-eared Bat	22. Buffer any cave habitat by 250 feet from proposed activities.	Year Round
Units adjacent to streams	Protect Crater Lake Tightcoil	23. Protect perennial streams and riparian areas with vegetation that have year-round water access with a minimum 10 meter (30 foot) no harvest buffer.	Year Round
Botany			
All units	Reduce the introduction and spread of invasive species	1. All road construction and harvest equipment would be pressure washed prior to working in the project area.	
All units	Reduce the introduction and spread of invasive species	2. Obtain gravel for road construction and reconstruction from a weed-free rock source. Rock sources would be inspected by the District Botanist.	
All units	Reduce the introduction and spread of invasive species	3. Minimize areas of soil disturbance during all phases of harvest activities including spur road construction, reopening existing temporary roads, fuels treatment, etc.	
All units	Reduce the introduction and spread of invasive species	4. Seed all disturbed areas with weed-free native grass seed, including landings, subsoiled skid roads, culverts, and temporary roads to reduce weed establishment.	
All units	Reduce the introduction and spread of invasive species	5. Berm, gate, rip and seed any new temporary and re-opened roads to reduce disturbance and incoming weed seed on vehicular traffic.	
All units	Reduce the introduction and spread of invasive species	6. Roads to be closed or decommissioned would be treated for invasive weeds prior to closing.	
All units	Reduce the introduction and spread of invasive species	7. Pretreat existing weed sites in and adjacent to harvest units and associated roads.	
All units with gaps	Reduce the introduction and spread of invasive species	8. Gaps would be placed to avoid known weed infestations.	
All units	Reduce the introduction and	9. If possible, Knutson-Vandenberg (KV) trust funds would be retained from the proposed timber sale to survey and control	

Unit #	Reason	Design Feature	Dates
	spread of invasive species	invasive weeds on all harvest units, landings, and roads in the planning area.	
20	Protect integrity of sensitive species and its habitat	10. Buffer <i>Bridgeoporus nobilissimus</i> by 150 feet.	
100	Protect integrity of sensitive species and its habitat; protect integrity of special habitat	11. If necessary, adjust eastern portion of stand to protect <i>Eucephalis gormanii</i> at Cougar Rock. 12. Consult district botanist during sale preparation. 13. Cougar Rock is an Area to Protect (ATP).	
67	Protect integrity of sensitive species and its habitat; protect integrity of special habitat	14. Buffer <i>Hypotrachyna riparia</i> by 150 feet. 15. Active oak management in Camas Prairie and wetland special habitat.	
29, 59	Protect integrity of survey and manage species and its habitat	16. Buffer <i>Peltigera pacifica</i> by 75 feet.	
15	Protect integrity of special habitat	17. Vine maple/talus is an Area to Protect (ATP).	
20, 27	Protect integrity of special habitat	18. Rock outcrop/rock garden is an ATP. 19. Buffer seep or wet area by 150 feet.	
32, 42	Protect integrity of special habitat	20. Red alter patch and rock garden are ATPs.	
33, 55	Protect integrity of special habitat	21. Alter wetland is an ATP. 22. Small wet meadow is an ATP.	
41, 58	Protect integrity of special habitat	23. Rock outcrops and oceanspray patches are ATPs.	
44	Protect integrity of special habitat	24. Talus and rock outcrops are ATP.	
50	Protect integrity of special habitat	25. Buffer alder/mannagrass wetland by 75 feet. 26. Rock outcrop is an ATP.	
56	Protect integrity of special habitat	27. Buffer sphagnum wetlands by 150 feet. 28. Rock outcrop on ridge is an ATP.	
57	Protect integrity of special habitat	29. Buffer seep by 50 feet.	
59, 95	Protect integrity of special habitat	30. Rock garden or outcrop is an ATP; manage for oak and madrone.	
60, 62, 98	Protect integrity of special habitat	31. Rock garden or rock outcrop is an ATP.	
72, 87	Protect integrity of special habitat	32. Buffer sedge pond/wetland (weedy) by 75 feet.	
Transportation			
Roads 2027720, 2027730, 2027732, 2027755, 2027760	Minimize erosion and sedimentation	1. Haul routes are not suitable for wet weather haul. These roads are not covered under fisheries consultation.	
All units	Minimize erosion and sedimentation	2. Aggregate surfacing must be durable rock (AASHTO T210). No more than 15% fines (#200 sieve).	
All units	Minimize erosion and sedimentation	3. All disturbed sites related to reconstruction and or maintenance such as waste area sites and culvert replacements would require erosion control methods.	
All units	Minimize erosion and sedimentation	4. Newly installed culverts would meet current sizing requirements on perennial streams.	
All units	Minimize erosion and sedimentation	5. All non-paved roads used for wet weather haul would be rocked with at least 4 inches of aggregate material, with	

Unit #	Reason	Design Feature	Dates										
		minimum size determined by road slope and proximity to streams.											
All units		6. All work done to or on a road would be consistent with the Road Management Objective for that road.											
All units		7. Right of Way Authorizations and/or Land Use Agreements with the State of Oregon required to provide legal access would be obtained prior to harvest activities.											
All units		8. All road work and activities to follow the Willamette National Forest Commercial Road Rules (Dec 2016).											
Aquatics (Fish and Hydrology)													
All units and haul routes	Protect fish and other aquatic species and their habitat	1. Include stream protection mitigation measures and design criteria referenced in the fisheries consultation documents (Biological Assessment and Letter of Concurrence from the National Marine Fisheries Service expected before the Decision Notice is signed). 2. Ensure that seeding and mulching of bare soil is implemented where any ditch clean out occurs. This would also reduce erosion and prevent weed establishment. 3. Waste material from road work would be placed in a stable designated area outside of Riparian Reserves.	Apply seed in the fall										
Units with Commercial Thinning in Riparian Reserves	Reduce potential for stream temperature increases, minimize sediment delivery to streams, and maintain bank stability. Protect various aquatic and terrestrial wildlife and plant species.	4. Commercial thinning in Riparian Reserves would leave no-cut buffers along streams that vary according to required protection measures. The primary shade zones on perennial streams would be left intact to ensure adequate stream shade to maintain desirable stream temperatures. 5. No-cut buffers on streams would ensure maintaining future large wood sources and contribute to terrestrial biodiversity (See table below for minimum no-harvest buffer widths. All buffers are measured from the trees nearest the stream rather than the water's edge).											
		<table><tr><th>Stream Class</th><th>No-harvest buffer width</th></tr><tr><td>Class 4 stream (intermittent)</td><td>50 feet</td></tr><tr><td>Class 3 stream (perennial) – year round and no fish are present</td><td>75 feet (primary shade zone)</td></tr><tr><td>Class 2 stream (fish)</td><td>100 feet</td></tr><tr><td>Class 1 stream (anadromous fish)</td><td>120 feet</td></tr></table>		Stream Class	No-harvest buffer width	Class 4 stream (intermittent)	50 feet	Class 3 stream (perennial) – year round and no fish are present	75 feet (primary shade zone)	Class 2 stream (fish)	100 feet	Class 1 stream (anadromous fish)	120 feet
		Stream Class		No-harvest buffer width									
		Class 4 stream (intermittent)		50 feet									
		Class 3 stream (perennial) – year round and no fish are present		75 feet (primary shade zone)									
		Class 2 stream (fish)		100 feet									
Class 1 stream (anadromous fish)	120 feet												
All units	Widths of Riparian Reserves	6. Site-potential tree heights to determine Riparian Reserve widths are 172 and 150 feet (see unit prescriptions). This includes all streams, unstable or potentially unstable areas such as earthflows, and wetlands less than one acre.											
All units with thinning in Riparian Reserves	Maintain Aquatic Conservation Strategy Objectives, including maintain potential for future down wood	7. The thinned portion of the Riparian Reserves would be at least 50% canopy cover after thinning. 8. Logging system changes would not reduce average canopy cover in thinned portion of Riparian Reserves to below 50%.											
All haul routes	Protect water quality, fish, and other aquatic species and their habitat	9. Any culvert replacement on perennial streams would be done during the in-stream work window between July 15 and August 31. 10. Wet weather haul would be immediately stopped if the timber sale administrator notices the potential for sediment delivery from road surfacing to live streams. Haul would not be resumed until road surfaces sufficiently dry out, potential sediment delivery is stopped or the cause is repaired.	July 15th to August 31st										
Temporary Roads	Protect water quality and	11. Native surface temporary roads would be dry season only. If waivers are requested to operate on native surface temporary roads during the wet season, the operator would be required to											

Unit #	Reason	Design Feature	Dates
	prevent increased peak flows	rock the road. The rock would be removed when operations are complete, but before decommissioning the road after use. 12. Native surface, temporary roads that spur off of roads not permitted for wet weather haul (2027720, 2027730, 2027732, 2027755, and 2027760) would be dry season only.	
Soils			
All harvest units	Minimize compaction, disturbance levels and for soil productivity during project implementation	1. Ground-based equipment is limited to slopes less than 30%, unless otherwise directed by a Soil Scientist/Hydrologist. 2. Ground-based equipment may be allowed on slopes greater than 30% but less than 40% in a few selected instances where it is determined that skidding on these steeper slopes is more beneficial to the various resources than implementing some other logging system. Decisions to operate on 30-40% slopes would be based on weather conditions, hillslope profile, soil properties, and presence of instability, type of equipment and the ability of the operator/contractor to implement the work successfully and safely. 3. Where practical ground-based equipment should travel on a slash mat to reduce off site soil erosion and soil compaction. Slash mat cover depth should range from 6-18 inches depending on slope gradient hillslope morphology (slope location).	
15, 27, 34, 59, 54, 56, 67	Minimize disturbance levels and promote long term slope stability.	4. Buffer/avoid unstable-unsuitable areas or consider an alternative prescription, logging system.	
All harvest units and associated access.	Minimize compaction, disturbance levels during project implementation	5. Predesigned skid trails and landings are required in all ground-based skidding units and would be approved by the sale administrator in advance of use. Skid trails shall be located outside of the no-cut buffers. a. Consult with soil scientist if new skidtrails are proposed in areas under high clay potential and referred to soil design criteria # 22 for potential units 6. Preexisting skid trails and temporary roads should always be used before new skid trails locations are approved. They should not exceed 15 feet in width, and the objective is to maintain a minimum of 10 feet to an average of 12-foot width throughout the length. 7. Space skid trails a minimum of 50 feet apart for processor/forwarder operations.	
Units mentioned in Soils design criteria # 4, 25	Protect soil resources	8. Limit the amount of adverse skidding to as little area as is feasible within a unit, including less number of passes. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Limit or avoid the grade of constructed skid trails on geologically unstable, saturated, highly erodible, or easily compacted soils.	
All harvest units /Skyline operations	Protect soil resources	9. Skyline corridors shall be as narrow as practical, no more than 12 feet and spaced approximately 150 feet apart. 10. A minimum of one end suspension of logs is required for all logging systems. Partial or one end suspension is required on skyline units, except at tail trees and landings.	
55, 58, 62, 67, 68, 74, 89, 95	Protect soil resources	11. No pre-bunching allowed.	
15, 27, 34, 200	Protect soil resources	12. Some pre-bunching is allowed with soil scientist consultation.	

Unit #	Reason	Design Feature	Dates
20, 28, 29, 30, 31, 32, 33, 41, 42, 43, 50, 56, 57, 59, 60, 61, 63, 66, 72, 87, 92, 140, 170	Protect soil resources	13. Pre-bunching is allowed in surveyed areas up to 45% slope. These are areas with suitable terrain and available acceptable access. 14. All pre-bunching areas have the same site location restriction and access requirements that ground-based logging and review/approval of activities outside of standard season of operation.	
All harvest units and associated access.	Minimize Displacement, maintain effective soil productivity nutrient levels	15. Retain existing duff percentages and woody material in accordance with Forest Plan Standard and Guidelines, stated in the <i>Table of Unit Specific duff retention Integrated Prescriptions</i> 16. Duff retention would be monitored by soil scientist as part of any activity that may affect the soil resource, such as harvesting, pile burning, or under burning. 17. Where operable, harvested trees should be topped and limbed in the units in order to provide small limbs and needles for nutrient recycling. This objective has to be tempered with the need to reduce fuel loading to control potential wild fires, and to meet site specific standards for slash loadings. 18. Where temporary roads, skidtrails or crossings used by the sale are being decommissioned, or where system roads are being decommissioned and taken off the system, pull available slash into treated areas with open soil to dissipate surface erosion and reduce sun exposure. 19. Material piling may occur by hand or with a grapple machine. Grapple piling requires only one pass of the machine across the landscape, and the machine works while sitting on slash. No grapple piling should occur during winter or wet weather seasons. Recommend grapple piling activities within flat areas, and road prisms.	Standard Operation Season and Outside standard season - Wet Weather Management
All applicable areas within harvested units	Minimize erosion and sedimentation	20. Construction or reconstruction of roads and landings would be done during the dry period (June 1-October 31) and not when soils are saturated or run-off occurs. Restrict winter haul maintenance to period of dry season. Unclassified or temporary roads used outside the standard operating season, should be rocked, snow covered, or frozen to reduce the potential for erosion and applied prior to the wet haul/winter season in order to prevent sediment delivery. 21. If needed, open temporary roads, skid trails and landings should be storm proofed with water bars or drain dips if they have to set through extended periods of wet weather (Temporary seasonal closure - winterize) or under predicted high precipitation events.. 22. In general, water bar location should occur where local terrain facilitates effective drainage while avoiding soil disturbance and sediment delivery. Construct water bars every 100' on slopes <15% and 50' on slopes >15%. Water bars shall be keyed into the cut bank and have a clear outlet on the downhill side. Water bars may be limited on skid trails when sufficiently covered with slash to minimize soil compaction and erosion. Specific water bar designs would be provided within soil resources report. 23. The Timber Sale Administrator would monitor wet weather haul, and as needed, consult resource specialists. When necessary, haul may be suspended during rainfall to prevent off-site movement of sediment into drainage courses. Conditions for suspensions as stated in soil design criteria # 22.	Wet Weather Management, Winter over snow management

Unit #	Reason	Design Feature	Dates
All harvest units and associated access.	Reduce soil compaction and displacement	24. Ground-based equipment should operate during standard seasons of operation in the dry season (from June 1– October 31). 21. If high/long precipitation events occur during the standard operating season, ideal soil conditions criteria's (#21) would be assess and follow to resume operations. The soil scientist would be available for consultation if re-routing or restrictions become necessary.	Standard Operating Season and Outside standard season - Wet Weather Management
Units with potential wet weather management limitations are: 20, 28, 29, 30, 31, 41, 42, 43, 50, 55, 56, 57, 58, 59, 60, 61, 63, 66, 67, 68, 72, 74, 87, 89, 92, 95, 120, 170, 190	Reduce soil compaction and displacement	25. Ideal site conditions criteria for ground-based operations would be monitor in the mentioned units with potential wet weather management limitations for: a. Expected Dominant Soil Conditions: i. No soil saturation ii. No clay soils. In general, dominant coarse and moderately coarse texture soils. iii. No off-site movement of sediment within ditch and drainages, no trenching or rutting before and during harvesting operations. iv. None to minimal water pooling (standing water or wet zones) within area. v. Minimal existing exposed soils and area disturbance. vi. None to minimal existing soil compaction b. Potential Weather Conditions i. Weather conditions should be assessed by sale administrator knowledge of project area (before and during operations). Assess soil conditions when weather conditions within project area have reached more than 1 inch precipitation during a 24-hour period. c. Equipment available and other management activities i. Like use low ground pressure equipment when practicable, ii. Other effective re-routes and recommendations from soil scientist (e.g., slash mats). 26. Request for operations outside the standard operating season would be assessed following ideal site conditions criteria #22 including other resources recommendations.	Standard Operating Season and Outside standard season - Wet Weather Management
All applicable areas within harvested units	Reduce compaction levels and improve overall productivity.	27. Subsoiling Efforts: subsoiling all landings, primary skid trails within identified units; temporary roads used in the sale area as part of the logging operations and possibly in road decommission projects. i. Subsoiling needs to be considered in light of the potential for root pruning, damage to existing regeneration, and the increased amount of soil disturbance. Consequently, “munching” or bucket ripping is the preferred style of subsoiling. Ideal subsoiling occurs when soils are mostly dry. ii. Subsoiling is defined as the de-compaction of the soil surface to a depth of 20 to 24 inches. Mulching, seeding and slash application should occur following subsoiling operations to aid soil productivity and protect open soils from direct rain impact in disturbed areas. 28. Up to 20 acres of enhancement, subsoiling is suggested within the project area.	
All harvest units above the snow transition zone		29. Ground-based equipment operation over Snow/frozen soil or over a deep, solid snow pack may occur in the following conditions: 30. 0 inches of frozen soil – Need at least 18 inches of settled snow or up to 24 inches of dense snow. 31. 4 inches of frozen soil – Need at least 9 inches of settled snow.	Winter over the snow operations

Unit #	Reason	Design Feature	Dates
		32. 6 inches of frozen soil – No snow cover necessary/plus 2 inches of snow (pack/settle) per archaeology concerns. 33. When necessary, and to reduce loosing dense snow pack, pre-pack snow on designated routes before work commences. This allows soil to freeze and the snow road to solidify. 34. Over snow, operations would be suspended or re-routed if thawing, soil exposure or uneven snow pack occurs during operations. Maintain these standards when reducing snow pack within skid trail areas to not lose dense snow pack, especially during short warming periods. 35. Suspend logging operations if continuous warming temperatures reduce packed and dense snow below values stated above. 36. Haul roads used outside the standard operating season, should generally be rocked, snow covered, or frozen to reduce the potential for erosion, unless other mitigating or extenuating circumstances are present. A minimum of 2 inches of snow over/frozen ground and or road prisms. 37. During thawing and melting events maintain drainage for reduction of runoff from any thawing, and snow storage melting.	
Pile burning, under burning	Minimize Displacement, maintain effective soil productivity nutrient levels	38. Conduct prescribed fire and pile burns to minimize the residence time on the soil while meeting the burn objectives. Burn when the duff and soil moisture conditions are high and where complete consumption of organic materials is not expected. 39. Conduct prescribed fire and pile burning in order to retain soil duff/litter and woody material using these criteria: - Retain existing duff percentages and litter/woody material in accordance to the percentage stated in the integrated prescriptions for unit specifics table. - Retained some down woody (large and snags) material within prescribed and pile burning sites. Large logs, greater than 16 inches diameter and greater than 10 feet long in a variety of good decomposition classes are preferred. 40. Fire line would be constructed with appropriate water drainage using natural contours and waterbars to shunt water. Rehabilitate constructed fire lines by installing water bars, raking topsoil back over the line, covering exposed mineral soil with duff and other organic matter or other mulch materials, or seeding, if recommended by the botanist, to help prevent weed/non-native invasion. 41. Upon completion of pile, burning operations consider dispersing partially burnt material to meet ground cover requirements.	
Heritage			
All units	Heritage resource protection	1. Information specific to heritage resource location and content is exempt from disclosure under the Freedom of Information Act (FSM 6271.2). In order to facilitate the decision-maker, the information would be made available to him/her. 2. All National Register of Historic Places (NRHP) eligible sites and potentially eligible sites must be avoided during all project activities. 3. Changes to the current unit configurations and/or the addition of any new units, would require consultation with the District Archaeologist in order to protect known and unknown heritage resources.	

Unit #	Reason	Design Feature	Dates
		4. Project activities planned outside of the area defined in the heritage resource inventory schema must be coordinated with the District Archaeologist prior to initiation. This includes the establishment of harvest landings, guy-line equipment anchors, equipment staging areas, and rock storage areas, slash burning and silvicultural treatments. 5. Prior to cultivating/ripping skid roads post-harvest a re-entry survey must be conducted in those areas deemed high probability for the occurrence of heritage resources. Coordination with the District Archaeologist is essential to ensure the protection of heritage resources. 6. In order to extend protection to heritage resources which have not yet been discovered, but which may be uncovered during the course of project activities, include contract clause in all project prospectus and contracts that outline the procedures to follow in the event heritage resources are inadvertently discovered or disturbed during project activities. If cultural material is inadvertently discovered, suspend operations and consult the District Archaeologist to allow for development of the proper course of action.	
27 and 44	Heritage resource protection	7. Consult with District Archeologist if equipment would be staged at the junction of the 2027 and 2027-750 roads	
89	Heritage resource protection	8. No staging of equipment on the 840 road on private land. Consult with archeologist during layout and contract writing process.	

2.08 Mitigation and Enhancement Recommendations Common to Alternatives 2, 3 and 4

Table 15 provides a list of mitigation and enhancement recommendations for wildlife trees and down wood common to Alternatives 2 and 4. Units proposed for aggregate retention would have snag/large down wood creation as a mitigation measure. Since there is no aggregate retention proposed for Alternative 3, there would be no down wood or snag creation. Some units have habitat mitigation measures recommended in riparian reserves. Other units have snag/down wood creation recommended as an enhancement measure and implementation is dependent on funding. Tree mitigation and enhancement techniques may include topping or girdling.

Table 15: Wildlife Tree and Large Down Wood Creation Recommendations for Alternatives 2 and 4

Unit	Acres of aggregate retention	Trees to be left/felled for large down wood (5 per acre)	Snag creation (2 per acre)	Total leave trees for snags and down wood
14	10	50	20	70
15	6	30	12	42
20	36	180	72	252
56	47	235	94 ¹	329

¹ This is for Alternative 4 only. Unit 56 is already prescribed for snag creation in excess of 2 snags per acre as part of site preparation and mimicking mixed severity fire.

2.09 Monitoring

Operations: Contract administrators would monitor treatments during implementation to ensure contractors are in compliance with their contract. Contract elements monitored would include harvest

specifications, bole damage to residual trees, down wood and snag retention, skid trail spacing and use of designated skid trails.

Fuels Treatments: The Sweet Home Ranger District fire and fuels personnel would monitor fuel loading during and following the fuels treatments. Fuels treatment results will offer data to use in the future.

National Aquatic Best Management Practice Monitoring: The National Best Management Practices Program provides a standard set of core best management practices and consistent documentation of the use and effectiveness of the practices. Post-implementation best management practices monitoring may include review of aquatic management zones, erosion prevention and control measures, cable and ground-based yarding operation effects, and site treatment.

Invasive Plant Monitoring: Monitoring for invasive plants for three years after the treatment would be completed. Identified weed populations would be treated.

Forest Plan Implementation Monitoring: The Forest Supervisor's Staff performs annual project monitoring at each Ranger District and compiles the results in the yearly Forest Monitoring Report. Implementation of treatments from this project would be subject to Forest Plan Implementation monitoring. Other implementation monitoring elements may include temporary road decommissioning, snag and large down wood abundance, and any seeding or planting of vegetation.

Reforestation: Ensure aggregate retention stands are sufficiently stocked (at least 150 trees per acre) within five years of site preparation. Forest Service Manual direction is to conduct first and third year stocking surveys to determine if the site can be certified as sufficiently stocked.

Chapter 3 – Affected Environment and Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives.

Cumulative Effects Analysis

This section of the FEIS considers the environmental consequences of implementation of the various alternatives. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

The analysis of direct, indirect, and cumulative effects on each resource includes defined analysis area boundaries, as well as the length of time effects are expected to last. These are specific to each resource and therefore may vary in physical and temporal scale.

Interdisciplinary Team

The interdisciplinary team (IDT) includes Forest specialists for each discipline (see Chapter 4 for team members and their qualifications). Specialists from soils/geology, wildlife, recreation (wilderness), hydrology (aquatics), engineering (transportation) and botany prepared technical reports to address the affected environment and expected environmental consequences of the proposed actions and alternatives of the Trout Creek project. Others wrote their analysis directly to the EIS. All reports and related documents are maintained in the project file, located at the Sweet Home Ranger District in Sweet Home, Oregon. In some cases, this chapter provides a summary of the report and may only reference technical data upon which conclusions were based. When deemed appropriate, those parts of specialist reports that are not included in this FEIS are incorporated by reference (40 CFR 1502.41).

Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT specialists. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of this FEIS. Referenced material is a consideration of the best available science.

Cumulative Effects

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

Appendix C provides a summary of past, present, and reasonably foreseeable activities in the project area that could contribute potential cumulative effects to the environment along with the Trout Creek project.

3.01 Forest and Stand Structure

Summary of Effects Analysis

This section details the effects on forest vegetation and structure of proposed silvicultural treatments to meet the objectives of the Trout Creek project. Stand exams and field reconnaissance yielded data that was used to model forest growth and effects of treatments.

Treatments are proposed in a mix of managed stands and fire-origin stands to meet project objectives. These treatments would include thinning of varying intensities, gap creation, retention of unharvested forest in skips, snag creation, and aggregate retention harvest (see Appendix E for unit-specific treatments by alternative). Thinning would improve stand health and vigor, as well as create conditions for successful hardwood fuelbreaks and understory hardwood tree planting. Tree planting in aggregate retention areas and gaps would increase tree species diversity of drought-tolerant species and conifer bough species. Gaps would improve structural complexity by releasing dominant trees to develop complex crown structure and initiating a second tree cohort. Skips would improve structural complexity by allowing inter-tree competition to occur at levels that continuously creates snags, which become down wood. Aggregate retention harvest would create complex early seral habitat. A mix of these treatments coordinated together and combined with prescribed burning would mimic the effects of mixed severity fire on a landscape scale (defined as approximately 136 acres or greater in size of coordinated treatments) in two areas within the project area. Many of these treatments would contribute timber products to local markets.

Four alternatives were analyzed to determine their direct, indirect and cumulative effects. Alternative 1 is the No Action alternative. Alternative 2 is the proposed action. Alternative 3 would not create complex early seral habitat or propose treatments in fire-origin stands. Alternative 4 would increase the acres of gaps and would increase the harvest intensity in complex early seral habitat treatments. Table 16 details the differences in alternatives by objective.

Table 16: Comparison of Alternatives Direct and Indirect Effects by Objective

Objective ¹	Resource Indicator	Measure	Alt 1	Alt 2	Alt 3	Alt 4
1	Level of competition for sunlight, water, and nutrients	Acres of thinning	0	733	629	711
1	Tree species composition of drought-tolerant species	Acres planted to western white pine, sugar pine, incense cedar, or Oregon white oak	0	439	43	461
1	Restoration of sugar pine and western white pine	Acres planted with blister rust-resistant stock	0	136	43	158
1	Canopy gaps present	Acres of gaps	0	35	43	57
1	Skips present	Acres of skips	0	489	344	489
2	Timber to local markets	Amount of timber in MMBF (million board feet)	0	12	8	15
2	Opportunity for future conifer bough collection	Acres planted that include noble fir	0	38	0	38

Objective ¹	Resource Indicator	Measure	Alt 1	Alt 2	Alt 3	Alt 4
3	Landscape area approximates the size of a mixed severity fire event (about 136 acres or more treated)	Acres treated in each landscape area	0	1 area of 296 acres & 1 area of 125 acres	1 area of 184 acres & 1 area of 125 acres	1 area of 296 acres & 1 area of 125 acres
3	Complex early seral habitat present	Acres of complex early seral habitat	0	101	0	101
4	Opportunities for wildfire management	Acres of long-lasting, minimal-maintenance fuelbreaks	0	119	43	119
5	Presence of hardwood-dominated areas in the project area	Acres planted to red alder, bigleaf maple, madrone, or Oregon white oak	0	238	155	238

Cumulatively, these actions would result in seral stage changes measured in the tenths of a percent at the scale of the South Santiam fifth-field watershed.

Scale of Analysis

Direct and Indirect Effects

The scale of analysis used for the direct and indirect effects is the project area. The project area provides a site specific location to evaluate changes caused by project activities. The changes analyzed are predictable, quantifiable, and linked to cause and effect relationships. The effects are described in terms of the magnitude (the amount of change –extent, duration, direction, and speed) of the action changing the stand conditions.

Cumulative Effects

The scale of the cumulative effects analysis is National Forest System (NFS) lands within the South Santiam fifth-field watershed. Small portions of the project area, containing 31 acres of proposed thinning treatments, are in the Headwaters of the Middle Santiam fifth-field watershed. Those 31 acres were lumped into the South Santiam fifth-field watershed to simplify analysis. The South Santiam fifth-field watershed encompasses the treatment areas and provides an appropriately sized area to reflect the scale where cumulative effects become stable. The area is large enough to bound the effects both spatially and temporally, relates well to cause and effect relationships of the treatments, is site specific to the location, and measures the change that is occurring to the stands.

The cumulative effects analysis is based on NFS lands, as management on private lands cannot be accurately predicted. There are 33,575 acres of private land in the South Santiam 5th-field watershed (about 33% of the watershed). In general, it can be assumed that management on private land will result in stands being in the early seral and mid seral-closed stages, but seral stage change cannot be predicted in terms of spatial or temporal arrangement. Appendix C includes an estimation of private land harvest for a five year period in the project area, but is subject to change due to timber market fluctuations.

Data Sources

Stand data collection occurred with stand exam contracts in 2012 and 2013, with additional stand exams being accomplished by Forest Service personnel in 2015. The stand exams were converted to a Forest Vegetation Simulator (FVS)-ready file type for growth and yield modeling. Some stands did not receive any stand exam plots. These units were sampled during field reconnaissance with quick plots, collecting basic information. This information was entered into a Microsoft Access database for use in FVS.

Stand treatment options were analyzed in FVS (Suppose Version 2.06). FVS variants for the Westside Cascades and Pacific Northwest Coast were updated in June of 2015 to replace the individual tree mortality equations with those from the Oregon Growth Analysis and Projection (ORGANON) model, which more accurately reflects snag recruitment over time (FVS bulletin 734-062615). FVS analyses in this report were done using the updated version (United States Department of Agriculture [USDA], 2002).

ArcGIS 10-3-1 was used to do GIS analyses and mapping.

Affected Environment

General

The project area is about 37,344 acres in size. Of these acres, 29,142 are managed by the U.S. Forest Service, and the remaining 8,202 acres are privately owned. The project area is primarily located within the South Santiam fifth-field watershed. The watershed is approximately 101,917 acres in size, with 68,342 of these acres managed by the U.S. Forest Service and 33,575 acres of private land that is primarily managed as high production industrial forest. Elevation ranges from 940 feet at the west end of the watershed to 5,440 feet at the top of Iron Mountain at the east end of the watershed. Elevation of proposed units ranges from 1,020 to 4,460 feet.

Disturbance History

The current forest vegetation is a result of past fire and logging disturbance. Fire was the main disturbance agent prior to effective fire suppression efforts in the early to mid-1900s. Many of the stands in the South Santiam watershed date back to a large stand-replacing fire event that occurred in the late 1850s (USDA, 2006). After this fire, many areas re-burned in the late 1800s and early 1900s. Remnant trees predating these fire events are rare, and tend to occur in clumps. The clumps are often associated with landscape features that sheltered them from intense fire, such as rock outcrops and cliffs or north-facing slopes with abundant moisture. Forests that resulted from these fires are even-aged and densely stocked. Species composition varies depending on aspect and elevation. Douglas-fir typically dominates lower elevations and warmer aspects while true fir (primarily noble fir) dominates higher elevations and cooler aspects. Although stand ages range from 100 to 170 years old, many remain rather even-aged and lack the structural complexity often associated with late seral forest. Due to this, tree species diversity is low and dominated by the initial shade-intolerant cohorts with little in the way of further cohort development. This uncharacteristically slow transition from an even-aged to uneven-age structural condition can partially be traced to fire suppression. Intermediate, mixed severity fire disturbances can accelerate stand structure by causing single-tree and group mortality, letting more light reach the forest floor, stimulating development of another cohort of trees (as well as shrubs and forbs), and inducing epicormic (new sprouting) branch development in surviving Douglas-fir (Tepley et al., 2013; Weisberg, 2004). Mixed severity fires tend to occur under less extreme weather conditions than stand-replacement fires, and are therefore more successfully suppressed. As a result, mixed

severity fires are becoming rare (Tepley et al., 2013). Lightning fires would be the primary cause of mixed severity fire today. There have been 66 lightning fires in the South Santiam watershed since the 1970s, when detailed recordkeeping began (GIS analysis). These 66 fires have only burned 47 acres total (an average of 0.7 acres per fire) due to successful fire suppression.

Logging became the dominant disturbance beginning in the 1950s. Since the 1950s there has been about 14,183 acres of regeneration harvesting on NFS lands within the South Santiam fifth-field watershed, most of which occurred prior to the mid-1990s. The regeneration harvests generally created patches on the landscape that are 5 to 90 acres in size. These patches have resulted in fragmentation of mature forests, although large patches of mature forest are still present in much of the watershed. The large patches of mature forest are concentrated in the Menagerie Wilderness Area (about 4,319 acres) and several Inventoried Roadless Areas (about 14,313 acres) that are located in the northwest and south-central area of the watershed (note that no treatments are proposed in these areas). These Wilderness and Inventoried Roadless areas account for 18% of watershed acres.

Since the early 2000s, silvicultural practices on NFS lands have focused on thinning in existing managed stands. On private lands industrial forestry practices of clearcutting, herbicide site preparation, and dense planting are commonly implemented. At this time most private land has been converted to plantation management with rotation ages of 40 to 60 years.

Seral Stage Distribution

The current and historic seral stage distribution is characterized using LANDFIRE Biophysical Setting descriptions (LANDFIRE, 2007). The Biophysical Settings split forest conditions into six different classes based on their structure. These classes are:

- Class A = Early seral
- Class B = Closed canopy mid seral structure
- Class C = Open canopy mid seral structure
- Class D = Open canopy late seral structure
- Class E = Closed canopy late seral structure
- Class NF = Non-forested areas (Water features, highways, meadows, rock features, etc.)

The Forest Service Northwest Oregon Ecology Group analyzed 2012 Gradient Nearest Neighbor (GNN) vegetation data to arrive at the current composition of Biophysical Setting classes throughout western Oregon. This data was clipped to the NFS portion of the South Santiam fifth-field watershed to ascertain the current Biophysical Setting class distribution. It was also clipped to all ownerships in the watershed to provide a picture of the overall seral stage distribution (note that this updated analysis replaces the analysis in the project scoping letter, which used 2005 GNN data).

The Biophysical Setting descriptions document average historic percentages of five classes of vegetation development (A through E) for each setting. Major Biophysical Settings in the South Santiam watershed are:

- North Pacific Mesic Western Hemlock-Silver Fir Forest (1,494 acres)
- North Pacific Montane Riparian Woodland and Shrubland-Wet (1,759 acres)
- North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest (6,696 acres)
- North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest (25,120 acres)

- North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest (66,416 acres)

These settings account for 101,485 acres of the 101,917 total watershed acres. The average historic percentage of each class was weighted by the percent acreage its parent Biophysical Setting represents in the watershed. This was done for each class of each Biophysical Setting to arrive at an overall weighted average of each class's historic average representation in the watershed.

Results comparing historic averages to the current condition on NFS land, as well as the watershed as a whole, are displayed in Table 17.

Table 17: Current and Historic Seral Stage Distribution in South Santiam Watershed

Class	Historic Weighted Average (%)	Current Average – NFS Ownership (%)	Current Average – All Ownerships (%)
A – Early Seral	8	1.3	5
B – Mid Seral-Closed	17	23.4	34
C – Mid Seral-Open	5	3.3	5
D – Late Seral-Open	7	1.2	1
E – Late Seral-Closed	63	69.5	54
NF - Non-Forested	N/A	1.3	1

Stand Conditions – Proposed Treatment Stands

Relative Density Index

Relative Density Index (RDI) is a measure of stand density that compares the Stand Density Index (SDI) of a stand to the maximum SDI for a specific species. SDI is calculated based on the density of stocking (as represented by average trees per acre) and the size of trees (as represented by quadratic mean diameter) in a stand. The maximum SDI for the Westside of the Cascade Range is typically 595, established for use with even-aged Douglas-fir (Long, 1985). Some stands are dominated by noble fir, and in this case a maximum SDI of 815 was used (from Forest Vegetation Simulator documentation). Stand SDI is divided by the maximum SDI and then expressed as a percentage as RDI. Generally, crown closure occurs by the time a stand reaches 30% RDI. Management is generally recommended to occur when RDI approaches 40%, and prior to reaching 55%. Competition-induced mortality begins at about 55% RDI (Tappeiner II et al., 2015). RDI values are presented and referenced in following sections.

Managed Stands

These managed stands are the result of clearcut regeneration harvest that occurred on NFS lands from the 1950s to about the mid-1990s. After clearcut harvest these stands were typically broadcast burned for site preparation and then densely planted to achieve full stocking. Planting was focused primarily on Douglas-fir. Pre-commercial thinning often occurred to reduce competition in young stands when they were 15 to 20 years of age. Current conditions of managed stands proposed for treatment are presented in Table 18.

Table 18: Current Conditions of Managed Stands Proposed for Treatment

	Stand Age (in 2017)	Trees Per Acre ¹	Canopy Cover ¹ (%)	Quadratic Mean Diameter (in) ¹	Basal Area (sq ft per acre) ¹	Average Height (ft) ¹	Relative Density Index (%) ¹
Average	44	203	73	12.6	168	78	48
Range	32-65	83-400	45-88	9-19	51-390	55-109	16-96

¹ Data is from trees 7 inches DBH and greater. The minimum DBH of a tree considered for harvest in the Trout Creek project 7 inches.

Managed stands proposed for treatment range from those that have not been commercially thinned, to those that were commercially thinned relatively recently (in the last 10 years). The recently thinned stands generally account for the larger quadratic mean diameter, larger average height, lower trees per acre, lower canopy cover, and lower RDI of the ranges in Table 18. Stands that have not been commercially thinned generally account for the smaller quadratic mean diameter, smaller average height, higher trees per acre, higher canopy cover, higher basal area, and higher RDI of the ranges in Table 18.

Fire-Origin Stands

Fire-origin stands are the result of fires that occurred in the late 1800's, as described in the Disturbance History section. Many of these stands are densely stocked, and dominated by the initial cohort of trees that established from seed immediately after the fires (Douglas-fir in lower elevations and noble fir in higher elevations).

Remnant trees that existed prior to the fire disturbance are rare, but scattered remnant Douglas-fir can be found in some stands. These remnant Douglas-fir are larger in diameter than the dominant cohort of trees, with more deeply fissured bark. Due to increased exposure to the elements after the fires of the late 1800s, most lost their tops to wind or snow and ice. Douglas-fir's ability to sprout new branches and re-build existing ones in a light-filled environment allowed these trees to persist even after losing their tops (Van Pelt and Sillett, 2008). Presently, the cohort of trees that initiated following the late 1800s fire disturbance has reached or surpassed the height of the remnant trees, and the remnant trees are starting to experience mortality from being shaded out.

Some stands have been commercially thinned in the past, while many have not. The distinctions in existing condition between stands that have been previously thinned and those that have not, as determined by stand exams and field reconnaissance, is presented below.

Fire-Origin Stands Previously Thinned

Some of the lower elevation Douglas-fir dominated stands easily accessible from mainline roads were commercially thinned in the 1970s, when they were 80 to 90 years old (according to microfiche records at the Sweet Home Ranger District office). Thinning treatments ranged from low intensity salvage harvest to moderate intensity thinning designed to reduce competition. The treatments accelerated growth of remaining trees in the initial cohort, and initiated a new cohort of shade-tolerant western hemlock with vigorous vine maple growth in many areas. However, due to the time elapsed since those thinning treatments, canopy cover has closed again in many areas, resulting in stagnated growth of the western hemlock and vine maple in the understory.

Fire-Origin Stands with No Previous Management

Most noble fir-dominated stands, as well as the lower elevation difficult-to-access Douglas-fir stands, are still densely stocked with the initial cohort of trees that regenerated after fire disturbance. As

described in the Disturbance History section, there has been little intermediate disturbance that would serve to diversify these stands' structure and tree species composition. Pockets of some noble fir-dominated stands regenerated to Pacific silver fir, and these pockets have experienced mortality, resulting in gaps in these stands. In some of the Douglas-fir stands, laminated root rot pockets have created expanding gaps. This has been the extent of stand development since initiation.

Current Conditions of Stands Proposed for Commercial Treatment

Table 19 summarizes the current conditions of fire-origin stands proposed for treatment. Stand ages have a relatively tight range, illustrating that these stands regenerated at about the same time. The low end of the range of the trees per acre and canopy cover column is represented by a stand that has a laminated root rot pocket. The proposed treatment for this stand (Unit 190) is to emphasize bigleaf maple for tall bugbane habitat (a plant that is in decline on the district according to monitoring by the district botanist), with the root rot pocket being an opportunity to establish maple by planting. The low end of the range of the quadratic mean diameter and average height is a result of two stands. One of these stands (Unit 27) contains areas of densely stocked (280 trees per acre) true fir and western hemlock that have resulted in suppressed growth. The other stand (Unit 67) is adjacent to Camas Prairie, and was more savanna-like according to aerial photos from the 1940s. This stand has since filled in with densely stocked, small diameter Douglas-fir. The low end of the range of average height, in addition to the two stands described above, is represented by two other stands (Unit 89 and 140) that were moderately thinned, resulting in the initiation of young western hemlock that are shorter than overstory trees and lower the average as a result. The low end of the range of RDI is represented by Unit 27, and is a function of the relatively small quadratic mean diameter of the stand. Refer to Figure 12 for unit locations.

Table 19: Current Conditions of Fire-Origin Stands Proposed for Treatment

	Stand Age (in 2017)	Trees Per Acre ¹	Canopy Cover ¹ (%)	Quadratic Mean Diameter (in) ¹	Basal Area (sq. ft per acre) ¹	Average Height (ft) ¹	Relative Density Index (%) ¹
Average	126	141	67	18.0	241	94	57
Range	117-137	92-192	59-75	13.0-21.5	129-345	76-115	36-79

¹ Data is from trees 7 inches DBH and greater. The minimum DBH of a tree considered for harvest in the Trout Creek project 7 inches.

Purpose and Need Objectives - Existing Conditions

1. Encourage Forest Health, Species Diversity and Structural Complexity

Health and Vigor

Relative Density Index (RDI) is a measure that can be used to represent stand health and vigor. For maximum health and vigor, treatment would typically be scheduled when a stand is at about 40% RDI and before it reaches 55% RDI. This would ensure that trees remaining after treatment would have adequate access to water, nutrient, and light resources to maintain a high rate of growth and canopy development. The average RDI for managed stands is 48%, which indicates that they are ready for treatment. The average RDI for fire-origin stands is 57%, which is past the level when treatment would be recommended. Many of these stands are experiencing low health and vigor as a result. Trees in these stands have access to fewer resources when trying to survive a drought, insect, or disease event.

Species Diversity

Species diversity is low in most stands. Managed stand stocking is dominated by planted Douglas-fir (83% of stocking by basal area), and fire-origin stands are dominated by the initial cohort of either Douglas-fir or noble fir (68% of stocking by basal area combined). Shade-tolerant western hemlock exists in most stands in minor to moderate amounts, especially in fire-origin stands that were previously thinned. Other species present in stands in minor amounts include Pacific silver fir, western redcedar, western white pine, bigleaf maple, red alder, madrone and Oregon white oak. Of the species present, Douglas-fir, western white pine, madrone, and Oregon white oak have traits that make them resilient to drought disturbances.

Tree species diversity in this area has been affected by blister rust, a disease originating in Asia and imported to North America in contaminated planting stock from Europe in the early 1900's. Blister rust affects five-needle pines, primarily by girdling and killing young trees. Five-needle pine species being impacted by blister rust in the project area include western white pine, and possibly sugar pine. Seed orchards that produce blister-rust resistant planting stock have been developed for these species. This stock is being used to restore these pine species to areas where they are having difficulty regenerating.

Structural Complexity

Structural complexity is represented by gaps and skips. Gaps are areas where light-loving plants can thrive and where a few dominant Douglas-fir trees can be retained in order to develop deep crowns and large branches characteristic of trees growing in open light conditions (Weiskittel et al., 2007). Gaps provide opportunities for shade-tolerant to moderately shade-tolerant tree species to regenerate or be planted to provide a multi-layered canopy. Skips are areas where shade-loving plants thrive and where intense inter-tree competition for water, nutrient, and light resources result in continuous snag and down wood creation.

Managed stands have few existing gaps. Gaps in fire-origin stands are limited to scattered pockets of Pacific silver fir mortality or laminated root rot disease centers. Skips pre-dominate in most managed and fire-origin stands. As a result, understory plant diversity is limited to shade-loving plants, understory tree regeneration consists solely of shade-tolerant species that are struggling to reach the canopy, crowns of mature trees are small and lack large branches, and snag and down wood creation is occurring throughout stands.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Harvesting and processing timber contributes to the local economy. Many treatments prescribed to address ecological objectives could result in trees of commercial size being harvested and processed in local mills. Most of the stands proposed for treatment have trees of a size that could provide timber products to local markets.

Conifer boughs are another forest product commonly harvested in mid to high elevations of the project area. Noble fir, typically under 35 years of age is the preferred conifer species for this activity. The project area contains some managed stands with a component of noble fir that are still young enough (under 35 years old) to have boughs accessible to bough harvesters on the ground. However, opportunities for conifer bough harvest are declining as the managed stands age.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

Mixed severity fire is the most common disturbance agent that would create spatial heterogeneity and complex early seral habitat on the Willamette National Forest (Tepley et al., 2013; Takaoka and F. Swanson, 2008). According to Morrison and F. Swanson (1990), mixed severity fire produces a mosaic of disturbance on the landscape. Low severity patches result from surface fire with occasional single-tree torching and would include areas where few trees are killed, 0-30% tree mortality. Moderate severity patches are the result of more intense fire that may include group torching and would include areas from 30.1-70% mortality. High severity patches are typically the result of crown fires that result in the death of most trees, greater than 70% mortality. The array of habitats these different fire severities create increase the spatial heterogeneity of habitat at the landscape scale. In addition to weather and fuel conditions, slope and aspect typically play a role in the severity of a burned patch. For instance, a steep south-facing slope is more likely to become a high severity patch than a gentle north-facing slope.

The scale of disturbance of historical fire events ranged from hundreds to thousands of acres. Morrison and F. Swanson (1990) reconstructed fire history from the years 1150 to 1985, and documented that the smallest mixed severity fire size they studied on the Willamette National Forest was about 550 acres. Cissel et al. (1998) synthesized several fire history reconstructions from the central west-side Cascades, and documented a smallest fire size of 136 acres with a mean of 1,624 acres.

After a mixed severity fire, high severity patches would display the characteristics of complex early seral habitat. According to M. Swanson et al. (2010), attributes of complex early seral habitat include:

1. More extreme environmental conditions (light, temperature and moisture).
2. Surviving organisms (individuals, seeds, rootstock, eggs, etc.).
3. Structural complexity (surviving live trees, snags, downed wood, perennial shrubs, annual forbs).
4. Spatial heterogeneity at a stand-level scale (e.g., a wildfire burns at different intensities, resulting in different levels of surviving trees from no survivors to many survivors).

Given the proximity to private land and other resources at risk, fire suppression has been a priority in the project area. As a result, the 66 lightning fires that have started dating back to the 1970s have all been extinguished and 47 total acres have burned from these fires. This has led to a lack of spatial heterogeneity and complex early seral habitat on NFS land. This is reflected in the disparity between the historic levels of early seral habitat (8%) compared to the current level (1%), as well as the disparity between the historic levels of late seral-open habitat (7%) compared to the current level (1%). The current condition is unlike the historic condition in scale of disturbance as well. According to GNN data, the early seral patches on NFS land have an average size of 0.4 acres, with the largest patch being 13 acres.

Consequences of a lack of complex early seral habitat can be characterized by declines in several bird species that rely on this habitat for nesting and foraging. For example, rufous hummingbirds are experiencing range-wide population declines of 2.7% per year and orange-crowned warblers are declining across their range at the rate of 3.5% per year. White-crowned sparrows, as shown in Figure 15, are declining range-wide at 3.9% per year (Rivers, 2014).

While typical harvest practices on private lands result in stands that would be grouped in the early seral stage, they would not display many of the characteristics of complex early seral habitat as defined by M. Swanson et al. (2010). Complex early seral characteristics typically are not goals of private land management. Harvest practices on private land would not be expected to result in structural complexity or spatial heterogeneity. Private land regeneration practices such as dense planting and herbicide spraying result in fewer shrubs and forbs. As a result, complex early seral habitat is lacking in the watershed across all ownerships.



Figure 15: White-crowned Sparrow (Photo credit: Will Elder, National Park Service)

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

The project area is directly adjacent to private lands and contains portions of the Menagerie Wilderness. This interface of public and private checkerboard ownership has resulted in neighboring parcels of land with differing management objectives and fuel loads. Concerns have been raised in public meetings about fire hazards due to fuel loading on NFS lands, including the Menagerie Wilderness, with the potential of wildfire to move across ownership boundaries.

Currently, there are few places in the project area where a wildfire could be safely managed. Roads are typical features used in fire management due to access. However, few roads in the project area could be safely used for fire management without first being cleared to create an emergency fuelbreak. This is due to infrequent use and maintenance of roads, and the tendency of roadsides to quickly and densely fill in with shrubs and young conifer trees.

5. Enhance and Create Hardwood Habitat and Diversity

Hardwood patches occupy an important but uncommon niche in the conifer-dominated forests of the project area. In addition to tree species diversity, hardwood trees provide habitat and food sources for song birds, bats and small mammals (Betts et al., 2010; Hagar, 2007).

Hardwood tree species present in the project area include bigleaf maple, red alder, Oregon white oak, and madrone. Bigleaf maple is found in minor amounts, primarily in late seral stands, in low to mid-elevations of the project area. Red alder is commonly found where past soil disturbance created a suitable seedbed and abundant light conditions. Oregon white oak is typically found as scattered single trees or small patches of trees on dry rock outcrops in the lower elevations of the project area. One notable exception to that habitat description is a grove of mature Oregon white oak directly adjacent to Camas Prairie. Madrone, like Oregon white oak, is typically found on dry rock outcrops, but can also rarely be found growing in dry late seral forests.

The Sweet Home Ranger District has few large stands of hardwood trees in its conifer dominated landscape. Two of the largest stands are in the project area, and resulted from ground-disturbing clearcut harvest about 50 years ago when in private ownership. Red alder is the dominant species, with bigleaf maple a minor component. Red alder is a short lived hardwood species and the alder-dominated stands in the project area will start experiencing mortality in the next ten to twenty years.

Tall bugbane, a formerly sensitive species, is a perennial herbaceous plant that is in general decline on the Sweet Home Ranger District. Tall bugbane prefers the cool, moist habitat found in the vicinity of hardwood trees such as bigleaf maple.

Oak and madrone were historically maintained on the landscape by frequent low intensity fire disturbance that prevented conifer seedlings from surviving. A lack of this fire disturbance has resulted in existing patches of oak and madrone becoming overtopped by conifer tree species.

Environmental Consequences

Direct and Indirect Effects

Resource Indicators and Measures

The Purpose and Need objectives of the project are:

1. Encourage Forest Health, Species Diversity and Structural Complexity
2. Contribute a Variety of Sustainable Forest Products to Local Markets
3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire
4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas
5. Enhance and Create Hardwood Habitat and Diversity

Indicators and measures, by objective, used to quantify direct and indirect effects are presented in Table 20. Appendix E contain tables of unit-specific treatments by alternative, and may be useful to reference while reading this section.

Table 20: Direct and Indirect Effects Resource Indicators and Measures by Objective

Objective ¹	Resource Indicator	Measure
1	Level of competition for sunlight, water, and nutrients	Acres of thinning
1	Tree species composition of drought-tolerant species	Acres planted to western white pine, sugar pine, incense cedar, or Oregon white oak
1	Restoration of sugar pine and western white pine	Acres planted with blister rust-resistant stock
1	Canopy gaps present	Acres of gaps
1	Skips present	Acres of skips
2	Timber to local markets	Amount of timber in MMBF (million board feet)
2	Opportunity for future conifer bough collection	Acres planted that include noble fir
3	Landscape area approximates the size of a mixed severity fire event (about 136 acres or more treated)	Acres treated in each landscape area
3	Complex early seral habitat present	Acres of complex early seral habitat
4	Opportunities for wildfire management	Acres of long-lasting, minimal-maintenance fuelbreaks
5	Presence of hardwood-dominated areas in the project area	Acres planted to red alder, bigleaf maple, madrone, or Oregon white oak

¹ Objective corresponds to the Purpose and Need objectives for the Trout Creek project shown above.

Alternative 1 – No Action

1. Encourage Forest Health, Species Diversity and Structural Complexity

Health and Vigor

Under Alternative 1, the “no action” Alternative, there would be zero acres of thinning. Competition for sunlight, water and nutrients would continue to increase. Health and vigor would decrease, resulting in reduced resiliency to disturbances such as drought. This can be illustrated using Relative Density Index (RDI). The current average RDI of the fire-origin stands is 57%, already over the 55% threshold for competition-induced tree mortality. This average would continue to rise as the RDI of individual fire-origin stands increases. The current average RDI for managed stands is 48%. Unit 58 was modelled in FVS to obtain RDI figures under Alternative 1 (Unit 58 is representative of the managed units proposed for thinning). With no action, in 25 years the RDI of Unit 58 would increase from a current level of 46% to 63%. This figure is above the level (55%) where competition for water, nutrients, and light is so intense that mortality occurs under typical conditions. When additional stressors such as drought become factors, trees have few resources to survive the stressor, leading to low resiliency and loss of forest cover.

In fire-origin units with remnant trees, the remnant trees would continue to be shaded out and experience mortality. While they would not persist as living green trees, they would become large diameter snags and eventually large down wood.

Species Diversity

In Alternative 1, zero acres would be planted with drought-tolerant species such as western white pine, sugar pine, incense cedar, madrone, or Oregon white oak (species that currently occur on the Sweet Home Ranger District in low numbers). Current trends and future projections for the Pacific Northwest include increased frequency, duration and intensity of droughts (Luce and Holden, 2009; Chmura et al., 2011; Devine et al., 2012; Restaino et al., 2016). Environmental Protection Agency data from long-term weather stations located in the project area indicate that over the last two decades, soil temperatures at 15 cm (about 6 inches) soil depth have increased 2.6 degrees Celsius (about 4.7 degrees Fahrenheit) in the months of August through October (R. Waschmann, personal communication, March 2, 2017). This decreases soil moisture, which increases moisture stress on trees.

Stands would lack a diversity of species capable of responding to drought stress, and would be more susceptible to drought mortality as well as associated insect and disease events. In particular, an insect and disease outbreak that affected Douglas-fir (which would continue to dominate the overstory tree composition in this alternative) would result in the loss of overstory forest cover. Douglas-fir bark beetle, in conjunction with laminated root rot, targets Douglas-fir. Currently, Douglas-fir bark beetle and laminated root rot cause low amounts of localized mortality in Douglas-fir. However, future droughts may exacerbate or cause outbreaks of greater severity of both Douglas-fir bark beetle and root rots such as laminated root rot (Kolb et al., 2016).

Blister rust-resistant sugar pine and western white pine would not be planted. Western white pine would continue its ongoing decline due to blister rust in the project area.

Structural Complexity

Under Alternative 1, no gaps would be created. Light-loving plants would not be present in the stands. Single-tree mortality and wind may create small gaps, but generally these would not be large enough for light-loving species to thrive. For example, Fahey and Puettmann (2008) found that in gaps of ¼-acre (0.1 hectare) in size, plant response occurred over a smaller area than the physical gap opening due to edge effects, resulting in few light-loving species colonizing the gap. They suggest that smaller gaps have limited effectiveness in promoting understory plant diversity. Also, planting of drought-tolerant species (including sugar pine and western white pine) in gaps would not occur, reducing resiliency to drought disturbances.

Alternative 1 would offer the largest acreage of skips. Shade-loving plants would thrive over most of the area. Understory plant diversity would be low due to this fact; limited to only shade-loving species. Shade tolerant trees would not be able to reach the mid or overstory, resulting in a continuation of the single-storied stand condition. Resiliency would be low due to the lack of diversity and high level of competition between trees. However, the high level of competition between trees would result in continuous snag creation throughout the stands in the project area.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Alternative 1 would not provide any timber products to local markets. More information on the effects of timber products to local economies can be found in the Economics section of chapter 3.

There would be zero acres planted with noble fir. As existing younger stands with a component of noble fir continue to age, opportunities for conifer bough collection would decrease. Within approximately 20 years, there would be no areas suitable for conifer bough collection in the project area.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

No landscape-scale areas (approximately 136 acres or more of coordinated treatments) would be treated, resulting in zero acres of landscape areas mimicking mixed severity fire. Due to this there would continue to be a lack of spatial heterogeneity of forest habitats. In particular, complex early seral habitat and late seral-open habitat would continue to decline as canopy cover increases in these stands. While maintaining closed-canopy conditions may benefit shade-loving plant and animal species, it would negatively impact species of plants and animals that prefer more open habitats. Additionally, opportunities to increase drought-tolerant tree species diversity (including sugar pine and western white pine) through planting in treated areas would be lost.

Stands currently in the early seral stage on NFS lands were all harvested between 1997 and 2004 (34 stands totaling about 495 acres, averaging 14 acres per stand). These stands were fully planted, and would therefore be expected to be in the early seral stage for about 20 years. The stands were harvested under the Northwest Forest Plan, and as a result of requirements for more structural retention in harvests covered by the plan, they would have some of the attributes of complex early seral habitat. As canopies close in these stands in the next seven years, complex early seral habitat would decrease.

Early seral acres are expected to remain fairly constant on private lands. As previously stated, however, private harvest practices would not result in the creation of complex early seral habitat. Wildfire events may create this habitat, but are less likely to happen in the project area because fire suppression is a priority due to interspersed public and private ownership and the presence of Late Successional Reserves.

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

Alternative 1 would establish zero acres of fuelbreaks. The risk of wildfire moving across ownership boundaries would remain at current levels, or increase as down wood accumulation accelerates as a function of increasing snag creation in stands with high levels of inter-tree competition for water, nutrients, and light (as illustrated by increasing RDI numbers).

In order to safely use roads for wildfire management, the roads would need to be cleared of vegetation to create a fuelbreak on an emergency basis.

5. Enhance and Create Hardwood Habitat and Diversity

Under Alternative 1, zero acres would be planted with hardwood species. The stands dominated by red alder would start to experience mortality. While current regeneration is low in the understory of these stands, it is dominated by western hemlock. As the red alder dies, it would likely be replaced by western hemlock, and the stands would become conifer-dominated. Bigleaf maple would persist in some late seral stands, but no additional bigleaf maple would be planted. As a result, tall bugbane would continue to decline in the project area. Existing Oregon white oak and madrone that are becoming overtopped by conifers would continue to be shaded out and experience mortality.

The overall result of no action on the hardwood component in the project area would be a decline in hardwood composition. This would have negative effects on wildlife species that rely on habitats where hardwood trees are present.

Alternative 2

1. Encourage Forest Health, Species Diversity and Structural Complexity

Health and Vigor

Thinning would be the treatment prescribed to increase health and vigor of residual trees. Alternative 2 would thin 733 acres (576 acres managed stands, 157 acres fire-origin stands), the most of any alternative. Trees would be removed across diameter classes, but removals would primarily consist of the less dominant trees. Trees remaining after thinning would experience less competition for sunlight, water and nutrients. Resiliency to disturbances such as drought would increase, as there would be less competition for soil water (Vose et al., 2016). The decrease in competition can be illustrated using RDI. For example, Unit 58 was modelled in FVS to obtain RDI figures after a thin to 50% canopy cover (Unit 58 is representative of the managed units proposed for thinning). Immediately after thinning the RDI would decrease to 28%, with this effect lasting for about 25 years before RDI would be at 40% and management would be considered again. For fire-origin stands, Unit 44 (representative of fire-origin units proposed for thinning) would have an RDI of 36% immediately after thinning. This effect would also last about 25 years before RDI would again reach 40%. This is consistent with findings by Latham & Tappeiner (2002) and Williamson (1982) that showed positive effects of thinning to growth of the remaining trees in fire-origin stands lasted for about 20 years.

Thinning has a positive effect on understory plant richness (after a recovery period of about five years following harvest operations), as well as understory tree establishment and growth (Bailey and Tappeiner, 1998; Muir et al., 2002; Chan et al., 2006). Thinning has short term negative effects on fungi such as chanterelles, with the negative effect dissipating after about six years (Pilz et al., 2006).

Thinning prescriptions would retain all remnant trees in fire-origin stands. Adjacent younger trees that are overtopping the remnant trees would be removed, increasing the amount of light to the remnant

trees. Access to more light would allow remnant trees to re-build and increase their crowns, and persist as live green trees for about the next 25 to 50 years. Large, live trees are important to many wildlife species, particularly if the trees contain cavities due to localized rot or broken tops (Bunnell et al., 1999).

Species Diversity

Alternative 2 plants drought-tolerant species on 439 acres. More than 60% of those acres are underplanting of incense cedar in previously thinned fire-origin stands. Treatments would increase resiliency to drought stress through an increase in stocking and diversity of drought-tolerant tree species. By focusing on species other than Douglas-fir, if an insect or disease outbreak that primarily affected Douglas-fir occurred there would be several other drought-tolerant species present to retain forest cover.

The proportion of tree species composition of drought-tolerant species such as western white pine, sugar pine, incense cedar, madrone, and Oregon white oak would be increased by several methods. The primary method would be creation of gaps and aggregate retention openings planted to a combination of the species listed above (among others). Gap size would be large enough that species of intermediate shade tolerance (such as western white pine and sugar pine) would persist and reach the canopy prior to gap closure. Planting blister rust-resistant sugar pine and western white pine would increase the healthy component of these drought-tolerant species.

Also proposed is underplanting of shade-tolerant incense cedar in fire-origin stands that had been previously thinned. This would occur at low levels, because the current canopy cover of many of these stands is not optimal for understory tree growth (Chan et al., 2006).

Structural Complexity

Alternative 2 has the least acres of gaps at 35 acres. Creating gaps of one-half acre to one acre in size would increase structural diversity. Retaining one to three dominant trees per acre would increase the structural complexity of gaps. Providing full light exposure around these dominant trees would promote development of large crowns and branches, increasing their future suitability for wildlife species that prefer these characteristics for nesting and roosting. Gap size would be large enough to see a response in light-loving plants (Fahey and Puettmann, 2008), resulting in an increase in plant species diversity.

Skips would also be a component of increasing structural diversity. Alternatives 2 would offer the most acres of skips, at about 489 acres (36% of proposed unit acres). Shade-loving plants would thrive in skips, allowing them to persist in treated areas. Competition between trees would remain high, resulting in continuous snag creation, which would in turn become down wood. For example, according to FVS modelling of Unit 58 (representative of managed units) snags greater than 7 inches DBH would be present in skips at the level of 1 snag per acre immediately after harvest, and would increase through the next 25 years to about 7 snags per acre. In skips in fire-origin stands, snags greater than 7 inches DBH would range from a fairly constant level of 1 to 2 snags per acre over the next 25 years in Unit 120, while Unit 56 would start at about 50 snags per acre and decrease to 35 snags per acre over the next 25 years. Skips would allow wildlife species that rely on snags and down wood for nesting and foraging to utilize these stands into the future.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Alternative 2 is in the middle of the three action alternatives at 12 MMBF of timber provided to local markets. More information on the effects of timber products to local economies can be found in the Economics section of chapter 3.

Alternatives 2 proposes 38 acres of aggregate retention harvest where noble fir would be included as a component of the post-harvest planting. These areas would provide opportunities for conifer bough collection in the next 20 to 40 years, helping the conifer bough product industry (such as wreath-making) maintain itself in the area.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

Alternative 2 would offer the greatest amount of spatial heterogeneity at the landscape scale (including mimicking all three fire severities – low, moderate, and high) and would also offer the most complexity in early seral habitat. As a result, Alternative 2 would best mimic mixed severity fire and provide the most benefit to a wide range of wildlife and insect species.

Alternative 2 would produce the most spatial heterogeneity on the landscape. This alternative would treat two landscape areas (one area of 296 acres and one area of 125 acres). This alternative would also offer patches that mimic all three levels of fire severity (high, moderate, and low). Aspect and topography would guide the placement of different severity patches on the landscape to mimic mixed severity fire. Drier south-facing slopes, west-facing slopes, and ridgetops would be treated to mimic moderate to high severity patches. Some north-facing slopes and east-facing slopes would be treated to mimic low to moderate severity patches. Riparian areas and some north-facing slopes would be skips and would mimic low severity patches.

Areas representing high severity patches would be treated with an aggregate retention harvest, retaining individual trees dispersed in loose clumps throughout the area to provide structural complexity in the form of live trees, snags and down wood. These areas would be underburned following harvest and then planted to a mix of drought-tolerant species, with conifer bough species also included in the planting mix in some units. Skips (aggregate retention), representing low severity patches, would be placed primarily on north-facing slopes and Riparian Reserves. Areas representing moderate severity patches would be thinned to 30 to 50% canopy cover, with gaps ranging from one-half to one acre in size. Snag creation would occur in all aggregate retention harvest units, but would be focused in greater numbers in units that have trees capable of providing a range of snag sizes, particularly large snags (Bunnell et al., 1999). Snag creation would occur by prescribed fire for fire-intolerant species such as western hemlock and Pacific silver fir, and by girdling for more fire-resistant species such as Douglas-fir. Figure 16 displays the spatial heterogeneity that would be created by mimicking a range of fire severity patches in one of the landscape-scale areas.

Harvest activities are obviously unable to exactly mimic the outcome of a wildfire. For example, removal of merchantable trees during harvest would leave fewer snags in a harvested area compared to an unharvested burned area of high severity. However, by varying harvest and snag creation intensities throughout a chosen landscape-area, the effects of mixed severity fire can be approximated. This increases the amount of spatial heterogeneity on a landscape scale, providing a range of wildlife habitats from closed-canopy forest to very open complex early seral habitat. Alternative 2 would offer the greatest variety of wildlife habitat due to treating the most acres and including patches of all three fire severities. It would offer the most cohesion and connectivity of treated units at a landscape scale, best mimicking a discrete, continuous fire event.

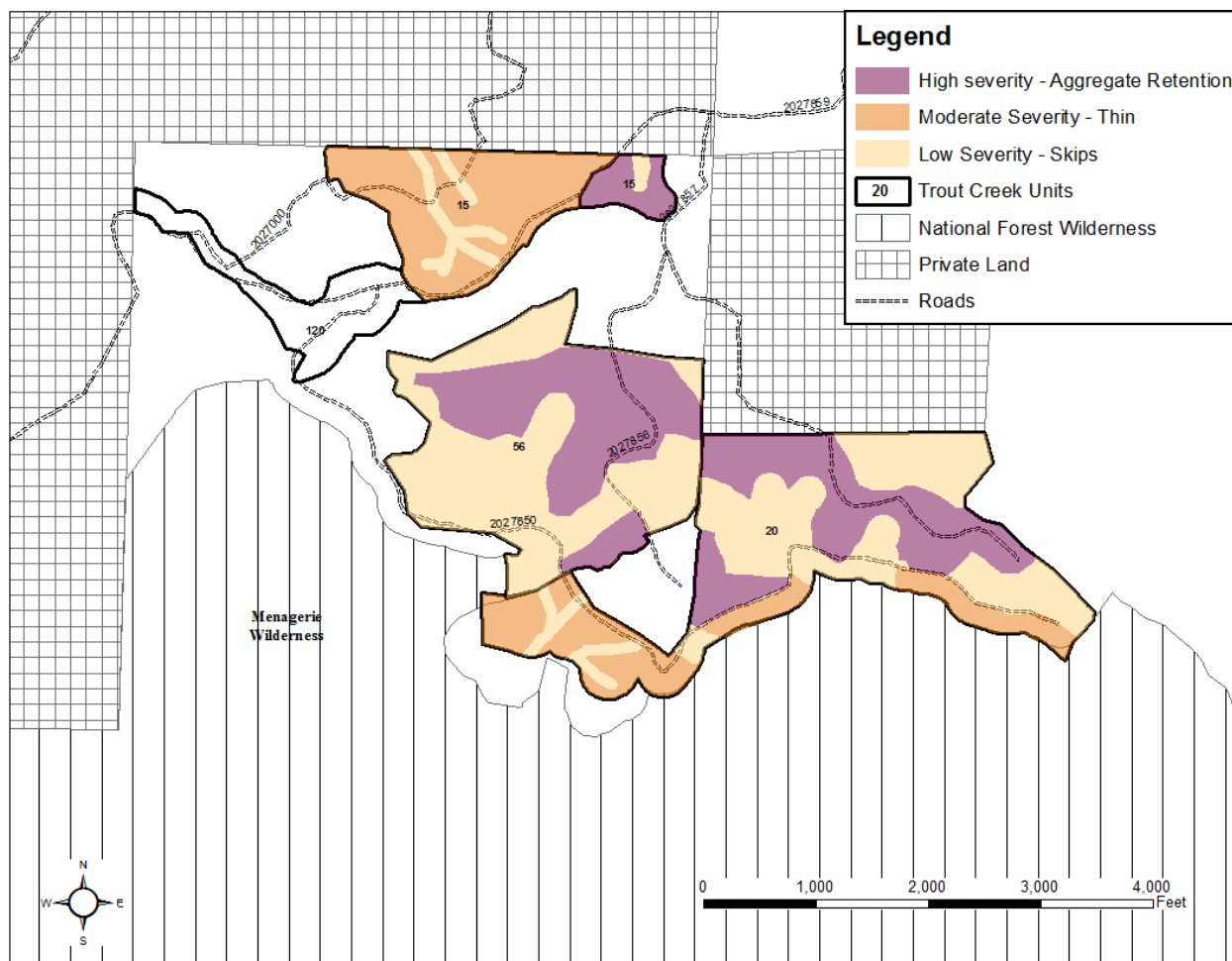


Figure 16: Landscape-scale Spatial Heterogeneity Created by Mimicking Mixed Severity Fire in Alternative 2

Complex early seral habitat would be created in aggregate retention harvest areas. Alternative 2 would create the greatest amount of complex early seral habitat, at 101 acres. The aggregate retention treatment would include all of the elements of complex early seral habitat as defined by M. Swanson et al. (2010). The harvest and burn would create openings with more extreme environmental conditions; surviving organisms would include seeds of forbs, rootstocks of sprouting shrubs, and individual trees; structural complexity would occur with the aggregate and individual tree retention, along with snag and down wood creation; and spatial heterogeneity at a stand-level scale would be achieved through the different patterns of aggregate (using topography as a guide) and individual tree retention. This would create habitat for bird species (such as rufous hummingbirds, orange-crowned warblers, and white-crowned sparrows) that rely on complex early seral conditions. Many animals (such as small mammals and their associated predators), other birds (such as woodpeckers and bluebirds), and insects (especially butterflies and moths) would benefit from the combination of diverse plant communities and surviving structures characteristic of complex early seral habitat (M. Swanson et al., 2010; M. Swanson et al., 2014). This habitat would likely last for about 30 years before tree canopies closed and the stand transitions to a mid-seral stage.

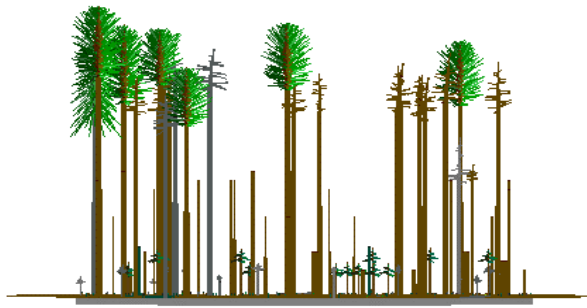


Figure 17: Visualization of Complex Early Seral Habitat Created in Alternative 2 in Unit 56

Alternative 2 would offer the greatest amount of complexity in the early seral habitat created in Unit 56 (fire-origin stand). Alternative 2 would offer the greatest amount of live tree retention (15 trees per acre) and the most snag creation in the treated area (45 snags per acre greater than 7 inches DBH) of Unit 56. As a result, in Alternative 2, Unit 56 would most closely mimic a high severity fire patch due to the greater number and size range of snags created. Figure 17 is a visual approximation of the treatments in Unit 56. Alternative 2 would create early seral habitat of the greatest complexity to benefit the many wildlife and insect species that rely upon it. In particular woodpeckers (including black-backed woodpeckers) would be expected to benefit from the number and size range of snags created in Alternative 2.

While aggregate retention harvesting is proposed in some units that have not reached or surpassed culmination of mean annual increment in cubic feet of volume, the Willamette Forest Plan states: “Exceptions may be made for commercial thinning, or where special resource considerations require earlier harvest (36 CFR 219.16(a)(2)(iii)).” Forest Service Manual 1921.12f also states: “Exceptions may also occur as a result of project-level analysis if decision-making includes appropriate public disclosure and opportunity to comment.” Units proposed for aggregate retention harvest in this project would be a project-level exception. Appropriate public disclosure and opportunity to comment has occurred in the form of public field trips and public scoping prior to writing the draft Environmental Impact Statement.

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

Alternatives 2 would offer the greatest acreage of hardwood fuelbreak creation (119 acres). The prescription for fuelbreaks would begin by thinning the overstory conifer canopy cover to 30%. This would be followed by underburning or mechanical removal of small non-merchantable conifer trees (less than 7 inches DBH), and completed with an underplanting of hardwood species such as red alder and bigleaf maple.

The risk of wildfire moving across ownership boundaries would decrease, because the high moisture content of hardwood leaves and litter would moderate fire behavior. This is illustrated by modelling in the Forest Vegetation Simulator (FVS). In a fire event occurring under severe conditions (70 degrees Fahrenheit temperature, 20 miles per hour wind, and low fuel moisture), fire behavior in the fuelbreaks was predicted to be a surface fire, which is the lowest intensity fire in the model. This would make the fuelbreaks and their associated roads safe places from which to manage fire. An associated positive effect would be an increase in hardwood habitat. These effects would last for the length of the average lifespan of the hardwood species planted (i.e., about 70 years for red alder, and about 150 years for bigleaf maple).

5. Enhance and Create Hardwood Habitat and Diversity

Alternative 2 would offer the greatest acreage of areas planted to hardwood species (238 acres). In addition, this alternative would include release of existing Oregon white oak and madrone that are being overtopped by conifer species. Proposed treatments would create and enhance hardwood habitat in several ways.

The existing stand dominated by red alder would receive a variable density thinning, which would create conditions suitable for underplanting the next generation of red alder. This would maintain the stand as hardwood habitat for the next 60 to 70 years.

Bigleaf maple would be favored for release in the thinning prescription of Unit 190, with additional bigleaf maple being underplanted following treatment. This would create more favorable habitat for tall bugbane, potentially increasing its population in this area.

Existing Oregon white oak and madrone that are becoming overtopped by conifers would be released by removal of conifers through timber harvest or by girdling the conifers. In addition, regeneration harvest would be prescribed for a portion of Unit 67, adjacent to Camas Prairie. This area would be burned for site preparation and planted at low levels with Oregon white oak to create savanna habitat that would be managed in conjunction with Camas Prairie. This would create hardwood habitat while also providing for use by Native American tribes. Use by tribes is the focus of the Camas Prairie Special Interest Area, where Unit 67 is located.

The overall result of these actions, along with the hardwood fuelbreaks described above, would be an increase in hardwood abundance, vigor, and longevity within the project area. This would have positive effects on wildlife species that rely on hardwood habitats, with these effects lasting for the lifespan of these trees (60 to 150 years).

Alternative 3

1. Encourage Forest Health, Species Diversity and Structural Complexity

Health and Vigor

Alternative 3 would thin 629 acres (629 acres managed stands, 0 acres fire-origin stands), the least of any action alternative. Alternative 3 would be least effective in decreasing competition for sunlight, water and nutrients; increasing understory plant richness; and increasing understory tree establishment and growth.

Alternative 3 would not treat fire-origin stands, so the remnant trees in these stands would be more likely to die and become large snags. As a result, in Alternative 3 large live trees of similar size would not be present as habitat elements in these stands for about 100 to 200 years into the future.

Species Diversity

Alternative 3 would offer 43 acres of planting of drought-tolerant species in gaps, the least of any action alternative. This is a result of excluding fire-origin stands from treatment of any kind, as well as eliminating aggregate retention harvest. Alternative 3 would be least effective in increasing the resiliency of stands to drought disturbance through an increase in stocking and diversity of drought-tolerant tree species. It would also offer the least amount of acres planted with blister rust-resistant western white pine and sugar pine, doing the least to increase the healthy component of these drought-tolerant species.

Structural Complexity

Alternative 3 has 43 acres of gaps, which is in the middle of the three action alternatives. The increased acres of gaps in Alternative 3 compared to Alternative 2 is due to gaps being added to the thinning prescriptions in Alternative 3 that replaced aggregate retention harvest in managed stands in Alternative 2. Compared to Alternative 2, this alternative would offer a greater number of dominant trees released and more acres where light-loving plants would thrive within thinned stands.

Alternative 3 has the least acres of skips as part of treatments (344 acres, 34% of stand acres) due to being restricted to managed units. There would be less structural complexity in the project area, as fewer stands would have a combination of gaps, skips, and thinned areas.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Alternative 3 would offer the least amount of timber products to local markets, at 8 MMBF. More information on the effects of timber products to local economies can be found in the Economics section of chapter 3.

Alternative 3 does not provide any acres of noble fir planting due to aggregate retention harvest being excluded from consideration. This alternative would have a negative effect on the conifer bough product industry maintaining itself in the area.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

Alternative 3 would have the least spatial heterogeneity at a landscape level, and be least effective at mimicking mixed severity fire.

Alternative 3 would treat the fewest acres due to fire-origin stands being excluded from treatment. It would still have two landscape areas, but one of the areas would be 184 acres rather than 296 acres. It would also only have two levels of fire severity, moderate and low, due to aggregate retention harvest being excluded as a treatment (Figure 18). In addition, the exclusion from consideration of aggregate retention harvest would result in no creation of complex early seral habitat.

The 184-acre treatment area in Alternative 3 would also lack cohesion on a landscape scale as compared to the 296-acre treatment area in Alternatives 2 and 4, as there would be an untreated area of about one-half mile between treated units (Figure 18). This would not mimic a continuous mixed severity fire event as well as Alternatives 2 and 4.

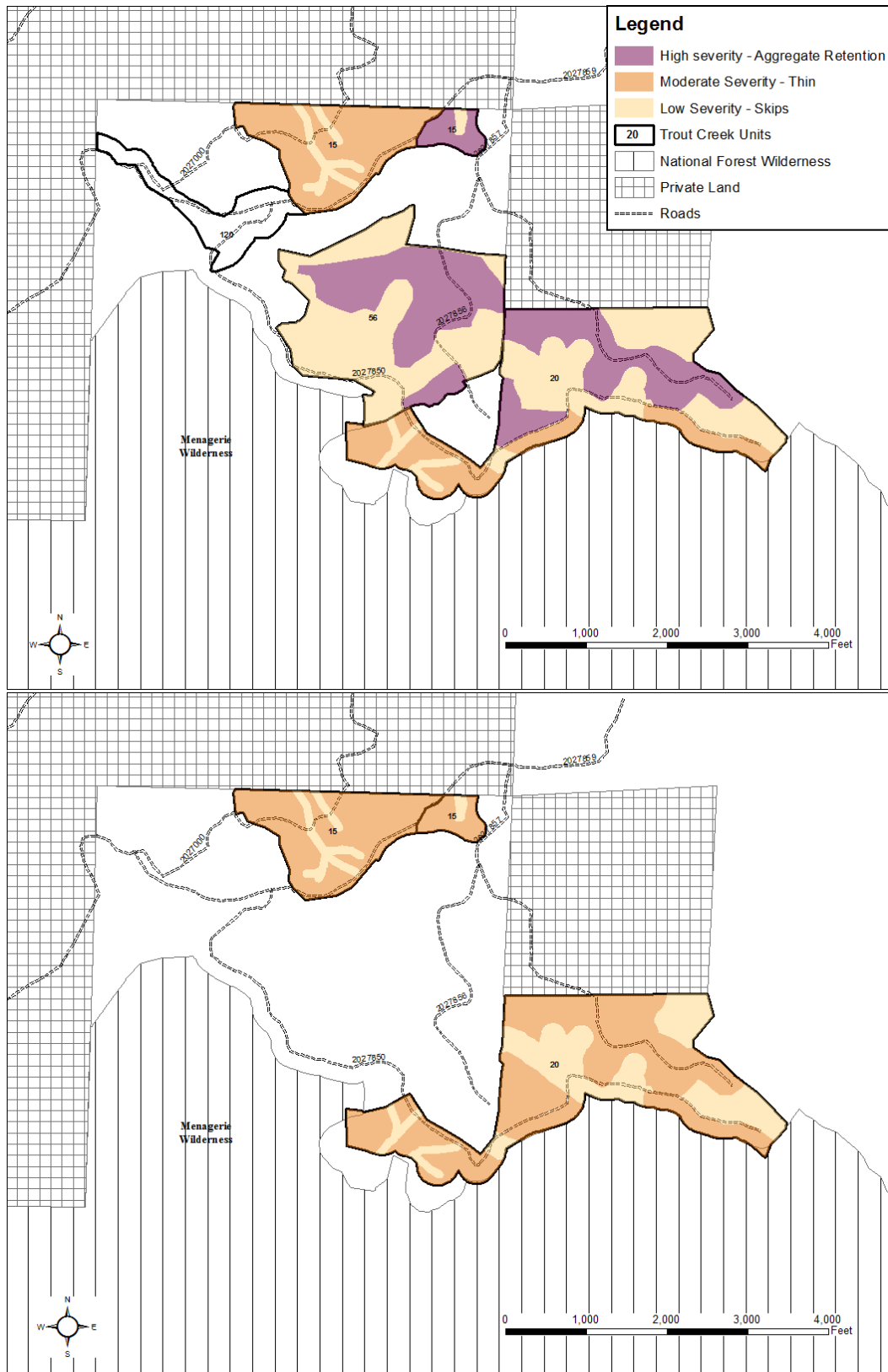


Figure 18: Comparison of Landscape-scale Heterogeneity between Alternatives 2 and 4 (top) versus Alternative 3 (bottom)

Alternative 3 would not include as much spatial heterogeneity at a landscape scale as Alternatives 2 and 4 (due to lacking areas where high severity patches are mimicked), would not offer cohesion and connectivity of treated units at a landscape scale, and would not create complex early seral habitat. As a result, Alternative 3 would least effectively mimic mixed severity fire and provide the least benefit to a wide range of wildlife and insect species.

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

Alternative 3 would offer 43 acres of hardwood fuelbreak creation, the fewest of any action alternative. This is due to fire-origin stands being excluded from consideration for treatment. Alternative 3 would be least effective in decreasing the risk of wildfire moving across ownership boundaries, and would provide the fewest number of safe areas from which to manage wildfire.

5. Enhance and Create Hardwood Habitat and Diversity

Alternative 3 would offer the fewest acres planted to hardwood species (155 acres). Also, Alternative 3 would not release existing Oregon white oak and madrone from overtopping conifers, create oak savanna adjacent to Camas Prairie, or enhance tall bugbane habitat. This is due to fire-origin stands being excluded from consideration for treatment in this alternative. Alternative 3 would be least effective of any action alternative in providing hardwood habitat for use by wildlife and insect species (particularly songbirds).

Alternative 4

1. Encourage Forest Health, Species Diversity and Structural Complexity

Health and Vigor

Alternative 4 would thin 711 acres (560 acres managed stands, 151 acres fire-origin stands). This is more than Alternative 3, but fewer than Alternative 2. In Alternative 4 the difference in thin acres from Alternative 2 is due to increased acreage of gaps in Alternative 4. Compared to Alternative 3, Alternative 4 would offer a greater decrease in competition for sunlight, water and nutrients; greater increase in understory plant richness; and greater increase in understory tree establishment and growth. This would make these stands more resilient to disturbances such as drought.

Alternative 4, like Alternative 2, would release remnant trees in fire-origin stands from competition, increasing the likelihood they remain in the stand as live green trees.

Species Diversity

Alternative 4 offers the most planting of drought-tolerant species such as western white pine, sugar pine, incense cedar, madrone, and Oregon white oak (461 acres). This is due to the increased acreage of gaps compared to Alternative 2. As in Alternative 2, more than 60% of the acres are underplanting of incense cedar in previously thinned fire-origin stands.

Alternative 4 would go the furthest toward increasing the resiliency of stands to drought disturbance through an increase in stocking and diversity of drought-tolerant tree species. It would also offer the most acres planted with blister rust-resistant western white pine and sugar pine, doing the most to increase the healthy component of these drought-tolerant species.

Structural Complexity

Alternative 4 would create 57 acres of gaps, the most of any alternative. This alternative would offer the largest number of dominant trees released and the most acres where light-loving plants would thrive.

Alternative 4, like Alternative 2, would offer 489 acres of skips (about 36% of proposed unit acres). Similar to Alternative 2, Alternative 4 would offer the most acreage of skips embedded in treated areas, where shade-loving plants would be able to thrive and snag creation through inter-tree competition would occur.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Alternative 4 offers the most timber products to local markets at 15 MMBF. More information on the effects of timber products to local economies can be found in the Economics section of chapter 3.

Alternative 4, like Alternative 2, would propose 38 acres of aggregate retention harvest where noble fir would be included as a component of the post-harvest planting. Alternative 4, like Alternative 2, would be most effective in maintaining the conifer bough product industry in the area.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

Alternative 4 would offer similar spatial heterogeneity at a landscape level as Alternative 2. Alternative 4 would be more effective than Alternative 3 at mimicking mixed severity fire, but less effective than Alternative 2.

Alternative 4, like Alternative 2, would produce the most spatial heterogeneity on the landscape. Both of these alternatives would treat two landscape areas (one area of 296 acres and one area of 125 acres). Alternative 4, like Alternative 2, would offer patches that mimic all three levels of fire severity (high, moderate, and low).

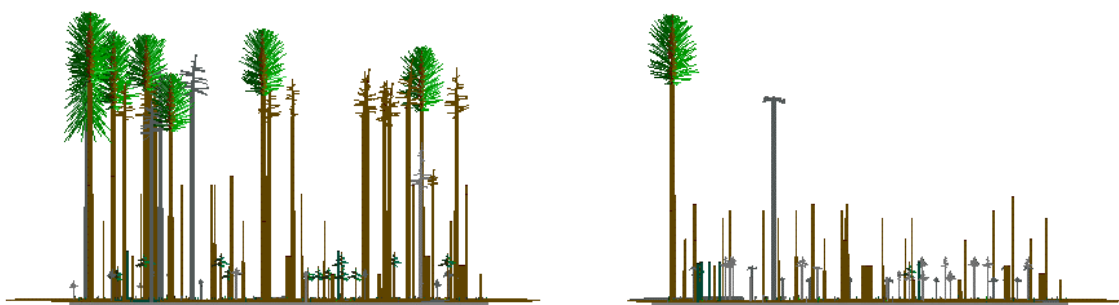


Figure 19: Comparison of Complex Early Seral Habitat Created in Alternative 2 (left) and Alternative 4 (right) in Unit 56

Alternative 4, like Alternative 2, would create 101 acres of complex early seral habitat. However, Alternative 4 would have a lower level of complexity in the early seral habitat created in Unit 56 (fire-origin stand). In Unit 56, Alternative 4 would have less live tree retention as well as less snag creation in the treated area (2 snags per acre greater than 7 inches DBH) as compared to Alternative 2 (45 snags per acre greater than 7 inches DBH). As a result, Alternative 4 would less closely mimic a high severity fire patch due to fewer numbers and size range of snags created, and would offer less complexity in the early seral habitat created. As a result, Alternative 4 would benefit fewer of the wildlife and insect

species that rely upon complex early seral habitat. Figure 19 is a visual comparison of the treatments in Unit 56.

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

Alternative 4, like Alternative 2, would offer 119 acres of hardwood fuelbreak creation. Alternative 4, like Alternative 2, would be most effective at decreasing the risk of wildfire moving across ownership boundaries, as well as providing the greatest number of safe areas from which to manage wildfire.

5. Enhance and Create Hardwood Habitat and Diversity

Alternative 4, like Alternative 2, would offer 238 acres of areas planted to hardwood species. Also like Alternative 2, Alternative 4 would include release of existing Oregon white oak and madrone that are being overtopped by conifer species, creation of oak savanna adjacent to Camas Prairie, and enhancement of tall bugbane habitat.

Alternative 4, like Alternative 2, would result in the greatest increase of hardwood species composition in the project area, and the greatest positive effects to wildlife and insect species that use hardwood habitat (particularly songbirds).

Comparison of Alternatives by Resource Indicator and Measures

The Purpose and Need objectives of the project are:

1. Encourage Forest Health, Species Diversity and Structural Complexity
2. Contribute a Variety of Sustainable Forest Products to Local Markets
3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire
4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas
5. Enhance and Create Hardwood Habitat and Diversity

The direct and indirect effects of the alternatives are compared using the established indicators and measures, by objective, in Table 21.

Table 21: Comparison of Alternatives Direct and Indirect Effects by Objective

Objective ¹	Resource Indicator	Measure	Alt 1	Alt 2	Alt 3	Alt 4
1	Level of competition for sunlight, water, and nutrients	Acres of thinning	0	733	629	711
1	Tree species composition of drought-tolerant species	Acres planted to western white pine, sugar pine, incense cedar, or Oregon white oak	0	439	43	461
1	Restoration of sugar pine and western white pine	Acres planted with blister rust-resistant stock	0	136	43	158
1	Canopy gaps present	Acres of gaps	0	35	43	57
1	Skips present	Acres of skips	0	489	344	489
2	Timber to local markets	Amount of timber in MMBF (million board feet)	0	12	8	15

Objective ¹	Resource Indicator	Measure	Alt 1	Alt 2	Alt 3	Alt 4
2	Opportunity for future conifer bough collection	Acres planted that include noble fir	0	38	0	38
3	Landscape area approximates the size of a mixed severity fire event (about 136 acres or more treated)	Acres treated in each landscape area	0	1 area of 296 acres & 1 area of 125 acres	1 area of 184 acres & 1 area of 125 acres	1 area of 296 acres & 1 area of 125 acres
3	Complex early seral habitat present	Acres of complex early seral habitat	0	101	0	101
4	Opportunities for wildfire management	Acres of long-lasting, minimal-maintenance fuelbreaks	0	119	43	119
5	Presence of hardwood-dominated areas in the project area	Acres planted to red alder, bigleaf maple, madrone, or Oregon white oak	0	238	155	238

¹ Objective corresponds to the Purpose and Need objectives for the Trout Creek project shown above.

Cumulative Effects

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

Cumulative effects occur for vegetation as a result of stands changing seral stages. This occurs as forest vegetation grows and ages, or when a disturbance (such as wildfire or regeneration harvest) returns the forest vegetation to a younger seral stage, or changes it from a closed to an open stage. Each measure was evaluated using the change in seral stage standard at the level of the South Santiam fifth-field watershed. Effects of past activities were incorporated in the existing condition assessment. Reasonably foreseeable actions in the South Santiam fifth-field watershed included approximately 63 acres of regeneration harvest from the Cool Soda project and approximately 5 acres of regeneration harvest in the Jude Ridge project. The Cool Soda project also included 9 acres of fuelbreak thinning.

Alternative 1 (No Action)

No cumulative effects to seral stages would occur, as the effects of Alternative 1 do not overlap in time and space with effects from past, present, or reasonably foreseeable actions.

Alternatives 2, 3 and 4

1. Encourage Forest Health, Species Diversity and Structural Complexity

The prescribed treatment for addressing stand health and vigor is thinning. Thinning would not result in a stand changing seral stages.

Increasing tree species diversity and restoring sugar pine and western white pine would not in itself result in a stand changing seral stages.

Gaps and skips would be components of thinning prescriptions. They would not be large enough to be tracked as separate stands, and would therefore not result in a change in seral stages.

2. Contribute a Variety of Sustainable Forest Products to Local Markets

Providing forest products to local economies would not in itself result in a stand changing seral stages.

3. Increase Spatial Heterogeneity, Including Complex Early Seral Habitat, at a Landscape Scale by Mimicking Mixed Severity Fire

Aggregate retention harvest creating complex early seral habitat would result in a change of seral stages. In Alternatives 2 and 4 there would be 52 acres removed from the mid seral-closed stage and 47 acres removed from the late seral-closed stage, for a total of 101 acres returned to the early seral stage. The resulting change is quantified in Table 22 at the level of the South Santiam fifth-field watershed, including the regeneration harvest from the Cool Soda and Jude Ridge projects (mid seral-closed to early seral). Table 22 also compares these levels to the historic average for the South Santiam fifth-field watershed calculated from the LANDFIRE Biophysical Setting models.

4. Improve Fire Resiliency and Strategically Manage Hazardous Fuels in High Risk Areas

The prescribed treatment for addressing this objective is thinning to 30% canopy cover. In Alternatives 2, 3, and 4 this thinning would move 43 acres from the mid seral-closed to the mid seral-open seral stage. Additionally, in Alternatives 2 and 4 the thinning would move 76 acres from late seral-closed to late seral-open. The resulting change is quantified in Table 22 at the level of the South Santiam fifth-field watershed, including the fuelbreak treatments from the Cool Soda project (mid seral-closed to mid seral-open). Table 22 also compares these levels to the historic average for the South Santiam fifth-field watershed calculated from the LANDFIRE Biophysical Setting models.

5. Enhance and Create Hardwood Habitat and Diversity

Most of the treatments prescribed for this objective are thinning or release treatments which would not result in a change of seral stage. However, Alternatives 2 and 4 include 2 acres of harvest to create an oak savanna adjacent to Camas Prairie. This would take 2 acres from the late seral-closed stage and return it to the early seral stage. The resulting change is quantified in Table 22 at the level of the South Santiam fifth-field watershed. Table 22 also compares these levels to the historic average for the South Santiam fifth-field watershed calculated from the LANDFIRE Biophysical Setting models.

Table 22: Cumulative Change in Seral Stage Percentage on NFS Land in the South Santiam Fifth-field Watershed by Alternative

Class	Historic Weighted Average (%)	Current Average – NFS Ownership (%)	Alt 2	Alt 3	Alt 4
A – Early Seral	8	1.3	1.6	1.4	1.6
B – Mid Seral-Closed	17	23.4	23.1	23.2	23.1
C – Mid Seral-Open	5	3.3	3.4	3.4	3.4
D – Late Seral-Open	7	1.2	1.3	1.2	1.3
E – Late Seral-Closed	63	69.5	69.3	69.5	69.3
NF - Non-Forested	N/A	1.3	1.3	1.3	1.3

Conclusion

The only proposed treatments that would result in a seral stage change is complex early seral habitat creation and hardwood fuelbreak creation. However, these treatments would result in changes in seral

stage of the magnitude of tenths of a percent in the South Santiam fifth-field watershed. Therefore there is no cumulative effect.

Connected Actions

Post-harvest Tree Planting

Reforestation would occur in all action alternatives. Alternative 2 would require planting on 101 acres of aggregate retention harvest, and provide opportunities to plant 35 acres of gaps, 2 acres of Riparian Reserve (underplant), and 303 acres of previously thinned fire-origin stands (underplant). Alternative 3 would provide opportunities to plant 43 acres of gaps and 2 acres of Riparian Reserve (underplant). Alternative 4 would require planting on 101 acres of aggregate retention harvest, and would provide opportunities to plant 55 acres of gaps, 2 acres of Riparian Reserve (underplant), and 303 acres of previously thinned fire-origin stands (underplant). Regeneration from seed would also be expected to occur in aggregate retention areas and gaps, with Douglas-fir and western hemlock the most likely species to grow from seed. To enhance the likelihood of seedling survival, logging slash and other large woody debris likely to persist through site preparation prescribed burning would be used to provide shade and some protection from browsing by ungulates. The planting would diversify species composition of stands, particularly of drought-tolerant and conifer bough species, and would ensure minimum Forest Plan stocking requirements are achieved in aggregate retention harvest areas.

Snag Creation

All action alternatives would provide opportunities for snag creation for wildlife purposes. Additional snag creation would occur in Alternative 2 on 61 acres and in Alternative 4 on 14 acres to mimic mixed severity fire, in units where there are trees large enough to make snags of the greatest value to wildlife. Prescribed fire and girdling would be used to create snags.

Fall and Leave

All action alternatives would provide opportunities for fall and leave to occur in some Riparian Reserves. There would be opportunities for additional fall and leave in all action alternatives on 5 acres in two managed stands. These managed stands contain areas that are inaccessible by logging equipment due to a cliff and a wetland (the areas are too small to consider helicopter logging). One other managed stand has opportunities for fall and leave thinning on 3 acres dominated by sprouted bigleaf maple stems. The fall and leave thinning would achieve similar benefits as commercial thinning, such as improving health and vigor of the remaining trees.

Shrub and Forb Planting

All action alternatives would provide opportunities to plant shrubs and forbs. In Alternatives 2 and 4, there would be opportunities for 27 acres of planting to increase plants for tribal use (huckleberries and hazel) or to increase rare plants on the district (tall bugbane). In Alternative 3, there would be opportunities for 15 acres of planting to increase plants for tribal use.

Dry Meadow Restoration

In all action alternatives, there would be an opportunity to restore a two acre dry meadow in Unit 20. Sub-merchantable conifers would be cut, piled, and burned. This would reduce conifer encroachment into the meadow, allowing meadow forbs to thrive.

Pre-commercial Thinning for Fuelbreak & Ground and Ladder Fuel Treatment

In all action alternatives, there would be an opportunity for pre-commercial thinning in young managed stands in Unit 170. Trees would be thinned to wider spacing than typical pre-commercial thinning to delay the onset of continuous crown cover. The pre-commercial thin would also favor hardwood species in order to promote less flammable fuels in the fuel profile. In Unit 56, the fuelbreak treatment on the 2027-850 road would be extended by treating ground and ladder fuels within 50 feet of the road. Ground and ladder fuels (trees less than 7 inches DBH) would be removed to reduce the chance of a wildfire spreading from the ground into the crowns of overstory trees.

3.02 Soils

Summary of Effects Analysis

The major short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990) include displacement, compaction, nutrient loss, and instability. Preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. The total area of cumulative detrimental soil conditions would not exceed 20% of the total acreage within the activity area, including roads and landings.

Recommendations for closure or decommission of some forest system roads in the Trout Creek project area were completed following the Willamette National Forest road investment strategy. The recommendations stated in this report relate only to the soil/geology benefits.

The field investigation indicated that no unit approached or exceeded the Willamette National Forest Standard (FW-081) of 20% of an activity area impacted by compaction. All the potential units were below or well below the Forest standard. There was no evidence to indicate long-term detrimental soil displacement, off-site soil movement, or substantive loss of productivity.

Soil and geology resource concerns related to management activities proposed for this project are mitigated with the following general items:

- The soils design criteria/mitigation measures are designed to maintain long-term soil productivity and provide a level of erosion control that is consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan (1990) and Oregon State Department of Environmental Quality guidelines.
- Standard contract language should provide sufficient erosion control measures during timber sale operations.
- Restoration and revegetation of areas disturbed by harvest activities (such as landings, temporary roads, and equipment storage areas) through subsoiling techniques and appropriate seed mix applications.

With proper project implementation and use of the design features, no adverse or long-term effects to soil resources are expected.

Scale of Analysis

For the soil resource, the scale of analysis for both direct/indirect and cumulative effects is almost always the unit. A unit is the stand polygon or activity area proposed for silvicultural treatment. The unit of measure for evaluating those effects is the percent of the "unit" affected. Potential impacts are evaluated on a unit-by-unit basis. Transects are used to describe and measure current conditions and previous management activity impacts such as the amount of compacted ground within a proposed unit. In some cases, multiple transects were walked in different directions in order to provide more information or to monitor and evaluate the initial results for accuracy. In many units, no formal transects were taken as it was readily apparent that existing compaction amounts were no more than a small percentage of the unit area. Transects were usually about 500 to 1000 feet in length. The total width of past but currently visible skid roads, landings or other disturbed areas was used taken to determine the numerical extent of existing disturbance/compaction, as a percentage of the transect distance.

Intensive field reconnaissance of proposed units including terrain surrounding the units and appropriate field data with measurement indicators was used to evaluate soil resource impacts under the no action, the proposed action (Alternative 2) and other action Alternatives (Alternatives 3 and 4).

The Measurement Indicators used to describe the changes to existing conditions for each alternative are stated in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990). These measurement indicators are displacement, compaction, nutrient loss, and instability. The level of change for analysis within each indicator is described below. Analysis of the measurement indicators provides the duration (short to long-term effect) and the intensity of potential impacts between or among alternatives.

Duration

Short-term: The effects last for a few weeks to one or two years;

Intermediate: The effects last from one or two years to about a decade:

Long-term: The effects last approximately 10 years or longer.

Intensity

Low, negligible, little or no, minimal, minor: The impacts are essentially zero, at the lowest levels of detection, or very slight but still noticeable.

Moderate, reasonable: The impacts are readily apparent, but meet standards and guides.

Excessive, substantive, major, critical: The impact is moderately severe and likely approaches the upper limits of standards and guides.

Significant, unacceptable: The impacts are severe, and likely exceed standards and guides or do not meet Best Management Practices.

Affected Environment

Geology

The project area is located within the Western Cascades physiographic region. Most of the units, especially those at the lower elevations, are located on a strata that were once called the Little Butte Sequence. Walker and Duncan (1998) have since remapped and classified the area as “Tu”. Undivided Miocene and Oligocene sedimentary rocks, basalt flows, tuffs, and breccias form the foundation for these drainages (Figure 1). Radiometric potassium/argon dates on parts of this formation are mostly 32 to 17 million years old (Walker and Duncan, 1989).

Overlying these older formations, some proposed units at higher elevations are located on flows and flow breccias of olivine andesite, basaltic andesite, and some basalt. Their potassium-argon age dates range from about 17 to 10 million years old. (Walker and Duncan, 1989). These rocks, the “Tba” of Walker and Duncan (1989), have previously been designated as the Sardine Formation by some authors. Underlying these upland volcanic deposits are basaltic and basaltic andesite lava flows, label as “Tub” formation by Walker and Duncan (1989). “Tub” formation is part of the Little Butte Volcanic Formations. The formation is dominant in the proposed units on the western side of the Trout Creek project area (Walker and Duncan, 1989). Younger Silicic vent complexes, mapped as “Tsv” formation, occurs within the East section of the project. These formations are areas in the Cascade Range that commonly include multiple intrusions and associated silicic eruptive breccia and erosional debris and some flows.

In the last several million years, these rock formations have been extensively modified by stream erosion, mountain glaciation and slope instability. The surface expression of these rock formations has been extensively altered by erosion since late Pliocene time, especially with glacial activity and large scale slope instability. The South Santiam drainage was likely not affected to any degree by the large ice cap glaciers that covered the High Cascade platform many miles to the east of this watershed.

The complex, relatively recent geologic history has produced a myriad of diverse landforms and soils. The rocks and strata of some of the older Tertiary volcanic deposits sometimes weather to form deep colluvial and residual soils that can give rise to unstable soils. Stabilized slump-earth flow features, such as sag ponds, bench, and scarp topography, and disrupted drainages are common in many parts of this project area. It seems likely that slump and earthflow instability has been a significant factor in slope development and stream channel morphology for the last several thousand years. However, large-scale slope instability from debris chutes, slump, and earthflow complexes have been relatively inactive in the last 500 to 1000 years or more, except in some localized areas.

The 1973 Soil Resources Inventory (SRI) of the Willamette National Forest mapped and described forest landforms and soils characteristics for management interpretations. The SRI mapping units are landtype delineations. Landtype units are field verified and described to identify potential unsuitable areas and indicators properties. Unsuitable and unmanageable landtypes are delineated within the project area as part of the landtype mapping process.

Soil Resources (Landtypes)

A major portion of the field investigation was directed at distinguishing the various identifiable landtype components within the units and surrounding area (as applicable). Some of the landtype analysis referenced in this report was originally conducted for previous planning activities. In general, the field investigation confirmed most of the original 1973 SRI designations and the previously mapped work. However, more detailed work was conducted in some areas. The major portion of the field work involved site-specific evaluation of existing conditions within most of the units.

Project field Investigations were conducted intermittently through the field seasons of 2012, 2013, 2014 and 2015. Field assessment consisted of reconnaissance of potential harvest units and surrounding areas for the proposed planned project area in order to help implement Willamette National Forest program direction. Specific field dates are stated in the primary soil and geology resources report. The primary soil and geology resources report was reviewed by the current Forest Soil Scientist in order to update and verify that provided field descriptions relate to any updated proposed actions and other activities.

Soil and geology site-specific recommendations, design criteria, and mitigations are based on landtypes field investigation, their specific attributes, and the determination of the impacts from prior management activities. Unsuitable, unregenerable landtypes, such as cliffs and rock outcrops, critical rocky areas, or wetlands and dry meadows were mapped as part of the field reconnaissance.

Based on the field landtype assessments; soils on these side slopes have been stable and productive for at least several hundred years. Soils either formed directly on the underlying volcanic bedrock, on the more limited glacial deposits, or on jumbled combinations of the two in the slump complexes. Both types have similar size gradations that range from loam, silt loams to gravelly or cobbly sandy loams. Depth to bedrock is highly variable and can range from 5 to 10 feet to many times that amount. The various landtypes are generally well drained where permeability is rapid in the surface soils and rapid to slow in the subsoil. Because of high infiltration rates, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 80% but are generally less than 60%. Offsite

erosion is generally not a concern because of the extensive vegetative ground cover and the gentle to moderate side slopes in much of the area.

Field assessments existent conditions:

Nutrient loss / Duff Retention

- Little physical evidence can be found in any unit to indicate whether past timber management activities resulted in significant, long-term detrimental soil displacement, off-site soil movement, or substantive loss of productivity.
- A wide variation also exists in the amount of decomposing organic matter now found in the units. Many of the natural stands in this project area have had an active fire history in the last 100 to 150 years. Many of the more recent fires, bug kill, and snow down, have created areas with considerable down timber. As a result, a wide range in the above ground tonnage of decomposing organic matter exists. Existing decomposing organic matter have a variable range depending on aspect, side slopes, slopes, and management requirement.
- Stand ages in this project area are highly variable, but most natural stands in the Moose and South Santiam drainages indicate that natural or human-caused fires were very prevalent in the last 90 to 150 years. There is also evidence that significant under burning happened in older stands when stand replacement fires occurred in nearby areas. As a result, natural accumulations of down woody debris are often limited and highly variable across many areas.
- Some of the older managed stands with lower utilization standards retained considerable large down woody debris. Younger managed stands, with PUM yarding and higher utilization standards, removed much of this type of material and slash burns consumed considerable amounts of the above ground organic matter.

Compaction

- Field reconnaissance of the proposed units shows some level of existing compaction, primarily associated to past harvest within the existing managed stands. The levels range from 0 up to 15%. Evidence of compaction from previous entry is very minor in the natural stands. Field reconnaissance of the proposed units shows little compaction associated with prior harvest and indicated that no ground-based unit approached the Willamette National Forest FW-081 Standard of 20% of an activity area impacted, in this case by compaction. All the potential units were well below the Forest standard.
- The field investigation indicated that no ground-based unit approached or exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted, in this case by compaction. All the potential units were below to well below the Forest standard.
- Field work in skyline areas on side slopes from 25 to 50%, as well as extensive field reconnaissance of the steeper ground in almost all other units, indicates that these units had relatively low existing compaction levels, or compaction was essentially non-existent.

Instability

Potentially unstable conditions are found in three units within managed areas and two units within natural (fire-origin) stands (Table 23).

Table 23: Unstable areas within Trout Creek project

Unit Number	Instability/Unsuited Description
15	An area of four or five acres below (west of) Rd 857 occurs in the middle of this unit. It contains a relatively recent debris chute (post-2000) and evidence of older failures. The recent slide dropped about 250 feet and stopped on a slope break, as did the older sites. Recommend long-term slope stability treatment.
27	The unsuitable wet area at Mile Post 13.5 - south-west corner should be deleted during the layout phase of the project.
34	Several small slump/debris chute type failures exist in this unit, north of the south slope break into the creek that runs, generally east / west through the unit. Recommend long-term slope stability treatment.
59	A stabilized landslide exists along the northwest boundary below (west of) Rd 2022. This site failed 25 years ago. Recommend long-term slope stability treatment.
44	The rocky unsuited area along the south boundary and at the northeast corner should be deleted during the layout phase of the project.
48	The unsuited rocky areas along the west and south boundary should be deleted during the layout phase of the project.
56	The west boundary above Rd 850 should avoid the rocky unsuited area and stay east of the actively unstable earthflow.
65	The rocky unsuited area along the west boundary should be deleted during the layout phase of the project.
67	The unsuitable wet area should be deleted during the layout phase of the project.

Other unsuited areas

As mentioned on Table 23, the mapped unstable and unsuitable areas within units 27, 44, 48, 56, 65, 67 will be avoided and dropped for project activities during the layout operation phase.

Environmental Consequences

The desired soil and geology conditions for the project area are determined by the Willamette National Forest Final Environmental Impact Statement (FEIS 1990). Land management activities should be planned and conducted to maintain or enhance soil productivity and stability. The total areas of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landing. These desired conditions depend on the levels of displacement, nutrient loss, compaction, and instability potential occurring after the implementation of the project and applicable mitigations. Table 24 summarizes soil management and measurement indicators for assessing effects.

Table 24: Management/Measurement Indicators for assessing effects

Issue	Management/Measurement Indicator	Justification
Displacement	50% of topsoil or humus enriched soil horizons are removed from an area of 100 square feet that is at least 5 feet in width.	FW-081
Compaction	Increase in soil bulk density by at least 15% and/or a reduction in macropore space of 50% over the undisturbed soil.	FW-081
Nutrient Loss	Insufficient duff retention or large woody material to ensure adequate nutrient cycling.	FW-085
Instability	Increase in size, intensity or number of slope failures.	FW-086

¹ Willamette National Forest Final Environmental Impact Statement (FEIS, 1990) - Chapter IV of the Willamette Forest Plan, Forest-wide Standards and Guidelines.

Direct and Indirect Effects

Alternative 1 – No Action

In areas already compacted or disturbed by the initial entries, the soil building process will continue to return the soil to near pre-harvest conditions in the longer term but low soil productivity in a short term. Short-term to intermediate-term impacts from harvest, such as soil disturbance, dust or mud, slash accumulation and disposal, and longer-term impacts such as compaction and nutrient loss would not occur.

Slope instability is a geologic process that is currently active in parts of this project area and can potentially affect some proposed units. Most potentially actively unstable or potentially highly unstable soils were deleted from the units in the action alternatives. Consequently, in the short or intermediate term, no effects to slope instability are anticipated whether the units are managed or not. In the long term, loss of stand integrity with disease, storm or fire might cause an increase in slope failure.

Alternatives 2, 3 and 4

Displacement

Displacement can occur with timber management during road or landing construction, yarding, or the mechanical treatment of slash, such as machine piling. Erosion control practices stated in the contract requirements and design criteria would reduce or eliminate displacement within all the proposed logging systems

Areas with a higher surface erosion potential or overland flow with ground-based activities are present in less than 28% of the project area. Less than 7% of those acres are adjacent to class 1 and 2 Riparian Reserves. Any displacement effects will be none to minimal and short-term by following applicable Riparian Reserve buffer (all stream classes), ground cover requirement (duff retention), low impact logging systems and other erosion control practices.

The logging suspension requirement for a proposed unit is mandated in the Land and Resource Management Plan to protect the soil from excessive disturbance or displacement. With cable systems, the area near tail trees and landings (usually about 100 feet) is excluded from this suspension constraint. Unless otherwise stated or mitigated, all designated streams require full suspension or yarding away from the stream course during the yarding process. Most of the units with steeper ground have little or no existing disturbance levels.

Prebunching occurs when processor felling is used to cut and orient fallen timber so that skyline logging systems can more efficiently bring the wood to the landing. Prebunching is allowed only on side slopes less than 45%. All prebunching areas have the same site location restriction and access requirements that ground-based logging and require review and approval of activities outside of normal operation period.

By applying all mentioned design criteria, disturbance from harvest activities (ground-base and skyline) will be well within the Regional and Forest standards and significant adverse impacts are not anticipated. With appropriate implementation, soil disturbance is minimal and off-site erosion is essentially non-existent. During harvest, the retention of stream adjacent trees (Riparian Reserve buffers) and the requirement of full suspension yarding over or away from stream courses will minimize or eliminate off-site erosion.

Compaction

The major source of compaction is ground-based skidding equipment. The field investigation indicated that no ground-based unit approached or exceeded the Willamette National Forest FW-081 Standard of 20%.

Skidding equipment is restricted to predesignated skid roads. Extensive monitoring over many years has shown that when designated skid roads are properly utilized in conjunction with line pulling and directional felling, compaction from ground-based tractor operations generally remains at about 9 to 13%. In units with existing compaction, when old skid roads are reused and some subsoiling is implemented, monitoring has shown that overall compaction levels at the completion of management activities generally remain around 12 to 15%.

Reducing the effective weight of the type of equipment and reducing the number of trips over a piece of ground are means to reduce the risk of soil compaction and displacement. For example, using a processor or forwarder system, the skid roads are usually about 50 to 60 feet apart, but the number of trips and shorting the skidding distance for each individual road are substantially less than with skidding.

Ground-based equipment operation over snow or frozen soil or over a deep, solid snow pack (24 inches of dense snow or equivalent) substantially reduces soil disturbance and compaction. Over-the-snow operations are encouraged for any of these units, as long as other resource objectives can be achieved and sufficient snow accumulation is available. Monitoring of previous over-the-snow operations on various Districts has shown that essentially no displacement or compaction occurs when it is properly implemented.

Piling may occur by hand or with a grapple machine. Post-harvest activities such as grapple piling requires only one pass of the machine across the landscape, and the machine works while sitting on slash. Extensive monitoring of grapple machine piling operations indicate that little or no additional compaction or displacement occurs when properly implemented.

One of the goals with entry into any of the ground-based units is to provide the opportunity to subsoil the created skid roads and landings in order to keep compaction to very low levels. As part of the primary subsoiling efforts, the purchaser is responsible for subsoiling all landings, primary skid trails within identified units, and existing and new temporary roads used in the sale area. Additional subsoiling efforts (enhancement subsoiling) are recommended for a total of 20 acres to further reduce compaction. Units will be monitored as needed during project implementation, and any units with a high increase to the initial compaction levels will be the highest priority for post-sale subsoiling activities.

Ground-based equipment would operate in the dry season, usually considered from May to October, unless otherwise restricted by other resource concerns or waived by soil scientist or hydrologist, due to wet weather management mitigations. The wet weather management standards are applicable to all proposed project activities and operations within and outside of the normal operation season.

In summary, with the use of designated and skid roads and landings, the reuse of the existing skid road system (if present), the subsoiling of landings and primary skid roads, following wet weather management standards and other mitigations, compaction is anticipated to be below the 15% level. Therefore, it will not be cumulatively significant at the completion of harvest activities.

Nutrient Loss

In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. Soil productivity/nutrient loss would be short-term by potential displacement of the

organic surface horizon and duff-litter covers. This reduction will be minimal by requiring unit by unit duff retention (ground cover) percent during and after harvest activities.

Duff retention is the amount of duff thickness and woody material (slash) remaining after management activities are completed. Retention objectives are based on several factors that include slope percent, surface soil type, erosion hazard potential, and existing pre-management duff thickness. Extensive monitoring and field reconnaissance in recent years has shown that the ground cover in thinned units is considerable because of the accumulation of slash and the release of brush and forbs with increased sunlight.

Management activities will be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling. The preservation of a live conifer root mat with thinning and the intention to maintain some duff retention will reduce any possible longer term impacts to the ectomycorrhizal web. Concentrations of larger down logs that were produced naturally or with the initial harvest should be left undisturbed as much as possible. For all action alternatives, the slash will either be scattered or broadcast in the units, piled and burned or under burned.

Actual duff retention measurements on under burns (both natural and management directed) on various Districts in the last few years indicate that the “broadcast burn” standards for duff retention are usually approached or achieved, even if they are not specifically required. Consequently, they serve as a good goal and are recommended as a desired objective for the units in this report.

On typical thinning, hand piles number about 40 per acre and occupy about 20 square feet per pile for a total of about 800 square feet per acre or about 1.8% per acre. Machine piles are substantively less in number, larger in size which maintained values about 1.8 to 2%. In many cases, only a few acres of any particular unit are hand piled or machine piled. Burning the piled slash may develop sufficient heat to affect the underlying soil. Pile burning is usually done in the fall or winter months when duff and soil moistures are higher and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect and not cumulative because of the limited overall acreage involved. Duff retention objectives will be provided on a unit-by-unit basis. With the retention of adequate duff and woody debris, potential adverse impacts to long-term soil productivity are not anticipated.

Instability

For the proposed units, the potentially highly unstable or actively unstable terrain were mapped and these areas will be avoided and dropped for project activities during the layout operation phase. Consequently, potential slope instability with proposed management in these units is not considered a concern.

Within some unstable areas and depending on terrain, thinning activities can enhance the growth of leave trees and promote a healthier stand with firmer roots and greater evapotranspiration activity that contributes towards a long term slope stability. After field assessment, it was determined that harvesting activities within units 15, 34 and 59 would achieve the maintenance of long-term slope stability.

Thinning is recommended in the three units to establish a stand of well dispersed larger trees at about 50% canopy closure. No gaps should be located in those areas. In the last unit, logging would be accomplished with a sky line system (within the mentioned areas), and no slash burning is recommended, except for hand piles immediately adjacent to the road corridor. Approximately a 50% canopy closure would be maintained after thinning.

The removal of trees from these units could in the short to intermediate term, reduce evapotranspiration as compared to the current condition and avoid longer term changes to the local ground water regime.. This is not considered a critical concern for three reasons:

- 1) These changes are anticipated to be within levels that are similar to natural rainfall amounts at two to ten-year storm events;
- 2) If no action occurs, suppression will result in the stands losing trees or growth with a similar loss in evapotranspiration in not much longer time frames; and
- 3) Monitoring of commercial thinning harvest implemented on potentially highly unstable or actively unstable terrain has shown good release and not exacerbated slope instability.

Field review of previously thinned units in the past several years on both stable and unstable landtypes has shown no increase in either slope instability or erosion in either uplands or riparian reserves. Thinning within those units with potentially highly unstable or actively unstable terrain will not immediately promote greater slope stability. However, thinning will create healthier stands with bigger trees that have larger crowns and more roots. Larger trees tend to increase slope stability, and if failures do occur, they provide larger wood for down slope riparian areas. As a long term condition, the recommended thinning (in those few units) will improve slope stability and reduce the potential for adverse off-site effects from future failures.

Rock Pit Development

Two potential rock pit developments in the project area are: a) proposals expansion of an already existing pit located at NFSR #2027000 MP 11.2 (11 mile pit), and a new pit development located at NFSR #2027825 MP 0.50 (Shank pit). These mineral material developments would provide various rock products for road maintenance and road reconstruction associated with the harvest and haul needs.

The potential expansion for the 11 mile pit could generate about 20,000 cubic yards. The New development (Shank pit) could generate about 40,000 cubic yards. Rock materials in proposed areas are generally volcanic rocks with basaltic andesitic composition, resulting in up to standards aggregates materials.

The proposed rock pit development could include:

- Processing / Staging zones: opening and/or clearing areas to be used for processing mineral material, equipment's staging, stockpiling and for truck movements.
- Access expansion: expansion (widening) of main road access and improvement to applicable standards to support equipment traffic and sizes.
- Rock source (mineral material removal): involve activities such as blasting, trenching, excavating, benching, or stripping, some vegetation removal within rock sources as part of expansion or new development activities and within a mineral material pit development and management plan.

A general review of soil and geological resources near the proposed rock pit development sections shows the following settings:

- The potential staging areas to be cleared are flat with no wet zones/wetlands, ditches, or stream zones, inside or adjacent.
- No depressions, wet zones, groundwater (springs), streams or instability features shows within the potential proposed pit footprint area.

Any ground disturbances activities within the proposed pit development areas that could affect soil and geological resources should adhere to the following concepts:

- A level of upgrades to potential access road would minimize any discharge, stability or displacement effects as part of the pit development and activity.
- Equipment usage, staging, parking as part of rock pit development and operation activities will adhere to a spill contingency plan, which includes pertinent mitigations.
- Reclamation plan will be developed as part of the rock pit plan. Reclamation activities timing depends on the quarry/pit usage, and lifespan but can be achieved in phases. Some of the reclamation activities are revegetation (usually seeding), topsoil reapplication, re-contouring, grading, etc.
- Pit Development plans would be developed to establish the best effective, economically feasible and with minimal impact potential for soils, geological resources.
- An in depth analysis of soil and geological resources would occur as part of the rock pit development and management plans.
- Any specific soil and geological resources site mitigations, or design criteria (i.e. buffering zones/ avoidance zones, etc.) would be adhere during the rock pit development and management plan analysis and implementation.

Therefore, no irreversible and /or irretrievable use of the soils or geology resource is anticipated, beyond that which has been previously identified in the Willamette National Forest Land and Resource Management Plan.

Comparison of Effects from Alternatives 2, 3 and 4

As part of the vegetation management activities, all action alternatives (the proposed action, Alternatives 3 and 4) have the same basic effects and the same soil protection measures, as described on a unit-by-unit basis.

The additional activity proposed within Alternative 3 and 4 is due to the sustainable road analysis within the Trout Creek Project area as part of the Willamette Road Investment Strategy.

Analysis and recommendations to road status for soil and geology resources are based on landtype information (following the Soil Resources Inventory), topography, and stability history and project field assessment.

The road analysis determined that 82% of the investment strategy within the project area shows no detrimental impacts to soil and geology resources. 74% of these roads are recommended to remain open as part of the sustainable road analysis. The additional 8 % is recommended for closure or decommissioning. No impact will be expected by adhering to forest service standards, maintenance standards and soil/geology mitigation and additional beneficial impacts (increase in productivity, natural reclamation, reduction in traffic, etc.) would be added with decommissioning and closure of segments.

There are 8.51 miles recommended for decommissioning. More than 80% of these roads show some potential soil and geology concerns (such as erosion potential, stability potential). The decommissioning of these segments is beneficial by reducing road density, increasing productivity by providing ground cover, increasing infiltration potential (drainage), increasing natural revegetation and resulting in appropriate restoration to reduce the risk of potential sediment movement.

Road segments closures are recommended temporarily by using berms or gates and long-term by maintaining currently closed roads. These roads represent less than 10% of segments with soil and geology concerns. A complete restoration of hydrologic connectivity, soil productivity and nutrient

increase will occur slowly and in a long-term capacity by closing these areas. This action is also beneficial as it reduces traffic effects allowing natural reclamation and regeneration within some areas and increasing resource protections (stability, increase in ground cover).

Cumulative Effects

Alternative 1- No Action

Stands (within managed and natural stand) will continue to develop. Plant diversity would diminish as well as soil biota because of the lack of sunlight. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Blowdown and snow down would continue to increase fuel loading in the short to intermediate term. The likelihood of a stand replacement fire would increase.

Soil productivity will be low within current compacted areas (including non-decommission or close roads), as natural revegetation is slow and none continuous.

Alternatives 2, 3, and 4

Future cumulative effects from existing compaction and proposed harvest activities are not anticipated for any unit by implementing subsoiling (de-compaction) practices, erosion control techniques and wet weather management mitigations.

Rock pit development is a foreseeable potential action within the project area, pit Development plans would be developed to establish the best effective, economically feasible and with minimal impact potential for soils, geological resources. By considering and adhering to any specific soil and geological resources site mitigations, or design criteria (i.e. buffering zones/ avoidance zones, etc.) during the rock pit development and management plan analysis and implementation.

Potential past cumulative effects from displacement, nutrient loss, and instability above forest standards; with previous management were not observed to any degree in the field reconnaissance, and their cumulative area is not considered significant for any unit.

With proper project implementation and mitigation, unacceptable cumulative effects (present) on the soils resource are not anticipated from any of the action alternatives. The utilization of soil protection measures and best management practices will preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for a cumulative effects review, and no deviations are planned.

3.03 Aquatics (Hydrology and Fisheries)

Summary of Effects Analysis

Aquatic ecosystem effects of the Trout Creek project are compared to an ecosystem impacted by past stream cleaning of large wood, the building of an extensive road network, and past logging practices that left little to no stream side trees. These past actions have converted naturally diverse ecosystems characterized by abundant large decaying trees, both on the ground and in the stream network, into cleared out streams and monoculture Douglas-fir plantations in about 35% of the project area. Some recovery has occurred since original impacts, but legacy effects to forest stands and streams are common.

In the no action alternative, and in units where no harvest is planned in Riparian Reserves, the conditions will slowly improve over time as Riparian Reserves established under the Northwest Forest Plan provide protected areas where recovery of diverse riparian forest can occur.

In the action alternatives where managed stand thinning in Riparian Reserves is planned, no harvest stream buffers will protect over 90% of the potential future in-stream wood, prevent increases in stream temperature, and ensure logging operations have no measurable impact to fine sediment and management indicators species for fisheries.

Road reconstruction, that would replace 17 failing live stream culverts (260 total culverts including ditch relief for Alternative 2), will have short term fine sediment impacts to fish species, including ESA listed fish (Likely to Adversely Affect fisheries consultation result), but will have long term benefits to aquatic ecosystems, and will not decrease the viability of any populations of fish. Road decommissioning will have short term fine sediment impacts, but will also protect hydrology and fisheries in the long term, including removing a current fish passage barrier.

Action alternatives would not reduce ARP values below forest plan standards.

Scale of Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects to aquatic resources for this project includes: the timber sale units; the action area (defined as the Moose Creek, Trout Creek, and Lower Canyon Creek subwatersheds); or the project area. The project area includes the action area (excluding areas outside the forest boundary) and a small portion of the project overlapping the ridgelines in Soda Fork and Bear Creek - Middle Santiam River subwatersheds (Figure 20). These slight ridgeline overlaps in the project area would have no measurable direct or indirect aquatic effects and are excluded from aquatic resources analysis in most of the analysis below.

Assessment Methodology

Data on current and historic watershed condition was gathered from the South Santiam Watershed Analysis (1995 and revised in 2005) and through GIS analysis of a Forest Service GIS data on streams, roads and vegetation. Recent stream condition information was determined through review of stream surveys in the project area. Field review of roads and streams in the general project area were explored until a general understanding of the field conditions of the area was gained.

Proposed treatment units were more intensively surveyed for streams, springs, wetlands, and information on riparian conditions. Riparian Reserves in older natural fire regenerated units were surveyed for any potential treatment needed to attain Aquatic Conservation Strategy Objectives

(ACSOs). Based on vegetative characteristics, the Fisheries, Hydrology, Wildlife, Silviculture and Botany specialists developed recommendations for the need to treat Riparian Reserves in the timber sale units.

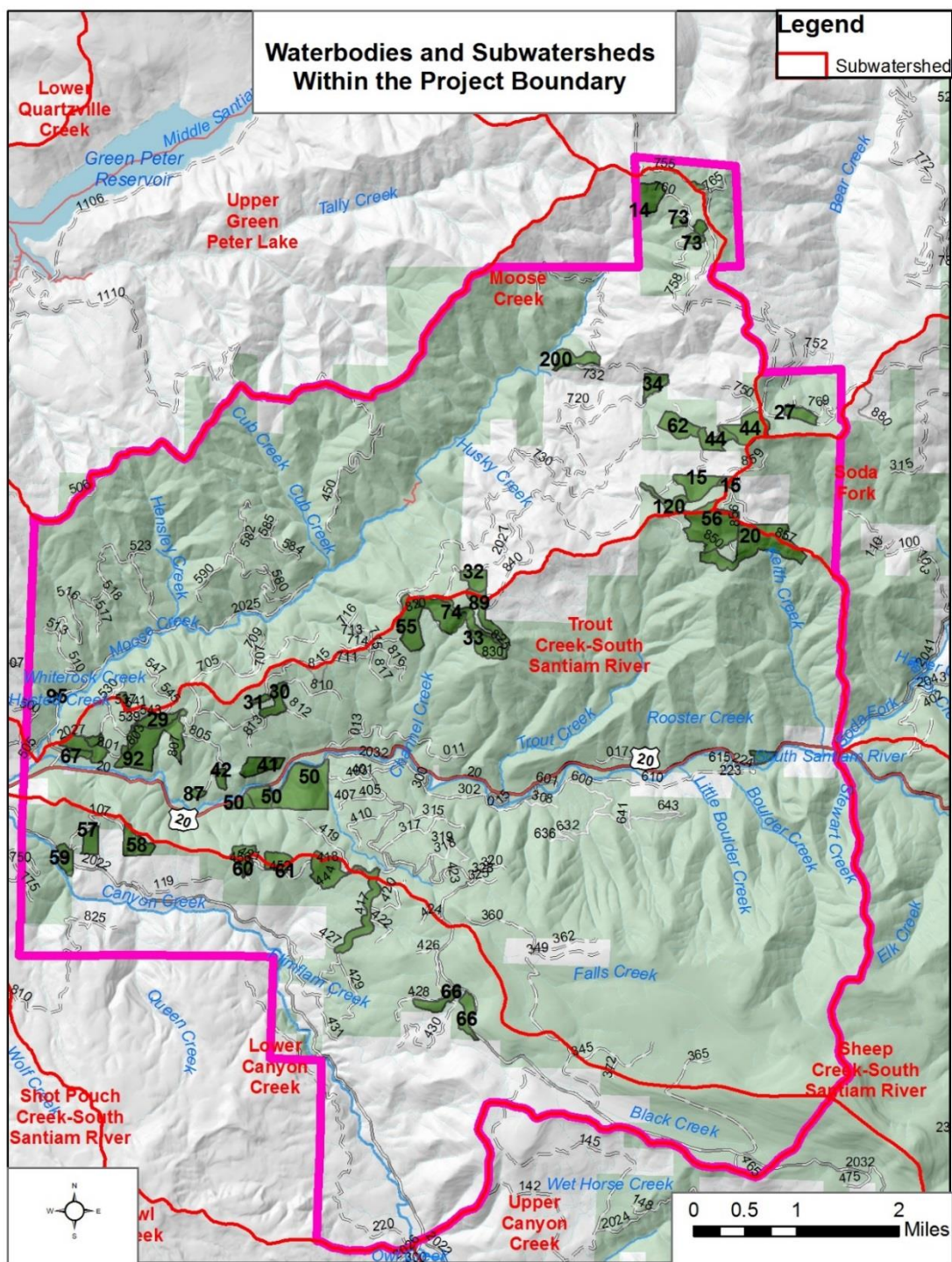


Figure 20: Waterbodies and 6th Field Sub-watersheds within the Project Area

Affected Environment – Riparian Reserves

Analysis of Riparian Reserves for this project will discuss the current condition of the reserves, and disclose the effects of silvicultural treatments within the reserves needed to attain Aquatic Conservation Strategy Objectives (ACSOs). The Northwest Forest Plan included the Aquatic Conservation Strategy (ACS) to protect the ecological health of the watershed and aquatic ecosystems on public lands. Meeting the intent of the ACS and restoration of habitat for federally-listed species is an important aspect of vegetation treatment projects on the Willamette National Forest. Properly functioning Riparian Reserves are important to the recovery of listed species.

Timber harvest in the project area started in the 1930s, and accelerated after World War II up into the 1970s and 80s prior to implementation of the Northwest Forest Plan. The harvest techniques resulted in removal of all riparian vegetation that provided large wood and shade to the small tributary streams in the project area. Small areas scattered across the landscape were clear-cut and replanted with Douglas-fir with the objective of future timber production. As a result, most of these plantations, or managed stands, are artificially dense, Douglas-fir dominated stands (Figure 21). There are approximately 4,800 acres of managed stands on Forest Service land in the project area. Additionally there are about 8,200 acres of private land in the project area that is managed making the total area in managed stands about 35% of the 37,000 acre project area.



Figure 21: An example of Riparian Reserves with typical young overstocked plantations in the project area

In the younger managed units, instream large wood counts are not known since few are fish-bearing and are not typically surveyed using the standard USFS protocol. However, since stream clean out was typically part of logging operations until the 1980s, most of the streams in previous clear cuts were cleared of any existing large wood. It is likely that at the unit scale the streams are devoid of historical quantities of pool forming large wood.

Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Poage and Tappeiner, 2002; Tappeiner et al., 1997). Stand densities in managed stands on Forest Service land in the project area average about 205 trees per acre (for trees > 7 inches dbh). These stands exhibit a lack of complexity and diversity that may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian dependent wildlife.

Older (>80 years) naturally established fire regenerated areas that developed after stand replacement fires typically develop a more open canopy structure, including sufficient down and standing dead wood, in-stream down wood, and have multi-story diverse vegetation throughout the stand (Pollock et al., 2012). Similarly, in the older fire regenerated stands in the project area, Riparian Reserves are exhibiting complex structure and species diversity, including down and standing dead wood and in stream wood. The units in this project include approximately 320 acres in older naturally established stands where existing condition of Riparian Reserves indicate complexity and diversity, and no need for treatment to attain ACSOs.

Riparian Reserves within the older stands in the project area have higher structural and species diversity and are providing adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input to waterbodies, and habitat for riparian-dependent wildlife. Figure 22 illustrates properly functioning conditions within older Riparian Reserves in the project area.



Figure 22: Existing condition for older Riparian Reserves, typical of fire regenerated stands in the project area

The desired condition within Riparian Reserves includes: large conifers; complex habitat structure representative of that which would result from natural disturbance patterns; diverse species composition; snags and logs on the forest floor and large wood for streams (USDA, 1994). This condition is important to be maintained for the benefit of aquatic plants, aquatic organisms, and terrestrial wildlife.

Environmental Consequences – Riparian Reserves

Direct and Indirect Effects

Alternative 1 – No Action

Current rates of large wood recruitment, provided by tree mortality from competition, disease, and bank erosion, would be maintained. No action would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives, because the action alternative would remove some of the future mortality expected from competition.

The No Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions of high species and structural diversity, with large dead and down wood, would slowly develop over time (several decades) and result from natural thinning. Without thinning to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels until natural thinning took place.

Accelerated restoration of riparian stands that currently do not meet ACSOs would not be accomplished. Alternative 1 would perpetuate the impacts of homogenous, densely stocked stand conditions longer into the future. The dense riparian stands would be at greater risk from wild fire, insect infestation, and disease, especially under expected future climate change scenarios (Vose et al., 2016).

Alternatives 2, 3 and 4

The Northwest Forest Plan (NWFP) prohibits timber harvest in Riparian Reserves except as needed to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS Objectives (NWFP Standards and Guides, TM-1(c)). Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. Therefore, there is a need to treat parts of the Riparian Reserves to accelerate attainment of desired conditions. Other areas, however, are currently meeting desired vegetation characteristics and treatment is not necessary.

Alternatives 2, 3, and 4 propose both active and passive management of Riparian Reserves. This analysis includes Riparian Reserve thinning for restoration, fall and leave treatments, prescribed fire and temporary roads. It explores the potential for effects of these actions and the potential impacts they could have on Riparian Reserves as a resource area. Riparian Reserve treatments are the same for each of the action alternatives.

Thinning in Riparian Reserves

The body of literature on the effects of thinning on stream and forest ecosystems is quite extensive. Several key factors in determining where this type of treatment would be beneficial for the attainment of ACS objectives were considered. In-stream wood recruitment, upland down woody material levels,

stand structure, and species composition are described below. Alternatives 2, 3 and 4 would thin approximately 71 acres within the 16,431 acres of Riparian Reserves in the project area, or about 0.4%.

In-Stream Wood

In-stream wood is important to the health of aquatic habitats, and many researchers have studied the areas along streams where wood recruitment typically occurs. Wood source areas are highly variable, but are strongly correlated to tree height and the dominant wood recruitment process for each stream reach (Spies et al., 2013). The dominant source area distance from streams ranges based on delivery mechanism and tree height and time of recruitment. According to Benda and Bigelow (2014), in the Douglas-fir plantations of the Cascades, bank erosion and tree mortality are the dominant processes (Benda and Bigelow, 2014). In these stream reaches, 90% of the wood is recruited from within 8 meters (26 feet), and the remaining 10% from within a distance equivalent to tree height (Benda and Bigelow, 2014).

In all of the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect wood recruitment zones, and other resource concerns such as temperature. The overall goal for protecting wood recruitment zones was to protect at least 90% of trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be at sufficient levels to sustain physical complexity and stability required by the ACS Objectives. No-harvest buffers range in width depending on stream type (i.e., 50 feet on intermittent streams, 75 feet on perennial non-fish bearing streams, and 120 feet on fish bearing streams). In unit 50, adjacent to Listed Fish Habitat (LFH) on the South Santiam River, there is no proposed thinning in Riparian Reserves (344 feet from the river). These no harvest buffers are expected to protect 90% of the future in stream wood recruitment in the 71 acres of Riparian Reserves where silvicultural treatment is planned, which is sufficient to sustain large wood in streams in treatment units.

Stand Structure and Species Composition

Based on an extensive literature review paired with extensive modeling, Spies et al. (2013) found that the “greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g., large trees, large dead trees, spatial structure and compositional heterogeneity, etc.) come in dense uniform managed stands less than 80 years and especially less than 50 years old.”

In Alternatives 2, 3, and 4, all of the stands where Riparian Reserve thinning would occur are under 80 years old. The Riparian Reserves in fire regenerated stands over 80 years old were surveyed, but they were found to already contain multiple canopies and species diversity. In short, they were already meeting ACS Objectives and there was no need to treat them in order to attain ACS Objectives.

There is currently a great deal of emphasis on protecting and restoring riparian forest reserves in order to protect both terrestrial and aquatic biodiversity. There are tradeoffs associated with thinning in Riparian Reserves where some species benefit from thinning and others are better off with more shade and dead down wood. Pollock, et al., 2012 found that young conifer stands like the ones proposed for treatment in this project would, if left untreated, develop the desired forest structure found in older forest reference conditions. On the other hand, treated stands would also follow a trajectory toward desired older forest structure, but along the outside limits of reference conditions (Pollock et al., 2012). Reference conditions were considered to have mature, late-successional conifer dominated stands with abundant large trees in the overstory, abundant large snags, down wood in streams, and a well-developed understory of shade-tolerant trees. It is also known that thinning increases shrub cover and greatly increases within-stand variability where shrub cover is absent before treatment (Harrington et al., 2005). Riparian Reserve thinning may also accelerate the development of late successional forest

attributes of value to some riparian and upland-associated species (Harrington et al., 2005). According to Pollock and Beechie (2014), more terrestrial and aquatic vertebrates utilize deadwood than live trees, and allowing Riparian Reserves to develop naturally may lead to the most rapid development of forest structures important to the most vertebrates, and be best for biodiversity in general.

In this project, a minimum of 50% canopy closure would be maintained in the thinned portions of Riparian Reserves in the project. Overall, the proposed thinning in Riparian Reserves is a compromise between active and passive restoration techniques, which implement some important active restoration such as shrub establishment, while protecting 90% future large wood input. Where Riparian Reserve thinning is proposed, increases in abundance of understory vegetation, species diversity, stand structural diversity, and tree growth are expected. With only 0.4% of the Riparian Reserves planned for thinning, and the no-harvest buffers established along stream channels, the effects to stand structure and species composition at the watershed scale will be within the range of natural variability.

Other Treatments

Within some treatment units, the introduction of low severity fire into patches of Riparian Reserves is anticipated during fuels treatments. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fire line around the Reserves which would potentially result in erosion. At low burn severities, large wood would not be removed from the Reserves. The net results, though localized, would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than managed stands without fuels treatments.

Fall and leave thinning is proposed for 12 acres in Riparian Reserves in 5 units throughout the project area to accelerate down wood, release under represented tree species, increase shrub component to the stand, and add in stream down wood (See Table 5, Non-commercial treatment units). For the same reasons as described above these treatments are well within the range of natural variability at the watershed scale and are expected to benefit the target restoration objectives identified at the unit scale.

Wherever possible, new temporary roads would be located outside of Riparian Reserves, and existing non-system roads would be used before new ones are planned. There are approximately 240 feet of new temporary road proposed within the Riparian Reserves that would be located at least 100 feet from any live streams. There are no temporary road stream crossings that could impact the Riparian Reserves. Typical rates of re-vegetation start occurring within 2 decades from natural regeneration if the disturbed area is not replanted. All temporary roads would be decommissioned after treatment activities are completed.

In summary, Alternatives 2, 3 and 4 would thin approximately 71 acres within Riparian Reserves (Table 25). The adverse impacts of thinning on in-stream large wood and future recruitment would be very minor at the watershed, project, and reach scales. Only approximately 0.4% of Riparian Reserves in the project area would be thinned, and within those units approximately 90% of the wood recruitment zones would be protected with stream side no-harvest buffers of 50 feet on intermittent streams and 75 feet on perennial streams. The minor reduction in wood recruitment would occur at a very slow rate due to the naturally slow rate of the dominant wood recruitment processes (bank erosion and tree mortality) of streams in the project area. The beneficial impacts of thinning to accelerate tree growth, riparian forest structure and shrub diversity would be very minor at all scales due to the relatively small area treated and slow rates of tree growth. Table 25 summarizes the acres of Riparian Reserves affected by the proposed thinning. The proposed management of Riparian Reserves in Alternative 2, 3 and 4 is needed to attain ACS Objectives. The Aquatic Conservation Strategy compliance document (Appendix B) explains how each Objective is maintained or improved. With only 0.4% of the Riparian Reserves planned for commercial thinning, and the no-harvest buffers established along stream channels, the

effects to stand structure and species composition at the watershed scale will be within the range of natural variability.

Table 25: Riparian Reserve Commercial Thinning in the Project Area

Total Riparian Reserve Acres within the Project Area	Unit Acres Overlapping Riparian Reserves	Activity	Acres Proposed for Silvicultural Treatment	
			Alternative 1	Alternatives 2, 3, and 4
16,431	109	Thinning	0	71

Cumulative Effects

All recent and planned timber harvest projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects are listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix C) were analyzed for effects to riparian condition and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Trout Creek project would not measurably contribute to impaired riparian conditions.

The Canyon Thin project overlaps the Trout Creek –South Santiam subwatershed and the Lower Canyon Creek subwatershed. Additional impacts from Canyon Thin to Riparian Reserves are similar as the same no-harvest buffers are applied to protect 90% of the potential future in-stream wood recruitment. The effect of past, present and reasonably foreseeable actions would not change the effects analysis for the Trout Creek project. The effects to Riparian Reserves would still be well within the range of natural variability.

Private timber lands are present on approximately 8,200 acres in the project area. The Oregon Forest Practices Act, which governs the way private land is managed, does not include Riparian Reserves (Oregon Forest Practices Act, 1971). On private land there may be commercial harvest that effects the connection between Riparian Reserves across the landscape in the short, medium and long term. Because Riparian Reserve treatments are only occurring in managed stands, primary shade zones are being protected, and a minimum of 50% canopy cover is being maintained, negative cumulative effects to Riparian Reserves at the watershed scale are not anticipated.

Affected Environment – Stream Shade and Temperature

Major road construction and timber harvest began in the project area in the 1940s, peaking in the 1970s and 80s. Much of the activities that occurred prior to implementation of the Northwest Forest Plan resulted in removal of riparian vegetation that provided shade for streams.

Human-caused thermal degradation of streams has been shown to be caused by reducing riparian vegetation, reducing groundwater discharge into the stream, simplified alluvial system and channel structure, simplified channel morphology, and reduced stream and tributary flow during low flow periods. These can be caused by past riparian and upland management, increased peak flows, removal of in-stream structural components such as large wood, stream confinement by roads, and summer water withdrawals (Poole, 2001).

Thermal degradation through reduced base flow is caused by converting native forest to managed stand management. Based on recent findings in a similar climatic and geologic condition to the project area, past conversion to industrial timber management has impacted base flows (Perry and Jones, 2016).

Assuming that all private industrial timber land has been converted into plantation management, approximately 35% of the project area has been converted to plantation management. With base flow potentially reduced by over 20% from historical conditions there is likely pronounced changes in base flow in the action area, resulting in increased stream temperatures in the action area. In the future, climate change will likely influence base flows and further impair their functioning (Mantua, 2010).

Preferred temperatures for salmon and steelhead in the project area are listed in Table 26. The state water quality standards for temperature in these streams is set to maintain suitability for spawning, rearing and migrating salmonid fish.

Table 26: Preferred temperature limits and ranges for salmonids (degrees Fahrenheit)

DEQ Standard for core cold water habitat	Preferred Juvenile Temperature Range	Preferred Adult Migration/Spawning	Lethal Limit
64	50-60	46-55	77

Stream temperature data were collected at various locations in the project area during the summer months (June through September) for a minimum of five years between 2006 and 2016. Summarized yearly data is in Table 27. The data is used to assess the stream temperature relative to water quality standards.

Table 27: Stream Temperature in the Trout Creek Project Area

Streams	Lowest 7-Day Average Daily Max Temp. °F ¹	Highest 7-Day Average Daily Max Temp. °F ¹	Average Value °F
Moose Creek	63	65	64
Trout Creek	62	68	64
South Santiam River	64	70	67
Lower Canyon Creek	66	73	68

¹ Yearly data collected from 2007 to 2016.

Existing condition for stream temperature in the project area is generally not meeting state standards. Changes in the range of maximum temperatures from one water year to the next are attributable to inter-annual differences in precipitation and stream flows. The annual timing of the maximum temperature occurred between July and August in all instances. This suggests that any past management impacted only the increased value for maximum temperature and has not affected inter-annual variability or annual timing of peak temperatures.

Under section 303(d) of the 1972 Clean Water Act, states are required to develop lists of impaired waters. According to the current 303(d) list report the Moose Creek and South Santiam River within the project are listed as impaired for temperature. The criteria is for salmon and steelhead spawning and rearing and core cold water habitat (Oregon DEQ., 2010. 303(d) List of Impaired Waters). Canyon Creek is lacking enough DEQ data to be officially listed, but it is temperature impaired. Trout Creek is not listed. Trout Creek flows out of the Menagerie Wilderness and does not have human caused thermal degradation. Streams that are listed have recently been moved from being impaired and having an approved TMDL Water Quality Restoration Plan (Category 3a) to needing a TMDL Water Quality Restoration Plan (Category 5) due to recent and still pending litigation.

Environmental Consequences – Stream Shade and Temperature

Direct and Indirect Effects

Alternative 1 – No Action

No harvest activities would occur so there would be no direct and indirect effects on stream shade or stream temperature. Riparian vegetation near perennial streams would continue to grow and provide stream shade on Federal land.

Alternatives 2, 3, and 4

The U.S. Forest Service (FS) develops Water Quality Restoration Plans (WQRPs) to address temperature limited streams on FS administered lands. Development and implementation of WQRPs are required by State law under the TMDL rule in Oregon. The Willamette National Forest submitted a Water Quality Management Plan to the Department of Environment Quality (DEQ) in 2008, which was approved, but is no longer valid because of a lawsuit. As a result, streams that are listed as water quality limited for temperature have recently been moved from being impaired and having an approved TMDL Water Quality Restoration Plan (Category 3a) to needing a TMDL Water Quality Restoration Plan (Category 5). Many of the WQRPs completed for the NWFP area found that management of riparian areas as required by the NWFP Aquatic Conservation Strategy (ACS) can provide sufficient stream shade to protect or recover stream temperature in waters listed as impaired for temperature on the State's 303(d) list. For all project elements in all action alternatives, treatments near riparian areas have been designed to comply with Northwest Forest Plan (NWFP) Temperature TMDL Implementation Strategy (2012) for water quality limited streams, and are not expected to impact shade on federal land within the project area.

A shade protection no-harvest buffer of at least 75 feet would be retained on all perennial streams to maintain effective shade within thinning units. Intermittent (Class 4) streams are dry during the summer when elevated temperatures occur. However, a minimum of 50 foot buffer would provide substantial shade on intermittent streams. Much of the stream-influenced microclimate would also be preserved since the gradients are strongest within the first 20-30 feet (Anderson, 2007) and a portion of the canopy cover throughout the rest of the Riparian Reserve will be maintained.

There is timber felling proposed near streams to restore large wood to the stream as well as thin managed stands and restore oak habitat. Proposed fall and leave treatments near streams would only reduce canopy cover to 70%. In unit 67 where 55 Douglas-fir trees are proposed to be felled in Riparian Reserves to restore Oak habitat, there are no perennial streams present. Because of these design criteria there will be very little increase in direct solar radiation. Because of the minute increase in solar radiation to perennial streams, there will be an immeasurable effect to stream temperature due to fall and leave.

No skyline or groundbased yarding corridor crossings are proposed over streams. Therefore, timber yarding would have no impact to stream temperature and shade.

Findings from the Riparian Elevation Science Review Team indicate that removal of over-story canopy within 150 feet of perennial stream channels has the potential to reduce effective shade (Leinenbach et al., 2013). There is no timber harvest in Riparian Reserves in naturally fire regenerated stands where Riparian Reserve widths are generally 172 feet on perennial and intermittent streams. Therefore, no reduction in effective shade or increases in stream temperature would occur in the treated natural stands.

No-harvest buffers on perennial streams in the managed stand thinning units are at least 75 feet. Several papers have been published recently indicating that hyporheic flow has a significant influence on stream temperature. Janishch et al. (2012) found that the canopy cover of “buffers” was not a strong predictor for temperature in small (<7feet wide) headwater streams. Streams with coarse-textured streambeds tended to be thermally unresponsive as compared with fine-textured streambeds or those with small, near-stream wetland areas. Rapid cooling has been observed after an extensive exposure to the sun after water re-entered forest cover in Australia (Rutherford et al., 2004), and, in Idaho, warming of headwater streams with no buffers did not lead to warming of fish-bearing streams downstream (Gravelle and Link, 2007). Zwieniecki and Newton (1999) indicated that stream temperature increases from harvesting activity were frequently lost within 150–300 m beneath downstream cover. This re-emphasizes the important role gravel and large wood play in channels.

The no-harvest buffer widths are based on the width of the primary shade zone as modeled in the Northwest Forest Plan Temperature TMDL Implementation Strategies (2012). By protecting the vegetation in the primary shade zone and thinning only in the secondary shade zone, existing shade can be maintained, and no reduction to stream shade will occur (NWFP TMDL, 2012). Research has shown that in many cases significant changes in stream temperature are not observed with partial no-harvest buffers within the Riparian Reserve width (Levno, 1967; Macdonald, 2003). Often, buffer distances less than one site potential tree have been shown to protect water temperature. Gomi and others (2006) reported maximum daily temperatures in headwater streams did not increase significantly when 30- and 90-foot buffers were applied. In dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun’s solar radiation. Typically the primary shade zone is half of the site potential tree height. Some of the streams in the Action Area are less than 3 feet wide, and the primary shade zone is typically less for these streams.

Wilkerson et al. (2006) reported maximum increases of 1.0-1.4 degrees C with 11m buffers and negligible increases with 23m or partially cut buffers in Maine. DeWalle (2010) theorized that at least 80% shade could be attained with 12m wide buffers on small (<6 meters wide) streams. In western Oregon, Zwieniecki and Newton (1999) reported that the presence of near continuous shade from an uncut buffer positioned on the south side of water led to protection from the effect of solar radiation. Groom et al. (2011a) found a 40% probability of exceedance of the Protecting Cold Water criterion on privately owned lands (0-21 meters) and a 5% probability of exceedance on lands managed to the more stringent state standard (0-52 meters).

Accurately predicting the magnitude of stream temperature increases on a highly variable landscape is extremely difficult. However, the research cited above supports the conclusion that while there may be a decrease in effective shade, localized increases in stream temperature are likely to be too small to differentiate from background variability. If localized increases in stream temperature occur, they will likely be less than 1 degree Celcius and are unlikely to be measurable in larger streams with fish present. The tributary streams that flow through the harvest units are small in size (<1-2 cfs in most cases). Research has shown that the magnitude of temperature effect is a function of the amount of water entering the stream relative to the stream discharge, and the difference in temperature between the stream and the inflowing water (Johnson and Jones, 2000; Wondzell, 2006; Wondzell, 2012). Therefore, any localized increase in stream temperature would be immeasurable in the South Santiam, Moose Creek, or Canyon Creek given the volume of water that these main channels carry.

Based on site specific geomorphic and hydrologic conditions, and no-harvest buffers, the magnitude of timber falling in managed units affecting the stream temperature is immeasurable. Proposed fall and leave near streams will only reduce canopy to 70%. In unit 67 where 55 Douglas-fir trees are proposed

to be felled in Riparian Reserves to restore Oak habitat, there are no perennial streams present. Because of these design criteria there will be very little increase in direct solar radiation, especially in proximity of fish that the temperature criteria is designed to protect. Because of the minute increase in solar radiation to perennial streams, there will be an immeasurable effect to stream temperature.

Based on implementation of the design criteria outlined in the preceding discussion and field observations during project reconnaissance, no measurable direct or indirect effects on stream temperature are anticipated within the project area, as a result of the action alternatives. Riparian vegetation near perennial streams would continue to grow and provide stream shade on Federal land.

Cumulative Effects

Alternatives 2, 3 and 4

All recent and planned timber harvest and hazardous fuels reduction projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix C) were analyzed for effects to stream temperature and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Trout Creek project would not measurably contribute to impaired stream shade or temperature.

Activities that cumulatively affect stream-shading vegetation include private timber harvest in the primary shade zone. The Oregon Forest Practices Act, which governs the way private land is managed, does not protect stream shade to the level protected on federal land (Oregon Forest Practices Act, 1971). On private land there may be commercial harvest that effects stream shade and thus stream temperature in the short, medium and long term. Because there are no direct or indirect effects to stream temperature from the Trout Creek project there will be no cumulative effects from this project.

Affected Environment – Stream Flows/Disturbance History

Projects involving timber harvest were analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage (ARP), as specified by the 1990 Willamette National Forest LRMP (Forest Plan). Following forest plan procedures, the analysis is done in the planning sub-drainages (P-Subs), defined in the 1990 Forest Plan. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered, against a threshold value (Midpoint) that was calibrated for the sub-drainage during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed. They are intended to represent a minimum level of vegetative recovery in the sub-watersheds to prevent increases in peak flows that will cause excessive bank erosion and degrade stream ecosystems. Recovery generally occurs when stands are over 35 years old and crown closures exceed 70%. The transient snow zone is considered to include land between the elevations of 1,500 and 4,000 feet. The analysis is based on stand age data extracted from the Forest's VEGIS database for Forest Service land. In the Trout Creek planning area, private land makes calculation of ARP values based solely on VEGIS very skewed because stand age on private land is generally not known. On private land and in gaps in Forest Service land data, satellite data was used to estimate stand age and canopy cover using the Gradient Nearest Neighbor (GNN) data method. Stand age and canopy cover obtained by this method were then used to fill in the gaps and complete the ARP analysis for P-sub in the project area (Table 28).

Environmental Consequences – Stream Flows/Disturbance History

Direct and Indirect Effects

Alternative 1 – No Action

No Action would result in no immediate changes to existing peak flows, having no direct, indirect, or cumulative effects on stream flow in the project area.

Alternatives 2, 3 and 4

Table 28 lists ARP values for current and recovery immediately after implementation of the project for alternative 4, which removes more canopy cover than any of the other alternatives. This is compared to midpoint ARP required by the LRMP as shown in the table. Alternatives 2 and 3, being less extractive, will have less effect to ARP. Completion of implementation is estimated to occur in 2019.

Table 28: Current and post treatment Aggregate Recovery Percentages (ARP) in the project area

Planning Sub-Drainage	Current Condition	Post Treatment Alternative 4 (Most Extractive)	Midpoint ARP from 1990 Willamette NF LRMP
Hensley	95.09	95.68	80
Moose	83.12	80.09	75
Lower South Santiam	91.49	85.46	70
Trout	94.65	91.06	75
Boulder	97.70	97.95	75
Lower Canyon	92.96	88.98	75
Black	93.96	93.54	65
Middle Canyon	71.88	72.33	80

ARP levels are maintained above recommended midpoint values for Alternative 4, except in Middle Canyon P-sub, but there are no units in the Middle Canyon P-sub so this project has no effect in this P-sub. This ARP analysis includes all lands within the P-sub, including private land. For all P-sub with timber harvest units, ARP values are maintained above midpoint values for all alternatives, even immediately after implementation when the potential for adverse impacts to vegetation would be greatest. Therefore, no altered peak stream flows are anticipated from implementation of the proposed actions. The map below shows the ARP levels immediately after harvest in 2019. Figure 23 is a Map of ARP levels post treatment for Alternative 4.

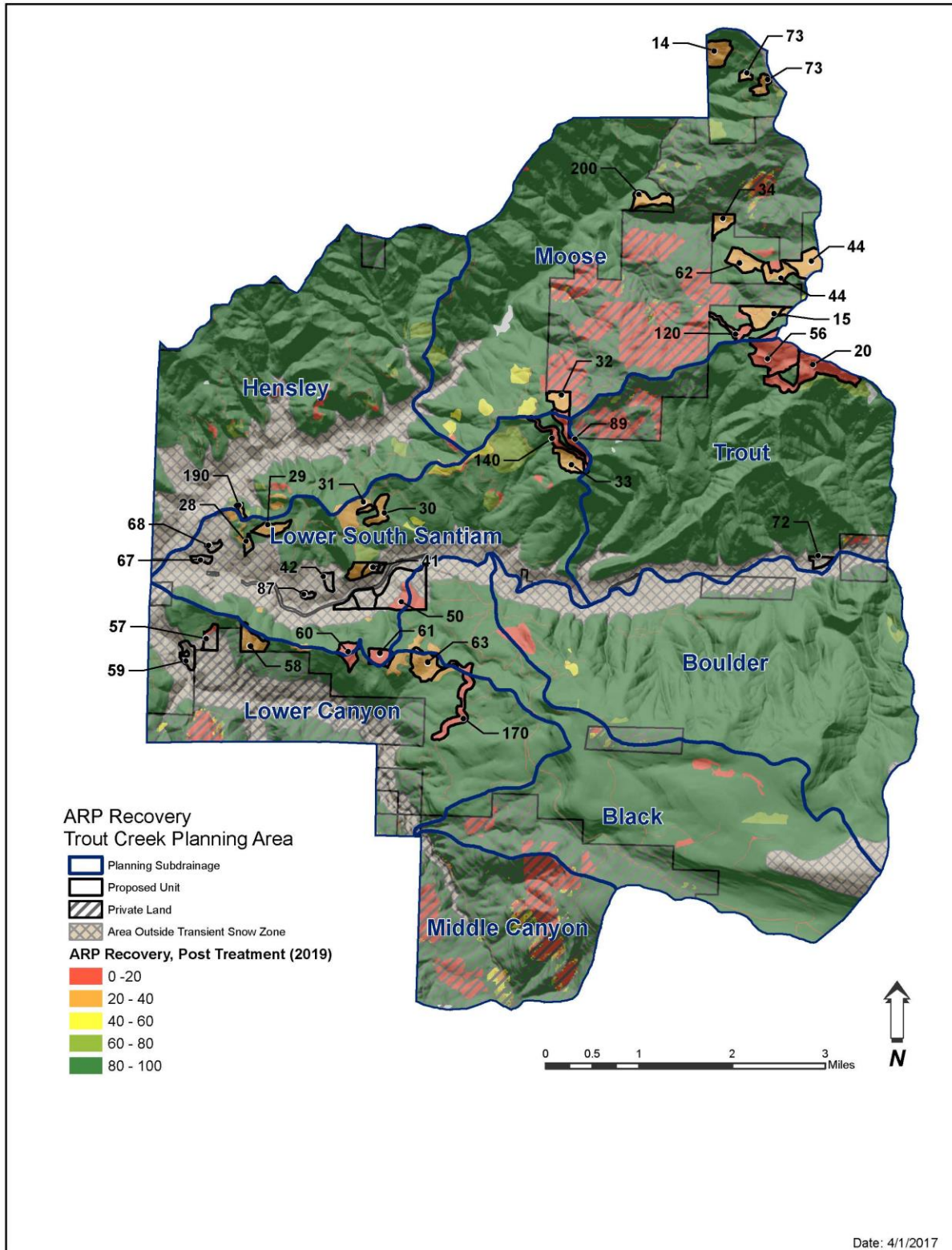


Figure 23: Map of ARP levels post treatment for Alternative 4

Cumulative Effects

Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix C) were analyzed for effects to ARP. They were already included in the analysis (past timber sales), or found to have no effect.

Private timber harvest could cumulatively degrade ARP values in the future, but that is not predictable. The Oregon Forest Practices Act, which governs the way private land is managed, does not protect exacerbated rain on snow related bank erosion to the level protected on federal land (Oregon Forest Practices Act, 1971). This potential bank erosion related sedimentation could impact aquatic ecosystems in the short, medium and long term.

The Trout Creek Project has no direct or indirect effects to ARP values; and therefore, has no cumulative effects on peak flows.

Affected Environment – Sedimentation and Roads

As described in the Soils section, this project area is located within the Western Cascades physiographic region. The soils of the project area are complex but are for the most part well drained. They have moderate to high infiltration rates that reduce overland flow and they have low susceptibility to soil erosion. Side slopes are generally less than 60%. Offsite erosion is generally not a concern because of the extensive vegetative ground cover and the gentle to moderate side slopes.

Turbidity measurements are not available, but roads are considered the main contributor to human caused increases in fine sediment and turbidity in streams. Road development in the action area is moderate (approximately 2.23 miles per square mile). Most major road systems were constructed in the 1950s to the 1970s with older road construction standards when few location and construction controls were in place. Some of these roads were built on steep side slopes with side cast construction standards, where excavated material was pushed over the edge onto the steep side slopes below. The remnants of this side cast are still evident, and failing side cast continues to be a source of sedimentation into streams in the action area. Road failure sites temporarily increase turbidity levels, causing displacement of fish, reduced feeding success, and other negative behavioral changes. Roads continue to be a substantial source of human caused sedimentation in the action area. However, this area has a very high background level of suspended sediment and turbidity due to the natural earth flows actively moving in the area and the flashy flows resulting from common rain on snow events.

Because road maintenance in the area is shared with industrial timber companies, the majority of the road system is well maintained, has good drainage culverts and ditches that are vegetated so little sediment enters streams during regular storm events. However, major storm events cause substantially more sedimentation, and often during heavy rain events the larger streams in the project area have naturally high turbidity (dark brown opaque appearance) for a day or two before clearing up again.

The major routes in the project area (roads 2022, 2032 and 2027) are well maintained roads used by timber companies and the public. Road 2022 is a popular public road for access to Canyon Creek. Road 2032 (Gordon Road) is a popular public road used to access campgrounds and trailheads. Road 2027 (Moose Mountain Road) is used extensively by timber companies and the public for access to hunting. Previous work on aquatic risk roads analysis has identified several roads in the project area that are posing high risk to aquatic environments (Gatchell, 2010).

Based on observations of existing road conditions during field reconnaissance for the project, and local climatic data, sediment outputs from roads were estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The current sediment yield from roads is estimated at about

332 cubic yards per year for the action area. Actual yields cannot be accurately calculated since there are numerous annual and inter-annual variations that would need to be considered including weather conditions, timing of peak flow events and site specific road condition information that is not available. Research comparing WEPP estimated sediment rates to actual rates has shown the model to over-estimate values, and that it is not reliably accurate. Therefore sediment predictions using WEPP modeling should only be used for relative comparisons rather than actual values expected to be produced.

In 2008, a legacy road project in the Moose Creek subwatershed identified and treated approximately 12 miles of aquatic risk roads. The treatments were primarily storm damage risk reduction treatments that did not prevent driving on the roads (theoretically), but reduced chronic road related erosion and the potential for catastrophic failure. Treatments involved installing waterbars and drivable drain dips over stream culverts. Roads treated included the 2025, 2025-518 (and spurs), 2025-580 (and spurs), 2027-705, 2027-810, 2027-812, 2027-813 and 2027-816. These treatments reduced the road related erosion in the project area and continue to ensure the roads are in stable condition in the event of major flooding threatening the road system. These roads can be seen on the subwatersheds map in Figure 20.

In 2010, the Canyon Thin Aquatic Risk Roads Analysis was completed for the Canyon Thin project, which identified approximately 21 miles of aquatic risk roads in the Lower Canyon and Trout sub-watersheds (Gatchell, 2010). Treatment recommendations included road decommissioning, road storage and storm damage risk reduction. Some of these treatments have been completed by the Upper Canyon Road Storage Project and the Gordon Spurs Road Storage Project. The Stewart Road Hydrologic Stabilization project has also implemented some of the treatments identified in this 2010 analysis. Post sale road treatments are planned for the Canyon Thin EA timber sales, which are still in process. The highest aquatic risk roads identified in this analysis were the Vine Maple Road (2000-011 and 2000-013) and Stewart Road (2000-600, 2000-632, 2000-636, 2000-641, and 2000-643). These two roads are proposed for decommissioning in this Trout Creek project. The 2032-315 and 2032-317 are also proposed for decommissioning in this project although they have already been treated by the Gordon Spurs project.

Between the Canyon Thin project and the Moose Creek legacy roads project, all the roads in the Trout Creek project area have previously been analyzed for aquatic risk and a majority of the recommended treatments have been implemented. With the final 9 miles of roads identified as high aquatic risk being decommissioned, the Trout Creek project area will have aquatic risk roads identified and treated.

The Willamette National Forest has published their Road Investment Strategy (RIS, 2015), used to identify the Minimum Road System needed for administrative and public access. The Road Investment Strategy (RIS) directs the forest to evaluate whether roads are needed and gives recommendations for road closure or decommissioning. The aquatic risk roads analyses previously completed for this project area was used to determine treatment of roads as the IDT completed the RIS roads analysis for the project area.

Environmental Consequences – Sedimentation and Roads

Direct and Indirect Effects

Alternative 1 – No Action

Rates of road related sediment yield would be expected to remain the same under Alternative 1. Alternative 1 would not correct existing road erosion problems which result in chronic sedimentation to

streams. Without timber harvest related road maintenance, the existing budgetary trend would result in only the main roads being maintained. Culverts that are not maintained could plug and cause washouts. The resulting sediment plumes could be detrimental to fish and amphibians. Over several decades, these road issues would stabilize as the disturbed areas re-vegetate. However, no project-related road storage or decommissioning would occur. Harvest activity on the portion of private land within the project area would continue. For all of the action alternatives, annual sediment yield increases during harvest activities because of increased haul, and decreases after project implementation because of reduced road miles from decommissioning. There is slightly less net increase in sediment in Alternative 3 compared to Alternatives 2 and 4, because there is 46 miles of haul routes instead 49 miles, but the slight increase is still about 2% in all alternatives. The decrease of about 5% in alternative 2 compared to approximately 7% decrease in Alternatives 3 and 4 is due to decommissioning more miles of road in Alternatives 3 and 4. Alternative 2 would decommission about 7 miles of road, and Alternatives 3 and 4 would decommission about 9 miles.

Table 31 provides a comparison of sediment outputs between all alternatives.

Alternatives 2, 3, and 4

Abandoned and unmaintained forest roads are common across the Trout Creek project area, and pose a threat to aquatic ecosystems, including habitat for threatened and endangered species (Madej, 2001; Luce and Wemple, 2001). This is partially a result of old road building practices and current lack of maintenance on existing roads. Analysis and treatment of aquatic risk roads is an important aspect of watershed restoration. The Road Investment Strategy final recommendation included analyzing 2.1 miles for decommissioning. Using this document as a guide, this project has identified 9.4 miles of road that are not needed and are proposed for decommissioning. Additionally, approximately 32 miles of road would be closed (changed from high clearance open roads to closed). The roads that would be closed are generally already closed on the ground, and closed aquatic risk roads have generally had the stream culverts removed with previous treatments, or will have them removed as funding becomes available. The closures mostly update the maintenance level (Maintenance Level 1) in the INFRA database to current condition. As required by Forest Service Handbook (FSH 7709.59_60), drainage maintenance would continue on any stream culverts not removed to prevent aquatic resource damage. Ideally all closed roads will have the stream culverts removed so that continued maintenance is not required. No closed roads will be expected to be used for administrative use (FSH 7709.59_60).

Forest roads can be a significant source of sediment entering streams (Megahan and Kidd, 1972; Wemple et al., 2001). Steep slopes with road cuts have potential to induce sideslope failures resulting in exacerbation of fine sediment delivery to stream habitat. Swanson and Dyrness (1975) found landslide occurrence was 30 times greater along roads than on unroaded forested areas in old cascade geology. Road cuts can intercept groundwater flow and decrease groundwater storage by bringing it to the surface, which in turn increases surface water during rain events and decreases summer low flows (e.g., Luce, 2002). Roads near streams can interfere with flood plain connection and storage, alter channel form, reduce riparian shading, and can introduce exotic species and pathogens (Luce et al., 2001). Loss of floodplain connection decreases groundwater storage and can lead to decreasing summer low flows. Road drainage structures can alter natural drainage patterns particularly when they plug and divert water to un-channeled hillslopes and interfere with large wood delivery downstream (Roni et al., 2002; Wemple et al., 1996).

Timber harvest would not be expected to increase fine sediment in stream channels. Several studies document the ability of buffer strips to reduce erosion and sediment delivery related to timber harvest. Rashin and others (2006) looked at 21 harvest sites that had a variety of treatments ranging from no

buffers to buffers up to 66 meters (216.5 feet) wide. They found that, “Of 157 individual erosion features determined to deliver sediment to streams during either the first or second year following timber harvest, 94% were located within 10 meters (33 feet) of the stream. Conversely, 74% of the 248 erosion features with no evidence of sediment delivery were greater than 10 m from streams. Results indicate that when erosion is initiated by ground disturbing activities within 10 meters (slope distance) of a stream, delivery of sediment was more likely than not.” Lakel et al. (2010) looked at the effectiveness of a variety of treated and untreated buffers in trapping sediment adjacent to timber harvest units. They concluded that streamside management zones (buffers) between 25 feet and 100 feet were effective in trapping sediment before it could enter streams. These streamside management zones consisted of both treated and untreated areas. Therefore, harvest units that do not have corridors crossing streams should not result in sedimentation to streams in the project units due to the equipment setback distances and the no-harvest buffers that are similar to the studies cited above.

In Alternatives 2 and 4, there are approximately 4.3 miles of temporary (non-system) spur roads proposed for use in the project. Approximately 2 miles are new temporary spur roads and approximately 2.3 miles are existing spur roads that will be re-opened. In Riparian Reserves, there will be approximately 240 feet of new temporary spur road constructed and approximately 1.4 miles of the existing temporary spur roads re-opened. In alternative 3 there will be slightly less miles of temporary spur road. None of these temporary roads cross streams. These roads are seasonally restricted to operation during the dry season, May 31st through October 1st, to minimize soil erosion and compaction. If waivers are requested to operate on the native surface temporary roads during the wet season, then the operator will be required to place rock during the dry season and then remove the rock when operations are complete, before de-compacting the road after use. All temporary spur roads would be fully decommissioned after the project is complete. Decommissioning would include the removal of all stream crossings, subsoiling the compacted surface, and revegetating with native species. Since none of the temporary roads cross streams, there is not expected to be measurable sedimentation effects for temporary roads in the Trout Creek project.

This project would include maintenance of proper drainage through maintaining and repairing existing road structures, including ditch-relief and stream culverts that are currently in poor condition. Road work associated with the Trout Creek project would include replacement of 260 culverts (17 live stream) that are currently in poor repair or inadequately sized to pass 100-year flood flows. These culverts currently pose an elevated risk of fill failure. Discussion with engineering personnel indicated that the average fill volume on live streams is about 50 cubic yards. An estimated 850 cubic yards of potential fill failure is at risk of entering the streams if the existing live stream culverts fail.

Culvert replacement would require in-stream work that would be done during the Oregon Department of Fish and Wildlife instream work window of July 15th to August 31st. Best Management Practices such as sediment barriers and flow bypass would minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 10 cubic feet per second when work occurs, based on personal observation during project reconnaissance. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should average 1 cubic yard or less per installation based on professional experience. This sediment would settle out within a 1000 feet (Foltz, 2007).

As seen in Table 29, the proposed action would replace approximately 260 culverts, with 17 live stream (perennial and intermittent) culverts. Approximately 243 ditch relief culverts will be replaced. Ditch relief culverts help disperse water onto vegetated hillsides, preventing sediment laden ditch water from entering streams. These culverts reduce road related sedimentation of streams.

Table 29: Road Maintenance and Reconstruction (Road Work) with number of culvert replacements and distance to LFH (Source Daniel Matthews, Engineering)

Road number	Road Maintenance (miles)	Live stream (LS) and ditch relief culvert replacements	Culvert Replacements within 1000 feet of LFH	Nearest Distance to LFH/CH (feet)
2022000	1.34	6 (0 LS)	2 (0 LS)	300
2022107	1.79	15 (0 LS)	1 (0 LS)	850
2027000	12.17	40 (4 LS)	0	1,500
2027537	0.30	2 (0 LS)	0	1,900
2027720	4.25	16 (1 LS)	0	2,700
2027730	2.40	12 (1 LS)	0	6,500
2027732	2.60	12 (1 LS)	0	9,300
2027752	0.95	8 (0 LS)	0	19,100
2027755	2.61	12 (0 LS)	0	17,300
2027760	1.25	9 (1 LS)	0	19,500
2027801	0.16	3 (0 LS)	3 (0 LS)	800
2027803	0.47	5 (0 LS)	0	1,300
2027805	1.31	10 (1 LS)	1 (0 LS)	800
2027810	0.43	4 (0 LS)	0	4,100
2027812	0.29	3 (0 LS)	0	3,300
2027813	0.66	5 (0 LS)	0	2,300
2027825	1.06	8 (0 LS)	0	5,300
2027830	0.17	1 (0 LS)	0	8,800
2027840	1.49	10 (0 LS)	0	5,500
2027850	2.35	18 (1 LS)	0	8,900
2027856	0.64	5 (0 LS)	0	12,300
2027857	1.95	12 (1 LS)	0	9,000
2032000	3.32	14 (5 LS)	12 (4 LS)	130
2032417	1.55	12 (1 LS)	0	3,200
2032418	1.71	10 (0 LS)	0	2,600
2032419	0.48	3 (0 LS)	0	2,600
2032421	0.39	2 (0 LS)	0	2,500
2032444	0.33	2 (0 LS)	0	4,300
2032456	0.11	1 (0 LS)	0	2,800
Total	48.5	260 (17 LS)	19 (4 LS)	N/A

The 17 live stream culvert replacements will cause sedimentation to streams and at the same time prevent future catastrophic failures resulting from the eventual collapse of degraded culverts.

A properly functioning system of ditch relief culverts and properly sized stream culverts is beneficial to water quality and aquatic biota (USDA Forest Service, 2012). The proposal to upgrade and replace the culverts identified in this project would be beneficial to aquatics. In order to implement the culvert replacements the sale of timber is required to pay for the needed upgrades. It is estimated that alternative 2 and alternative 4 would both adequately fund the culvert replacements identified in Table 29. However, alternative 3, could only replace about 30% of the culverts identified as needing replaced.

Table 30 provides a summary of the culvert replacements and the potential amount of stabilized fill material that would have a reduced risk of entering streams. The summary is based on the assumption that only 30% of the culverts will be replaced under alternative 3. It also estimates the amount of sediment produced from the culvert replacements. Based on professional experience, each live stream culvert replacement would produce on average approximately 1 cubic yard or less of fine sediment that

would enter streams at the replacement site during re-watering after replacement in the summer (perennial streams only), and during the first winter storms.

The estimate of sediment entering streams from the culvert replacements would be approximately 17 cubic yards for Alternative 2 and 4 (Table 30). For Alternative 3, the estimated sediment would be approximately 5 cubic yards. In comparison, the estimated volume of fill stabilized from potential culvert failure is about 850 cubic yards for Alternative 2 and 4, and approximately 250 cubic yards for Alternative 3. All action alternatives would reduce the potential for runoff effects and culvert failures that may affect water quality.

Table 30: Estimated sediment produced short term and stabilized long term by culvert replacements at road/stream crossings by alternative

Alternative	Number of Stream Culverts Replaced	Potential Sediment Stabilized (Cubic Yards)	Sediment Produced (Cubic Yards)
Alternative 1	0	0	0
Alternative 2	17	850	17
Alternative 3	5	250	5
Alternative 4	17	850	17

Most harvest-related sediment input to streams comes from skid trails, roads that were poorly located, or skyline corridor crossings. Research has shown that by keeping these at least 33 feet from streams and following Best Management Practices (BMP) guidelines, essentially all of the harvest related sediment is eliminated (Rashin et al., 2006, Lakel et al., 2010). In addition, soils in the project area have naturally high rates of infiltration and low potential for overland flow.

Decommissioning the Stewart road (2000-600/636/632/641/643), Vine Maple road (2000-011, 2000-013) and 2032-315/317 (Shiftless and Pole roads) will produce short term sediment that enters streams, but will reduce sedimentation from roads overall by stabilizing the roads and returning drainage patterns to their natural condition. Because BMPs such as following instream work timing (July 15th to August 31st) and dewatering culvert removal sites, sedimentation is expected to be kept to a minimum. Decommissioning the 2032-308 (Stewardess Road) and 2000-017 (Trout Creek Road) may also cause slight amount of short term sedimentation from culvert removals, but since there are no stream culverts on these roads, it is expected to be very slight and during the fall rains when natural sedimentation is very high in streams. The short term sedimentation caused by the Trout Creek Project decommissioning is expected to be minimal and not cause any adverse effects to fish species or other aquatic life in the stream ecosystem.

An analysis of estimated sediment outputs from roads in the project area was completed using the roads module of the Watershed Erosion Prediction Project (WEPP) model. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. For all of the action alternatives, annual sediment yield increases during harvest activities because of increased haul, and decreases after project implementation because of reduced road miles from decommissioning. There is slightly less net increase in sediment in Alternative 3 compared to Alternatives 2 and 4, because there is 46 miles of haul routes instead 49 miles, but the slight increase is still about 2% in all alternatives. The decrease of about 5% in alternative 2 compared to approximately 7% decrease in Alternatives 3 and 4 is due to decommissioning more miles of road in Alternatives 3 and 4. Alternative 2 would decommission about 7 miles of road, and Alternatives 3 and 4 would decommission about 9 miles.

Table 31 shows the estimates of sediment production rates based on WEPP. The WEPP road model is not reliably accurate and is best used to assess differences between alternative and not the actual sediment yield from roads in the action area.

For all of the action alternatives, annual sediment yield increases during harvest activities because of increased haul, and decreases after project implementation because of reduced road miles from decommissioning. There is slightly less net increase in sediment in Alternative 3 compared to Alternatives 2 and 4, because there is 46 miles of haul routes instead 49 miles, but the slight increase is still about 2% in all alternatives. The decrease of about 5% in alternative 2 compared to approximately 7% decrease in Alternatives 3 and 4 is due to decommissioning more miles of road in Alternatives 3 and 4. Alternative 2 would decommission about 7 miles of road, and Alternatives 3 and 4 would decommission about 9 miles.

Table 31: Estimates of Sediment Production Rates for the Trout Creek Project Area

Sediment Production	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Current condition	During harvest	After harvest	During harvest	After harvest	During harvest	After harvest
Total Road Sediment Yield (cubic yards/year)	332	338	316	337	308	338	308
Change in road sediment (cubic yards/year)	N/A	6	-16	5	-24	6	-24
Percent change in road sediment	N/A	+2%	-5%	+2%	-7%	2	-7%

The South Santiam River, including the project area, provides municipal water to the City of Sweet Home at Foster Dam, approximately 10 miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Trout Creek project that could adversely affect municipal water quality, but with project design features there is not expected to be a measurable effect because sediment is produced approximately 15 miles above the intake for Sweet Home. The intake is also in the dam at Foster Reservoir and sediment will settle out in the reservoir.

By implementing the activities associated with the Trout Creek project, human caused sediment input from roads would decrease slightly (5-10%) from current levels. Annual pulses of sediment would continue. In some years the sediment input would be greater than in other years, but overall the sediment input levels are expected to remain near current levels until a large flood event occurs. Risk of road and fill failures during major storm events would be reduced as well. Overall, implementation of these alternatives would reduce management-caused sedimentation within the project area.

Cumulative Effects

Alternatives 2 and 3

All recent and planned timber harvest and road decommissioning projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix C) were analyzed for effects to sedimentation and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the direct effects expected from the Trout Creek project would not contribute measurably to sedimentation beyond the contribution already disclosed in the direct effects analysis.

Activities that cumulatively affect stream sedimentation include private timber harvest and private timber haul along roads in the project area. On private land there may be commercial harvest, associated new road construction, and log haul that effects sedimentation of streams. This sedimentation could impact aquatic ecosystems in the short, medium and long term.

Affected Environment – Fisheries

Management Indicator Species (MIS)

The Willamette National Forest Land and Resource Management Plan (LRMP) identifies Management Indicator Species (MIS) species as anadromous fish and resident trout (US Forest Service, 1990, p. IV-73). They were selected because they are important for commercial and sport fishing and because they are representative of the health of the stream systems. Also, their habitat can be easily affected by timber harvest. The four MIS fish species that use this project area are Upper Willamette River (UWR) Winter Steelhead, UWR Spring Chinook, Cutthroat trout, and resident Rainbow trout. A hybridized cross between Cutthroat and Rainbow trout also exists in the project area.

Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The MIS fish were also selected to indicate healthy stream and riparian ecosystems across the landscape. MIS fish-bearing streams are widespread across the project area. Habitat for each MIS fish species exists within the project area and is included in the analysis area.

Winter steelhead and spring Chinook are listed as threatened under the Endangered Species Act (ESA). Chinook are spawning, with the aid of transport upstream around Foster Dam, in the main stem of the South Santiam up to approximately river mile 63 where further upstream passage is blocked by a cascading falls below the confluence with Elk Creek. Winter Steelhead spawn in the South Santiam, Moose Creek and Canyon Creek within the project area. The Winter Steelhead above Foster Dam are not genetically compromised by intermingling with hatchery fish below the dam, and are considered a core genetic stronghold important for long term recovery of the species.

Out-migrating juveniles must pass through Foster Reservoir and Dam (Figure 24). The returning adults are collected by the hatchery below Foster Dam and transported upstream to two out-planting locations on the South Santiam River at Riverbend Campground and Gordon Road. Over the past few years, on an average year, approximately 200 returning adult Winter Steelhead are transported above the dam to spawn.



Figure 24: Foster Dam blocks anadromous fish passage upstream and makes downstream passage treacherous for the juveniles out-migrating to the ocean

In general, the MIS Fish selected for the Willamette NF have similar stream and riparian ecosystem requirements (e.g., cold water habitat). The primary difference is that the anadromous fish require the ability to migrate out to the ocean and return to spawn. This access is restricted by Foster Dam. In the 1960s Foster Dam was constructed, eliminating over 18 miles of anadromous fish habitat. Various attempts over time have been made to mitigate the dam. A new fish collection facility was completed below the dam in 2015. Anadromous salmonids are theoretically collected with less stress and transported above the dam.

In the 1960s through the 1980s a practice of removing large wood from stream channels removed most of the large wood available for fish habitat. The amount of large wood in streams is now one of the most significant indicators of not properly functioning fish habitat. It is generally accepted that 80 pieces of large wood per mile indicates properly functioning fish habitat for salmonids. A 2012 stream survey of the South Santiam found an average of approximately two pieces of large wood per mile.

In Moose Creek, Soda Fork and Canyon Creeks subwatersheds there has been restoration of large wood in the UWR Winter Steelhead spawning portions of these larger streams. The South Santiam main stem is still devoid of large wood where stream cleanout was extensive for navigation.

Fish passage barriers caused by culverts that block access to habitat are present in the project area. The locations and fish affected are shown in

Table 32 and Figure 25.

Table 32: Fish Passage Barriers in the Trout Creek Project Area

Fish Passage Barrier Stream	Road blocking MIS Fish habitat	MIS Fish Species Affected	Miles of habitat blocked
White Rock Creek (2 barriers)	Moose Creek Road (2025) and 2025-510	Cutthroat, Resident Rainbow	0.3
Boulder Creek	2000-610	Cutthroat, Resident Rainbow	1.2
Keith Creek	Hwy 20	Cutthroat, Resident Rainbow, Winter Steelhead	1.7
Unnamed Tributary of South Santiam crossing Vine Maple Road	Vine Maple Road (2000-011)	Cutthroat	0.2
Black Creek	Gordon Road (2032)	None. Note that Brook Trout were introduced above this barrier	N/A

The barrier on White Rock Creek, a tributary of Moose Creek, consists of two culverts that block passage. One barrier is on road 2025 and the other on road 2025-510. It is possible this stream could be used by juvenile steelhead.

The majority of the road system is well maintained, has good drainage culverts and ditches that are vegetated so little sediment enters streams during regular storm events. However, major storm events cause significantly more sedimentation, and often during major events the streams can have elevated turbidity for several days. Because the natural sources of sedimentation in this area produce such a large normal amount of sediment that includes fine clays, suspended sediment and turbidity is considered functioning at risk.

The existing condition for MIS Fish habitat which supports resident rainbow trout and cutthroat trout is stable or improving and therefore the populations are considered stable or improving. The Spring Chinook and Winter Steelhead require trap and haul around Foster dam to access the project area.

These populations are considered unstable or at risk and are federally listed as threatened under the Endangered Species Act.

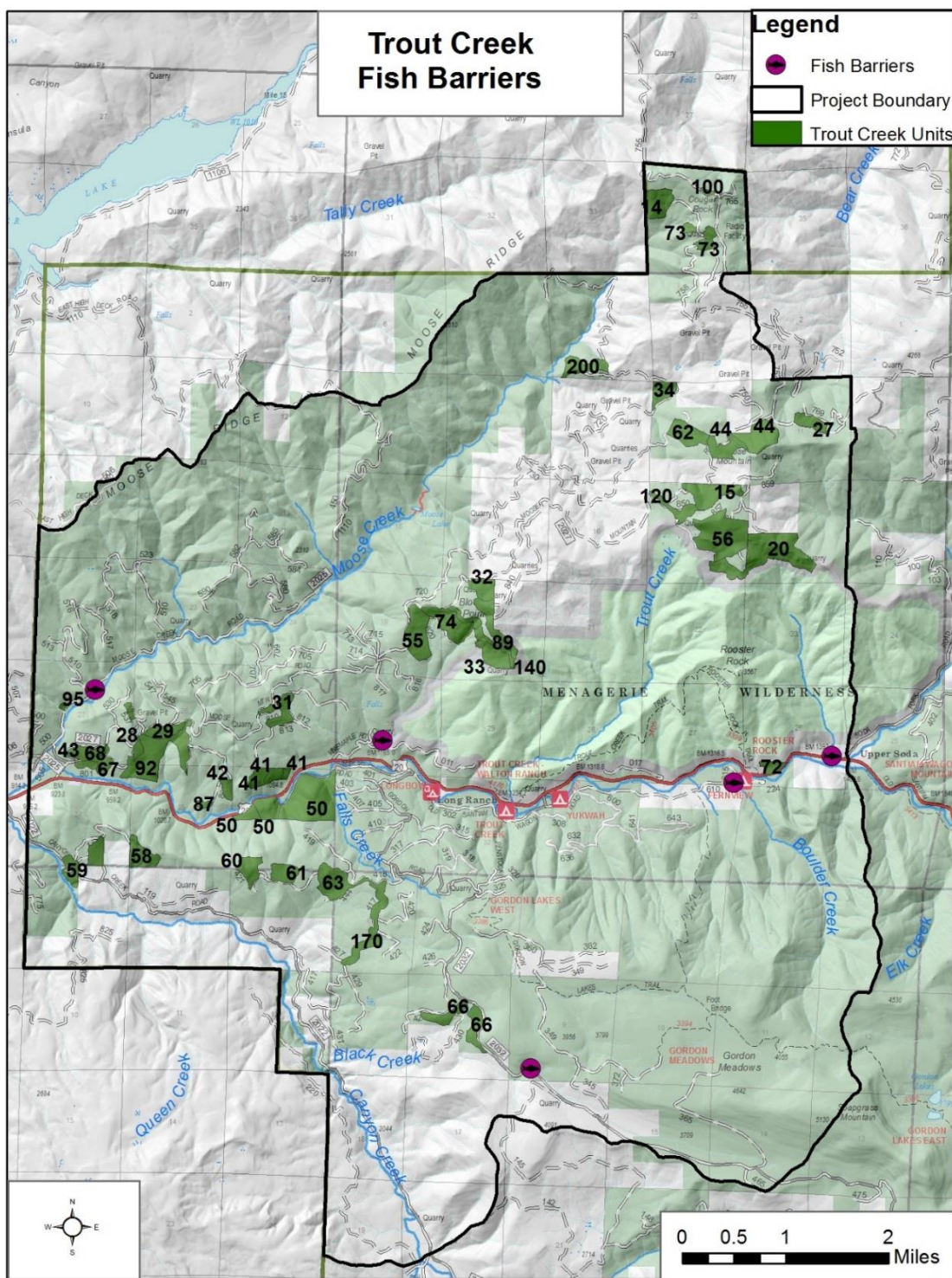


Figure 25: Fish Passage Barriers in the project area

Environmental Consequences – Fisheries

Direct and Indirect Effects

Alternative 1 – No Action

There would be no direct effects to MIS Fish habitat in Alternative 1. Indirect effects to habitat would occur over time as trees mature and recruit into the stream channels in the project area. Passive restoration by protection of Riparian Reserves would result in long-term recovery to desired future conditions, especially large wood in streams.

Landscape delivery of fine sediment, as modified by the road network, would continue, leaving deteriorating roads and culverts untreated. The current levels would remain within the range of conditions necessary to sustain native aquatic biota. Periodic stream crossing failures may occur at undersized and outdated culverts, potentially delivering large pulses of fine sediment to fish bearing reaches. Culvert failures may induce stresses on resident fish populations, but not at magnitudes that would be expected to extirpate local populations.

Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90% of the wood recruitment zones with no-harvest buffers (Johnston, 2011), the No-Action alternative would protect 100%. In streams within the project units, recruitment trees are of sufficient size to meet ACS Objectives. In-stream wood abundance is very low and the higher amount of wood naturally recruited to channels in alternative 1 would be slightly more beneficial to MIS Fish species than the action alternatives. The 10% of potential large wood recruitment lost is too small to be stable in habitats occupied by listed fish.

The No-Action alternative would not utilize thinning to enhance vegetation and increase species diversity. Desired riparian conditions would develop over time (several decades) and result from natural thinning. The currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease.

Alternative 1 is not likely to have any measurable effect on MIS fish habitat. There is potential for culvert failures to lead to temporary increases in fine sediment, but it would still be within the range of natural variability.

Alternatives 2, 3 and 4

No-harvest buffers on all streams would minimize effects to aquatic species and their habitat and protect the majority of future large wood for stream recruitment. Project design features were incorporated into all activities to protect aquatic resources (see Design Features, Table 14). Due to these project design features, Alternatives 2, 3 and 4 would result in short-term negative effects such as increased turbidity, but would have beneficial effects to fish habitat in the long run. For detailed analysis of how the project actions affect aquatic species and their habitat, see the Fisheries Biological Assessment located in the project file.

The greatest potential for direct effect to MIS fish would be fine sediment increases during project implementation while roads are decommissioned, culverts are replaced and road maintenance is occurring. There would be a short term turbidity effect during re-watering of replaced culverts in the summer and in the fall during the first flush of rain. Juvenile and adult salmonids appear to be little affected by temporarily high concentrations of suspended sediments that occur during brief periods

related to storms (Bjornn and Reiser, 1991). Once the project is complete, sediment production rates return to slightly less than pre-project conditions. All the action alternatives would reduce the potential for runoff effects and culvert failures that may affect MIS fish. Road decommissioning of the Vine Maple road will remove a fish passage barrier culvert and open up currently unavailable habitat for cutthroat trout.

Conditions in Riparian Reserves in the native stands would be maintained. In overstocked, conifer-dominant Riparian Reserves lacking structural and species diversity, thinning would occur in Riparian Reserves. The desired benefit of thinning in Riparian Reserves is to improve stand structure, vegetation diversity, and accelerate development of large trees. McDade et al. (1990) found that 92% of wood originates from within 100 feet of the stream channel. Johnston et al. (2011) found wood originated up to 213 feet from the stream but that 90% of LWD originated from within 59 feet of the stream at 90% of the sites studied. Because of the thinning in manages stands as close as 75 feet on perennial streams and 50 feet on intermittent streams it is expected that there will be a small reduction in future large wood in streams from reduced future mortality. Thinning only outside of the 75 feet no-harvest buffer would result in retention of the majority of potential wood (>90%) while achieving desired vegetation characteristics that support productive aquatic communities. The action alternatives may have a slightly lower rate of in-stream wood recruitment than the No-Action alternative, but the benefits to vegetation diversity and accelerated tree growth would be greater. The major wood recruitment process in the project area is stream adjacent recruitment. The only two units with timber harvest in the action alternatives adjacent to MIS fish habitat are units 50 and 59. Unit 50 has a no-harvest buffer of 344 feet and unit 59 has a buffer of 120 feet to further retain the majority of potential large wood entering the stream near MIS fish habitat. The potential effects from lost large wood recruitment on MIS fish and their habitat would not be expected to be measureable, and would be expected to be within the range of natural variability. Riparian fall and leave projects would help accelerate restoration of in stream large wood in the units where it would be implemented.

Cumulative Effects

Each of the projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix C) were analyzed for effects to fisheries and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the direct effects expected from the Trout Creek project would not affect fish in the project area beyond the range of natural variability.

Activities that cumulatively affect fisheries include private timber harvest. On private land there will be commercial harvest that removes future potential large wood for streams. This loss of future large wood may have a negative cumulative impact on aquatic ecosystems and fisheries in the long term.

Compliance with the Forest Plan and Other Regulatory Direction

The action alternatives and aquatic mitigation measures proposed in the Trout Creek project were reviewed by the District Hydrologist and the District Fisheries Biologist against all Federal and State laws and regulations governing streams and endangered species of fish. All rules and regulations related to ESA listed fish species, MIS fish species, hydrology, stream channels and water quality would be met by any of the action alternatives.

3.04 Wildlife

Summary of Effects Analysis

The effects of Alternatives 2, 3 and 4 were compared to the No Action alternative for the following wildlife species or categories: (a) northern spotted owl, (b) Forest Service sensitive species, (c) Forest Service Survey and Manage species, (d) Forest Service management indicator species, and (e) migratory birds. These categories were selected for analysis based on standard wildlife concerns with such actions identified in past planning documents (such as the Forest Plan), public comments about the project, Forest Service policies and regulations (e.g., Endangered Species Act Section 7 Consultation, and Survey and Manage standards and guidelines), and issues identified by the project interdisciplinary team and public.

Alternatives 2 and 4 would remove or degrade about 872 acres each of natural stands and young managed forest habitat in the Planning Area. Alternative 3 would remove or degrade about 654 acres of managed stands. All action alternatives would adversely affect species that use these habitat types; however, because effects are marginal at the project and Forest-scales, the action alternatives are expected to maintain the viability of all wildlife species that utilize this habitat. Because viability is being maintained, the proposed alternatives would not contribute to a loss of viability at the project or Forest-wide scale. The proposed alternatives would create a small amount of early seral habitat and benefit species such as elk and some migratory birds that prefer this habitat. These benefits would occur at the site-scale, but there would not be meaningful benefits to the species at the project or Forest-scale due to the small amount of habitat affected.

Alternatives 2 and 4 would remove and downgrade 130 and 88 acres, respectively, of suitable owl habitat which may affect spotted owls and their habitat; however, because effects are negligible at the project and Forest-scale, it is not expected to jeopardize the continued existence of the spotted owl. Alternative 3 would remove 74 acres of dispersal owl habitat and may affect but it is not likely to adversely affect spotted owls or their habitat. Spotted owl critical habitat would be affected by Alternatives 2, 3 and 4. They would remove or downgrade suitable and dispersal habitat which may likely adversely affect critical habitat; however, because effects would be marginal at the Forest-scale, critical habitat would continue to provide demographic support to overall northern spotted owl populations and connectivity for owls between critical habitat subunits. Alternatives 2 and 4 would remove or downgrade suitable habitat within the home range of 3 known owl sites which may affect and likely adversely affect the sites; however, because suitable habitat would remain above threshold levels, the functionality of the owl sites for nesting and rearing young would be maintained. There would be no effects to Recovery Action 32 habitat.

Scale of Analysis

The scale used to assess direct, indirect and cumulative effects on wildlife species associated with the Trout Creek project includes all project activity units and the project area. The project area consists of 37,344 acres in Bear Creek, Soda Fork, Moose Creek, Trout Creek and Lower Canyon 6th field sub-watersheds of the Middle Santiam and South Santiam River 5th field watersheds. Four Big Game Emphasis Areas were also used to assess effects to elk and deer habitat. For the threatened northern spotted owl, in addition to project units, project area and watershed scales, a 300 meter, 0.5 and 1.2 mile radius buffer around all pair activity centers that may be affected by the proposed project was used to assess effects. These habitat radii were used to determine available amounts of suitable and dispersal habitat.

Affected Environment – Early Seral Habitat

Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements, whereas other species thrive in middle age or old forests. Early seral habitat (defined as less than 20 years old) is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades.

Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the South Santiam River watershed than in the past. A small amount of early seral habitat is present in surrounding rock outcrops at higher elevations and there are very few open meadows in the project area. A 2012 Gradient Nearest Neighbor analysis of all ownerships shows that about 5% of the South Santiam 5th field watershed is early seral habitat.

The Trout Creek project area occurs in the South Santiam River 5th field watershed, with less than 32 acres occurring in the Middle Santiam River 5th field watershed. For the purposes of this analysis, since 32 acres is a negligible amount, they are analyzed in combination with the rest of the project acres in the South Santiam River 5th field watershed.

Environmental Consequences – Early Seral Habitat for Wildlife

Direct and Indirect Effects

Alternatives 1 and 3

With implementation of Alternatives 1 and 3, the amount of diverse early seral habitat in the South Santiam River watershed would remain about 5% and continue to decrease as these stands move from early seral to mid-seral over time. Natural tree mortality (insects, disease, wildfire, or blowdown) within the Trout Creek units is not expected to be significant or likely to produce many openings in the short-term future, resulting in noticeable increase in early seral habitat across the landscape. Refer to the Forest and Stand Structure section for a more detailed existing condition analysis.

Alternatives 2 and 4

With implementation of Alternatives 2 and 4, the amount of diverse early seral habitat in the Trout Creek project area would increase. Early seral habitat would be created by gaps and early seral creation (Aggregate Retention) treatments. Historically the South Santiam River watershed contained about 8 percent of early seral (GNN, 2012). The total acres of early seral and gaps created by treatments is 136 acres. Of the total project area, 37,350 acres, treatments on 136 acres represent 0.36% of the project area. At the watershed level, this would increase early seral habitat by 0.13% for a total of 5.13%. These acres would be expected to provide early seral habitat for about 15 to 20 years.

Cumulative Effects

The Jude Ridge project is adjacent to the Trout Creek project area and it proposes to create 27 acres of early seral habitat. Private lands, or 22% of the Trout Creek project area, have been cut over the past 20 years. The clear-cuts on these private lands are expected to provide low quality early seral habitat for the next 10 to 20 years.

Affected Environment – Northern Spotted Owl

The northern spotted owl is a federally threatened species under the Endangered Species Act (ESA) that uses forest habitat in the project area. Effects of the various proposed actions for the Trout Creek project were addressed by the Willamette Planning Province Level I Terrestrial Team (2017) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the FY2018 Biological Opinion (BO) (FWS Reference Number 01EOFW00-2017-F-0555). This BO fulfills the Forest Service's legal requirement with respect to Section 7 of ESA for the Trout Creek Project. This EIS incorporates by reference this BO, as well as the Biological Assessment. A summary of the effects of the alternatives on the northern spotted owl is provided in this section.

Northern Spotted Owl Habitat

Northern spotted owl habitat is classified as (1) suitable habitat that provides for nesting, roosting, and/or foraging, (2) dispersal-only habitat that provides for protection from avian predators and at least minimal foraging opportunities during dispersal and colonization periods, and (3) non-habitat. Suitable habitat also provides for dispersal and movement of owls. The Trout Creek project area contains a mix of forest stand age classes. Northern spotted owl habitat was analyzed with GIS applications, aerial photography, historic data and field visits in the project area. Using forest mapping of owl habitat there are currently about 23,189 (62%) acres of suitable habitat, 960 (3%) acres of dispersal habitat, 5,001 (13%) acres of non-habitat and 8,200 (22%) acres of private land or other agency lands in the Trout Creek project area. Most of the private lands are managed for commercial timber harvest and are assumed to be unsuitable habitat for spotted owls.

Northern spotted owl habitat is classified as follows:

1. Suitable habitat that provides for nesting, roosting, and/or foraging, consisting of "...forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90 %); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly. This habitat is described as nesting and roosting habitat in the revised northern spotted owl recovery plan (USFWS, 2011)." Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. Those units for the project which were considered to be suitable spotted owl habitat provide for foraging and roosting with marginal potential for nesting due to the relatively young growth form of the upper canopy and the absence or relatively low number of legacy trees over 250 years old.
2. Dispersal-only habitat provides for protection from avian predators and at least minimal foraging opportunities during dispersal and colonization periods. Dispersal habitat consists of, at a minimum, stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS, 2011). It is comprised of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average dbh with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, and to roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that would provide some roosting and foraging

opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (Willamette National Forest, 2009). While dispersal habitat is often referred to in a general sense as stands that are 40-79 years old, growing site conditions, tree spacing, elevation, stand size and landscape juxtaposition, pre-commercial thinning history, and stand structure, all play a role in the habitat a stand may provide at a particular age after harvest or other disturbance event.

3. Non-habitat refers to land which is capable of growing habitat, but does not currently function as either suitable or dispersal habitat.

Recovery Action 32

Recovery Action 32 of the 2011 “Revised Recovery Plan for Northern Spotted Owls” identified a need to maintain older, more structurally complex multi-layered conifer forests containing large-diameter trees, high amounts of canopy cover, and decadent components such as broken-topped trees, mistletoe, large snags, and fallen trees (USFWS, 2011). Guidance for identifying such stands was developed for the Willamette National Forest with review by US Fish and Wildlife Service and Bureau of Land Management (Doerr, 2012). No Recovery Action 32 habitat occurs in the proposed treatment units.

Critical Habitat Unit

Critical habitat is a designation for land within the range of a listed species that has the physical or biological features essential for the conservation of a species and may require special management. For the northern spotted owl, these features include particular forest types of sufficient area, quality, and configuration to support the needs of territorial owl pairs, including habitat for nesting, roosting, foraging, and dispersal. The Trout Creek project is located within the 2012 Critical Habitat Unit 6, West Cascades South, subunit WCS3, which totals 319,736 acres. The Trout Creek project contains 815 unit acres within subunit WCS3 and 16,520 acres of the WCS3 subunit are within the project boundary.

Northern Spotted Owl Nest Sites

Effects of habitat modification on individual northern spotted owl nest sites are assessed at three spatial scales: (1) the general home range of breeding spotted owls is estimated as a 1.2-mile circle around the nest tree, (2) a core area defined as a 0.5-mile radius around the nest tree, and (3) a 300-meter radius around the nest tree is referred to as the “nest patch.” It is estimated that at least 40% of the home range and 50% of the core area should be suitable habitat to support owl nesting and rearing of young. Owls may successfully fledge young when suitable habitat drops below these percentages, but the likelihood of this decreases as suitable habitat declines below the threshold values. Owl nest sites for this project are based on surveys conducted during nesting season in 2014, 2015 and 2016 in accordance with survey protocols established by US Fish and Wildlife Service. Historic owl nest sites were also used for this analysis. Nine known owl sites occur in the vicinity of the proposed harvest units, one of which is known to be active.

Environmental Consequences – Northern Spotted Owl

Direct and Indirect Effects to Northern Spotted Owl Habitat

Alternative 1 – No Action

Alternative 1 would have no effect on suitable or dispersal spotted owl habitat. Non-habitat managed stands would slowly develop into dispersal habitat within another 10-15 years as the stands thin themselves. Those stands which are currently dispersal habitat would develop into low quality foraging habitat within 40-50 years. Stands which currently have larger remnant trees of larger diameters could become low quality nesting habitat within that timeframe as well. The stands which are currently foraging habitat with some nesting opportunity would develop towards old growth conditions and start to become high quality suitable owl habitat fitting Recovery Action 32 stand characteristics in about 50-100 years.

Alternative 2

Alternative 2 would treat stands between 31-140 years which are non-habitat, dispersal or suitable habitat for the northern spotted owl. Some of the older stands have scattered remnant overstory trees with potential owl nesting structures. Table 33 displays Alternative 2 proposed treatment acres by age class.

Table 33: Age Class Acres by Treatment Type – Alternative 2

Treatment Types	Acres By Age Class		
	34-40 years	41-80 years	>80 years
Commercial Harvest (Thinning, Gaps, and Skips ¹)	302	662	293
Early Seral/Regeneration	0	52	49
Prescribed Underburning	73	156	49
Non-commercial Treatments (Planting Restoration, Fall & Leave, Snag Creation, and Dominant Tree Release)	17	42	311
Total	392	912	702

¹ Skips are not harvested; however, depending on their size and location within the unit they may no longer provide spotted owl habitat.

Treatments in suitable habitat

Alternative 2 would remove about 130 acres or less than one percent of suitable owl habitat in the project area, making the habitat unsuitable for spotted owls (Table 34). These acres include 49 acres of early seral habitat creation, and 81 acres of fuelbreaks or heavy thinning. These acres also include 2 acres of clearing in units 140 and 44, each, to accommodate rock pits. In about 40 years post-harvest, the early seral openings would develop into dispersal habitat. Suitable owl habitat would develop after 80-140 years post-harvest, and the stands could achieve characteristics that fit the Recovery Action 32 description due to the retention of legacy trees that would exist in the stands at that time. Heavily thinned acres would take about 10-20 years post-harvest for dispersal habitat to develop. Units with retention between up to 40 and 80 trees per acre with harvest treatments would allow these stands to provide higher quality dispersal habitat compared to what would occur in a harvest without leave tree retention. In addition, 303 acres of suitable habitat would be maintained where only under-planting for restoration purposes are proposed.

Table 34: Treated Acres by Spotted Owl Habitat and Treatment

Treatment	Suitable Acres	Dispersal Acres	Non-habitat Acres
Harvest (Removed and Maintained)	218	473	181
Post-harvest Broadcast Burn/Pile Burning	130	203	131

Proposed thinning treatments, with one-acre gaps, in Alternative 2 would downgrade 88 acres, or less than one percent, of suitable owl habitat in the project area, converting it into dispersal owl habitat. These stands, which would retain 40-80 trees per acre and have 50% canopy cover post-harvest are expected to develop into low quality suitable habitat in about 10-15 years and into old growth conditions in about 50-100 years.

Alternative 2 proposes post-harvest broadcast and pile burning on approximately 130 acres of suitable owl habitat. The intent of this treatment is to mimic a natural fire occurrence and reduce activity generated fuels (refer to Fire and Fuels section). Post-harvest broadcast burning may result in a small amount of overstory tree mortality. Generally, an overstory mortality level of up to 10% is allowable and desirable for wildlife habitat because it helps create dead wood structures which are used by the spotted owl rodent prey base and other species.

Treatments in Dispersal Habitat

About 473 acres of dispersal habitat, which makes up approximately 49% of the dispersal habitat in the project area, would be harvested (Table 34). Approximately 74 acres of early seral creation and heavy thinning with one-acre gaps, would remove dispersal habitat. Moderate thinning on 399 acres would maintain dispersal habitat with an average of approximately 40% canopy cover. Proposed thinning stands are expected to close their canopies back to pre-harvest conditions within 7-10 years. Units with heavier thinning treatments and lower average canopy retention near 30% would need approximately 10-15 years to reclose their canopies back to pre-harvest conditions. Moderate thinning of dispersal habitat may benefit overall forest structural development and improve long-term (greater than 25 years) spotted owl habitat conditions. Post-harvest snag and large down wood habitat enhancement in selected thinning units would improve stand structure conditions even more for spotted owls and their prey in the long-term. Additionally, Alternative 2 proposes post-harvest broadcast and pile burns on approximately 203 acres of dispersal owl habitat in order to return fire back into the ecosystem and reduce activity generated fuels (refer to Fire and Fuels section). Under-planting on 10 acres of dispersal owl habitat are proposed for restoration purposes.

Treatments in Non-Habitat

Approximately 181 acres of forest stands that are currently non-habitat for spotted owls would be thinned, this includes 8 acres of thinning in Late Successional Reserves designated lands. These acres total to less than 2% of all the non-habitat forest stands in the Trout Creek project area. About 49 acres proposed for heavier thinning with an average canopy retention near 30% would delay the development of dispersal owl habitat for approximately 20-25 years. Moderate thinning treatments with canopy retention of 50% would benefit spotted owls because after 7-15 years, forest structure would be improved over the current condition, and they would develop into dispersal habitat conditions faster than if they were left to develop naturally. Structural enhancements such as snag and down wood placement would further benefit spotted owl habitat quality. This would improve the habitat in the near future, about ten years, and longer term for 20-30 years. Pile and broadcast burns are proposed on 131 acres of unsuitable habitat.

Treatments in RA32 Stands

Recovery Action 32 habitat is a subset of the higher quality suitable habitat and does not include dispersal or non-habitat. No Recovery Action 32 habitat occurs in the proposed treatment units.

Alternative 3

Alternative 3 does not propose commercial harvest treatments in suitable spotted owl habitat, so the effects would be the same as described under Alternative 1 stands older than 80 years of age. Treatments are proposed in stands under 80 years of age, thus the effects of this Alternative are less than those of Alternative 2. This action proposes to remove 74 acres of dispersal habitat through heavy thinning and early seral creation. It would also maintain 399 acres of dispersal habitat and thin 181 acres of non-habitat. Not harvesting the currently suitable owl habitat would maintain this habitat and the structural dead wood elements for use of foraging for spotted owls and their prey. Alternative 3 would have similar effects on forest structure and response as described in Alternative 2 for similar treatments.

Alternative 4

Alternative 4 proposes an additional 22.5 acres in gaps, no greater than one acre in size, when compared to Alternative 2. This would affect an extra 6 acres and 9.5 acres of suitable and dispersal owl habitat, respectively. An additional 7 acres of gaps are proposed in non-habitat. These gap acres would have a negligible increase of effects to suitable and dispersal owl habitat when compared to Alternative 2.

Cumulative Effects to Northern Spotted Owl Habitat

Alternative 1 – No Action

Alternative 1 would have no effect on spotted owl habitat; therefore, no cumulative effects exist to be considered.

Alternative 2

The baseline condition for this analysis accounts for past activities that affected owl habitat in the project area and assumes that none of the private land is suitable for owl habitat. The ongoing harvest under the Canyon Thin EA and the future thinning Jude Ridge project are all in stands less than 80-years old and not in suitable owl habitat. There are no other reasonable foreseeable actions that would remove or downgrade suitable owl habitat in the project area.

On a broader scale, Davis et al. (2016: entire) conducted the Northwest Forest Plan monitoring to show trends in spotted owl habitat over the first 20 years of implementation from 1994 to 2013. They found a net decrease of 1.5% in spotted owl nesting/roosting habitat on federal lands from 9,089,700 acres in 1993 to 8,954,000 in 2013 (abstract summary not paginated). Gross losses on federal lands were 473,000 acres from wildfires (5.2% loss), 116,100 acres from timber harvest (1.3% loss), and 59,800 acres from insect and diseases (0.7% loss). Because the gross losses were greater than the net losses, it indicates that the process of forest succession is compensating for some of the habitat loss.

Dispersal habitat increased by 2.2% on federal lands, but dispersal capable landscapes decreased by 5% due to habitat losses on the surrounding non-federal lands. Large wildfires continue to be the major loss of spotted owl habitat on federal lands and most of these losses occurred within the conservation network of large reserves designed for spotted owl conservation.

The 20-year monitoring results show that within the Western Cascades of Oregon, there was a net gain of 27,100 acres of spotted owl nesting/roosting habitat (1.5% increase) on federal lands, despite gross losses of 101,500 acres (4.3% loss) (Davis et al., 2016, p. 21). The losses include 34,900 acres due to timber harvest, 63,000 acres due to wild fires, and minor losses due to insects and unspecified causes. Within the Western Cascades of Oregon, there was a net gain of 122,200 acres of spotted owl dispersal habitat (3.4% increase) on federal lands, despite gross losses of 121,500 acres (3.7% loss) (Davis et al., 2016, p. 31). The losses of dispersal habitat include 28,300 acres due to timber harvest, 89,300 acres due to wildfires, and minor losses due to insects and unspecified causes. Recruitment of dispersal habitat on federal lands in the Western Cascades of Oregon is more than compensating for habitat losses with the recruitment rate about twice the rate of dispersal habitat loss.

The analysis of dispersal-capable landscapes found no loss of landscape connectivity in the interior of federal lands within the Western Oregon Cascades (Davis et al., 2016). There has been no loss in landscape connectivity for spotted owls that exists along a wide corridor across the Cascade Range from the Canadian border south into northern California. However, substantial loss to dispersal capable areas has occurred along the southwest area of the Willamette Province adjacent to the Willamette Valley and this loss extends south and west across a connection area between the Oregon Coast and Cascades Range south of the Willamette Valley. There also has been some areas of dispersal-capable landscape loss and a few small areas of gain along the eastern edge of the range of spotted owl in the east side Cascades area in the northern half of Oregon.

Based on the above-described effects and the new Northwest Forest Plan monitoring information, ***Alternative 2 may affect and is likely to adversely affect spotted owl habitat; however, it is not expected to jeopardize the continued existence of the spotted owl.***

Alternative 3

Alternative 3 would not affect suitable habitat and the landscape would still support nesting spotted owls. This action would remove dispersal habitat through heavy thinning, gap and early seral creation. Considering direct, indirect and cumulative effects, ***Alternative 3 may affect but is not likely to adversely affect spotted owl habitat and it is not expected to jeopardize the continued existence of the spotted owl or result in any incidental take of spotted owls.***

Alternative 4

Similar to Alternative 2, considering direct, indirect, cumulative effects and the new Northwest Forest Plan monitoring information ***Alternative 4 may affect and is likely to adversely affect spotted owl habitat; however, it is not expected to jeopardize the continued existence of the spotted owl.***

Direct and Indirect Effects to Northern Spotted Owl Critical Habitat

Alternative 1 – No Action

Alternative 1 would have no effect on Northern Spotted Owl Critical Habitat Unit Cascades South, subunit WCS3. Non-habitat managed stands would slowly develop into dispersal habitat within another 10-15 years as the stands thin themselves. Those stands which are currently dispersal habitat would develop into low quality foraging habitat within 40-50 years. Stands which currently have larger remnant trees of larger diameters could become low quality nesting habitat within that timeframe as well. The stands which are currently foraging habitat with some nesting opportunity would develop towards old growth conditions and start to become high quality suitable owl habitat fitting Recovery Action 32 stand characteristics in about 50-100 years.

Alternatives 2 and 4

The following effects and discussion is specific to treatments which would occur in Northern Spotted Owl Critical Habitat Unit Cascades South, subunit WCS3. It should be noted that some of these treatment acres and effects have been discussed previously, although those discussions encompassed additional acres and areas not within designated critical habitat.

Treatments in Suitable Habitat within Critical Habitat

The project proposes to remove 104 acres of suitable habitat within the WCS3 unit by harvesting and creating fuelbreaks on 54 acres and early seral habitat on 49 acres, making the habitat unsuitable for spotted owls. Early seral acres are expected to develop into dispersal habitat in about 40 years post-treatment and into suitable habitat in about 80-140 years. Harvest and fuelbreak treatments are proposed for heavy thinning with a post-harvest canopy cover between 20 and 40%. In about 10-15 years post-harvest, these stands would develop into dispersal habitat. Suitable owl habitat would develop after 50 years or less post-harvest. Alternative 2 also proposes to downgrade 5 acres of suitable to dispersal with an average canopy cover of about 50%. Post thinning, these stands would function as dispersal habitat since the final average canopy cover would remain above 40%. About 246 acres of suitable habitat within the WCS3 unit would be maintained where only under-planting for restoration purposes are proposed to take place.

Treatments in Dispersal Habitat within Critical Habitat

Early seral habitat creation on 36 acres would remove dispersal habitat making the habitat unsuitable for spotted owls. In about 40 years post-harvest, these early seral acres would develop into dispersal habitat and into suitable owl habitat after 80-140 years post-harvest. Dispersal habitat would be maintained on 105 acres proposed for moderate thinning with an average of approximately 50% canopy cover. These stands are expected to close their canopies back to pre-harvest conditions within 7-10 years.

Treatments in Non-Habitat within Critical Habitat

The project proposes harvest treatments on 77 acres of non-habitat stands, which includes thinning 8 acres in Late Successional Reserves. Thinning treatments may accelerate the development of non-habitat conditions into dispersal and suitable habitat by thinning overstocked stands and/or providing additional structure to the stands. These stands are not currently functioning as spotted owl habitat, and thinning of these stands would improve habitat structure for spotted owls in the longer term after approximately 10 years.

Treatments in Known Owl Sites within Critical Habitat

The U.S. Fish and Wildlife Service (USFWS) has determined spotted owl habitat viability thresholds of 50% suitable habitat in the core area and 40% suitable habitat in the home range. Suitable habitat levels below these thresholds are thought to compromise the reproductive success of owls.

MSNO NEW13: Early seral creation proposed in Alternatives 2 and 4 would remove 11.5 acres of suitable habitat, 5 of which are within CHU, and 36 CHU acres of dispersal habitat within the 1.2 mile home range radius. Thinning would downgrade 12 acres of suitable habitat and maintain 27 CHU acres of dispersal habitat within the home range. This owl site currently contains approximately 276 acres and 1,760 acres of suitable habitat within its core and home range, respectively. Proposed treatments would still retain suitable habitat above threshold levels and maintain the functionality of this owl site for nesting and rearing young. The core area for this owl site would not be affected.

MSNO 0064: Thinning is proposed on 8 acres of non-habitat within the 1.2 mile home range radius. This owl site currently has approximately 498 acres in the core area and 2,445 acres in its home range of suitable habitat, well above threshold levels. Thinning would have a beneficial effect on this owl site as it would accelerate the development of dispersal and suitable habitat by harvesting overstocked stands and/or providing additional structure to the stands.

MSNO 4094: Thinning is proposed on 4 acres and 8 acres of non-habitat within the 0.5 mile core area and 1.2 mile home range radius, respectively. Thinning would have a beneficial effect as it would accelerate the development of dispersal and suitable habitat by harvesting overstocked stands and/or providing additional structure to the stands. This owl site currently has approximately 431 acres in the core area and 2,455 acres in its home range of suitable habitat, well above threshold levels.

MSNO 4460: Proposed fuelbreaks on 30 acres within the 1.2 mile home range radius would remove suitable owl habitat. Treatments would also include 26 acres of thinning which will maintain dispersal habitat. This owl site currently has approximately 397 acres and 1,873 acres of suitable habitat within its core and home range, respectively. All proposed treatments would retain suitable habitat above threshold levels and maintain the functionality of this owl site for nesting and rearing young. The core area for this owl site would not be affected by the proposed action.

MSNO 0687: Treatments would downgrade 5 acres of suitable habitat and 50 acres of non-habitat would be thinned within the home range. This owl site currently has approximately 431 acres in its core and 2,316 acres of suitable habitat in its home range. Non-habitat treatments are expected to benefit this site by accelerating the development of dispersal habitat. Downgrading would still retain suitable habitat well above threshold levels and maintain the functionality of the site. No treatments are proposed in the core area.

MSNO 2963: Treatments would maintain dispersal habitat on 45 acres and thin 49 acres of non-habitat within the core. Proposed treatments would also maintain 144 acres of dispersal habitat, 21 of which are in CHU, and thin 71 acres of non-habitat, this includes 22 acres in CHU, in the home range. This site currently has approximately 310 acres in the core area and 1,547 acres in its home range of suitable habitat, above threshold levels in both areas. Thinning in non-habitat would have a beneficial effect as it would accelerate the development of dispersal and suitable habitat by harvesting overstocked stands and providing additional structure to the stands. All proposed treatments would maintain habitat above threshold levels and retain the functionality of this owl site for nesting and rearing young. Critical habitat would not be affected in the core area.

Alternative 3

This alternative would not thin suitable habitat stands within Critical Habitat, so effects to spotted owl sites in Critical Habitat would be limited to thinning of dispersal habitat and non-habitat. Alternative 3 may affect spotted owl Critical Habitat due to 36 acres of dispersal habitat removal. This alternative would also thin and maintain 105 acres and 77 acres of dispersal and non-habitat, respectively. Alternative 3 would not adversely modify spotted owl critical habitat. This action would not preclude meeting recovery goals for spotted owls and the landscape would still support nesting spotted owls and dispersal post-treatment.

Cumulative Effects to Northern Spotted Owl Critical Habitat

Alternative 1 – No Action

Alternative 1 would have no effect on spotted owl critical habitat; therefore, no cumulative effects exist to be considered.

Alternatives 2 and 4

Because Alternatives 2 and 4 would remove 104 acres of suitable habitat within WCS3 these alternatives **may affect and are likely to adversely affect northern spotted owl critical habitat**; however, given the amount of suitable habitat and functional home ranges that would remain after implementation, WCS3 would continue to provide demographic support to overall northern spotted owl populations and connectivity for owls between Critical Habitat subunits. There are no other reasonably foreseeable or ongoing projects that would remove older forest critical habitat in the project area.

Alternative 3

Alternative 3 would harvest dispersal and non-habitat, which is not limiting on the landscape in WCS3. Because treatments would remove about 36 acres of dispersal habitat through thinning, delaying the development of suitable habitat, and considering direct, indirect and cumulative effects, **Alternative 3 may affect and is likely to adversely affect spotted owl critical habitat**.

Direct and Indirect Effects to Northern Spotted Owl Known Sites

Alternative 1 – No Action

Because Alternative 1 does not implement any future actions, there would be no effects on any known owl sites.

Alternatives 2 and 4

Northern spotted owl surveys were conducted during nesting season in 2014, 2015 and 2016 in accordance with survey protocols established by USFWS. Fifteen historic known spotted owl activity centers are located inside or overlap with the planning area. Nine owl sites overlap with proposed project activities, of which three sites have treatments proposed in suitable habitat. Effects for Activity Center's MSNO NEW13, 0064, 4094, 4460, 0687, and 2963 are discussed in the NSO Critical Habitat section of this document.

MSNO 0661: Proposed treatments would maintain 28 acres in the core area of dispersal habitat. Early seral creation and thinning would remove 14 acres and maintain 45 acres of dispersal habitat in the home range. This owl site is below the viability threshold of 50% and 40% suitable habitat in the core area and provincial home range, respectively. It currently contains 172 acres, or 34% of suitable habitat in the core area and 297 acres or 11% of suitable habitat within its home range, below viability threshold levels. This is a poor site, due to the limited amount of suitable habitat. The stands being treated in the core area would experience a moderate thinning maintaining an average of 50% canopy cover. Additionally, the prescription would create 5 snags and down wood per acre post-treatment. These stands are expected to close their canopies back to pre-harvest conditions within 7-10 years. Because treatments would maintain dispersal habitat, the functionality of this owl site would be also maintained.

MSNO 0688: Early seral creation on 2 acres would remove dispersal habitat within the home range. Non-habitat would be thinned on 12 acres in the core area and 55 acres in the home range. This is a

marginal site due to the limited amount of suitable habitat. This owl site currently has about 210 acres or 42% and 542 acres or 19% of suitable habitat in its core and home range, respectively. This is less than the viability threshold needed for functionality of the site. Because the removal of 2 acres of suitable habitat would affect 0.05% of the total home range, the effect to the overall home range is negligible. Thinning treatments would benefit the site because it would accelerate the development of non-habitat conditions into dispersal and suitable.

NLAA MSNO 2976: Thinning is proposed on 5 acres of dispersal habitat and 39 acres of non-habitat in the core of this site. Thinning would remove 18 acres of dispersal and 100 acres would be maintained within the home range. Treatments are also proposed on 49 acres of non-habitat within the home range. This site currently has approximately 177 acres in the core area and 1,067 acres in its home range of suitable habitat, below threshold levels in both areas. This is a marginal site due to the limited amount of suitable habitat. Some thinning acres would have a beneficial effect to this site as it would accelerate the development of dispersal and suitable habitat by harvesting overstocked stands and providing additional structure to the stands. Stands thinned to 30% canopy would delay the development of dispersal habitat.

Alternative 3

Because Alternative 3 does not harvest suitable spotted owl habitat, there would be no changes to suitable habitat acres within any core areas or provincial home ranges; therefore, the effects to owl sites would be less than Alternatives 2 and 4. No regeneration or early seral creation is proposed. Alternative 3 would only thin dispersal and non-habitat and would have the same effects for owl at all sites as described in Alternative 2 for similar treatments.

Cumulative Effects to Northern Spotted Owl Known Sites

Alternative 1 – No Action

Alternative 1 would have no effects on spotted owl known sites, thus no cumulative effects exist to be considered.

Alternatives 2 and 4

Cumulative effects of other habitat modification activities within 0.5 mile core area and 1.2 miles home range areas of the individual owl sites discussed above were considered in this analysis. Considering direct, indirect, and cumulative effects, **Alternatives 2 and 4 may affect and are likely to adversely affect northern spotted owls**. The landscape would still support nesting spotted owls and dispersal post-treatments.

Alternative 3

Alternative 3 does not propose treatments in suitable habitat; therefore, affects are reduced when compared to Alternatives 2 and 4. Because Alternative 3 would remove dispersal habitat within some of the owl sites through early seral creation and considering direct, indirect and cumulative effects, **Alternative 3 may affect but is not likely to adversely affect spotted owls**.

Direct and Indirect Effects to Northern Spotted Owl from Disturbance

Alternative 1 – No Action

Alternative 1 would have no effects to spotted owls from disturbance because no activities are proposed to occur.

Alternatives 2, 3 and 4

Some of the proposed activities may cause noise disturbance to spotted owls if they occur during the breeding season due to their proximity to nest patches. The spotted owl breeding season is from March 1 – Sept 30, with the critical breeding period occurring March 1 – July 15. In particular, seasonal restrictions during the critical breeding period would be imposed on units 73, 60, 61, 63, 59, 42, 50, 14, 100, 170, 200 and roads 758, 760 and 755 to limit disturbance and help minimize effects to spotted owls near two owl sites. Restrictions will be applied to activities such as timber harvest, road work, pile-driving, rock crushing, burning (broadcast and pile), chainsaw operations and blasting. The unit wildlife biologist may increase disturbance distances and restriction dates according to the best available scientific information and site-specific conditions. In particular, blasting, pile-driving and rock-crushing may need to be restricted during the entire breeding period. No helicopter operations are proposed for the Trout Creek project. If owl nest activity is detected in areas not previously identified, seasonal restrictions and standard buffer distances would be applied. No activities are proposed within the disruption distance of a known owl site.

Cumulative Effects to Northern Spotted Owl from Disturbance

Alternative 1 – No Action

Alternative 1 would have no cumulative effects on spotted owl from disturbance.

Alternatives 2, 3, and 4

There are no effects associated with past, present, and reasonably foreseeable activities in the project area that when added to the effects of the proposed action are expected to result in cumulative disturbance effects. Because proposed activities would occur within a distance which could cause noise disturbance to two known spotted owl activity centers, Alternatives 2, 3 and 4 **may affect but are not likely to adversely affect spotted owls**.

Proposed Threatened and Forest Service Sensitive Wildlife

Sensitive species are species that are not federally listed under the Endangered Species Act, but are designated by the Forest Service and given special consideration in project analysis due to viability concerns. The goal of the Forest Service is to manage for these species so they would not become federally threatened or endangered. Effects of the alternatives on Forest Service sensitive species are considered in a project wildlife Biological Evaluation. This environmental assessment tiers to the analysis in the Biological Evaluation and provides a summary of the effects in Table 35 and in the following discussion. Seven sensitive species have habitat or potential habitat in the project area and were analyzed in detail in the project Biological Evaluation.

Table 35: Summary of effects of by alternative on seven sensitive species that occur or have potential habitat in the Trout Creek project area

Species ¹	Effect Determination For Alts. 2 and 4	Effect Determination For Alt. 3	Rationale For Determination
American Peregrine Falcon	MAII ²	MAII ²	Activities are proposed in all management zones. Seasonal harvest restrictions in primary and secondary home ranges during breeding season.
Harlequin Ducks	No Impact	No Impact	The prohibition of harvesting during nesting season and the 150 foot buffer on perennial streams mitigates potential impacts.
Lewis Woodpecker	MAII ²	MAII ²	Marginal impact to foraging and fall dispersal habitat at the Project and Forest scale.
Fringed Myotis and Townsend's Big-eared Bats	MAII ²	MAII ²	Effects to foraging habitat and potential tree roosting and natal habitat is minor at the project and Forest scale. Probability that an occupied roost or natal site would be fallen during logging or hazard tree felling operations is low.
Johnson's Hairstreak	MAII ²	No Impact	Effects are trivial to western hemlock habitat at the project and Forest scale and would occur in habitat that currently has no or very low dwarf mistletoe abundance.
Sierra Nevada Red Fox	MAII ²	MAII ²	Effects to Sierra Nevada red fox home range are negligible and some proposed treatments would be beneficial to SNRF's food source

¹ Alternative 1 would have No Impact on any Sensitive Species.

² MAII: may adversely impact individuals, but would not result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.

Affected Environment – American Peregrine Falcon

The American peregrine falcon inhabits cliffs and rocky outcrops that tend to overlook fairly open areas with an ample food supply (Csuti et al., 1997). This species may forage in a variety of forest types. Peregrine falcons, like many raptors, are sensitive to physical and noise disturbance. Noise disturbance can include activities, such as helicopter use, chainsaw activity and heavy equipment use within the vicinity of an active nest site. Physical disturbance, such as recreational use (e.g., rock climbing and hiking) of peregrine falcon habitat can cause nest failure. Three management zones identify general distances for peregrine habitat use and site management.

- Primary Zone: Average of 0.25-0.75 miles around a nest site.
- Secondary Zone: 0.5-2.0 miles from a nest site.
- Tertiary Zone: 3.0 or more miles from a nest site.

Several potential and occupied habitat sites exist on the Forest. This species has been documented on the District and one known nest site is located within the project area. This nest was occupied in 2016.

Environmental Consequences – American Peregrine Falcon

Direct and Indirect Effects

Alternative 1 – No Action

Under this alternative there would be no impacts to American peregrine falcons.

Alternatives 2, 3, and 4

The Trout Creek project would not modify any suitable peregrine nesting habitat. Thinning treatments proposed may result in a slightly different prey in and around the units, but the overall prey base for peregrine falcons is not expected to decline in these areas. Peregrine falcons prey primarily on birds and selectively use open areas for hunting. Gaps, early seral creation and prescribed fire would create a mosaic of open areas interspersed with forested habitat that may improve foraging conditions. These treatments, together, may result in a beneficial effect or neutral effect to potential forage habitat. Portions of all three management zones overlap with several Trout Creek units which may disrupt peregrines. In order to mitigate potential impacts to the American peregrine falcon, including noise disruption during nesting, all silviculture activities, such as heavy equipment operations and prescribed fires, would be restricted within the primary and secondary management zones from February 1st to August 15th. No helicopter use is proposed for the Trout Creek project.

Cumulative Effects

Alternative 1 – No Action

Because there would be no impacts to American peregrine falcons, this alternative does not contribute to any cumulative effects to the species.

Alternatives 2, 3, and 4

Because silviculture activities are proposed in all three management zones of a known falcon territory ***it is my determination that Alternatives 2, 3 and 4 may impact individuals, but would not likely result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.*** There are no other reasonably foreseeable or ongoing projects that would impact peregrines or their habitat.

Affected Environment – Harlequin Duck

A small population of harlequin ducks nest and rear their young along mountain streams in the Oregon Cascades. They begin to arrive on the breeding grounds in early March with the peak courtship period from late April to late May. Females nest from the end of April to mid-June and males depart the streams and return to their wintering grounds on the Pacific coast of North America in late May and June. Females raise their young on the streams until late July. At that time they begin to move downstream and start returning to their ocean wintering grounds with few to no birds remaining on the forest by the middle of August. Harlequin ducks have been documented on Quartzville, Moose, Canyon and Owl Creeks and the Middle and South Santiam Rivers on the Sweet Home Ranger District.

Environmental Consequences – Harlequin Duck

Direct and Indirect Effects

Alternative 1 – No Action

Under this alternative there would be no effects to harlequin ducks.

Alternatives 2, 3, and 4

Buffers to protect streams and riparian corridors are part of Alternatives 2, 3 and 4; therefore, proposed activities under these alternatives would not affect foraging habitat as harlequin ducks forage for macro-invertebrates in streams. Buffers would also protect suitable nesting habitat from being directly affected. Treatments proposed adjacent to nesting habitat for harlequin ducks may disturb and flush a female off her nest and cause nesting failure during project implementation. However, the prohibition of harvesting adjacent to harlequin duck nesting habitat from March 1 through July 15 and the restriction of activities within 150 feet of live streams would mitigate potential impacts to harlequin ducks.

Cumulative Effects

Alternative 1 – No Action

Because there would be no impacts to harlequin ducks, this alternative does not contribute to any cumulative effects to the species.

Alternatives 2, 3, and 4

The prohibition of harvesting from March 1 through July 15 and the restriction of activities within 150 feet of live streams would mitigate potential impacts to harlequin ducks and their habitat. Alternatives 2, 3 and 4 would not create additional cumulative effects to harlequin ducks in the project area. No other activities are known to be occurring in the project area which could impact harlequin ducks. The on-going Canyon Thin, and future Calapooia and Jude Ridge projects have no impact on this species. Other past, present and reasonable foreseeable forest management activities would maintain forest habitats suitable for nesting. ***For these reasons, it is my determination that the proposed Alternatives would have no impact on harlequin ducks or their habitat.***

Affected Environment – Lewis' Woodpecker

There are limited records of Lewis' woodpecker on the Willamette National Forest. This species has not been documented breeding on the Willamette National Forest, but occurs on the Forest during fall dispersal. In Oregon it nests in white oak woodlands, ponderosa pine woodlands, mixed oak-pine woodlands, and cottonwood riparian woodlands. Lewis' woodpeckers are weak primary cavity nesters and most often secondary cavity nesters. In spring and summer, they eat mostly insects and spiders. In the fall, their diet turns to acorns and berries. They cache acorns under bark and in crevices of trees. Winters are spent in oak savannah. Drastic declines in Oregon since the mid-1960s are speculated to be from destruction of lowland oak habitat and competition with European starling (Marshall et al., 2003). Although they have not been recorded in the project area, a regular movement of these woodpeckers occurs along Cascades ridges in the fall (Marshall et al., 2003). Lewis' woodpeckers were observed on

such a ridge outside the project area in September of 2016 foraging around snags killed by a recent prescribed fire to restore meadow habitat (Forest Service NRIS wildlife observation).

Environmental Consequences – Lewis Woodpecker

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no effect on the development of nesting structures, such as tree snags, that would benefit the woodpecker.

Alternatives 2, 3 and 4

Alternatives 2 and 4 propose timber harvest in managed and natural stands with potential foraging habitat for this species. Alternative 3 proposes treatments only in managed stands with potential marginal foraging habitat. Timber harvest in all alternatives would degrade potential Lewis' woodpecker habitat by reducing future snags; however, all natural stand units would retain some legacy trees. Silviculture prescriptions also require that snags and coarse woody debris be retained in all units and removed only if deadwood poses a safety concern or for operational purposes. Prescribed burning would likely provide some benefit to this species by creating snags and open areas that would attract insects that this species would forage on.

Cumulative Effects

Alternative 1 – No Action

This alternative does not propose treatments in Lewis' woodpecker habitat; therefore, it would not contribute to any cumulative effects to this species.

Alternatives 2, 3 and 4

Alternatives 2 and 4 proposed treatments would affect about 0.05% of potential Lewis' woodpecker habitat at the forest level and about 2.33% of the project area. Alternative 3 would affect about 0.04% and 1.8% of potential marginal habitat at the forest and project level, respectively. Thus Alternatives 2, 3 and 4, considering the direct, indirect, and cumulative effects, impacts would be negligible to this species. Because the effects to potential foraging habitat are insignificant at the project and forest scale and because some project activities would have a beneficial effect to foraging habitat, and considering past, present and future projects ***it is my determination that proposed Alternatives 2, 3 and 4 may adversely impact individuals, but would not likely result in a loss of viability in the Planning Area.***

Affected Environment – Fringed Myotis and Townsend's Big-eared Bats

These two bat species are known to nest and roost in tree and snag cavities and under loose bark (Lacki et al., 2007), although both species have typically been associated with caves and buildings (Verts and Carraway, 1998). Very little is known about fringed myotis habitat in Oregon. Occurrence has been documented on the Forest and three were captured in 1971. Although widely distributed throughout western Oregon, Townsend's big-eared bats are seldom abundant. Only one maternity colony has been documented on the Forest in the Middle Fork Ranger District. One roosting location exists on the Sweet Home Ranger District. In general, on the Westside Cascades, snags are thought to be the main roosting

habitat for fringed myotis and a minor roosting component for Townsend's big-eared bats. No tree or snag roost sites have been documented by the Forest Service in the project area or on the Forest, but such sites are very difficult to detect. The effects of the alternatives on these bats considered a) changes to foraging habitat, b) changes to roosting structures, c) potential for direct mortality to bats, and d) amount of roosting habitat affected.

Environmental Consequences – Fringed Myotis and Townsend's Big-eared Bats

Direct and Indirect Effects

Alternative 1 – No Action

There would be no effect on bat foraging or roosting habitat and no risk of direct mortality to bats. The 218 acres of stands over 80 years old are expected to begin transitioning into old-growth forests in about 50-100 years (FEMAT 1993:IX-24 old-growth conifer stand description) which should contain large snags and abundant decadent tree components that could potentially provide high-quality roosting forest habitat for these bats. The 654 acres of younger stands under 80 years old would take over 100 years to begin the transition to old-growth forest.

Alternatives 2, 3 and 4

Proposed harvest units under 80 years of age currently contain little to no snag habitat, and only very few potential bat roosting trees and snags that may be used by bats would be lost with Alternatives 2, 3, and 4. The 218 acres of older stands proposed for harvest in Alternatives 2 and 4 do contain higher levels of snag habitat which may be lost if they are a safety hazard during logging operations. Some of these stands would also have prescribed burning treatments after logging which would likely result in some additional loss of snag habitat.

Foraging Habitat

Bats readily use a variety of habitats over large areas for foraging including open and forested areas. Alternatives 2 and 4 propose various treatments on 871 acres including thinning, gaps and seral creation. The site-specific effect of this change on bat foraging habitat is uncertain and could range from negative to beneficial. The magnitude of the effects on foraging habitat at the landscape and forest level scales are insignificant however, because the action alternatives would affect approximately 2.33% of the Trout Creek project area and 0.05% of Willamette National Forest.

Roosting Habitat

The Trout Creek units contain some large snags and decadent features that might provide potential tree roost sites for bats, but at a lower abundance than would be found in old-growth forests. Proposed timber harvest in the stands over 80 years of age in Alternatives 2 and 4 would retain some of the larger trees and a large snags, but the harvest and possible subsequent underburns in some of the units would largely degrade bat roosting tree habitat on 218 acres for both alternatives. Prescribed burning may also create new snags which may be used by bats after 10 or more years. Stands mapped as suitable spotted owl habitat were used as a proxy for potential bat tree roost habitat because they contain larger trees and snags. It is estimated that there are about 23,189 and 826,384 acres of potential bat tree roosting habitat in the Trout Creek project area and on the Willamette National Forest, respectively. On the Forest, this makes up about 48.7% of the total forest acres. In the Trout Creek project area, it comprises 62.1% of the total acres. Alternatives 2 and 4 would degrade about 0.93% of the estimated

bat tree roosting habitat in the project area, and 0.03% of the total Willamette National Forest bat tree roosting habitat. Alternative 3 is not expected to degrade bat tree roosting habitat because the young stands contain very few or no snags.

Because at least 9 trees per acre would be left in the regeneration harvest areas, in addition to snags and downed wood being created, it is estimated that in about 80 years the proposed harvest units would regenerate to a two-age stand that would begin to resemble old-growth as described by USFS (1986). These stands would still be lower quality bat roosting habitat at that time than the untreated stands in Alternative 1 because they would have fewer large snags and large decadent tree components.

Potential Mortality

Fringed myotis have strong fidelity to natal roost sites and pups are weaned by end of July to the end of August depending on factors, such as lateness of spring (Ormsbee, pers. comm.). If snags or trees used as natal sites are fallen prior to that time, it is likely that some or all the pups and adults would be killed. Mitigation measures would protect some snags, but some would be fallen for safety and operational reasons. Some logging may occur before pups are weaned, especially in years when parturition is delayed. Thus, there is a possibility that direct mortality to bat pups could occur as a result of timber harvest in Alternatives 2 and 4. For an uncommon species, loss of a natal colony could have significant impacts on the viability of the species at the forest level. The possibility of a natal colony being directly harmed by logging is highly unlikely, however, because the bats are thought to be relatively uncommon and natal colonies are thought to occur at low densities on the landscape. The older stands in Alternatives 2 and 4 up to 136 years old, where activities are proposed, have a lower amount of potential roost sites than old growth forests or forests with substantial numbers of 250-year old trees and are not the highest probability sites for bat roosts. The 218 acres of older forest harvested in Alternatives 2 and 4 represents 0.93% of the estimated total potential bat tree roosting habitat for these species in the Trout Creek project area. Proposed additional mitigation measures would further reduce the possibility of direct mortality (refer to Design Criteria section). As the numbers of natal sites increases, so does the possibility that impacting 218 acres of forest would impact a site. However, as the number of sites increases on the forest, the chance that loss of a single site would result in the species no longer maintaining a viable population on the Forest inversely diminishes because many unaffected natal sites would still exist. Alternative 3 is expected have a significant lesser degree of bat mortality because the young stands contain a negligible amount of roosting habitat.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have no impact on bat foraging or roosting habitat and no risk of direct mortality to bats; therefore, it would not contribute to any cumulative effects.

Alternatives 2, 3 and 4

The evaluation above incorporates past Forest Service activities in the project area in the analysis of the current condition (e.g., estimate of potential bat roosting habitat available accounts for past timber harvest) and assumed all of the private lands were logged and unsuitable for bat tree roosting. The ongoing harvest under the Canyon Thin EA is all in stands less than 80-years old, not in suitable owl habitat, and would not impact any of the estimated potential bat tree roosting or natal habitat. No other timber harvest on Forest Service lands is reasonably foreseeable in the project area so there are no additional cumulative effects in the Trout Creek project area.

Because effects to bat foraging and potential tree roosting and natal habitat are minor at the project and Forest scale, and because the probability of falling a tree or snag containing a natal colony or family is low, ***it is my determination that, for fringed myotis and Townsends's big-eared bats, Alternatives 2, 3 and 4 may adversely impact individuals, but would not likely result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.*** There are no effects associated with past, present, and reasonably foreseeable activities in the project area that when added to the effects of the alternatives are expected to result in cumulative disturbance effects.

Affected Environment – Johnson's Hairstreak

This butterfly species is associated with older western hemlock forests and relies on dwarf mistletoe on western hemlock trees as a host plant for its larval stage (Davis et al., 2009). The species is difficult to detect because it spends much time in the upper canopy. Twenty two locations comprised of 76 individuals have been recorded on the Willamette National Forest (Forest NRIS database). It is considered to be very localized and scarce with a few "big" years. Peak conditions for this butterfly exist in old-growth and late successional second-growth forests. Younger forests that contain dwarf mistletoe may also have the potential to support populations. Elevation ranges from sea level to 6,000 feet. This butterfly is typically located in the forest canopy.

Environmental Consequences – Johnson's Hairstreak

Direct and Indirect Effects

Alternatives 1 and 3

Under Alternative 1 the value of the habitat for the butterfly species is expected to increase with time. Alternative 3 proposes harvest in stands under 80 years of age, so the impacts would be immeasurable because the chances of these younger stands having any dwarf mistletoe are very low. Therefore, under Alternatives 1 and 3 no impacts would occur to Johnson's hairstreak habitat.

Alternatives 2 and 4

A small degree of western hemlock containing dwarf mistletoe was located during stand exams. The habitat in the harvest units is currently considered low-quality for the hairstreak. As the stands age, however, western hemlock would become more dominant and the possibility of dwarf mistletoe establishment should increase. The early seral habitat creation with leave trees proposed in Alternatives 2 and 4 would negatively impact potential habitat for Johnson's hairstreak by removing understory and overstory trees. Immediately following logging, fewer hemlock trees would remain so there would be fewer sites where dwarf mistletoe could establish. Additionally, mistletoe spreads more rapidly in multistoried stands since the understory trees are showered by mistletoe seeds from plants in the overstory (USFS, 2000). The regeneration harvest would remove the multi-storied canopies that currently exist in the stand. However, western hemlock would readily regenerate in the understory following treatment. By 80 years post-treatment and continuing as the stands age, it is expected that there would be a large component of western hemlock that would be suitable for dwarf mistletoe establishment and thus, potential habitat for the Johnson's hairstreak.

Alternatives 2 and 4 would impact approximately 218 acres of potential Johnson's hairstreak butterfly habitat, for about 80 years. An evaluation of stands greater than 80 years of age in the Trout Creek project shows that currently there are about 23,189 acres, or 62%, of potential habitat for the butterfly species, and 404,500 acres of potential habitat on the Forest, or 22.5% of total forest acres.

Alternatives 2 and 4 would impact 0.93% and 0.05% of the estimated potential Johnson's hairstreak habitat in the Trout Creek project area and on the Forest, respectively.

Cumulative Effects

Alternative 1 and 3

Alternatives 1 and 3 would have no impact Johnson's hairstreak; therefore, they would not contribute to any cumulative effects.

Alternative 2 and 4

Johnson's Hairstreak is not a Survey and Manage species, so no surveys are required. Surveys were not conducted for this butterfly species because the lack of mistletoe precluded finding eggs and isolating larval stages on the host plant (Davis et al., 2011) and the chances of seeing adults in the upper canopy of the units is remote. Retaining all trees greater than 80 years of age would not fit the Purpose and Need of the Project and was not considered necessary to maintain species viability because only a very small percentage of the potential habitat would be affected. Western hemlock would readily regenerate in the stands after treatment, and the alternatives as designed are expected to maintain Johnson hairstreak's viability at the project and Forest-scale. Because Alternatives 2 and 4 would impact a negligible amount of the total western hemlock habitat at the project and Forest-scale and would occur in habitat that currently has no or very low dwarf mistletoe abundance, it is my determination that, for Johnson's hairstreak, ***Alternatives 2 and 4 may adversely impact individuals, but would not likely result in a loss of viability in the Planning Area, nor cause as trend toward federal listing.***

Alternatives 1 and 3 would have no impact on this butterfly species. There are no other reasonably foreseeable or ongoing projects that would impact Johnson's hairstreak or their habitat. The on-going Canyon Thin EA and the future Jude Ridge and Calapooia projects only include treatments in young managed stands.

Affected Environment – Sierra Nevada Red Fox

The Sierra Nevada red fox (*Vulpes vulpes necator*-SNRF) was added to the Forest Service sensitive species list in 2015. Persistent presence of this fox with multiple individuals has been documented in the Santiam Pass and the Willamette Pass areas as well as on the Deschutes NF (Willamette National Forest NRIS data; USFWS, 2015a). Individuals have also been found in McKenzie Pass on both the Deschutes and Willamette NFs. The Sierra Nevada red fox is a subspecies of red fox that is adapted to snowy, high elevation habitats (USFWS, 2015a) and all locations documented on the Willamette NF are above 4,000 feet elevation (Willamette National Forest NRIS data). Scat surveys conducted in 2016 in the project area and other locations on the Sweet Home Ranger District did not detect SNRF's.

Environmental Consequences – Sierra Nevada Red Fox

Direct and Indirect Effects

Alternative 1 – No Action

Under the No Action alternative there would be no impacts to the Sierra Nevada red fox.

Alternatives 2, 3 and 4

SNRF use montane conifer forests, meadows, and rocky areas and appear to be opportunistic predators and foragers. Their diet includes rodents, lagomorphs, pikas, deer carrion, and manzanita berries in California. It is assumed they use comparable prey and food items in Oregon. In the Lassen (California) area, adult summer home ranges average about 6,300 acres. Alternatives 2, 3 and 4 would impact about 520 acres located above 4000 feet elevation proposed for timber harvest, including seral creation and gaps. Thus, Alternatives 2 and 4 could directly affect about 8.3% of a home range if resident foxes occurred in the project area. Alternative 3 could affect 4.7% of a fox home range. Gaps and seral creation may be beneficial to SNRF by increasing grasses and shrubs which promote more prey and by increasing fruiting shrubs that are an important supplemental food source.

Direct mortality to SNRF from Alternatives 2, 3, and 4 is possible during harvest operations especially if they occur prior to pups being weaned, before July 31st. Thus, there is a possibility that direct mortality to pups could occur. When adults and pups are mobile, they can move away and avoid areas being actively logged; therefore, the possibility of direct harm by logging is unlikely during this time.

Cumulative Effects

Alternative 1 – No Action

Because there are no impacts to this species under Alternative 1, it would not contribute to any cumulative effects.

Alternatives 2, 3 and 4

No other timber harvest on Forest Service lands is reasonably foreseeable in the project area so there are no additional cumulative effects in the Trout Creek project area. Because effects to Sierra Nevada red fox home range are negligible and some proposed treatments in Alternative 2, 3 and 4 would be beneficial to SNRF's food source, ***it is my determination that, for the Sierra Nevada red fox, the proposed Alternatives 2, 3 and 4, may adversely impact individuals, but would not likely result in a loss of viability in the Planning Area, nor cause a trend toward federal listing. Alternative 1, would have no impact on this species.***

Survey and Manage Species

The Northwest Forest Plan was amended with standards and guidelines for conducting project surveys and managing known sites for certain rare or endemic species that were associated with late successional forest habitat (USDA and USDI, 2001). The species covered by this direction are referred to here as "Survey and Manage" species. There are four wildlife Survey and Manage species on the Willamette National Forest: Crater Lake tightcoil snail, Oregon megomphix snail, red tree vole, and great gray owl. Table 36 summarizes the needs and results of Survey and Manage species.

Table 36: List of Survey and Manage Species associated with the Sweet Home Ranger District and their occurrence in the project area

Species	S&M Category	Survey Triggers			Survey Results			Site Management
		Within Range of the Species?	Contains Suitable Habitat?	Habitat Disturbing?	Surveys Required?	Survey Date (month/year)	Sites Known or Found?	
Vertebrates								
Great Gray Owl (<i>Strix nebulosa</i>)	A	Yes	Yes	No	No	N/A	N/A	Units are not within proximity of nesting habitat
Red Tree Vole (<i>Arborimus longicaudus</i>)	C	Yes	Yes	Yes	Yes	2013-2016	Yes	Most units with vole activity were dropped or buffers were placed
Mollusks								
Crater Lake Tightcoil (<i>Pristiloma articum crateris</i>)	A	Yes	Yes	No	No	N/A	N/A	All suitable habitat would be adequately buffered by a minimum of 10 meters
Oregon Mmegomphix (<i>Megomphix hemphilli</i>)	A	Yes	Yes	Yes	Yes	2015	Yes	Most units with megomphix activity were dropped or buffers were placed

Affected Environment – Great Gray Owl

This species is most common in lodgepole pine forests adjacent to meadows, yet in some locations like the Willamette National Forest, shelterwood harvesting has also been found to be beneficial because it opens up closed forest canopy cover for foraging (Forest Service and Bureau of Land Management, 2001). The required habitat characteristics of suitable great gray owl habitat include: (1) mature or old-growth conifer stands, (2) with canopy cover >50%, (3) within proximity [660 feet] to openings > 10 acres that could be used as foraging areas, and (4) containing potential nest trees (Survey Protocol for the great gray owl within the range of the Northwest Forest Plan v4.0, October 2016). There are no known great grey owl nest sites in the project area. Pre-disturbance survey(s) for the great gray owl are not required because the proposed harvest units in Alternative 2 do not have proximity to natural openings > 10 acres, and pre-disturbance surveys are not required in suitable nesting habitat adjacent to man-made openings at this time (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v4.0, October 2016).

Environmental Consequences – Great Gray Owl

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would not affect great gray owl or its habitats because no activities are proposed to occur.

Alternatives 2 and 4

Proposed harvest units in Alternatives 2 and 4 do not have proximity to natural openings > 10 acres or potential nesting habitat. Early seral habitat may initiate an early successional stage that can support small-mammal populations. Alternative 2 proposes 101 acres of early seral creation and 35 acres of gap which may enhance opportunities for great grey owl foraging and Alternative 4 proposes an additional 22.5 acres in gaps when compared to Alternative 2.

Alternative 3

Alternative 3 does not propose harvest in stands identified as being near historic great gray owl locations or near openings 10 acres in size or greater. Alternative 3 would create approximately 43 acres of gaps, which may enhance opportunities for great gray owl foraging.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have not affect great gray owl or modify their habitat; therefore, no cumulative effects exist to be considered.

Alternatives 2, 3 and 4

Proposed activities are not proposed to occur within or near known great grey owl nesting habitat and treatments may improve foraging habitat. Therefore, **Alternatives 2, 3 and 4 would have a beneficial effect or no negative impacts to this species. These actions would maintain species persistence and viability.** There are no other reasonably foreseeable or ongoing projects that would impact great grey owls or their habitat.

Environmental Consequences – Crater Lake Tightcoil Snail

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no effects to the Crater Lake tightcoil because no activities are proposed to occur.

Alternatives 2, 3 and 4

Pre-disturbance surveys for the Crater Lake tightcoil are not required because all proposed harvest units in Alternatives 2, 3 and 4 containing suitable habitat would be adequately buffered by a minimum of 10 meters following the management recommendations for this species (BLM, 2002). Protection buffers

would be placed around perennial wetland areas. Thus, no impacts are expected to occur to this species.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would not affect the great grey owl; therefore, no cumulative effects exist to be considered.

Alternatives 2, 3 and 4

Because all perennial wetlands would be protected by buffers, ***no impacts are expected to occur and the overall population viability in the project area would be maintained and the persistence of the species should not be compromised***. The on-going Canyon Thin project and the future Jude Ridge and Calapooia projects have no effects on this species.

Affected Environment – Oregon Megomphix

This snail occurs at low to moderate elevations, below the zone of seasonally persistent snow pack. Megomphix snails are most often found within the mat of decaying vegetation under sword ferns and big-leaf maple trees and near rotten logs. Most occupied sites are on well-shaded slopes and terraces, and many are near streams (Applegarth, 2000). Pre-disturbance surveys to protocol standards were conducted in the project area. Surveys found 49 Megomphix occupied sites in stands with suitable habitat. Stands under 80 years of age proposed for thinning were not surveyed as these stands fall under the category for Survey and Manage wildlife species, exemptions “A”, under the “Pechman exemptions.”

Environmental Consequences – Oregon Megomphix

Direct and Indirect Effects

Alternatives 1 – No Action

Alternative 1 would have no effects to Oregon Megomphix or their habitat because no activities are proposed to occur.

Alternatives 2, 3 and 4

All units where Megomphix activity was found were dropped, with the exception of two units. Unit 170 and 190 contain three and two sites, respectively. A one acre no-harvest buffer has been placed around each site following management recommendations (Applegarth, 2000). Thus, no impacts are expected to occur to this species.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have no effects to Oregon Megomphix or modify their habitat; therefore, no cumulative effects exist to be considered.

Alternatives 2, 3 and 4

Because units where Megomphix are located were dropped and protection buffers were placed, no impacts are expected to occur therefore, ***no concerns for species persistence exists and the population viability is expected to be maintained.*** There are no other reasonably foreseeable or ongoing projects that would impact this species.

Affected Environment – Red Tree Vole

The standards and guidelines to conduct red tree vole surveys were developed, along with other habitat protection measures from the Northwest Forest Plan, to provide a reasonable assurance of persistence of certain species, such as red tree vole, which were believed to be rare and uncommon across the range of the Northwest Forest Plan at the time it was developed. For vertebrate species, like voles, this persistence objective is consistent with the goals of providing for viable and well-distributed populations under the National Forest Management Act Regulations (USFS and BLM, 2001; USFS and BLM, 1994).

The Trout Creek project contains suitable habitat for this species. Pre-disturbance red tree vole surveys were conducted in the project area in line with surveys protocols (USFS and BLM, 2012). Units were dropped or buffered where red tree vole activity was found in accordance with management recommendations for this species (USFS and BLM, 2000). Project surveys were not required in stands to be thinned under 80 years of age for Survey and Manage wildlife species due to exemptions “A”, under the “Pechman exemptions.”

Environmental Consequences – Red Tree Vole

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no effects to red tree voles or their habitat because no activities are proposed to occur.

Alternative 2 and 4

Surveys found vole activity in stands with suitable habitat. All units where vole activity was found were dropped, with the exception of four units. Unit 170 contains two active nests, a 10 acre no-harvest buffer has been placed around each active site to protect nests. Unit 28 is a managed stand with marginal vole habitat, an active vole nest was found during surveys, this site would be buffered by one site-potential-tree to protect the nest. Units 92 and 43, were found to each have one active nest and one inactive vole site. The prescribed treatment of underplanting native species in these two units are not considered ‘habitat-disturbing’ treatments; therefore, a buffer is not necessary.

Alternative 3

This alternative does not propose harvest in stands over 80 years of age. Treatments would occur on 654 acres of low quality red tree vole habitat. Surveys were not conducted in these stands given that these units fall under the Pechman exemption category.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have no effect to red tree voles or modify their habitat; therefore, no cumulative effects exist to be considered.

Alternative 2, 3 and 4

Alternatives 2, 3 and 4 adhere to the 2001 Survey and Manage direction and protects all known red tree vole sites. Proposed activities are expected to occur outside of known red tree vole active sites and such proposed activities may impact individuals of the population by reducing canopy cover, connectivity and canopy complexity. In the active red tree vole areas, dispersal would be difficult and suitable habitat would be restricted to riparian and suitable habitat corridors until the area recovers to mature stand conditions. Therefore, Alternatives 2, 3 and 4 may impact individuals or their habitat temporarily, but the actions would maintain species persistence and viability. There are no other reasonably foreseeable or ongoing projects that would impact red tree voles or their habitat.

Management Indicator Species

The use of management indicator species in project planning is established by the 1982 National Forest Management Act planning regulations. Management indicator species are species whose response to land management activities can be used to predict the likely response of a wide range of species with similar habitat requirements. The “Final Environmental Impact Statement for the 1990 Willamette National Forest Land and Resource Management Plan” identified management indicator species and the rationale for their selection (USDA, 1990). A requirement is that viable populations of management indicator species be maintained at the Forest level. The effects of the alternatives on northern spotted owl are addressed above in a specific section for that species. The project Biological Evaluation concluded that the action alternatives would have no impact on bald eagles because the treatments do not affect lakes and fish-bearing streams. The Biological Evaluation also determined that the action alternatives may impact peregrine falcons because all three management zones would be affected; however, it would not likely result in a loss of viability. Table 37 summarize the wildlife management indicator species for the Willamette National Forest. The effects of the alternatives on the remaining management indicator species are addressed below.

Table 37: Wildlife management indicator species for the Willamette National Forest

Indicator Species	Indicator Habitat	Reason Selected in 1990
cavity excavators ¹	dead and decaying trees	ecological indicator, limited habitat
elk	winter range	commonly hunted
deer	winter range	commonly hunted
pileated woodpecker	old growth and mature conifers	ecological indicator, limited habitat
marten	old growth and mature conifers	ecological indicator, limited habitat
northern spotted owl ²	old growth and mature conifers	ecological indicator, limited habitat, proposed threatened species ²
bald eagle ³	old growth conifers near large bodies of water	federally threatened species ³
peregrine falcon ³	cliff nesting habitat near abundant prey	federally endangered species ³

¹ USDA Forest Service (1990) identified the following species in this group: red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis woodpecker, black-backed woodpecker, and northern three-toed woodpecker.

² Became a federally threatened species in June 26, 1990, as the Willamette NF Plan was being finalized.

³ Bald eagles and peregrine falcons were subsequently delisted and are now Forest Service sensitive species.

Affected Environment - Cavity Excavators, Pileated Woodpecker and Deadwood Abundance

Cavity excavator MIS are used as an ecological indicator for the abundance of dead and decaying trees. Pileated woodpeckers are MIS that use snags, but also prefer old and mature forests. Cavity excavator MIS species that occur or have potential habitat in the proposed Trout Creek units are red-breasted nuthatch, northern flicker, hairy woodpecker, Lewis woodpecker, downy woodpecker, red-breasted sapsucker, black-backed woodpecker, pileated woodpecker and northern-three toed woodpecker.

Lewis woodpecker is a Forest Service sensitive species the does not breed on the Sweet Home Ranger District but occurs along the Cascade Mountain ridges in the fall (Marshall et al., 2003; NRIS Wildlife database). Effects to Lewis woodpecker are addressed above in a specific section for the species. The project Biological Evaluation concluded that effects to potential foraging habitat are insignificant at the project and forest scale and some project activities would have a beneficial effect to foraging habitat; therefore, the alternatives would have a beneficial or neutral impact on the Lewis woodpecker.

None of the other species are federally listed Endangered or Threatened Species, Forest Service Sensitive species, U. S. Fish and Wildlife Service Birds of Conservation Concern (USFWS, 2008), or species that are regionally identified as having current viability concerns. Population trends for these species from breeding bird surveys from 1996–2013 indicate stable populations in Oregon for hairy woodpecker and downy woodpecker, and increasing population trends for pileated woodpecker and red-breasted sapsucker (Sauer et al., 2014). A decline in northern flicker and red-breasted nuthatch has been detected from 1996-2013. Northern flicker is a common resident species that is ubiquitous to most forest habitats in Oregon. They are most abundant in open forest habitat and along forest edges with available large (31 inches dbh or greater) snags (Marshall et al., 2003). The red-breasted nuthatch appears to be fairly common in Oregon and is somewhat flexible to use different forest types. This species is showing a slight population decline due to intensive forest management that reduces the amount of large diameter trees, snags, and structural diversity (Marshall et al., 2003). Despite a recent decline in numbers, both northern flickers and red-breasted nuthatches are well above population levels that would suggest a viability concern.

Deadwood Abundance/DecAID Project Analysis

A collection of information, referred to as DecAID, has been developed by Region 6 to help projects identify the levels of snags and downed logs required to meet wildlife population needs (Forest Service, 2012). At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability. The proposed treatments are within the 5th field South Santiam watershed which was used to evaluate deadwood at the landscape level for this project (less than 32 acres occur in the Middle Santiam River 5th field watershed, for the purposes of this analyses, since 32 acres is a negligible amount, these acres are analyzed in combination with the rest of the project acres in the South Santiam River 5th field watershed).

DecAID evaluates deadwood levels by wildlife habitat type. The South Santiam watershed contains about 27,127 acres of Montane Mixed Conifer Forest and 39,455 acres of Westside Lowland Conifer-Hardwood Forest habitat (Acker, 2015). Treatment units in the Trout Creek project are in these habitat types.

DecAID takes advantage of the spatially-comprehensive dataset of vegetation structure developed for Oregon and Washington by a team from the Pacific Northwest Research Station and Oregon State University using the statistical imputation method Gradient Nearest Neighbor (GNN) (LEMMA, 2015). DecAID includes a process (“Distribution Analysis”) that allows use of GNN data to evaluate the current

frequency distribution of different densities of snags and amounts of cover of down wood within geographic areas such as watersheds selected by users. By using inventory plot data from unharvested areas and information on historic disturbance regimes, the process also allows estimation of reference conditions for both snags and down wood (Forest Service, 2012).

The median historic condition for the South Santiam River watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages and an estimate of the normal distribution of seral stages derived from the assumed fire return interval (Acker, 2015). Median values are the mid-point where half of the time deadwood levels would be at or higher than that value and about half the time they would be at or lower than the value. Studies have indicated that fire frequency and severity varied considerably in the past due to substantial variability in weather conditions, and fire severity varied from century to century (Wimberley et al., 2000). Therefore, levels of dead wood have fluctuated considerably over time and plus or minus 50% of the estimated median value was used to approximate the historic range of variability.

Downed Logs

DecAID analysis (Acker, 2015) found that downed logs in the total large size class (> 20 inches diameter) in the Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest in the South Santiam River watershed were similar to estimated historic median conditions (Figure 27 and Figure 29). That means that the abundance of downed logs currently is similar to what was historically present within the South Santiam River watershed. For small size class (> 5 inches diameter) downed logs in the Westside Lowland Conifer-Hardwood Forest habitat type and Montane Mixed Conifer Forest habitat type the portion of the landscape with 2-4% cover is more than 1.5 times reference conditions (Figure 26 and Figure 28).

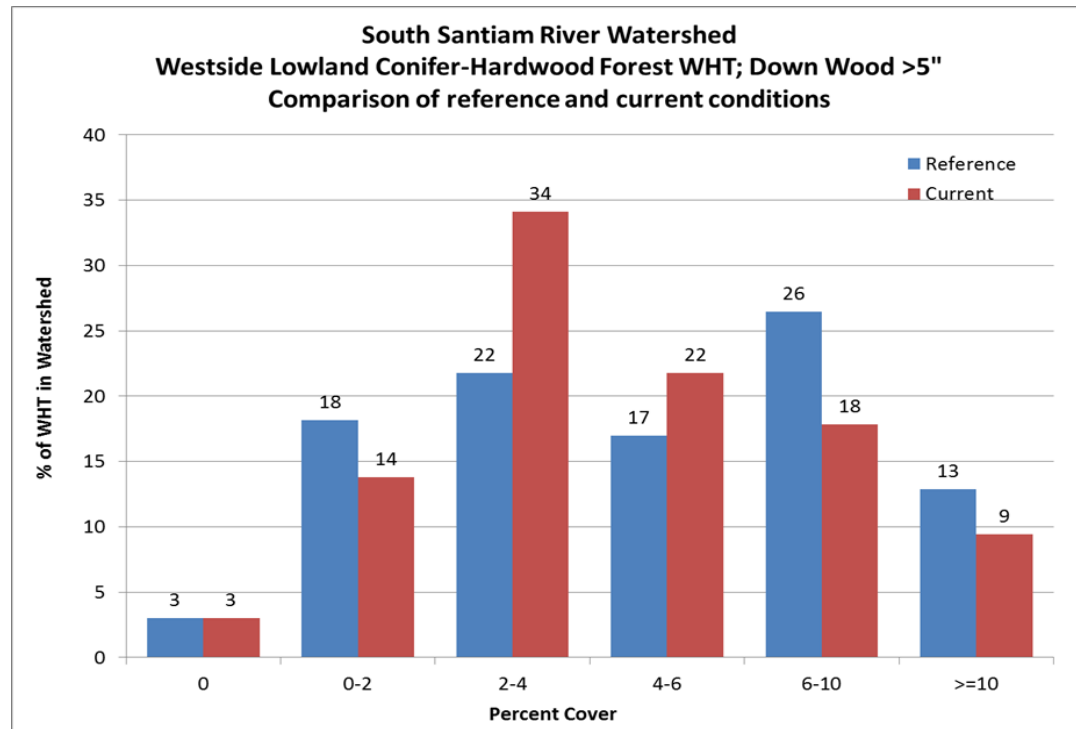


Figure 26: DecAID analysis showing estimated current and historic downed wood for the South Santiam River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker, 2015)

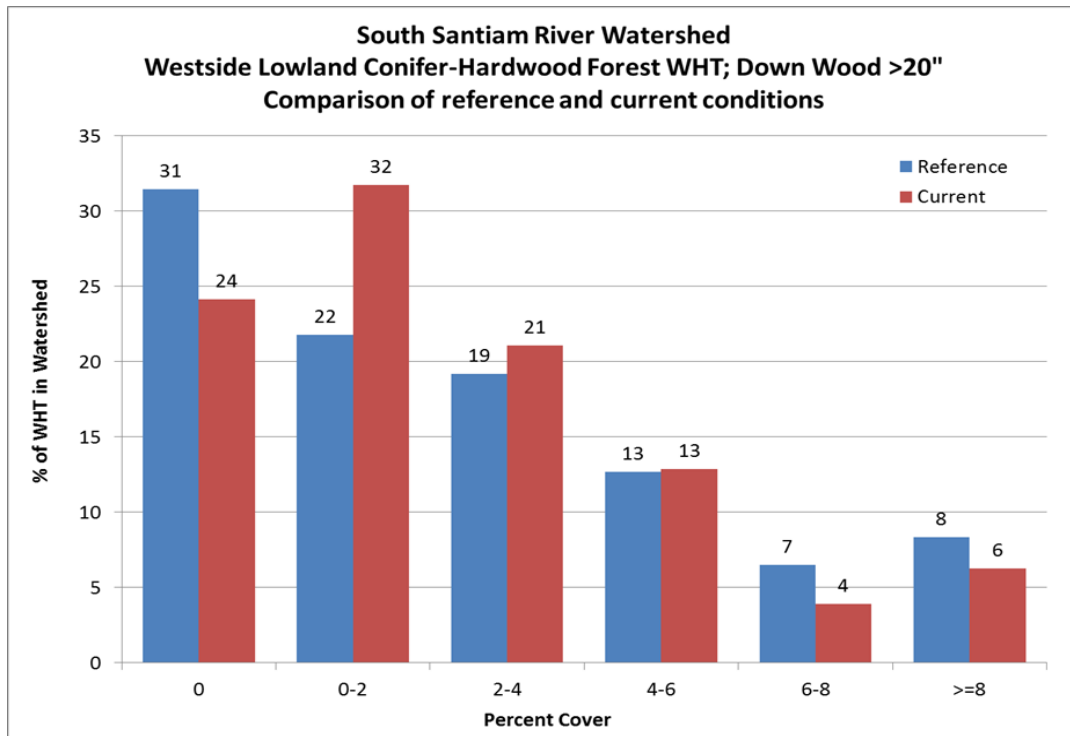


Figure 27: DecAID analysis showing estimated current and historic large-diameter downed wood for the South Santiam River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker, 2015)

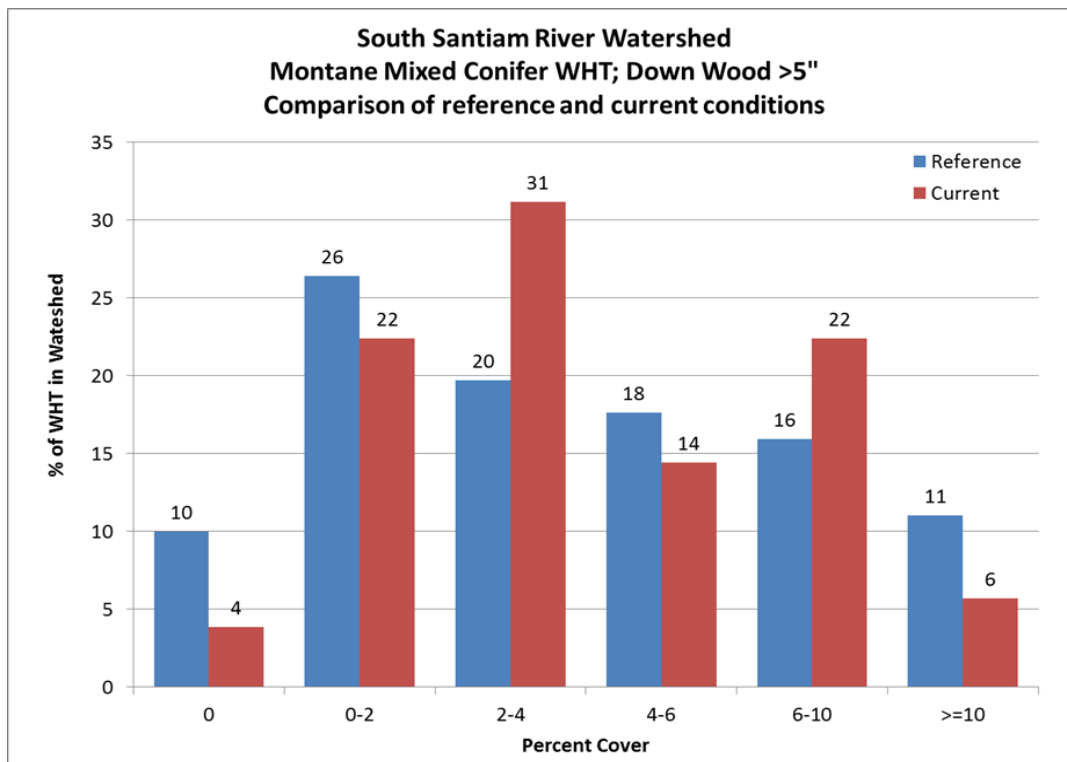


Figure 28: DecAID analysis showing estimated current and historic downed wood for the South Santiam River watershed in Montane Mixed Conifer habitat (Acker, 2015)

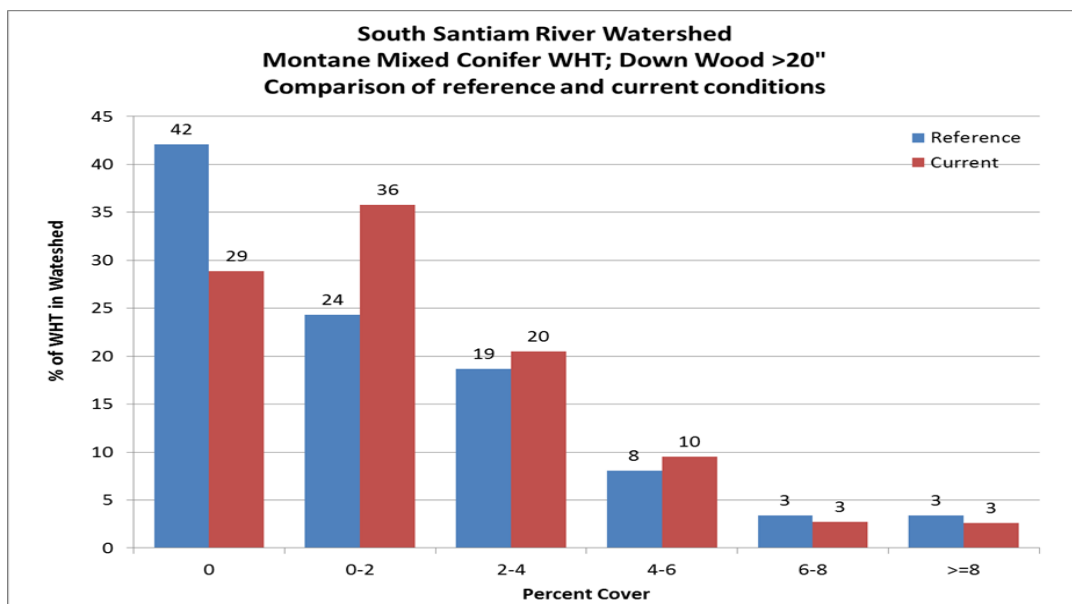


Figure 29: DecAID analysis showing estimated current and historic large-diameter downed wood for the South Santiam River watershed in Montane Mixed Conifer habitat (Acker, 2015)

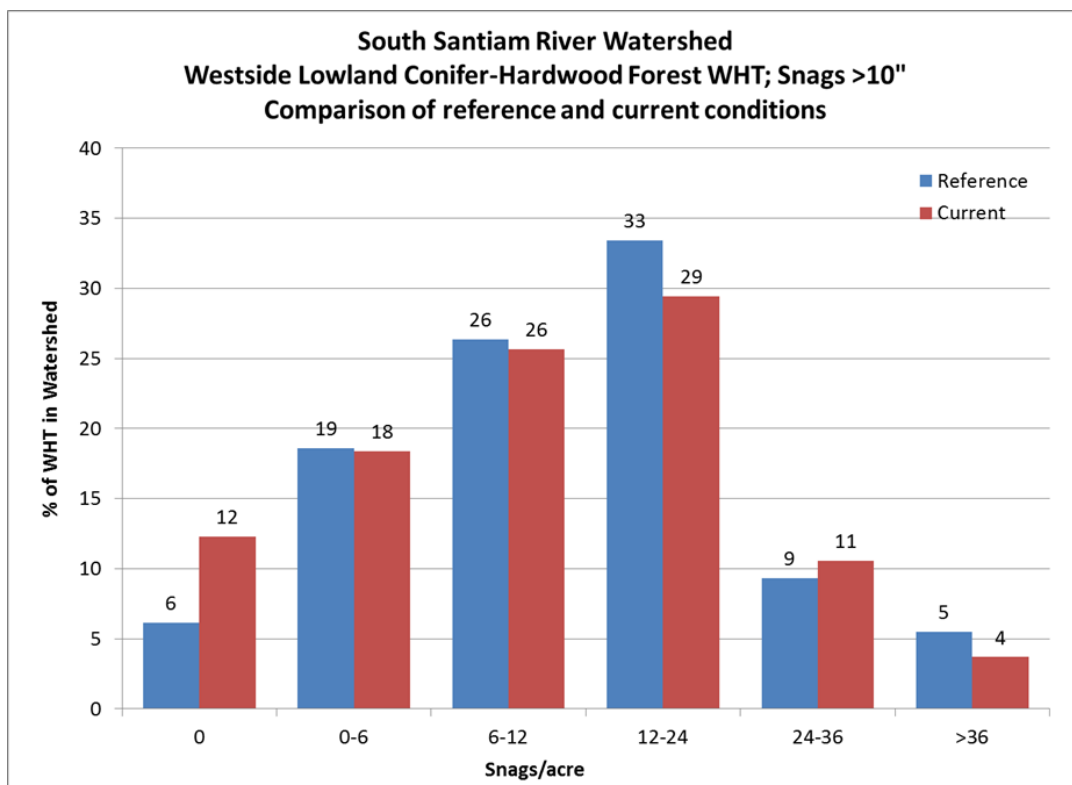


Figure 30: DecAID analysis showing estimated current and historic snags for the South Santiam River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker, 2015)

Snags

DecAID analysis (Acker, 2015) found that snags in both total size class (> 10 inches dbh) and large size class (>20 inches dbh) for both Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest were less than estimated historic median conditions (Figure 30, Figure 31, Figure 32, and Figure 33). In particular, the percent of area with no snags is higher now than what historically occurred, according to the DecAID analysis. For snags greater than 10 inches dbh, 12% of the Westside Lowland Conifer-Hardwood Forest and 14% of the Montane Mixed Conifer Forest in the South Santiam River watershed have no snags compared to an estimated historic median condition of 6% for both habitats (Acker, 2015). For snags greater than 20 inches dbh, 22% of the Westside Lowland Conifer-Hardwood Forest and 25% of the Montane Mixed Conifer Forest in the South Santiam River watershed have no large snags compared to an estimated historic median condition of 11% and 15%, respectively. Past logging and fire suppression are likely important reasons why large areas in the watershed lack snags.

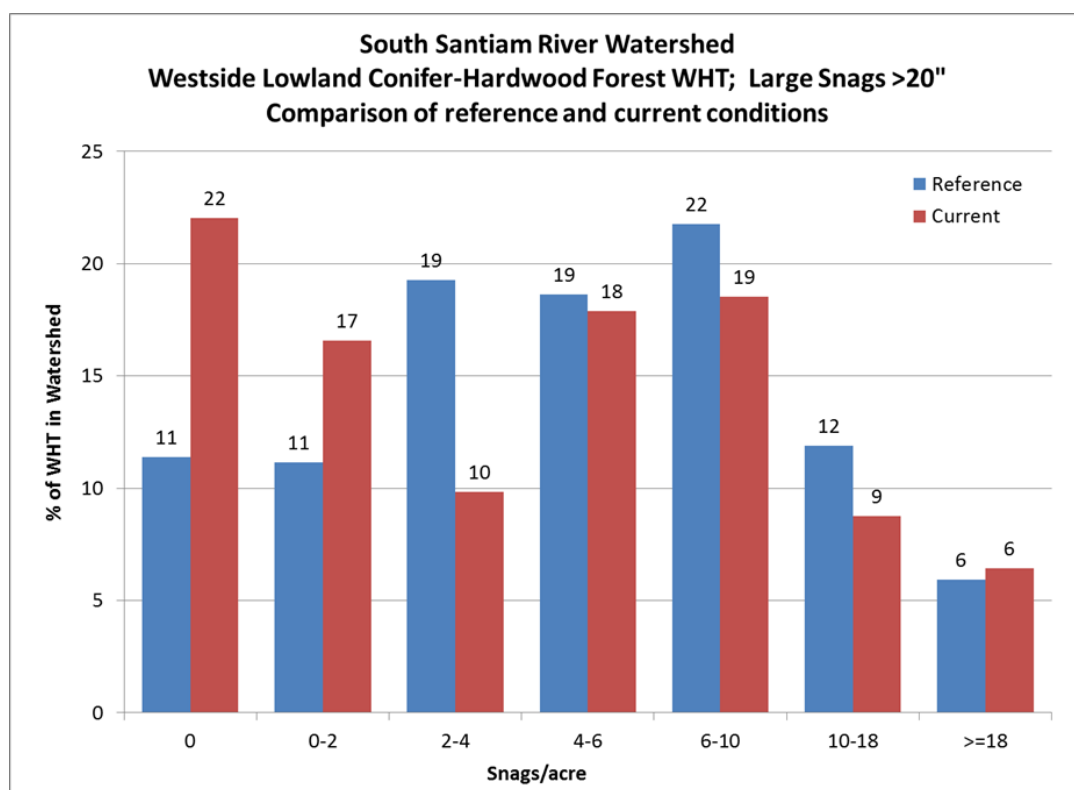


Figure 31: DecAID analysis showing estimated current and historic large-diameter snags for the South Santiam River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker, 2015)

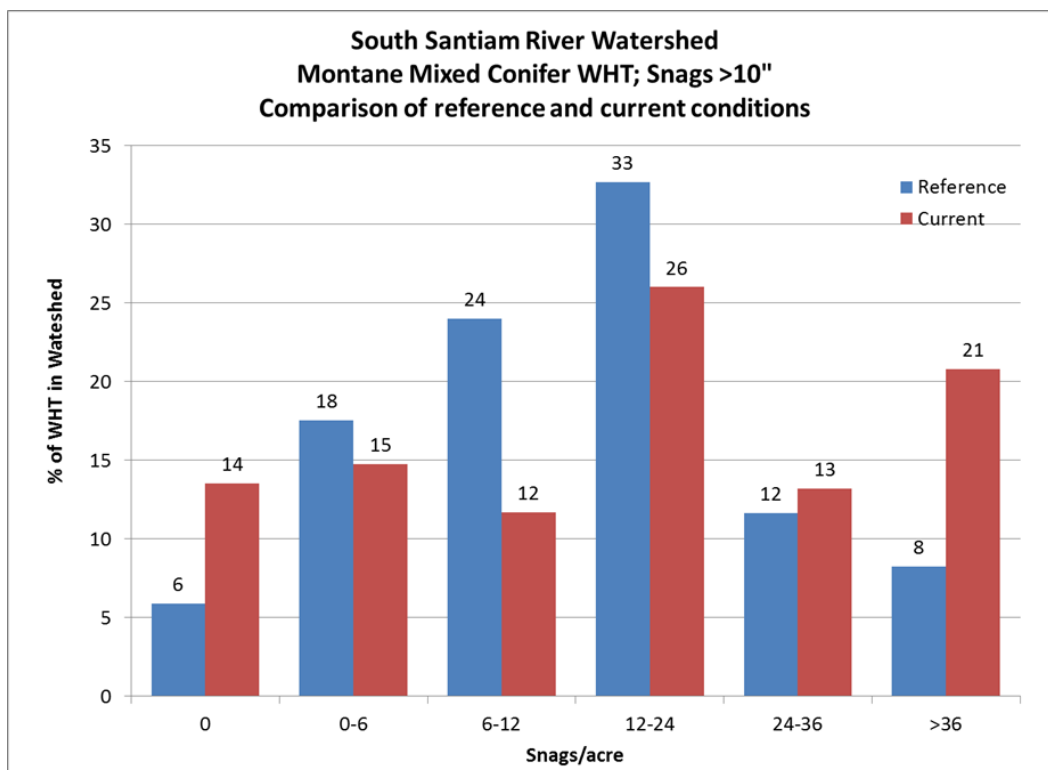


Figure 32: DecAID analysis showing estimated current and historic snags for the South Santiam River watershed in Montane Mixed Conifer habitat (Acker, 2015)

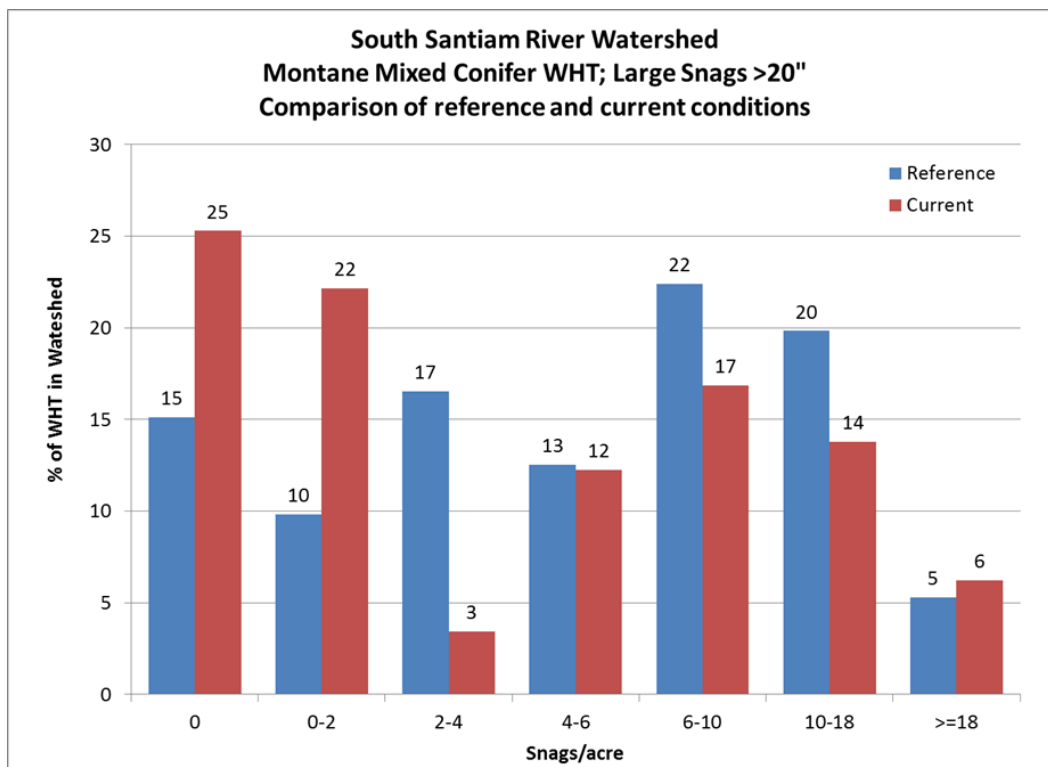


Figure 33: DecAID analysis showing estimated current and historic large-diameter snags for the South Santiam River watershed in Montane Mixed Conifer habitat (Acker, 2015)

Cavity Excavator Snag Population Potential Analysis

The Willamette National Forest Plan has a Standard and Guideline (FW-121) that states: “Habitat capability for primary cavity excavators shall be maintained to provide for at least 40% or greater potential populations. Habitat shall be provided and monitored at the sub-drainage level.” The method that the Forest Plan used to calculate habitat population potential is no longer considered “best science” for determining that viable populations will be maintained, but it does provide for a minimum number of snags at the watershed scale.

In order to determine the current distribution of large snags and the capability of the landscape to support primary cavity excavators, an analysis was conducted at the forest level for all 5th field watersheds using the DecAid snag estimates (Willamette SO, wildlife files).

The 20-inch dbh and above size class available in the DecAID snag analysis data was used in these calculations, while the snag population potential method is based on 18-inches dbh and above. Consequently, the results slightly underestimate population potential because snags 18-19.9 inches dbh are not counted. Snag habitat potential in each watershed did not include acres on private land since the population potential standard applies to Forest Service lands.

The calculations indicate that, on the Willamette National Forest, there is a current snag population potential of about 54% in the Westside Lowland Conifer Hardwood habitat type and 56% in the Montane Mixed Conifer habitat type. In the South Santiam River watershed, the current snag population potential is estimated at about 63% in the Westside Lowland Conifer Hardwood habitat type and 58% in the Montane Mixed Conifer habitat type. The analysis suggests that the Trout Creek project area is above the minimum snag population potential of 40%, and above the average condition across the Forest.

Snags in Westside Lowland Conifer-Hardwood and Montane Mixed Conifer Forest Habitat Types

The snag analysis suggests that for both the Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest habitat, snags are currently below historic levels in the South Santiam River watershed (Table 38). The current low density of snags and greater percentage of areas lacking higher levels of snags compared to historic conditions is mainly due to past clear-cut harvesting that removed existing snags as well as the trees that could provide future snags. Additionally, fire suppression results in fewer acres burned by wildfires which may have also reduced deadwood abundance in the watershed (refer to Fire and Fuels section).

Table 38: Estimated Snag Population Potential for the Westside Lowland Conifer Hardwood (WLCH) and Montane Mixed Conifer (MMC) Wildlife Habitat Types in the South Santiam River Watershed and in Willamette National Forest

Analysis Area	Habitat Type	Current	Historic
South Santiam River Watershed	WLCH	63%	77%
Willamette National Forest	WLCH	54%	75%
South Santiam River Watershed	MMC	58%	74%
Willamette National Forest	MMC	56%	74%

Hundreds of wildlife trees have been created in various harvest units in the South Santiam River watershed since the late 1980s to mitigate for the loss of snags from timber harvest and ongoing fire suppression activities. Treatments used were girdling, inoculate, saw-top, and combinations of these various treatments. Snag creation is a post-harvest activity that is proposed in the Trout Creek project area. Additionally, to maintain current snag population potential conditions, all silviculture treatments

would require that all snags and down wood in harvest units be retained (except those needed to be fallen for safety or operational concerns). An assessment of snag levels would be conducted after prescribed burning to ensure that Forest Plan standards and guidelines of maintaining or creating 2 snags per acre are met. Moreover, a minimum of two snags per acre would be created in all early seral creation (i.e., aggregate retention) units

Logs in Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest Habitat Types

Although current levels of large downed logs are within historic levels, the Northwest Forest Plan specifies 240 linear feet of logs per acre greater than or equal to 20 inches must be retained in regeneration harvest units (early seral creation/aggregate retention). Logs less than 20 feet in length cannot be counted towards this total, and only decay classes 1 and 2 can be counted. Down logs must reflect the species mix of the original stand. In the Trout Creek project units proposed for early seral creation, 5 trees per acre (or 240 linear feet) of fall and leave would be implemented from Douglas-fir reserve trees to meet Forest Plan standards. Approximately 9 acres of down wood creation is also proposed in the Riparian Reserves in Units 33 and 34. The fall and leave trees would provide down wood for nutrient recycling, habitat for aquatic and terrestrial species, gaps for diversity of structure, and recruitment for vegetation diversity.

FSVeg Tolerance Levels Analysis

Stand exam data was collected from 14 stands proposed for commercial treatments in the Trout Creek project. Eleven of the stands are managed stands, and three are fire-origin stands. They are representative of the conditions of all stands proposed for treatments. Based on this data, in managed stands there is an average of 15 snags/acre greater than 6" DBH, with a weighted quadratic mean diameter of 9.6". In fire-origin stands, there is an average of 54 snags/acre greater than 6" DBH, with a weighted quadratic mean diameter of 14.3". Within the plots sampled, snags ≥ 20 " diameter were uncommon.

The Forest Vegetation Simulation model was run using stand exam data to estimate the change in snags over time for No-action and action Alternatives 2, 3, and 4 (Figures 34 and 35). The model only factors in background mortality over time due to competition, and does not account for dead wood created or lost through logging damage, prescribed fire, or stochastic events such as wind or wildfire. The model runs for action alternatives only factor in snag dynamics in treated areas, skip areas would follow the no-action trends.

DecAID provides data on wildlife use of CWD habitat under natural conditions based on the most recent research available. Tolerance levels are used to indicate a level of assurance for providing habitat that meets the needs of wildlife species. The higher the tolerance level is for the species, the more individuals in the population that are likely being provided habitat. The graphs below include the 30%, 50%, and 80% tolerance levels for wildlife as displayed by the dashed lines. The tolerance levels used in the graphs are derived from the DecAID narrative for Westside Lowland Conifer-Hardwood Forest habitat of the Western Oregon Cascades when the objective is to manage for wildlife, ecosystem functions, and natural conditions. Tolerance levels for individual species vary widely and some species such as the pileated woodpecker prefer much higher densities of large (≥ 20 " diameter) snags compared to the general guidelines for wildlife.

Snags >10" DBH

Current levels of snags > 10" diameter are at or slightly above 30% tolerance level for wildlife in the proposed treatment units. Snags > 10" diameter are expected to stay the same or slightly decrease over the next 20 – 90 years before a slight rise in trajectory with thinning treatments. No treatment (No Action) areas would approach 50% tolerance level within the first 20 years and would continue to increase, peaking at approximately 80 years. After 80 years, snag levels would plateau slightly below 80% tolerance level.

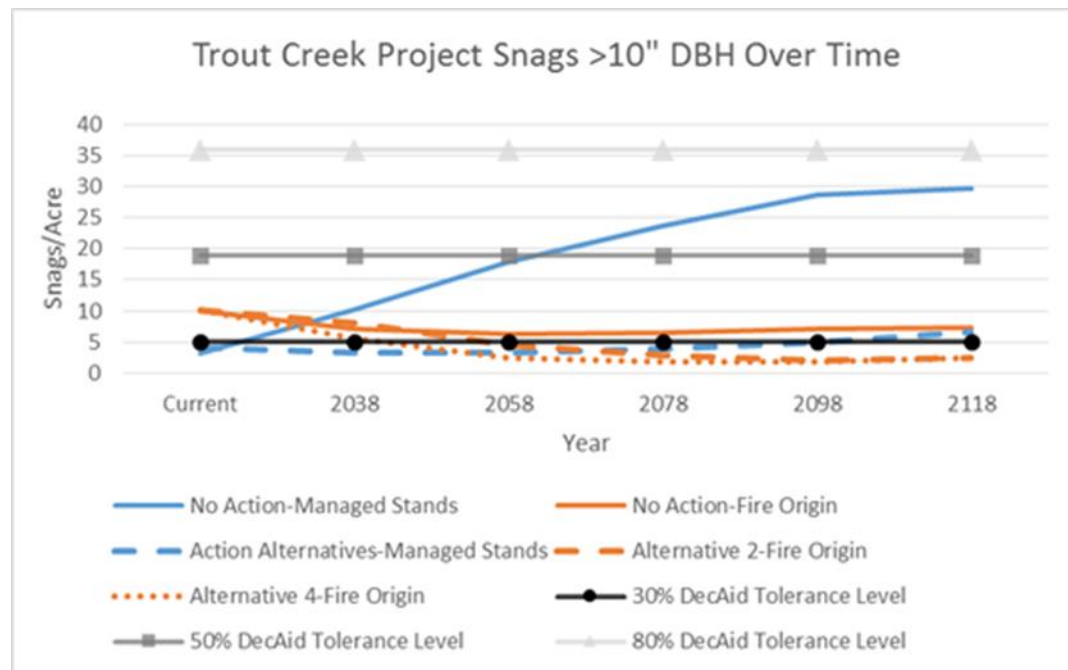


Figure 34: Forest Vegetation Simulation (FVS) showing short and long term changes over time to snags >10 inches for Alternatives 1, 2, 3, and 4 in the Trout Creek Project units.

Snags > 20"DBH

Current levels of snags >20" diameter are not well represented in the proposed treatment units and fall below the 30% tolerance level for wildlife. The number of snags > 20" diameter would remain the same, below the 30% tolerance level, for wildlife in thinning treatments for the next 100 years. No treatment (No Action) areas in managed stands would approach the 30% tolerance level in approximately 80 years and would continue to increase at a fast rate, eventually reaching between the 30 and 50% tolerance range in 90 to 100 years.

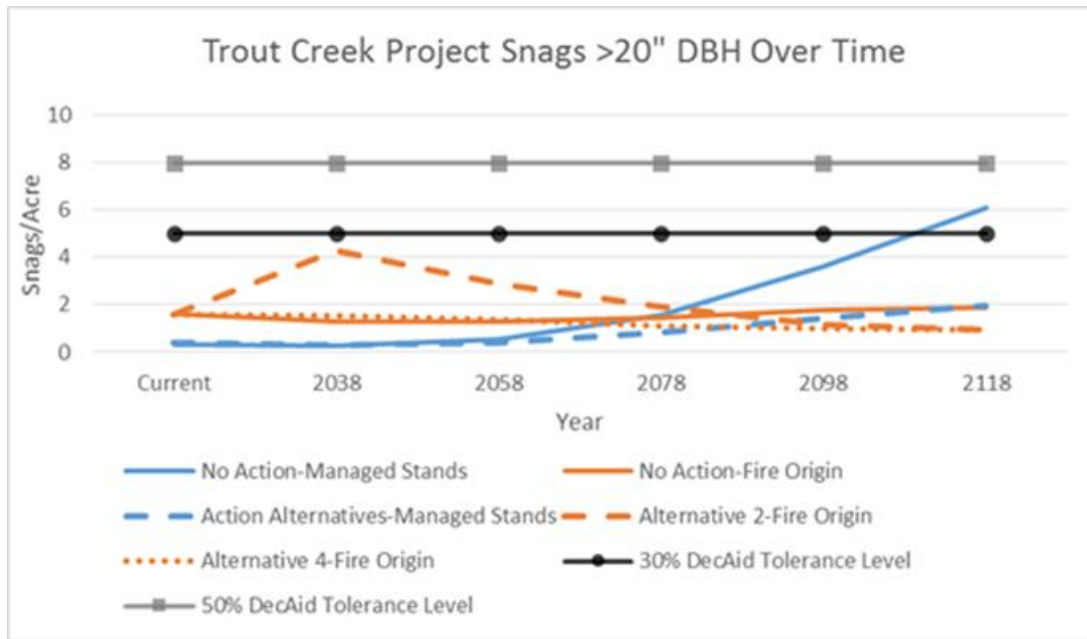


Figure 35: Forest Vegetation Simulation (FVS) showing short and long term changes to snags >20 inches in the Trout Creek Project units.

CWD habitat is managed under Standards and Guidelines (S&Gs) in the Willamette Forest Plan as amended by the Northwest Forest Plan ROD. S&Gs for CWD levels are directed at retention and recruitment associated with regeneration harvest. In cases where management plan allocations overlap, the more restrictive standards and guidelines of both allocations apply. As part of the post-harvest plan, post-treatment snag assessment would occur at the stand level and snag creation would be implemented in stands with less than 2 large snags per acre on average. The assessment would account for snags lost to hazard tree removal and for snags created through logging damage and underburning. Assessing post-treatment snag levels would help meet minimum desired levels and avoid excessive snag creation in the event that logging activities or underburning result in higher than expected mortality. In addition, to reduce impacts to deadwood dependent wildlife species, the following design features would be applied:

- Retain current snag, defective tree, and down wood habitat to the greatest extent feasible during project activities.
- Apply measures such as contour falling, strategic placement, or piling to maximize wildlife use potential for dead wood when safety or logistic reasons prevent protection of existing features.
- Assess green tree mortality associated with prescribed underburning to document accuracy of mortality estimate and anticipated post-treatment snag levels to ensure applicable prescriptions are met.

The DecAID analysis shows that the current condition of large snags in the watershed is below reference conditions. Although large snag creation in the treatment units is expected to have a short-term benefit to wildlife, it is not expected to measurably improve large snag levels at the watershed scale since the proposed treatment units make up about 1% percent of the watershed analysis area.

Large down wood is within historic levels at the watershed level. Trends with large down wood in treated areas would be expected to follow similar patterns as snags, although with a lag time to allow

for snags to chunk down and become down wood. The effects would not measurably affect down wood levels as treatment units would make up only 1% of the watershed analysis area.

Environmental Consequences – Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no impact on any cavity excavator MIS or pileated woodpeckers and would not affect current levels of snags and dead wood. The forest would continue to develop towards old-growth and this should result in a future increase in large snags and large downed logs in those stands and improve future habitat for woodpeckers that prefer old forest habitat, such as the pileated woodpecker.

There would be no increase in habitat for species, such as northern flicker, that prefer forest edges and open forest habitat with large snags. There would be no additional wildlife tree and large down wood creation.

Alternatives 2, 3 and 4

Snag abundance may initially decline on 1,016 acres of forest in Alternative 3 and 1,358 acres of forest in Alternatives 2 and 4. It should be noted that these acres exceed the total harvested acres because they include skips, gaps and untreated Riparian Reserves, all of which may be impacted if they contain older snags that pose a safety hazard to the logging operations. Many of the managed stands proposed for thinning in the alternatives have few, if any, large snags present currently, and so few large snags are expected to be lost in those areas. Trout Creek design features to create snags in the regeneration units in Alternatives 2 and 4 and protect existing snags where possible would mitigate this effect. In addition, post-harvest snag and down wood creation is proposed in thinning units as part of the KV plan.

The proposed Trout Creek harvest alternatives would affect snags and downed logs on about 3.6% of the total project area. No other timber harvest is reasonably foreseeable on NFS lands in the South Santiam River watershed. Clear-cut harvesting is expected to continue on the 8,202 acres of private lands in the watershed. These private lands are mostly previously logged forests with current low levels of snags and downed logs. Considering cumulative effects, downed wood levels in the South Santiam watershed are expected to remain within historic levels and increase over time as past regeneration harvest areas on NFS lands mature. Snag levels in the watershed are expected to initially remain below historic levels in the Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest habitats. Snag levels are expected to increase over time, however, and return to the range of historic variability as past regeneration harvest areas on NFS lands develop towards mature and older forest stages. Because leave trees would be retained, and snags and downed logs would be created well above minimum Forest Plan Standards and Guidelines the proposed Trout Creek project would temporarily degrade, but not remove, habitat for most cavity excavators.

There may be benefits to treating the older stands above 80 years of age in Alternatives 2 and 4 to Northern flickers since they prefer large snags, forest edges, and open forest habitat, all of which would be created by the silviculture treatments. Pileated woodpeckers are expected to continue to use the older stands after treatment since they are known to use shelterwood harvest areas (Forest Service 1990: III-73). Assuming that suitable owl habitat would be preferred pileated woodpecker habitat, Alternatives 2 and 4 would degrade 218 acres, or less than 1%, of this habitat in the Trout Creek project

area. Alternative 3 would not treat any suitable spotted owl habitat and would thus not degrade any pileated woodpecker habitat.

Cumulative Effects

Alternative 1 – No Action

Because there would be no impact to cavity excavators MIS, pileated woodpecker, or dead wood with Alternative 1, there are no cumulative effects to consider.

Alternatives 2, 3 and 4

Using the combined acres of suitable and dispersal owl habitat, which represent forests with trees capable of producing 11 inches and larger snags, as a proxy for general cavity excavator habitat, Alternatives 2 and 4 would degrade 1.1% of the habitat in the Trout Creek project area and Alternative 3 would affect 0.2%. Hazard tree removal along the haul route is also expected to result in a very slight additional decrease in snag habitat within the project area. The on-going Canyon Thin project and future Jude Ridge project would not affect the Trout Creek planning area. Private lands, which make up 22% of the project area, are expected to remain relatively poor habitat for cavity excavator MIS and pileated woodpeckers. Because Alternatives 2, 3 and 4 would impact only a small amount of the available habitat, snag and downed wood mitigation measures would be implemented, the individual MIS species are not on any viability “watch-list”, and, considering cumulative effects, future down wood and snag levels are expected to increase as past clear-cuts on NFS lands mature. Alternatives 2, 3 and 4 are expected to maintain population viability of cavity excavator species and pileated woodpeckers in the project area and South Santiam watershed. The project would not contribute to any loss of viability of these species at the larger Forest scale.

Affected Environment - Elk and Deer

Elk and Deer Forage

Elk and deer are Forest management indicator species, not because of viability concerns, but because they are important big game hunting species in Oregon. The project area is in the state-designated Santiam and McKenzie Wildlife Management Units (WMU). Since the beginning of the Willamette Forest Plan in 1990, deer numbers and hunter success have fallen by about 50% and elk numbers have declined substantially below Oregon Wildlife Management Objectives (USDA Forest Service, 2011). Reduced forage quality and quantity due to the reduction in clear-cut logging on the Willamette National Forest are factors that may have played a role in this decline of elk and deer.

An elk nutrition model has been developed that predicts Dietary Digestible Energy (DDE) on the Willamette National Forest (Rowland et al., 2013) based on percent canopy cover (lower canopy cover, higher DDE), proportion of hardwoods (more hardwoods, higher DDE), and potential vegetation zone (silver fir/mountain hemlock forest types have higher DDE than western hemlock forests other factors being equal). Cook et al. (2004) found that increased summer forage quality (which DDE represents) improved elk reproduction and survival. An increase in summer and fall elk forage quality can directly increase calf weights prior to winter, overwinter calf survival, pregnancy rates, adult fall fat accumulation, and herd productivity (op cit.). The benefits of increased summer forage quality that have been demonstrated for elk are also expected for deer.

Recently, as part of the Willamette Forest Monitoring Report for 2014-2015, changes in elk forage quality were evaluated across the Forest by running the elk nutritional model using Gradient Nearest Neighbor (GNN) data. GNN data are widely used by the Forest Service for large-scale mapping and habitat trend analysis, including for the 20-year Northwest Forest Plan Monitoring (e.g., Davis et al. 2015, 2016). The years 1993 and 2012 were used as “bookends” to compare changes in elk nutrition on the Forest and in the project area and reflect the year with available GNN data that is closest to Year 1990, the start of the Willamette Forest Plan, and the most recent year with available GNN data, respectively.

The elk nutritional model (Rowland et al., 2013) divides elk forage into six classes ranging from poor to excellent (Table 39).

Table 39: Elk Forage Classes Relative to DDE values

DDE Class	DDE values
Poor	<2.40
Low-Marginal	≥-2.4 to <2.575
High-Marginal	≥-2.575 to <2.75
Low-Good	≥-2.75 to <2.825
High-Good	≥-2.825 to <2.90
Excellent	≥2.90

DDE = dietary digestible energy (kcal/g)

DDE values are estimated from two sets of equations for dominant potential vegetation types that are applicable to the Willamette NF (Douglas-fir/Western hemlock-Springfield area and Pacific silver fir/Mountain hemlock), percent canopy cover, and proportion of hardwoods (Rowland et al., 2013). The values are very general in that they do not account for the different plant association within the potential vegetation type, but the model is useful in showing broad changes in nutritional forage values when calculated over large areas like a watershed or Forest. Within the Douglas-fir/western hemlock forest, the model predicts poor nutrition forage values at high canopy cover and low hardwood abundance (e.g., >60% cover and no hardwoods; >75% cover and >20% hardwoods). Using the Westside nutrition model, Douglas-fir/western hemlock forests never reach “good” nutritional quality (i.e., DDE >2.75 kcal/g), but can reach the “high-marginal” forage class at low canopy cover (e.g., <20% cover and no hardwoods; <30% cover and >20% hardwoods).

The silver fir/mountain hemlock series is about a forage class higher than Douglas-fir/western hemlock under similar canopy cover and hardwood percentages. Dense stands lacking hardwoods are predicted to be marginal for elk nutrition. Good forage values occur in stands with moderate canopy and increasing hardwood abundance (e.g., <30% cover and no hardwoods; <50% cover and >20 hardwoods). Excellent forage nutrition is predicted to occur in open stands, typically early seral forests (e.g., 0% canopy cover with no hardwoods; <20% cover and 20% hardwoods).

Proposed treatment units occur in four Big Game Emphasis Areas (BGEAs), which were combined and used to evaluate the effects of the Alternatives on big game habitat. The four BGEAs total slightly more than 38,245 acres of big game habitat and are referred to as the project analysis area for big game forage in the remainder of this section. The acres in each elk forage class in 1993 and 2012, and for each Alternative are displayed in Table 40 for these BGEAs.

Table 40: Elk Forage Class Distribution in 1993 and 2012 and for Alternatives 2, 3 and 4 in the Big Game Project

DDE Class	Acres (%) by DDE Class				
	1993	2012	Alt 2	Alt 3	Alt 4
1 - Poor	16,463 (43.1%)	18,713 (48.9%)	17,842 (46.7%)	17,941 (46.9%)	17,842 (46.7%)
2 - Low Marginal	15,562 (40.7%)	15,103 (39.5%)	15,930 (41.7%)	15,864 (41.5%)	15,930 (41.7%)
3 - High Marginal	4,397 (11.5%)	3,186 (8.3%)	3,224 (8.4%)	3,192 (8.4%)	3,224 (8.4%)
4 - Low Good	624 (1.6%)	257 (0.7%)	264 (0.7%)	262 (0.7%)	264 (0.7%)
5 - High Good	176 (0.5%)	111 (0.3%)	111 (0.3%)	111 (0.3%)	111 (0.3%)
6 - Excellent	674 (1.8%)	527 (1.4%)	527 (1.4%)	527 (1.4%)	527 (1.4%)

The big game project analysis area is composed of 4 BGEAs which include Bear, Lower South Santiam, Boulder and Moose.
DDE = dietary digestible energy (kcal/g)

Open Road Densities

Studies have shown that elk avoid open roads that receive regular motorized traffic (Rowland et al., 2004, 2013). Standards and guidelines in the 1990 Willamette Forest Plan established road habitat effectiveness values for each Big Game Emphasis Area that directly translate into desired maximum open road densities for each BGEA. The desired maximum open road densities compared to the current open road density is shown in Table 41. All BGEAs in the project analysis area currently meet the desired open road density.

Because of the low amount of recent clearcutting on the Forest and the lack of large-scale fires in the project analysis area, cover for elk and deer is abundant and not limiting the populations. Moreover, Cook et al. (1998) found that thermal cover did not enhance elk survival and reproduction and could not compensate for inadequate forage conditions.

Table 41: Comparison of MVUM Open Road Density to Forest Plan Elk Road Density Standards and Guidelines by Big Game Emphasis Area in the Project Analysis Area

Big Game Emphasis Area	Forest Plan Elk Emphasis Level	Forest Plan Desired ¹ Maximum Open Road Density for Elk (road miles/sq. mile)	MVUM Open Road Density (road miles/sq. mile)
Bear	Low	< 4.8	2.11
Boulder	High	< 1.95	1.6
Moose	High	< 1.95	1.7
Lower South Santiam	High	< 1.95	1.7

¹ Willamette Forest-wide Standards and Guidelines FW-151 and FW-153 establish minimum Habitat Effectiveness Values for open roads in Moderate and Low BGEAs. These road habitat effectiveness values directly translated into the maximum desired open road densities (Wisdom et al., 1986) shown in this table.

MVUM = Motor Vehicle Use Map which is the Forest Service record of roads on National Forest Lands designated for public vehicle use pursuant to 36 Code of Federal Regulations (CFR) 212.51.

Environmental Consequences – Elk and Deer

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would maintain the current low quality big game forage levels in the project area and would have no effect on open road densities or big game cover. As such, Alternative 1 would have no direct, indirect, or cumulative effects to big game.

Alternatives 2 and 4

Alternatives 2 and 4 propose commercial harvest treatments on about 1,358 acres each or about 3.6% of the four BGEAs that comprise the big game project analysis area. The current canopy cover and proportion of hardwoods in each treatment unit were estimated from stand exam data and observations made during field reconnaissance. Estimated changes in canopy cover were determined from stand simulations and it was assumed that the proportion of hardwoods remained the same, post-treatment. Changes in elk nutrition were then calculated for each treatment unit. Commercial thinning and quality early seral treatments would lower overstory canopy cover to a degree that would result in a model-predicted increase in forage quality. The understory enhancement treatments and fuel treatments would not measurably change overstory cover or predicted elk forage quality.

Alternatives 2 and 4 would have identical effects on forage quality, about 871 acres of poor quality foraging areas would be converted to low-marginal (827 acres), high-marginal (37 acres) or good (7 acres) foraging habitat (Table 40). Assuming the canopy will grow back at a rate of about 2% per year (Chan et al., 2006; Wilson and Puettmann, 2007), the improvement in forage from the thinning treatments is expected to last about 10 years on average. Harvest units where canopy is reduced below 30%, should increase big game forage for about 20 years assuming full stocking with planting if necessary, post-harvest.

The reduction in poor nutritional habitat and the increase in marginal quality habitat (Table 40) could result in a small temporary increase in elk and deer populations in Alternatives 2 and 4, depending on other factors such as weather, disease and predation. Because there would be essentially no change in good and excellent forage habitat, no large increase in big game populations or harvest levels are expected as a result of this alternative alone.

Alternatives 2 and 4 would have no long-term changes in roads open to the public for motorized use. There would be a reduction in elk and deer use within and adjacent to the treatment units during the time that logging, yarding, and under-burning was occurring, but elk and deer are expected to return to the area soon after activities ceased. Effects of disturbance would be temporary. Cover values would remain high and would not be a limiting factor on the populations.

Alternative 3

Alternative 3 proposes harvest treatments on about 1,016 acres or about 2.3% of the four BGEAs that comprise the big game project analysis area. Commercial thinning treatments would lower overstory canopy cover and increase hardwood abundance to a degree that would result in a model-predicted increase in forage quality. The understory enhancement treatments and fuel treatments would not measurably change overstory cover or predicted elk forage quality. About 772 acres of poor quality foraging areas would be converted to low-marginal (761 acres), high-marginal (6 acres) or low good (5

acres) foraging habitat (Table 40). No excellent forage habitat is expected to be created by nutritional model.

Assuming the canopy will grow back at a rate of about 2% per year, the improvement in forage from the thinning treatments is only expected to last about 10 years on average. Harvest units where canopy is reduced below 30%, should increase big game forage for about 20 years assuming full stocking with planting if necessary, post-harvest. The reduction in poor nutritional habitat and the increase in marginal quality habitat (Table 40) could result in a small temporary increase in elk and deer populations in Alternative 3 compared to the no-action alternative, but less than would be observed in Alternatives 2 and 4.

Alternative 3 would result in no long-term changes in motorized roads open to the public and cover would remain at high levels that would not limit elk and deer populations. In all action alternatives, deer and elk are expected to continue to be limited by the availability of high quality forage habitat.

Cumulative Effects

The big game analysis area is comprised of four BGEAs totaling about 38,000 acres. The baseline condition was set at 2012 when the last GNN coverage was available to calculate elk forage values from the nutritional model. No stand replacement fires have occurred in the analysis area since that time. Commercial thinning has been very limited in the analysis area. The future Jude Ridge project would harvest about 264 acres which would temporarily reduce the amount of poor quality foraging areas and increase the amount of marginal quality foraging areas by less than 0.7% in the analysis area. There are no other ongoing or reasonably foreseeable activities on National Forest System lands in the big game analysis area that would meaningfully improve forage habitat for deer and elk.

About 22% of the analysis area is comprised of non-NFS lands. Many of these are managed for timber production and are expected to provide early seral habitat when they are periodically clear-cut. Because the non-Forest Service lands are mostly in the Douglas-fir/Western hemlock series they should temporarily provide areas of high-marginal DDE forage when they are logged.

Alternative 1 – No Action

No improvement of elk forage would occur on Forest Service lands. Barring natural disturbances such as fire, previously logged area would continue to regenerate and forage would decline in the open managed stands that remain. Private lands comprise about 22% of the project area and future clearcutting on private lands is expected to improve forage quality. Overall the amount of area in poor nutritional quality is expected to increase on NFS lands and deer and elk populations are expected to remain at the reduced levels.

Alternatives 2, 3 and 4

Excluding natural disturbances that cannot be predicted, Alternatives 2, 3 and 4 would result in a temporary improvement in big game forage. The future Jude Ridge project would also temporarily improve forage quality on 0.7% of the analysis area. There are no other ongoing or reasonably foreseeable activities on National Forest System lands in the big game analysis area that would meaningfully improve forage habitat for deer and elk. Consequently, the cumulative effects are similar to the effects described above for each alternative. It is not possible to accurately predict future deer and elk populations due to the numerous factors that affect them. However, because of the expected reduction in areas with poor nutritional quality, there may be a small temporary increase in deer and elk populations in the analysis area under the action alternatives.

Affected Environment - Marten

Marten are members of the weasel family that prefer mature and old conifer-dominated forest habitat. They use cavities in snags and logs for denning, resting, and natal sites. Although the Willamette Forest Plan established marten habitat areas, designated as 9c management areas, at strategic locations across the entire forest (USDA, 1990), recent information suggests marten primarily occur in montane conifer forests above 4,000 feet elevation (Aubry and Lewis, 2003). Camera set monitoring on the Willamette National Forest beginning in 2012 have detected marten at about 90% of the stations established above 4,000 feet elevation (n = 37 stations) compared to 0% of stations below that elevation (n = 33 stations). About 700,000 acres (39%) of the Willamette National Forest are above 4,000 feet elevation and considered marten habitat. The Trout Creek project alternatives propose treatments adjacent to one 9c marten habitat management area.

Environmental Consequences – Marten

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would maintain the current forest habitat and stands would continue to develop large diameter trees, large snags, and large downed logs as the stands progress into old growth forests. The structural features that marten prefer would continue to increase over time.

Alternatives 2 and 4

Alternatives 2 and 4 propose commercial thinning on 140 acres of managed stands and 95 acres of natural stands in habitat at or above 4,000 feet elevation. Commercial harvest is expected to degrade marten habitat. Negative effects from thinning include loss of future snags and down wood that could provide resting and denning sites and habitat for prey. Longer-term, positive benefits from thinning include larger tree size, better developed canopies, and multi-layered stands. Units where snag and down wood creation would be created post harvest, would improve these stands for about a century until the trees fall and the logs decay by providing habitat structures preferred by this species and their prey. Gaps and regeneration harvest on 115 acres would remove marten habitat, these stands would recover to late-successional habitat conditions in about 100 years or more. These treatments together make up about 7.9% and 0.05% of the marten habitat in the project area and the estimated marten habitat on the Willamette NF, respectively.

Alternative 3

Alternative 3 would not include regeneration harvest, nor would it include units in high quality marten habitat. This action alternative proposes 182 acres of thinning above 4,000 feet elevation and 12 acres of gaps. These treatments would affect about 4.4% and 0.03% of the marten habitat within the project area and the estimated marten area on the Forest, respectively.

Cumulative Effects

Alternative 1

Because there would be no impacts to marten or their habitat under this alternative, there are no cumulative effects to consider.

Alternatives 2, 3, and 4

There are no other ongoing or reasonably foreseeable actions on the NFS land in the project area that would meaningfully alter marten habitat. Considering direct, indirect and cumulative effects, ***the proposed action alternatives would maintain the viability of marten habitat in the Project Area***. Viable populations of marten are expected to continue to persist across the Willamette National Forest in the montane mixed conifer habitat zone.

Affected Environment - Effects to Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-704). The USFWS is the lead Federal agency for managing and conserving migratory birds in the United States. However, under Executive Order 13186, all Federal agencies are charged with the conservation and protection of migratory birds. A memorandum of understanding between the Forest Service and USFWS require, during NEPA planning, that the Forest Service, to the extent practicable, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the Forest Service to consider approaches for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (USDA Forest Service and USDI Bureau of Land Management, 2013). Effects to Forest Service sensitive birds, federally listed birds, and birds that are management indicator species have been addressed previously. Four additional migratory bird species that have been identified by the USFWS as species of conservation concern (USFWS, 2008) and that have habitat in the proposed treatment units are addressed in this section. These four species are northern goshawk, rufous hummingbird, olive-sided flycatcher, and the purple finch.

An emerging concern for migratory birds in the Pacific Northwest is declining early-successional forest habitat (Swanson et al., 2010). Early seral conifer habitat is important for many migratory bird species, including three of the above species of conservation concern (Altman and Hagar, 2007). In particular, there is a lack of complex early seral habitat, which is early successional forests with abundant and diverse shrub understory composition, abundant large diameter snags and downed logs, and substantial green tree retention. While logging on private lands may create early seral habitat, important elements such as large diameter snags, downed logs and live leave trees are rarely retained in any quantity, and shrub and forb understory may be suppressed by herbicide treatment.

Environmental Consequences – Migratory Birds

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no direct effect on migratory bird habitat and would not increase habitat for early-seral species. The proposed Trout Creek units would continue to develop toward old growth over many decades which would result in improved nesting and foraging habitat for northern goshawks and other species that prefer this habitat.

Alternatives 2 and 4

Thinning and early seral creation for Alternatives 2 and 4 would degrade or remove about 214 acres over 80 and 78 acres between 40 and 80 years of age. These stands may currently, or in the near future as they continue to develop toward old growth, provide foraging habitat and potential nesting areas for

northern goshawks. No goshawks or nest trees have been detected in project area units. Mitigation measures would protect any raptor nests that are incidentally found in the treatment units during layout or implementation. Suitable and dispersal habitat for spotted owls was used as a proxy to represent goshawk potential habitat. Thinning and early seral creation proposed in Alternatives 2 and 4 represent about 1.16% and 0.03% of the estimated potential goshawk habitat in the project area and Willamette National Forest, respectively. Therefore, the effects to goshawk habitat are minor at the project and Forest scales.

Alternatives 2 and 4 are consistent with the Migratory Bird Treaty Memorandum of Understanding. In some units, seasonal restrictions on tree falling and yarding prior to July 15 would minimize disturbances to nesting birds and reduce the likelihood of harm to individual birds. Measures to retain existing snags, where possible, and to retain live trees and, create snags, would provide structural features migratory birds would use. Both alternatives would provide about 101 acres of early seral habitat. Migratory birds that favor shrub habitat in early seral conifer stands, like the rufous hummingbird and purple finch, may benefit for about 20 years or until dense conifer regrowth reestablishes in the units. Species, such as the olive-sided flycatcher, which favor forest openings with large snags, may benefit for as long as the snags remain, which could be about 30 years or more.

Alternative 3

The effects of Alternative 3 activities to potential goshawk habitat would be negligible. Thinning proposed represent about 0.003% and 0.0007% of the estimated potential goshawk habitat in the project area and Willamette National Forest, respectively. No early seral creation would be created under this proposed alternative. Benefits to migratory birds that use early seral habitats would occur on 43 acres of proposed gaps in thinning units. This alternative would provide fewer benefits to early seral dependent migratory birds than Alternative 2.

Cumulative Effects

Alternative 1 – No Action

There would be no effects to migratory birds from Alternative 1; and thus, no cumulative effects would occur.

Alternatives 2, 3 and 4

A possible increase in early-seral dependent migratory birds, such as rufous hummingbird, purple finch, and olive-sided flycatcher, may be expected in the treatment units and forest edges adjacent to the units, but the increase in birds would be minimal at the landscape level. Private timber lands in the sub-watersheds would continue to provide some lower-quality early seral bird habitat where stands have been recently clear-cut. No other projects that remove older forest habitat are reasonably foreseeable in the project area. Considering cumulative effects, about 67% of the project area would remain goshawk nesting and foraging habitat after implementing Alternatives 2 and 4. Viable populations of goshawks and other migratory birds that use older conifer forests are expected to be maintained at the landscape level.

3.05 Botany and Invasive Plants

Summary of Effects Analysis

The botany Biological Evaluation determination for sensitive vascular plants, lichens and bryophytes is no impact. The project will have no environmental effect on sensitive species habitat, individuals, a population, or a species. The Biological Evaluation determination for sensitive fungi is may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Known sites of botanical sensitive and survey and manage species are buffered in all action alternatives.

The Trout Creek Project has a high risk of introducing or spreading known populations of invasive weeds under Alternatives 2 and 4, and a low to moderate risk under Alternative 3. Weed control measures are identified under the Project Design Criteria in Chapter 2.

Buffering special habitats from direct activity and to protect microclimate of the wetter sites will be consistent with the Forest Plan which states that these sites shall be maintained. Active management of special habitats in Units 59, 67 and 95 will be a benefit to these habitats.

Scale of Analysis

The spatial extent of analysis is the entire project area, located in the South Santiam 5th field watershed, and including the following 6th field watersheds: Moose Creek, Trout Creek, Lower Canyon Creek, and a small portion of Soda Fork and Bear Creek.

Affected Environment- Special Botanical Species (Sensitive and Survey and Manage Species)

Regulatory Framework

Sensitive botanical species are addressed in the Forest Service Manual (FSM) 2670 and Forest-wide Standard and Guidelines 156-161 and Amendment 158 to the Willamette Land and Resource Management Plan (USDA, 1990). Protection of federally listed Threatened and Endangered species is mandated by the Endangered Species Act. No federally listed Threatened or Endangered, nor suitable habitats for these listed plants are known to occur in the project area. Sensitive species are protected by USDA Forest Service regulations and manual direction (FSM 2672.4).

Forest management activities that may impact populations of or alter habitat for TESP (threatened, endangered, sensitive, or proposed) species require a Biological Evaluation (FSM 2671.44) to be completed. The Biological Evaluation process (FSM 2672.43) is used to assist in determining the possible effects the proposed management activities have on species listed or proposed to be listed by the U.S. Fish and Wildlife Service and species listed as sensitive by the USDA Forest Service, Region 6.

The Northwest Forest Plan, Record of Decision (ROD, USDA and USDI, 2001) designated special management of just over 300 “survey and manage” species to reduce or eliminate effects of management actions on these old-growth associated species whose persistence is not assured through the system of reserved lands. The Northwest Forest Plan requires surveys for projects that could alter habitat for survey and manage species and management of populations if they are found. There is an exemption for thinning in stands under 80 years old.

Methodology

Management proposals were investigated to determine whether survey and manage species and proposed, endangered, threatened, or sensitive (PETS) species habitat may exist within or adjacent to the project area. Sources used include the Oregon Biodiversity Information Center Database of Rare Species, the Inter-agency Geographic Biotic Observations (GeoBob), the Oregon Flora Plant Atlas, the Forest Service national PETS plant species database (NRIS TESP-IS), scientific literature, aerial photos, topographic maps, and knowledge provided by individuals familiar. There are 93 species on the Regional Forester's 2011 Sensitive Plant List documented or suspected to occur on the Willamette National Forest. All species were evaluated for inclusion in the survey list for this project.

Current Condition

A pre-field review is conducted prior to surveys to determine whether special status botanical species occur in the project area. Prior to the Trout Creek botanical surveys, five Region 6 sensitive species had been documented in this portion of the South Santiam Watershed. These species are two lichens, *Bryoria subcana* and *Hypotrachyna riparia*, and three vascular plants, *Eucephalis gormanii*, *Ophioglossum pusillum*, and *Polystichum californicum*. In addition, 24 survey and manage species had been documented. Intuitive controlled surveys conducted in the field seasons of 2012-2015 revealed the presence of two more Region 6 sensitive species and numerous more sites of survey and manage species than had been previously located. The two sensitive species are fungi, *Boletus pulcherrimus* and *Bridgeoporus nobilissimus*.

The analysis area contains habitat for 55 species of the 93 on the Regional Forester's Sensitive Species List (dated Dec 2011). Of these 55 species, 15 are fungi for which few or no surveys were conducted. Single year fungal surveys are considered impractical because fungi fruit inconsistently from year to year (USDA and USDI, 2001). One exception is *Bridgeoporus nobilissimus*, a fungus that forms a perennial fruiting body. Fungal surveys are required for habitat disturbing projects in old growth forest; however, the Trout Creek Project does not propose activities in old growth. Surveys were conducted for the remaining 40 species in all stands that contained suitable habitat for those species. Depending on the species, suitable habitat may include noble fir stumps and snags, wetlands, seeps, rotten wood, rock outcrops and older forest stands. Table 42 outlines the 2001 ROD Survey and Manage categories. A Biological Evaluation for the Trout Creek EIS is in the project file. All rare botanical species in the project area are outlined in Table 43.

Table 42: 2001 ROD Survey and Manage Categories

Relative Rarity	Pre-Disturbance Surveys Practical	Pre-disturbance Surveys Not Practical	Status Undetermined
Rare	Category A *Manage All Known Sites *Pre-Disturbance Surveys *Strategic Surveys	Category B *Manage All Known Sites *N/A *Strategic Surveys	Category E *Manage All Known Sites *N/A *Strategic Surveys
Uncommon	Category C *Manage High-Priority Sites *Pre-Disturbance Surveys *Strategic Surveys	Category D *Manage High-Priority Sites *N/A *Strategic Surveys	Category F *N/A *N/A *Strategic Surveys

Table 43: Sensitive and Survey and Manage Species in the Trout Creek Planning Area

Species	Life Form	Category	Number of Sites	Location
<i>Boletus pulcherrimus</i>	Fungus	Sensitive and Survey and Manage B	1	Unit 55
<i>Bridgeoporus nobilissimus</i>	Fungus	Sensitive and Survey and Manage A	3	Units 14, 20, and 56
<i>Bryoria subcana</i>	Lichen	Sensitive and Survey and Manage B	1	Headwaters of Moose Creek
<i>Clavariadelphus occidentalis</i>	Fungus	Survey and Manage B	11	Lower Moose Mountain
<i>Eucephalis gormanii</i>	Vascular Plant	Sensitive	1	Adjacent to Unit 100
<i>Gomphus clavatus</i>	Fungus	Survey and Manage F	2	Lower Moose Mountain
<i>Helvella elastica</i>	Fungus	Survey and Manage B	3	Lower Moose Mountain
<i>Hypotrachyna riparia</i>	Lichen	Sensitive	1	Near Unit 67, Camas Prairie
<i>Ophioglossum pusillum</i>	Vascular Plant	Sensitive	1	Whiterock Marsh
<i>Otidea leporina</i>	Fungus	Survey and Manage D	1	Lower Moose Mountain
<i>Peltigera pacifica</i>	Lichen	Survey and Manage E	6	Falls Creek, Moose Mountain, in Unit 59 and near Unit 29
<i>Phaeocollybia attenuata</i>	Fungus	Survey and Manage D	5	Lower Moose Mountain
<i>Phaeocollybia dissiliens</i>	Fungus	Survey and Manage B	1	Lower Moose Mountain
<i>Phaeocollybia fallax</i>	Fungus	Survey and Manage D	4	Lower Moose Mountain, Unit 43
<i>Phaeocollybia pseudofestiva</i>	Fungus	Survey and Manage B	1	Lower Moose Mountain
<i>Phaeocollybia sipei</i>	Fungus	Survey and Manage B	2	Lower Moose Mountain
<i>Polystichum californicum</i>	Vascular Plant	Sensitive	1	Canyon Creek Meadows
<i>Pseudoaleuria quinaultiana</i>	Fungus	Survey and Manage B	1	Moose Ridge
<i>Pseudocyphellaria rainierensis</i>	Lichen	Survey and Manage A	4	Moose Creek, Falls Creek
<i>Ramaria araiaspora</i>	Fungus	Survey and Manage B	24	Lower Moose Mountain, Falls Creek
<i>Ramaria celerivirescens</i>	Fungus	Survey and Manage B	2	Lower Moose Mountain
<i>Ramaria gelatiniaurantia</i>	Fungus	Survey and Manage B	1	Moose Mountain
<i>Ramaria rubrievanescens</i>	Fungus	Survey and Manage B	1	Moose Mountain
<i>Ramaria stuntzii</i>	Fungus	Survey and Manage B	11	Moose Mountain
<i>Sarcodon fuscoindicus</i>	Fungus	Survey and Manage B	1	Lower Moose Mountain
<i>Sowerbyella rhenana</i>	Fungus	Survey and Manage B	14	Lower Moose Mountain
<i>Sparassis crispa</i>	Fungus	Survey and Manage D	2	Moose Mountain
<i>Usnea longissima</i>	Lichen	Survey and Manage F	Many	Lower Moose Mtn., South Santiam River, Canyon Creek, Units 41, 42, 43, 50, 55, 59, 87 and 92

Multiple surveys were conducted within the Trout Creek project area for botanical species on the Regional Forester's Special Status Species List (Revised December 2011), and the Survey and Manage List (USDA and USDI, 2001). Field surveys were conducted using the intuitive controlled method in the summers of 2012-2015. All survey protocols for Survey and Manage species groups were followed. The

following discussion addresses only those Special Status species that are in or immediately adjacent to proposed units.

Boletus pulcherrimus is a red-pored bolete that stains blue when handled. It is found sparingly in older forests in the Cascades and coast range. It fruits in the fall. It was incidentally located in Unit 55. *B. pulcherrimus* is included on both the sensitive and survey and manage lists.

Bridgeoporus nobilissimus is a fungus that forms a perennial conk that usually grows on large diameter noble fir stumps and snags at upper elevations in the Cascades and Olympics. It has occasionally been found on other true fir species. There are four conks known to be in the planning area, two in a managed stand (Unit 20) and two in fire origin stands adjacent to Units 14 and 56. *Bridgeoporus* is included on both the sensitive and survey and manage lists.

Eucephalis gormanii is a local endemic wildflower that blooms in late summer. It is found in rocky areas and scree usually on north and east aspects at higher elevations. There is a population on the north side of Cougar Rock adjacent to Unit 100.

Hypotrachyna riparia is a small lichen that grows on Oregon ash trees in the foothills of the Cascades. There are very few sites of this lichen; there are only three known sites in Oregon, all of which are in Linn County. It is located adjacent to Unit 67.

Peltigera pacifica is a lichen usually found on decaying wood but sometimes on mineral soil and often near water. It is located in Unit 59 below the cliff and just north of Moose Mountain Road near Unit 29.

Phaeocollybia fallax is a mycorrhizal fungus. The fruiting body has a green cap, pale violet gills, and the stipe is orange at the base. There is a historical location just north of Unit 43.

Usnea longissima is a charismatic lichen that forms long pendulous strands in low elevation moist forests, often in riparian areas. Although it is relatively abundant in its habitat, it is threatened or extirpated throughout its world range (McCune and Geiser, 2009). It was located in many of the lower Trout Creek units such as Units 67 and 50. As a survey and manage species in category F, there is no requirement to manage known sites.

Environmental Consequences – Special Status Botanical Species

Direct and Indirect Effects

Alternative 1 – No Action

Under Alternative 1, the No Action Alternative, no direct effects are anticipated because no sensitive or survey and manage botanical species would be disturbed by project activities.

Indirect effects to special status species would be minimal. No harvest would occur with this alternative. Alternative 1 would provide the benefit to rare fungi because most of them form mycorrhizal relationships with conifers and thinning has been shown to have negative, short-term (5-7 years) impacts to fungi (Pilz et al., 2003). There would be no removal of mycorrhizal host trees by aggregate retention harvest or gap creation. The effect of foregoing thinning to rare lichens and bryophytes is less clear. Lichens prefer slow growing substrates that overstocked stands would provide but they also prefer some species such as Pacific yew that would be better developed and more abundant in a thinned stand. Bryophytes thrive under low light conditions and high levels of down wood that can be expected under the No Action Alternative.

The overstocked managed stands would undergo a slow decline before naturally opening up enough to provide for an understory. Natural processes, including windthrow, snowdown, fire, insects, and disease pockets would create openings within the dense stands. Coarse woody debris would be abundant as trees die due to overcrowding and other stressors and remain on site to decay.

Alternative 2

The proposed action includes thinning, regeneration harvest, gap creation, hardwood fuel break creation, alder treatment, and oak savannah restoration. In managed stands, approximately 576 acres will be thinned to varying degrees of canopy cover, 52 acres will be aggregate retention harvested, 168 acres will receive alder treatment, and 34 acres will be a hardwood fuel break. In fire origin stands (100-150 years old), 157 acres will be thinned to varying levels of canopy cover, 112 acres will be heavily thinned and burned, and 9 acres of oak/savannah habitat will be restored. Additionally, there will be skips, gaps and early seral habitat creation. Associated road work and fuels treatment are also proposed. Road decommissioning is proposed for seven miles.

Direct effects of the proposed action on special status vascular plants, lichens and bryophytes is minimal because sites within or adjacent to units are buffered. The exception to this is *Usnea longissima*, a survey and manage species in category F, for which there is no requirement to manage known sites. Its presence in riparian reserves and along untreated creeks and rivers will maintain the population in the landscape.

Buffers are for:

- *Boletus pulcherrimus* in Unit 55 – portion of stand deleted from unit.
- *Bridgeoporus nobilissimus* fruiting bodies in or adjacent to Unit 14, 20 and 56 are buffered by 150 feet.
- *Eucephalis gormanii* adjacent to Unit 100 – portion of stand deleted from unit.
- *Eucephalis gormanii* adjacent to Unit 100 – portion of stand deleted from unit.
- *Hypotrachyna riparia* adjacent to Unit 67 is buffered by 150 feet.
- *Peltigera pacifica* in Unit 59 and adjacent to Unit 29 is buffered by 75 feet.
- *Phaeocollybia fallax* near Unit 43 – outside unit.
- *Usnea longissima* in multiple units protected by Riparian Reserves.

There may be direct effects and indirect effects to special status fungi because surveys were not conducted for them since single year surveys were deemed impractical (USDA and USDI, 2001). The fire origin stands currently provide habitat for these species. It is likely that currently unknown sites of Sensitive and Survey and Manage fungi may be negatively affected in the short-term by host tree removal, physical disturbance, soil compaction, and disruption of mycelial networks (Kranabetter et al., 1998; Amaranthus and Perry, 1994). Twelve of the 16 sensitive fungi species and most of the survey and manage fungi are mycorrhizal. A study of hypogeous (a below-ground fungi, similar to truffles) found that thinning significantly reduced the diversity and amount of fruiting bodies (Gomez et al., 2003). Seven of the sensitive fungi are hypogeous. Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning but appear to rebound after several years (Pilz et al., 2003).

Regeneration or aggregate retention harvest has been shown to have an even greater negative effect on fungal mycelium than thinning. The removal of trees leads to loss of tree roots and subsequent

reduction in the diversity and abundance of mycorrhizal fungi (Byrd et al., 2000). Increased solar radiation leads to reduced soil moisture particularly during the Pacific Northwest's summer drought. Green tree retention can provide some legacy of fungal diversity during the development of the next stand (Luoma et al., 2006). However, sporocarp production and ectomycorrhizal species richness is significantly reduced at all harvest levels (Luoma and Eberhart, 2005).

Indirect effects to rare botanical species and their habitats vary depending on stand age, composition and the proposed activity. Minor forest tree species are favored in most of the silvicultural prescriptions over Douglas-fir. This will lead to an increase in stand complexity and diversity over the long-term (20-100 years) that may provide better habitat for rare botanical species. Thinning of Douglas-fir managed stands could eventually lead to more structurally diverse late-successional habitat. Reduced organic debris from timber harvest and subsequent fuel treatment has been shown to have adverse effects on mycorrhizae development (Jurgensen et al., 1997). Further, one tree species that is being favored by the thinning prescriptions and is being planted in some units is western redcedar (*Thuja plicata*) and this species does not support ectomycorrhizal species. A large proportion of western redcedar in a stand reduces contact between root systems of host trees (Kranabetter and Kroeger, 2001).

Soil compaction resulting from harvesting equipment and the creation of temporary access roads can reduce host tree root growth and root tip availability for fungi (Amaranthus et al., 1996; Amaranthus and Perry, 1994; Williamson and Neilson, 2000). Compaction may occur with ground-based yarding, new temporary road construction, landing construction, and grapple piling of fuels. Kranabetter and Kroeger, (2001) note that thinning prescriptions that leave some stand basal area with good tree vigor may accommodate both commercial timber harvest and mycorrhizal fungi. The addition of understory trees and shrubs may benefit the sensitive mycorrhizal species. Duff retention and coarse woody debris creation would benefit both the sensitive mycorrhizal and saprophytic species (Lindblad, 1998).

There is little habitat for rare bryophytes in the planning area; there are no known locations and no sites were located in the course of surveys, therefore no effects to these species are anticipated.

Thinning may affect lichens by removing substrate and altering the microclimate (Sarr et al., 2005). Some rare lichens are thought to be dispersal-limited rather than sensitive to microclimatic changes (Sillett, 1995). Alternative 2 may have indirect effects to epiphytic lichens by removal of their substrate by thinning, early seral creation/aggregate retention harvest and gap creation. The creation of hardwood fuel breaks in the fire-origin stands will not benefit rare lichen habitat.

One result of thinning in Alternative 2 may be to enhance habitat for *Bridgeoporus nobilissimus* in the long term (greater than 20 years) in some areas while negatively impacting habitat in others. This species forms a perennial conk on large diameter noble fir stumps and snags. Thinning the dense stands of noble fir in the managed stands (Units 14, 15, 62, 73 and 100) will create larger diameter trees for future habitat. However, the creation of hardwood fuel breaks, regeneration harvest and gap creation will not favor *Bridgeoporus nobilissimus* because the increased exposure may cause potentially suitable existing stumps to dry out. Aggregate retention harvest and gap creation will increase light and reduce humidity. Noble fir stumps that may provide habitat for *Bridgeoporus nobilissimus* may become unsuitable due to drying and mechanical damage during timber harvest and subsequent grapple piling. The canopy is not expected to close for approximately 20 years after thinning, and 30 years after early seral creation harvest.

If the hardwood fuel breaks and fuels treatments reduce the risk of a stand replacing fire, then indirectly, habitat for all special status botanical species will benefit. The effectiveness of hardwood fuel breaks on a stand replacing fire is difficult to quantify. Given these possible scenarios, Alternative 2 may

have negative and positive indirect effects to rare botanical species, however, it is not expected to adversely impact rare botanical species over the long-term.

Alternative 3

Alternative 3 was developed to respond to the issues of aggregate retention harvest in managed stands and harvesting in older stands. All of the older stands were dropped along with most of the aggregate retention harvest. Road decommissioning was increased to 10 miles. Alternative 3 includes thinning in managed stands only and does not treat any fire origin stands. Approximately 629 acres will be thinned to varying degrees of canopy cover, 168 acres will receive alder treatment, and 34 acres will be a hardwood fuel break.

As in Alternative 2, no direct effects to special status species are expected due to buffers of existing sites with the exception of *Usnea longissima*, a survey and manage lichen found primarily in riparian areas.

Thinning of densely stocked Douglas-fir managed stands could eventually lead to more compositionally and structurally diverse late-successional habitat that would benefit special status species. Thinning in noble fir managed stands could lead to larger diameter trees that could eventually provide habitat for *Bridgeoporus nobilissimus*. However, the creation of a hardwood fuel break in a noble fir managed stand (Unit 20) may open up the stand to the point that existing stumps dry out and few noble fir remain in the stand. Indirect effects to special status fungi from timber harvest are similar to what is described in Alternative 2, however, the effects are to a lesser extent because there are no fire origin stands included in this alternative. There are 43 acres of gaps in this alternative, which have will negatively affect mycorrhizal connections at least in the short term.

Alternative 4

Alternative 4 covers the same acres as Alternative 2. Alternative 4 was developed in response to public comments asking for heavier thinning and more volume to local timber markets. Thinning intensities and gap creation were increased in several units. Road decommissioning was increased to 10 miles.

As in Alternative 2, no direct effects to special status species are expected due to buffers of existing sites with the exception of *Usnea longissima*, a survey and manage lichen found primarily in riparian areas.

Indirect effects to special status species are similar to Alternative 2. Heavier thinning and more gaps will have an additional negative effect on special status fungi. The acres of gap creation increases to 400.5 with subsequent negative effects to mycorrhizae.

Cumulative Effects

Alternative 1- No Action

Most of the habitat loss for special status species in the watershed has been associated with timber harvest. Alternative 1 does not add any acres of harvest to what has occurred in the past, therefore there are no additional cumulative effects.

Alternatives 2, 3 and 4

The area analyzed for cumulative effects was the South Santiam (101,917 acres) watershed. About 56,000 acres of old-growth forest was clearcut in the South Santiam watershed in the last 50 years. Old-growth forests were harvested because they were considered over-mature and decadent compared to younger, faster growing stands. These forests certainly contained multiple populations of rare botanical species. Fungal diversity declines with clearcutting and fire (Byrd et al., 2000; Bruns et al., 2002) and

most of the stands were burned after harvest. Despite the large amount of past harvest activity there are 51,550 acres of mature and old-growth forests still remaining in the South Santiam including two inventoried roadless areas and the Menagerie Wilderness. These forests serve as refugia for many rare botanical species that would be able to re-colonize the younger stands as they mature and become more complex in structure and diversity. Approximately 250 acres of fire-origin stands will be treated in Alternatives 2 and 4 to the extent that they will negatively impact ectomycchorizal fungal species (gaps, thinning to less than 40 trees/acre). Alternative 3 that treats managed stands only, minimally adding to the cumulative effects in the watershed.

Affected Environment – Special Habitats

Regulatory Framework

Special habitats are non-forested areas including, meadows, ponds, caves, rock gardens, talus and cliffs. These sites are important reservoirs of biodiversity and provide habitat for a wide variety of plants, fungi, and animals, many of which are not found in forested areas. In fact, while special habitats cover only about 5% of the area in the Cascades Range, 85% of native flowering plants are found in these areas (Hickman, 1976). In addition, special habitats provide habitat for many species currently on the Region 6 Sensitive Species List.

The Willamette LRMP (USDA, 1990) contains a standard and guideline FW-211 which directly influences the management of non-riparian special habitats. It states:

“Special wildlife and plant habitats not currently identified in non-harvest management areas shall be maintained. This should include the ecotone and a buffered area sufficient to maintain the microclimate of the site.”

In order to manage for these special habitats, the Special Habitat Management Guide (2010) was developed to guide inventory and maintenance of these habitats on the Willamette National Forest.

Current Condition

Many of the units in Trout Creek contain special habitats (Table 44). Scattered rock outcrops, talus, wetlands, and seasonal ponds are the most common special habitats in the area. These special habitats provide habitat for various plant communities and contribute to species diversity of the area, which is otherwise fairly uniform. Special habitats in units are buffered or protected from direct disturbance by designating the habitat as “Area to Protect” or ATP. Special habitats within managed stands tend to have more weed species due to past disturbance.

Table 44: Special Habitats in Trout Creek Units

Unit	Special Habitat	Condition/Buffer
15	Vine maple/talus	Area to Protect (ATP)
20	Rock outcrop Seep	ATP 150 feet
27	Small wet area Rock garden	150 feet ATP
32	Red alder patch Rock garden	ATP
33	Linear alder wetland	ATP
41	Rock outcrops; oceanspray patches	ATP
42	Alder wetland	ATP
44	Talus and rock outcrops	ATP
50	Alder/mannagrass wetland	75 feet

Unit	Special Habitat	Condition/Buffer
	Rock outcrop	ATP
55	Small wet meadow	ATP
56	Sphagnum wetlands	150 feet
	Rock outcrop on ridge	ATP
57	Seep	50 feet
58	Rocky slope at top of stand	ATP
59	Rock garden	ATP; manage for oak and madrone
60	Rock garden	ATP
62	Rock outcrop	ATP
67	Camas Prairie; wet area	Active management for oak
72	Sedge wetland	75 feet
87	Pond/wetland (weedy)	75 feet
89	Rock outcrop	ATP
95	Rock garden	Girdle conifers for oak/madrone
100	Cougar Rock	ATP

Environmental Consequences – Special Habitats

Direct and Indirect Effects

Alternative 1 – No Action

There will be minimal direct or indirect effects to special habitats under the No Action alternative. Trees in, or surrounding the special habitats will continue to grow but at a slower pace than under the action alternative due to the lack of thinning. Existing weed populations in special habitats will likely continue to spread, altering the plant composition of those sites. Some of the special habitats in Trout Creek are adjacent to roads. Past management activities no doubt had an effect on special habitats, including changes to the microclimate and hydrology, soil compaction, and introduction of invasive weeds.

Alternatives 2 and 4

Special habitats are generally protected from physical disturbance in all action alternatives. Buffers, when prescribed, should be sufficient to protect the microclimate and prevent invasive weed introduction. Unit 67 is designed to enhance oak savannah adjacent to Camas Prairie in Alternatives 2 and 4. Units 59 and 95 are designed to enhance oak and madrone trees growing on rock outcrop by removing Douglas-fir either by commercial harvest or girdling. Buffers are not prescribed for rock outcrops, talus or other dry, rocky features. These areas are designated as ATP to protect the habitat from physical disturbance (i.e., cable logging, skyline corridor).

Several of the special habitats in managed stands have invasive species in them and some control measures will be taken with the action alternatives. Hydrological changes to wet special habitats may occur due to temporary road construction, reconstruction, culvert placement, and tree removal, however buffers should mitigate these effects. Providing traditional resources for the tribes will have no effect on special habitats.

Alternative 3

Other than in Unit 59, there will be no direct effects under the alternative because special habitats are buffered or designated as ATP. Less active management will occur in special habitats under Alternative 3. Units 67 and 96 are not included in this alternative however Unit 59 will still be treated to promote

Oregon white oak and madrone. Indirect effects include a possible increase in weed presence but design features should limit weed encroachment. Indirect effects are less under this alternative because there are fewer units with special habitats.

Cumulative Effects

Alternative 1- No Action

There will be no cumulative effects under the No Action alternative.

Alternatives 2, 3 and 4

The project area was used to analyze cumulative effects on special habitats. Past timber harvest, road construction and associated activities on public and private lands have adversely affected special habitats by introducing invasive weeds and altering the microclimate. Given the protective measures of this action, additional cumulative effects are not anticipated.

Buffering special habitats from direct activity and to protect the microclimate of the wetter sites is consistent with the Willamette Land and Resource Management Plan (LMRP) which states that we shall maintain these sites.

Affected Environment – Invasive Plants

Regulatory Framework

Invasive plants are addressed in the Final EIS for Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants (USDA, 2005); Amendment 259 to the Willamette Land and Resource Management Plan (USDA, 1990); and the Willamette National Forest Integrated Weed Management Plan (USDA, 2007). The following documents guide the treatment of competing and unwanted vegetation in the Pacific Northwest:

- Guide to Noxious Weed Prevention Practices (2001)
- Executive Order 13112 (February 3, 1999)
- Noxious Weed Control and Eradication Act (2004)
- Willamette National Forest Noxious Weed Prevention Guidelines (2005)

Current Condition

Non-native plants are species that have been introduced either intentionally or unintentionally to areas where they do not naturally occur. Most invasive, non-native plants in the Pacific Northwest originate from Europe and Asia. The predators and diseases that control these plant species in their native habitats are not present in the habitats where they have been introduced. Unchecked by predators or disease, such plants may become invasive and dominate a site, displacing native plants and altering a site's biological and ecological integrity. For example, invasive plants can reduce biological diversity, displace entire native plant communities, decrease and degrade wildlife habitat, alter fire regimes, change hydrology, disrupt mycorrhizal associations, alter nutrient dynamics, and increase soil erosion. Invasive plants can also reduce the quality of recreational experiences. Project activities, timber harvest, various ground-disturbing activities and haul may introduce and/or spread invasive plant species.

The Trout Creek planning area contains ample invasive weed species. By far the most problematic are false brome (*Brachypodium sylvaticum*) and non-native blackberries (*Rubus armenicus* and *R. discolor*), both of which are found in multiple Trout Creek units and along roads accessing those units. Other non-native weeds that occur to a lesser extent are shiny geranium (*Geranium lucidum*), Herb Robert (*Geranium robertianum*), creeping buttercup (*Ranunculus repens*), and Scotch broom (*Cytisus scoparius*).

Established weeds common in the Trout Creek planning area are oxeye daisy, St. John's-wort, Canada thistle, curly dock, and tansy ragwort. Direct control efforts are not practical due to their widespread occurrence along the road system.

Environmental Consequences – Invasive Plants

Direct and Indirect Effects

Alternative 1 – No Action

The No Action alternative has the least risk of spreading weeds. There would be no new ground disturbances within the planning area other than what is ongoing and occurring by natural processes. There would be no new weed populations established or spread in the forested landscape as a result of this action. Without ground disturbing activities, mineral soil would not be available for weed seedling establishment and there would be no removal of competing vegetation. The rate of spread would be expected to continue at current levels. Traffic from logging on private timberland, recreationalists and Forest Service personnel will continue to spread weeds along roads and in dispersed recreation sites.

Alternatives 2, 3 and 4

Invasive weeds are expected to spread under the action alternatives due to the increased light and disturbance created by regeneration harvest, thinning, gap creation, fuels reduction, and removal of competing vegetation. The greater the number of acres in which the existing forest is disturbed, and the higher the disturbance level, the greater potential for weed spread. Table 45 outlines the proposed activities by alternative and rates their risk level with regard to weed introduction and establishment.

Table 45: Risk Matrix – Comparison of Invasive Weed Introduction Potential by Alternative

Project Element	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Managed Stand Units					
Thin leaving 30% canopy cover	Acres	0	88	88	88
Thin leaving 40-50% canopy cover (variable density)	Acres	0	90	222.5	90
Thin leaving 50% canopy cover	Acres	0	398	318.5	383.5
Aggregate Retention	Acres	0	52	0	52
Gaps	Acres	0	26	43	40.5
Skips	Acres	0	362	344	362
Total acres	Acres	0	1016	1016	1016
RISK RATING FOR MANAGED STANDS		Low	High	Medium	High
Fire Origin Units					
Thin leaving 30% canopy cover	Acres	0	76	0	76
Thin leaving 50% canopy cover	Acres	0	81	0	75
Aggregate Retention	Acres	0	49	0	49
Gaps	Acres	0	9	0	15

Project Element	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Skips	Acres	0	127	0	127
Total acres	Acres	0	342	0	342
RISK RATING FOR FIRE ORIGIN STANDS		Low	High	Low	High
Associated Activities					
Ground-based yarding	Acres	0	328	239	328
Skyline with one end suspension	Acres	0	537	429	537
Total number of landings created and rehabilitated	# of landings	0	221	132	221
Length of haul routes	Miles	0	47.3	45.5	45.5
New temporary road construction	Miles	0	2.1	1.3	2.1
Re-open existing non-system spur roads	Miles	0	2.3	2.0	2.3
Road storage	Miles	0	29	29	29
Road decommissioning	Miles	0	6	10	10
Grapple pile	Acres	0	157	94	157
Underburn	Acres	0	278	162	278
Non-commercial treatments	Acres	0	370	51	370
RISK RATING FOR ASSOCIATED ACTIVITIES		Low	High	Medium	High
OVERALL RISK RATING		Low	High	Low-med	High

Alternatives 2 and 4 rate very similarly with Alternative 4 having a slightly higher risk due to the increase in miles of road decommissioning. Most of the roads to be decommissioned currently have false brome infestations on them and are undergoing treatment. Decommissioning reduces access for weed treatment, particularly on long stretches of road. Both alternatives have a HIGH risk of weed spread due to the greater level of ground disturbance and the current existence of weed populations in the area. Alternative 3 has a LOW-MEDIUM risk of weed spread due to reduced acres being harvested, reduced acres of ground-based equipment and reduced acres of grapple piling as compared to Alternatives 2 and 4.

Cumulative Effects

Alternative 1 – No Action

There are no cumulative effects for Alternative 1 – No Action.

Alternatives 2, 3 and 4

The area analyzed for cumulative effects is the Trout Creek analysis area and the road system accessing the analysis area. Ground-disturbing activities such as ground-based yarding systems used during timber harvest, road construction and reconstruction, vehicular traffic and recreation use contribute to the incremental increase in invasive weeds.

The impact of non-native invasive weeds on native plant communities is cumulative. The more disturbance and activity any given area is subject to, the more the risk of invasive weed introduction, establishment, and/or expansion. Past road construction and maintenance, timber harvest (approximately 56,000 acres in the South Santiam watershed), and recreation use have resulted in numerous weed sites. This project would open and reclose approximately 2.0-2.3 miles of non-system temporary road, construct 1.3 - 2.1 miles of new temporary non-system road, and thin or otherwise treat approximately 1500 acres. Post- harvest monitoring and control measures in project design

features will reduce these cumulative effects. The identification of project Design Criteria is also consistent with the Region 6 Invasive Plant EIS/ROD (2005) and the Willamette National Forest Integrated Weed Management EA (2007).

Mitigation/Project Design Criteria

- Money will be collected from the proposed timber sale to survey and control invasive weeds on all harvest units, landings, and roads in the planning area.
- Continue to pretreat invasive species along the highway corridor, and survey for, and control weeds in harvest units and along roads.
- All road construction and logging equipment will be pressure washed prior to working in the area.
- Obtain gravel for road construction and reconstruction from a weed-free rock source.
- Minimize areas of soil disturbance during all harvest activities including spur road construction, re-opening existing temporary roads, fuels treatment, etc.
- Seed all disturbed areas with native species, including landings and subsoiled skid roads to reduce weed establishment.
- Berm, gate, or rip and seed any new temporary and re-opened roads to reduce disturbance and incoming weed seed on vehicular traffic.

3.06 Roads and Access

Summary of Effects Analysis

Implementation of Alternative 1 would allow continued deterioration of the existing road system. With most drainage structures in the project area beyond their design life and with limited maintenance funding, road and drainage failures would increase over time reducing access and negatively impacting water resources in the project area (including the Menagerie Wilderness that is impacted by roads situated above and outside its boundaries). Implementing Alternatives 2, 3, or 4 would have primarily beneficial effects in the project area over the long term by identifying roads to store, maintain, or decommission, as required under Travel Management Rule 36 CFR 212. Each action Alternative would also generate funding to accomplish some or all of this work.

The project area has approximately 161 miles of road that were analyzed. With Alternative 2 (the preferred Alternative), approximately 48 miles of road would be maintained or reconstructed, 32 miles of road stored, and 6 miles decommissioned. Alternatives 3 and 4 would maintain and store similar miles, but would increase the amount of decommissioning to 10 miles. Under all action alternatives, 1 mile of new system road would be constructed. Some short term negative road impacts from road construction, maintenance and rock pit development are expected, but these effects would be minimized with environmentally friendly design features, seasonal operating restrictions, and monitoring while work is in progress.

Scale of Analysis

The Willamette National Forest completed a roads analysis in 2003. The Willamette National Forest Roads Analysis met the requirements of roads analysis at the Forest level.

A travel analysis was conducted for this project as a guide for managing the National Forest System (NFS) roads in the Trout Creek Project planning area. Field work occurred from 2014 to 2016. A travel and road management plan was developed as a result of the analysis and details current road status such as open and stored roads, road conditions, stream culvert location and conditions, road maintenance levels, and road access and travel management classifications. Data spreadsheets display this information and all documented information resides in the transportation analysis file. The travel and road management plan proposes management recommendations for roads within the transportation analysis area. The travel analysis and plan considered such road-related items as safety, risk to resources, future expected use, public and private access, emergency access, and maintenance costs.

The 2003 Willamette National Forest Road Analysis selected a set of key forest roads. These Key Forest Roads “should be operated and maintained to standards consistent with its Road Maintenance Objective. The public will be encouraged to use the system of Key Forest Roads for access into and through the Forest.” (USDA, 2003).

In 2015, to comply with Subpart A of the Travel Management Rule (66 Fed. Reg. 3206 (2001); 36 C.F.R part 212), the Willamette National Forest analyzed the benefits, risks and costs of the entire road system, incorporated stakeholder input and developed a Travel Analysis Report (TAR). This analysis is called the “Willamette National Forest Road Investment Strategy” (RIS, 2015) and provides recommendations that should be implemented in order to protect resources, provide reliable access for administrative and public use, and reduce fiscal costs over the long term. Another obligation of the rule is to identify the minimum road system needed for safe and efficient travel and for the protection,

management, and use of National Forest system lands. National and regional direction instructs Forests to complete this next step through NEPA analysis and also further analyze the [RIS] recommendations at the project level and incorporate into decisions. Please refer to Appendix D for more detailed information concerning the Road Investment Strategy and anticipated road activities in this project area.”

Affected Environment

The approximately 170 miles of existing roads in the project area include approximately 161 miles of Forest Service system roads, 8.6 miles of state highway, an undetermined number of miles of non-system roads, private roads, and no County roads. Most non-system roads are remnants of past logging activities, or have been created by the public. The Forest Service road system in the project area consists of approximately 9 miles of arterial road, 31 miles of collector roads and 130 miles of local roads (FS road types are defined in Appendix D.)

In and near the Trout Creek project area past management activities have provided the current network of Forest Roads that were developed primarily for timber sales. This system of roads now provides access to the area for various administrative activities, fire protection, public recreation, and harvest of forest products. Approximately 13 miles of road are asphalt surfaced, 46 miles are surfaced with crushed aggregate, 68 miles are surfaced with pit run rock, and 3 miles are native surfaced. Approximately 145 miles of road within the project area are currently open to mixed motorized use (MVUM 2013). Additional non-system roads add to access in the project area. The total miles of non-system roads is unknown, but the action alternatives would treat those used for this project (Alternatives 2 and 4 - 2.3 miles; Alternative 3 - 2.0 miles) as temporary spurs that will be decommissioned after use (see Table 46).

Table 46: Key Forest Roads

Road Number	Key Forest Road	Objective Maintenance Level
2000600	Yes	3 – Suitable for Passenger Cars
2022000	Yes	3 – Suitable for Passenger Cars
2025000	Yes	3 – Suitable for Passenger Cars
2027000	Yes	2 – High clearance vehicles
2027755	Yes	2 – High clearance vehicles
2032000	Yes	3 – Suitable for Passenger Cars
2032345	Yes	3 – Suitable for Passenger Cars
2032417	Yes	2 – High clearance vehicles

In recognition of reduced funding available for road maintenance, additional analysis has been conducted using a Forest Roads Investment Strategy (RIS) (WNF 2016) to further define the minimum road network needed to provide access to the forest. The RIS is an effort to manage the existing road system more effectively using feedback from internal specialists and public users of the forest to determine the values and risks associated with each road segment across the forest compared to the access value. The result is a database with a recommendation on the proposed status of each road segment that will be considered when projects are conducted that utilize those roads. Using the RIS recommendations and additional information gathered during the project specific interdisciplinary analysis, each road in the project area was further evaluated by the IDT for status: remain open, close (store), or decommission. A summary of these considerations, guided by the RIS, is shown in Table 47 for each of the action alternatives in the project area. Appendix D provides a road-by-road listing of the additional analysis by the IDT showing the prescription determined with comparison to the RIS team

recommendations. The project area is shared with private land holdings, some of which are covered by contracts with the Forest Service which include use and maintenance of roads shared with these partners. These contractual requirements were factored into District level analysis, particularly with regard to roads identified for decommissioning. Roads identified for action but not included in this project will be considered for work toward desired status as forest funds allow.

Table 47 shows RIS recommended roads either Remain Closed (RC), Analyze for Closure (AC), Analyze for Decommissioning (AD), Defer Recommendation for later analysis (DR), or Remain Open (RO). Table 47 also shows the Trout Creek IDT recommendations for road status for Alternatives 2, 3 and 4. The proposed status if each road in each alternative were made based off of RIS recommendations, input from Resource Specialists and field surveys.

Table 47: Road Status Summary Table (all values reported in miles)

Action*	Road Investment Strategy			Alternative 2			Alternatives 3 and 4		
	Closed	Open	Total	Closed	Open	Total	Closed	Open	Total
Analyze for Closure	-	13.1	13.1	-	30.9	30.9	-	29.9	29.9
Remain Closed	1.8	6.5	8.3	0.1	0.1	0.2	0.1	0.1	0.2
Remain Open	-	128.5	128.5	-	123.2	123.2	-	120.0	120.0
Defer Recommendation	-	6.6	6.6	-	-	-	-	-	-
Analyze for Decommissioning	-	3.8	3.8	1.7	4.2	5.9	1.7	8.5	10.2
Total	1.8	158.5	160.3	1.8	158.5	160.3	1.8	158.47	160.3

* Not all recommendations from the RIS and District analysis will be acted on by this project

There are currently approximately 3 miles of system roads in the project area that are closed. These roads are closed by means of gates, berms, or other physical barriers implemented through administrative closures or naturally by vegetative growth or blown down timber. There are approximately 2 miles of roads in the project area that have been previously decommissioned.

The current road system allows for access to conduct a wide variety of public, Forest Service management, and fire protection activities in the area. Specifically, Forest Roads provide access to the Menagerie Wilderness, 3 developed Forest Service campgrounds, 1 group campgrounds, numerous trailheads, lakes, and various dispersed camping sites, scenic drives, rock climbing, firewood gathering, hunting, and special forest products harvest.

The road system receives maintenance in accordance with established road management objectives. Over the last few decades, a limitation on road maintenance funds on the Forest has resulted in a backlog of maintenance work including road side brushing, drainage and ditch cleanout, and road surface repair on many of the key and secondary roads in the project area. Under Alternatives 2, 3, and 4, there are drainage improvements, brushing, and surface reconstruction which would be implemented prior to commercial haul. Most of the culverts on the roads in the project area are beyond their design life, in poor condition and/or undersized, and are in need of replacement. Alternatives 2 and 4 would include the installation or replacement of approximately 260 culverts and Alternative would include the installation or replacement of approximately 248 culverts. Additional deferred maintenance is expected in the future unless maintenance budget funding is improved. Project objectives, which include road storage and decommissioning, will reduce the maintenance backlog and slow the deterioration of the roads system by focusing reduced maintenance funding on fewer road miles.

For the action Alternatives, a number of system roads will be utilized, temporary spurs will be built, and less than one mile of permanent road will be constructed. Appendix D gives a breakdown of the

temporary spurs and new construction, identified with treatment unit and approximate acres accessed. Appendix D identifies those roads in the project area that will be utilized for the project that will receive maintenance or other work.

The project area includes a number of rock pits. Two have been identified for use in this project. One, located on Road 2027, MP 11.2, is an existing pit that would need some expansion, stripping, site development, and blasting. The other pit is a new development located on Road 2027825, MP 0.50. It would require initial development including stripping, blasting, and site and access improvement to turn it into a viable rock pit. For each pit, development and use would impact approximately 3 acres or less. There will be no rock pit creation in Alternative 3. The development of these pits will reduce or eliminate dependence on commercial rock sources, in line with our mission, and will allow additional maintenance work to be completed now and in future maintenance activities because of reduced material costs. The existing pit is already included and the new rock pit will be added to the database of active pits across the forest. This database includes pit development planning, resource assessment, and assists in oversight of all activities involving each pit. A detailed description of activities associated with rock pit expansion and created are included in Appendix D.

Environmental Consequences

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Alternative 1 would not change the use pattern of roads or correct existing road maintenance problems. Without treatment-related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance in the project area. Brush and tree growth with associated reduced visibility, debris on roads, and surface irregularities from storms, OHV, and other traffic will result in additional and continued unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage associated with localized erosion. There is currently a backlog of road maintenance and some local roads are impassible due to slides, drainage failures, fallen trees, and brush encroachment. Culverts that are not maintained because of impassible roads will eventually plug and cause washouts with sediment reaching into major drainages such as Moose Creek, Trout Creek, Falls Creek, and the South Santiam River. This trend is expected to continue as more roads deteriorate over time.

Alternatives 2, 3 and 4

Road maintenance would occur on 48 miles of road with Alternatives 2 and 4 and 46 miles with Alternative 3. Road maintenance would protect the existing road infrastructure, improve safety on the road and decrease or eliminate sedimentation from roads used for project implementation. Road maintenance may include roadside brushing, road surface blading, ditch and culvert drainage maintenance, culvert replacement and/or installation of drainage dips and water bars which will result in proper drainage, surface rocking, asphalt patching for safe use of the roads (see Design Features, Section 2.07, in Chapter 2). Roadside brushing will increase sight distance improving visibility for safer driving. There are miscellaneous segments of low standard road identified as potential haul routes throughout the project area that would require reconstruction and road surface rehabilitation to support commercial haul.

Maintenance proposed with Alternatives 2, 3, and 4 may cause a minor temporary increase in sedimentation while road maintenance work is being completed prior to treatments and associated

road use. The end result of maintenance work will be to decrease both the volume and velocity of water that carries sediments off roads into adjacent streams. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts may increase sediment delivery briefly until road surfaces and slopes stabilize, typically within one season. Attention will be paid during road reconstruction and maintenance activities to minimize potential delivery to adjacent streams and BMPs will be applied to prevent sediment delivery to the greatest extent possible. Designated water sources for filling water tankers for surface blading, compaction and dust abatement operations will have specific withdrawal procedures detailed in the contract to protect aquatic species both at the withdrawal site and downstream.

Alternatives 2, 3, and 4 would provide necessary road maintenance on haul routes and roads used for other treatment activities. This would reverse the trend of declining road conditions across an estimated 90 miles of road or approximately 60 percent of the project area's road system. The miles of road open to motorized public access in all three action alternatives would be reduced post treatment. All roads either stored or decommissioned as a result of this project would still be available for walk-in use. Maintenance activities will cause some short-term delays or detours for road users while roadwork is being performed. OHV use on roads currently open to mixed use would be restricted while treatment activities are taking place.

Alternatives 2 and 4 would build approximately 4.4 miles of temporary roads. Alternative 3 would build approximately 3.3 miles of temporary roads. The temporary roads will be a combination of existing non-system roads reopened and new construction. Implementation of the action alternatives would result in a temporary increase of disturbance due to additional miles of temporary roads and increased traffic to access the treatment stands. Temporary roads would be decommissioned once activities are completed and would not change total system road miles or significantly impact access in the long term. A benefit of the action alternatives will be a reduction in total road miles in the project area as non-system roads that are opened for this project will be decommissioned after use. Appendix D includes information about temporary road miles anticipated under the action alternatives.

Most of the original road system was constructed to accommodate logging with large yarding towers or logging caterpillars used to log large tracts of land with little regard for resource damage. Current thinning protocol utilizes small, mobile, typically road-based yarders or ground-based systems that have a much reduced impact on the various resources, but require better access than the existing roads provide. Temporary spur road construction to accommodate these new systems has been kept to a minimum in the action alternatives and utilizes previously used skid trails and other previously disturbed areas wherever possible. New temporary non-system roads would typically be located on gentle slopes and designed to minimize soil disturbance, as possible. Figure 36 and Figure 37 show temporary roads located in the Trout Creek project.

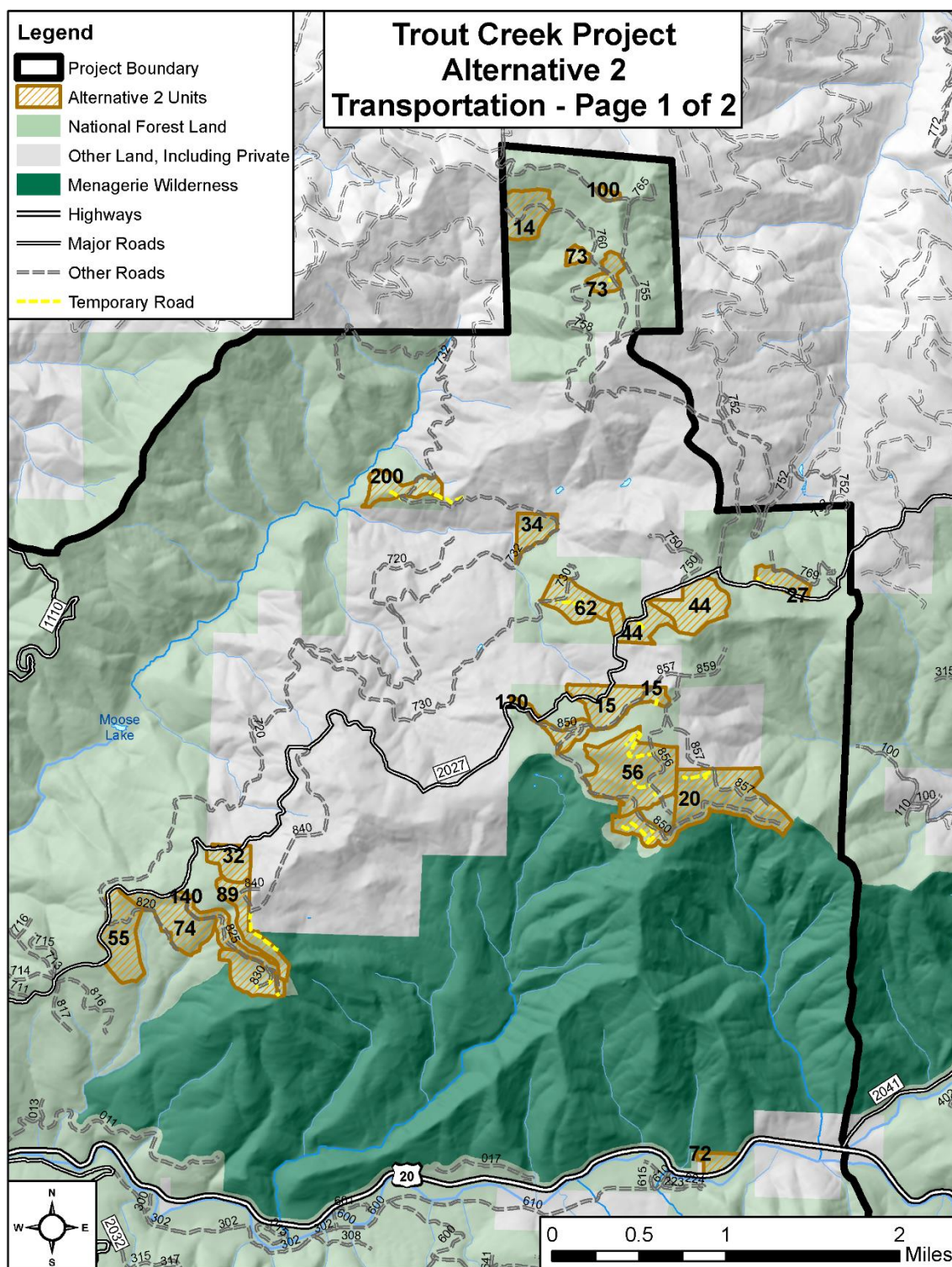


Figure 36: System Roads and Temporary Non-System Roads in the Trout Creek project for Alternative 2 (Map 1)

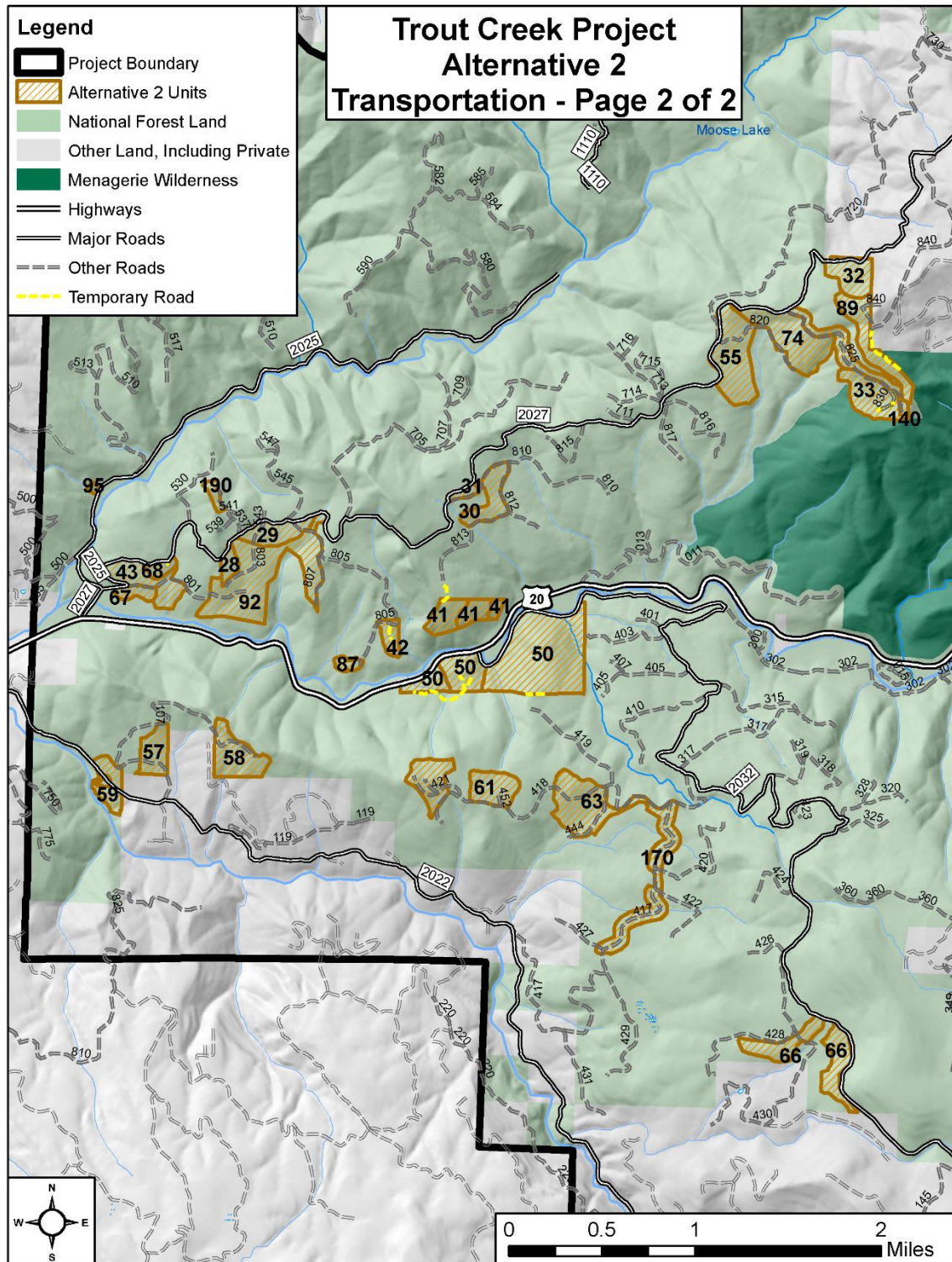


Figure 37: System Roads and Temporary Non-System Roads in the Trout Creek project for Alternative 2 (Map 2)

The project would implement approximately 31 miles (Alternative 2) or 29 miles (Alternatives 3 and 4) of system road storage and 6 miles (Alternative 2) or 10 miles (Alternatives 3 and 4) of road decommissioning within the project area. Refer to Table 48 for details. These roads would be closed through placement of various types of barriers. Roads identified for storage may include any of the following treatments as needed; closure by physical barrier, non-drivable water bars, removal of culverts from stream channels with fills of shallow to moderate depth, reduction of fill depth for culverts in deep fill locations. Note that removed culverts may be staged on the road for future use. Stored roads would include minimal disturbance to the roadbed because they will be reopened in the future for various management activities, including timber harvest and fire suppression activities. Roads identified for decommissioning may include any of the treatments identified with road storage but will also include removal of all culverts, slope re-contouring as needed to reestablish a more natural contour, and sub-soiling as needed to promote natural drainage and soil productivity. System roads that are decommissioned will be removed from the FS road system database. As noted previously, roads closed by gates are not considered stored but are closed to protect wildlife or environmental values and can be accessed for administrative purposes.

Road storage with gates, earth berms, or other means would decrease vehicular access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, and reduce road maintenance costs. Roads stored or decommissioned by the project would be left in a hydrologically stable condition to protect water quality. There would be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access stored roads for fires suppression will become a fire suppression cost.

Table 48: Proposed Road Activities Associated with Harvest

Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
New Road Construction	Miles	0	1	1	1
Temporary Road Construction	Miles	0	4.4	3.3	4.4
Roads Maintained	Miles	0	48	46	48
Roads Stored	Miles	0	31	29	29
Roads Decommissioned	Miles	0	6	10	10
Rock Pit Development	Cubic Yards	0	60,000	20,000	60,000

See Appendix D for a road-by-road breakdown of haul roads identified for use in this project. For these roads, maintenance or reconstruction will be performed, the details of which have been spelled out previously in general terms. After project disposition is also identified in the appendix for these roads.

Cumulative Effects

Past management actions have created approximately 161 miles of Forest Service road within the project area that require continuing road maintenance to provide adequate safe use and resource protection. Past budgets have resulted in maintenance cycles that have led to a decline in road condition across the project area. Alternative 1 has some short term positive cumulative effects due to no change in the minimal road maintenance being conducted. However, long term impacts will be all negative for the roads and water resources as the continuing decline in the condition of the roads and drainage structures will ultimately result in significant downstream negative sediment delivery as roads and stream crossings fail. These negative impacts will also affect the adjacent Menagerie wilderness

even though no roads enter the wilderness. The proximity of roads above the wilderness in the drainage will impact the streams there as they deteriorate and fail over time. Alternatives 2, 3 and 4 would provide needed road maintenance on haul routes and roads used for other treatment activities. Road maintenance, road storage, and decommissioning treatments proposed under the action alternatives would improve the road system by reducing potential sedimentation, increasing safety, and reducing future maintenance costs allowing better prioritization of future maintenance needs

The Forest Service does not anticipate any future significant timber sale or public works projects in the Trout Creek project area that will impact this planning effort. However, it is anticipated that harvest activities, with associated haul and other disturbance, will continue on the adjacent private timber lands in the project area. Refer to Appendix C for a complete list of past, present and future activities occurring in the Trout Creek project area.

3.07 Fire and Fuels

Scale of Analysis

Landscape level and project wide data was used to analyze the historic role of fire and its effects across the project area. Stand specific data was used in the fuels treatment recommendations for individual units.

Affected Environment

Fire on the Landscape

Within the Trout Creek planning area, naturally occurring lightning fires were one of the primary agents of disturbance prior to European American settlement. Before the beginning of fire suppression and large scale timber harvest activities, fires of variable size and intensity created a mosaic of forest types and age classes that benefitted wildlife habitat, stand dynamics, soil properties, and watershed hydrology. Some amount of fire on the landscape was also introduced by the Native American communities within the greater geographic area, but these events are thought to be focused primarily in the valley bottoms to the west (Morrison and Swanson, 1990). Small specific sites within the planning area, such as Camas Prairie at the confluence of Moose Creek and the South Santiam River, are thought to have been burned regularly to maintain or enhance camas fields. The extent of this burning across the landscape is not fully understood. In 1860, a party that scouted what would become the Santiam Wagon Road described several prairies in the vicinity of the project area, most likely a result of burning practices of the local Tribes (Wylie, 1860).

Fire Regime and Frequency

Fire frequency is a general term referring to the reoccurrence of fire in an area over a given time. The idea of a fire frequency, or return cycle, as a regular occurrence is not as predictable in the western Cascades and the Trout Creek planning area as it is in drier forest types. In the Douglas fir western hemlock forests of the western Cascades fire frequency can range anywhere from 95 to 145 years between events (Agee, 1993).

The term fire intensity refers to the amount of heat that is created at the flaming front of a fire as it moves across the landscape. The term fire severity describes the effects that a fire has on the landscape. It is important to note that these terms are not necessarily interchangeable. It is possible for low intensity fires in deep duff that do not produce much heat to have high severity fire effects in forest soils or vegetation, while high intensity fires in a grass fuel model that produce a lot of heat may have little impact on soils or vegetation and be classified as low severity.

A fire regime describes the pattern, frequency, and severity of the wildfires that prevail in an area. While the traditional model of Douglas-fir/western hemlock forests has emphasized high severity fire as the primary disturbance agent in the western Cascades, recent studies are beginning to suggest that lower severity, non-stand replacing fires may have also played a role in forest succession (Tepley, 2013). These non-stand replacing fires foster the development of a multi-cohort canopy where shade-intolerant and shade-tolerant species exist in the same stand. The impacts of fire varied greatly across this region and helped to shape the historic structural diversity that resulted in a variety of age classes and seral types.

A fire history study within the Cook-Quentin and Deer Creek drainages, approximately 10 miles southeast of the planning area, shows a high degree of variability in both fire frequency and severity. Some sites had evidence of fire return cycles as frequent as every 20 years while others were fire-free for up to 500 years. In the Deer Creek study area, fire was less frequent with small low to moderate severity fires periodically occurring in the upper elevations and larger high severity fires occurring infrequently and generally following the classic stand replacement model. The fire regime of the Cook-Quentin study area showed a fairly frequent mixed to low severity fire cycle that created mortality in patches in even-aged stands and served to thin preexisting stands. The stands that resulted from these fires were multi-aged and fit more into a mixed severity model where patchy fires of varying severity create a mix of both stand replacing and non-stand replacing fires. That leads to variations in stand structure that favors predominantly Douglas-fir over fire intolerant species (Morrison and Swanson, 1990).

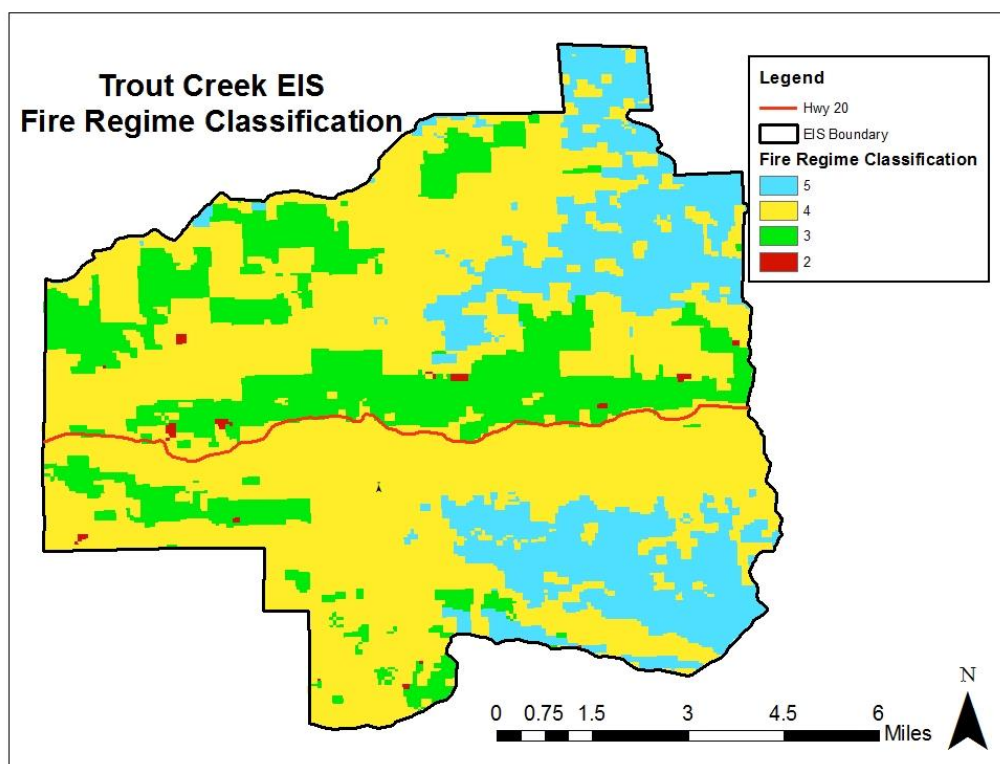


Figure 38: Fire Regime Classification of the Trout Creek Planning Area

Since 1970 there have been 65 lightning fires in the South Santiam watershed, with a 47 total acres burned. While fires continue to occur on the landscape, fire suppression efforts have been largely successful in preventing fire from playing its natural role as a disturbance agent. The last large fires in the area were a series of human caused fires in the Seven Mile area between 1885 and 1911.

The Trout Creek planning area has a mixture of fire regimes and includes the following (Figure 38):

- Fire Regime II: 0 to 35 year fire return interval; high severity (over 75% mortality)
- Fire Regime III: < 35 to 150 year fire return interval; mixed severity (25-75% mortality)
- Fire Regime IV: < 35 to 150 year fire return interval; high severity (over 75% mortality)

- Fire Regime V: 150+ year fire return interval; high severity (over 75% mortality)

Fuel Profile and Fire Behavior

The following are summaries of expected fire behavior and fuel profile conditions of stands within the planning area (NWCG, 1982).

Fuel Model 5: These stands are comprised of shrubs or young conifers with little to no dead wood where fire often carries through surface and ground fuels. Fires occurring in these stands are often of low intensity due to the light surface fuel loading. However, under severe weather conditions, such as high wind events or times of the year when foliar fuel moisture is low, these stands can see an increase in fire intensity. Managed stands that have been recently thinned fall into a separate category due to their heavier fuel loadings. Figure 39 provides an example of Fuel Model 5.

Fuel Model 8: These are stands with closed canopies of short needle conifers where surface fuels are primarily needles and small accumulations of twigs and branches. Some limited areas of heavy fuel accumulation may be present but do not substantially effect fire behavior. Most fires are slow burning ground fires although under severe weather conditions, such as high wind events or periods of low humidity and high temperatures, these fuels may pose a hazard and transition from a surface fire to a crown fire. Figure 39 provides an example of Fuel Model 8.



Figure 39: Fuel Model 5 (left) and Fuel Model 8 (Right)

Fuel Model 10: These are older stands with multiple canopy layers and greater quantities of large down dead material. During periods of elevated fire danger, this fuel type is more likely to result in higher fire intensities and has a greater probability of individual and group tree torching.

Fuel Models 11, 12 (Stands Post Commercial Harvest): Following timber harvest, stands will see an increase in the amount of fuel distributed on the forest floor. These elevated fuel loadings will create potential for increased fire intensity until fuels reduction activities take place or sufficient time elapses for fuels to break down and decompose (approximately 5 to 15 years).



Figure 40: Fuel Model 10 (left) and Fuel Model 12 (right)

Summary of Effects Analysis

Proposed actions for Alternative 2, 3, and 4 would reduce fuel loadings following timber harvest, reduce risk from wildfire to public and private lands, and introduce fire as an ecological function to portions of the landscape. Treatment of activity generated fuels would be accomplished through piling and burning and prescribed underburning to meet Forest Plan standards and guidelines for post-harvest fuel loadings. Risk from wildfire would be reduced through reduction of fuel densities in strategic areas such as roads corridors and areas adjacent to private lands in stands following post-harvest fuel treatments. Alternatives 2 and 4 include 278 acres of underburning and 157 acres of pile burning, and Alternative 3 includes 229 acres of underburning and 94 acres of pile burning. Immediately following timber harvest activities an increase in potential fire intensity will exist until fuels treatments are completed.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Under Alternative 1, the effects of fire suppression and past management activities would continue. Lack of fire disturbance would prevent the creation of new early seral conditions. Existing open areas and meadows would continue to fill in with conifers and mid-seral closed canopy conditions will continue to dominate the landscape. Managed stands would remain at their current stocking levels and short-term impacts to fire danger would be avoided as no resulting slash would be created during harvest operations. Over time however, these stands will begin to self-thin either through competition for resources, insect damage, disease, or a combination of environmental factors. Fuel loadings and fire danger would increase as a result of this self-thinning, similar to that following commercial harvest, but without any mitigating fuels treatments. Without release from dense stocking levels, tree vigor would decline and average tree diameter and bark thickness growth would stagnate leaving dense stands of small diameter trees susceptible to fire damage in the event of a wildfire.

Alternative 2

Post-harvest Fuels Treatments

Following timber harvests, there will be an increase in potential wildfire behavior. The greatest risk from fire will come in the first five years after the harvest. Needles and small twigs will remain attached to branches and limbs that form slash on the ground. Depending upon the amount and distribution of fuels, fires in the harvest area could be fairly active with high intensities, particularly in areas of heavy thinning and gaps where direct sunlight is able to reach the forest floor.

Fuel reduction treatments such as piling and burning of limbs and branches, chipping, or prescribed underburning can mitigate the effects of commercial harvests and reduce long term wildfire risk and intensity. Fuels treatments will generally be completed within 1 to 2 years following harvest and reduce total fuel loading to within or below standards set by the Willamette Forest Management Plan Standards and Guidelines FW-212 and 252.

While stands will see a short term increased risk from fire post-harvest, over the long term, the individual trees will become more fire resistant as increased growth rates will create larger diameter, thicker barked trees that will be able to withstand higher temperatures in the event of a wildfire.

All Underburn

Each underburn will have an individual Prescribed Fire Plan developed with specific prescription parameters. Prescribed burning will be conducted when threat of fire escaping from the defined unit boundaries is low and smoke management forecast are favorable. Some units will be seasonally restricted from burning activities to avoid impacts to wildlife during critical breeding periods. Units that are prescribed underburning may require fireline dug down to mineral soil around the perimeter of the burn unit.

Post-Harvest Underburning

Underburning following timber harvest would take place on approximately 278 acres and is intended to achieve a variety of resource objectives. The primary objective is the treatment of activity generated slash created by timber harvest to bring fuel loading within or below standards established by the Willamette National Forest Management Plan to reduce threat from wildfire. Underburning is the most effective way to mitigate post-harvest fuel loading and break up fuel continuity across the landscape by treating entire units. These burns target the consumption of the smaller diameter fuels, the primary drivers of fire behavior. Once this size class of fuels are consumed, future fires within these stands would lack sufficient fuel loading to burn with much intensity and would be easily controlled. Some material such as downed logs, duff, and small pockets of live and dead fuels will remain after any underburns (Figure 41 and Figure 42), but would generally not affect the ability of firefighters to safely and effectively suppress any future fires within these stands.



Figure 41: Post-harvest underburning would create a mosaic of burned and unburned areas throughout stands



Figure 42: Underburns would be timed to ensure adequate duff and down wood retention

Secondary objectives for underburns include a variety of natural resource benefits such as promotion of early seral species, improvement of big game forage, and creation of new snags. Burning would be timed to minimize consumption of duff and large woody debris. While fire would naturally occur at a larger scale throughout the planning area and have a greater degree of variability in terms of intensity and severity, prescribed underburning allows for a controlled replication of the natural fire disturbance process while minimizing threats to public safety and private property.

Low Severity Underburning

Burning in these units would take place on approximately 231 acres. These underburns would replicate low intensity fire disturbance and have an acceptable mortality range in overstory trees of 0-10%. The burning would create a mosaic of burned and unburned areas and consume most of the activity generated fuels from timber harvest activities while replicating natural fire disturbance and its effects on the environment.

Mixed Severity Underburning (Unit 56)

Underburning in Unit 56 (47 acres) would have the same objectives and effects as other post-harvest underburning but with different mortality objectives. In this unit, the desired mortality range would be 15-25% with the intention of creating pockets of snags and canopy gaps for the establishment early seral habitat (Figure 43). This mortality range would more closely replicate the effects of mixed severity fire in a Fire Regime III landscape than a typical low severity underburn and create a structurally rich environment for species that benefit from fire disturbance and snag patches. In the event the prescribed fire does not create the desired range of mortality, additional snags may be created within the unit through girdling or other means. No mortality created by prescribed burning would be salvage logged. The Forest, Stand and Structure section in Chapter 3 offers further description and a map of the treatments proposed for Unit 56.



Figure 43: Example of post burn mortality pockets in mixed severity underburning

Hardwood Fuel Breaks (Units 20, 72, 89, 120, 140, 170)

Creation of Hardwood Fuel Breaks would take place on 119 acres. These units are located in close proximity to private land along strategic ridgetops and road corridors where fire suppression resources may be most effective in controlling fire spread (Figure 44). Transition of these stands from areas dominated by conifers to areas dominated by hardwoods, such as red alder and big leaf maple, would create stands that have a higher foliar moisture content, are more resistant to tree torching, and reduce the rates of potential fire spread and flame lengths. This would reduce fire intensity and increase the effectiveness of suppression resources in controlling the spread of wildfire across the landscape. Many of these units are located adjacent to the Menagerie Wilderness. In this area, fires that escape initial attack may need to be contained outside of the wilderness boundary due to the safety concerns and operational difficulty of suppressing fires in a wilderness with limited access.

Hand or Machine Piling and Burning

Piling and burning of harvest created slash would take place on approximately 157 acres. Piling would be focused on concentrations of post-harvest slash to reduce overall fuel loading and decrease fire hazards. Pile burning would mitigate most post-harvest fuel loading but would not provide the same replication of the natural fire disturbance process as prescribed underburning. Some amount of material would be left to decompose on site and break down over time. In areas where these concentrations remain, some elevated resistance to fire control would exist until the material fully breaks down, approximately 5-15 years after harvest. Pile burning would generally take place in the fall when fire season has been declared over and there is little chance of fire spreading outside of the created piles.

Comparison of Alternatives

Table 49: Comparison of Post-harvest Fuels Treatments by Alternative

Treatment ¹	Unit of Measure	Alt 1	Alt 2	Alt 3	Alt 4
Underburning	Acres	0	278	229	278
Pile Burning	Acres	0	157	94	157
Total Fuel Treatments	Acres	0	435	323	435

¹ Post-harvest fuels treatments methods may change depending on feasibility.

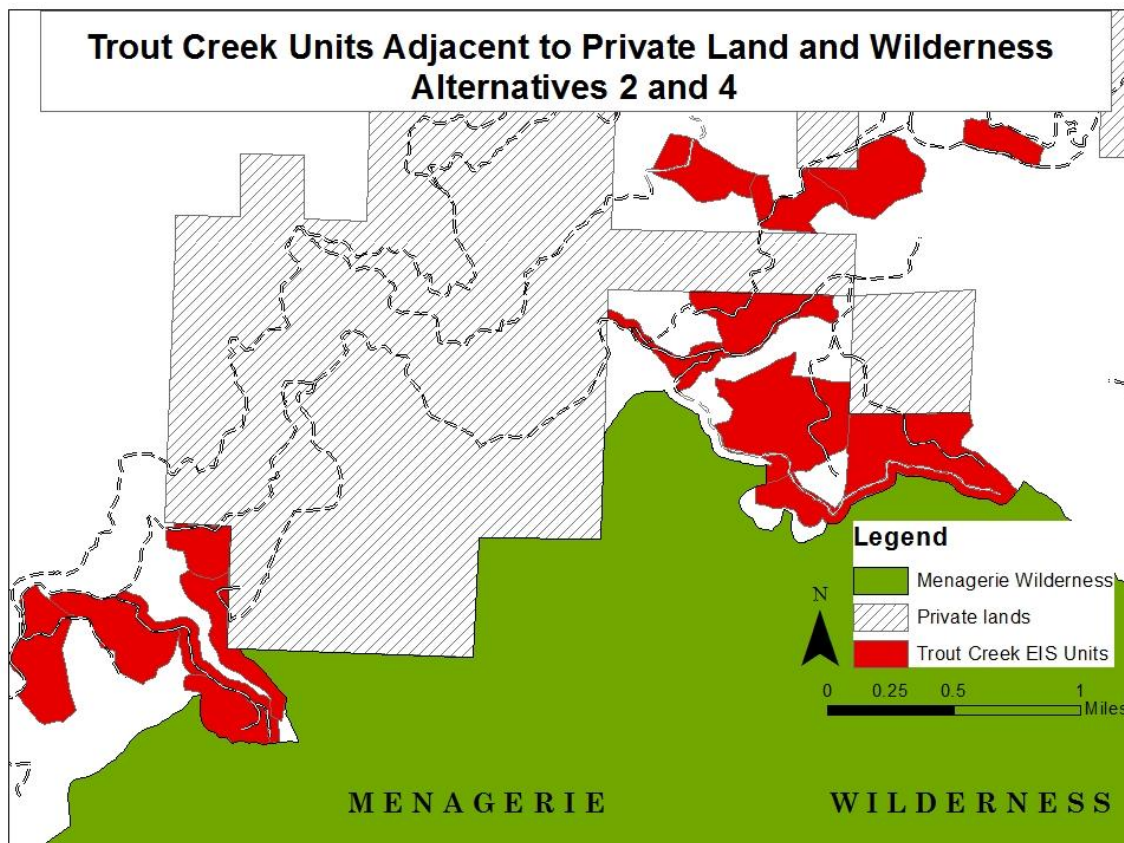


Figure 44: Trout Creek units adjacent to private land and wilderness in Alternatives 2 and 4

Alternatives 3 and 4

Alternative 3 would treat 112 less acres of activity generated fuels due to the reduction in harvest acres (Figure 45). Unit 56 would not be harvested and no mixed severity fire underburning would take place in that stand. The number of acres converted to hardwood fuel breaks would decrease from 119 acres in Alternative 2 to 43 acres in Alternative 3.

Alternative 4 would treat the same number of acres as Alternative 2 except that additional volume would be removed from Unit 56. While the underburning would still take place and the early seral habitat creation on the forest floor would be achieved, the removal of the additional volume from the

stand would decrease the amount of residual snags left in the unit and the post burn structural complexity.

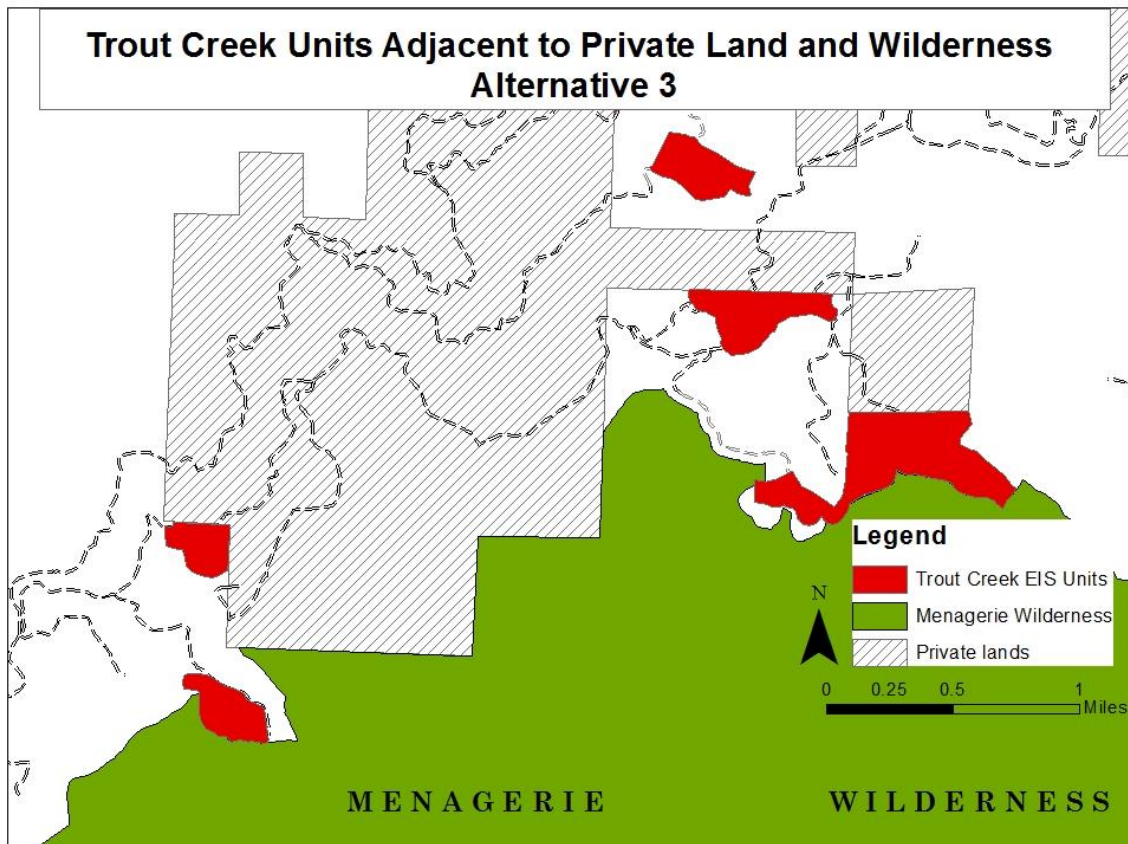


Figure 45: Trout Creek units adjacent to private land and wilderness in Alternative 3

Cumulative Effects

Alternative 1 – No Action

No cumulative effects would take place as no post-harvest fuels treatments or projects would take place.

Alternative 2, 3, and 4

Effects to fire and fuels from actions proposed in the Trout Creek project (Alternatives 2, 3, and 4) overlap in time and space with effects from the following actions:

- Sweet Home Rec/Admin Hazardous Fuels Project: Hazardous fuels reduction on approximately 12 acres to be completed between 2017-2018 at the Gordon Lakes and Rooster Rock Trailheads and the Cougar repeater site. Effects from the proposed actions combined with this project would help to reduce fuels in key locations across the project area.

- Camas Prairie Prescribed Burning: Approximately 11 acres of prescribed burning is conducted in the fall every other year (2017, 2019, 2021, etc.) to restore and enhance a native prairie ecosystem. The proposed actions in Unit 67 would expand the perimeter of the meadow and increase the future size of the prescribed burning by 2 acres.

The proposed actions would have a limited overall cumulative effect on fire and fuels concerns in the project area. While there would be a short term increase in activity generated fuel across the project area, following fuels treatments stands would be more fire resilient and moved closer to the desired future condition.

3.08 Air Quality

Summary of Effects Analysis

The community of Cascadia may experience short duration (approximately 2-5 days) of smoke impacts from burning activities associated with the Trout Creek project. Burning would be coordinated through the Oregon Department of Forestry's Smoke Management Program and impacts to local communities would be avoided as much as possible.

Scale of Analysis

The area defined for analysis is the treatment units within the project area. Additionally the larger airshed in which smoke may travel is also considered and would be included in the smoke management forecasts for individual units at the time of burning.

Affected Environment

The State of Oregon has been delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To regulate these standards, the state developed the Oregon Smoke Management Plan and the State Implementation Plan. These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission control in Oregon (Forest Plan, 1990).

Smoke Sensitive Receptor Areas (SSRA) and Class I Airsheds are priority areas regulated in order to protect air quality. The Willamette Valley is the closest SSRA to the project area however the community of Cascadia represents the area most likely to be affected by prescribed burning activities from the project. The Mt Washington and Mt Jefferson Wilderness Areas are the closest Class I Airsheds to the project area and are both approximately 20 miles from the project area. Class I Airsheds must be protected from visibility impairment July 1 through September 15.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Under Alternative 1, no management actions would take place and no smoke emissions would be created.

Alternatives 2, 3, and 4

Prescribed fire in the project area would comply with Oregon Smoke Management Plan regulations. Smoke emissions would be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. Regulations enforce specific days which are suitable to burn in relation to other land owners burning or weather forecasts.

Recreationists and some local residents near project area may be temporarily impacted by smoke from prescribed burning or pile burning. In the Oregon Smoke Management Plan, non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon SMP, 1995). Mitigation measures such as signing along roads or near treatment areas would be made prior to burning.

Prescribed burning creates particulate matter. Prescribed underburning in the spring and fall is the activity most likely to impact local communities and forest users. From past experience on the district underburning often consumes:

- 80% of the fine fuels 0-1 inch diameter (1 and 10 hour fuels)
- 60% of the 1-3 inch fuels (100 hour fuels)
- 20% of the 3-9 inch fuels (1000 hour fuels)

Large woody material over 9 inches is most often too wet to be consumed and often only the bark is charred. Because the smoke prediction model consumes 100% of 1, 10, and 100 hour fuels in spring-like conditions, it generates higher estimates of particulate matter values than have been actually experienced in past treatments. Prescribed burning activities would take place over several years and be timed avoid concentrations of smoke and impacts to communities. Table 50 summarizes the total particulate matter emissions by the model.

Table 50: Particulate Matter Emissions from Burning by Alternative

Particulate Matter	Alternatives 2 and 4	Alternative 3
PM 2.5 total	41 tons	83 tons
PM 10 total	48 tons	98 tons

Additional pile burning activities would take place in the fall following timber harvest. Pile burning would also be coordinated through the Oregon Department of Forestry and a daily limit to smoke emissions would be followed.

Cumulative Effects

Alternatives 2 and 3

Effects to air quality overlap in time and space with the following projects:

- Jude JR Timber Sale: Approximately 18 acres of underburning scheduled to take place between 2017 and 2021. Although Jude JR is outside the Trout Creek project area, emissions from both projects would share the same airshed for smoke management purposes.
- Camas Prairie Prescribed Burning: Approximately 11 acres of prescribed burning are conducted in the fall every other year (2017, 2019, 2021, etc.) to restore and enhance a native prairie ecosystem.

Cumulative effects of all burning would be mitigated through coordination with the Oregon Department of Forestry's Smoke Management Program. Adequate smoke dispersal would be verified prior to any prescribed fire activities.

3.09 Economics

Summary of Effects Analysis

This economic analysis focuses on the direct, indirect, induced costs, and benefits of the action alternative and the connected actions described in Chapter 2. Net present value and benefit to cost ratio are the primary economic criteria used to compare the effects of the action to the Federal Government termed economic efficiency analysis. Both net present value and benefit to cost ratio are positive for all action alternatives. All proposed alternatives would be above cost, including sale preparation and sale administration costs.

Most timber sales from the Sweet Home Ranger District are purchased and operated by individuals and companies based in Linn County, Oregon. Merchantable saw timber is also generally marketed and processed within Linn County. The average wood processed between 2010 and 2014 in Linn County was 272 MMBF over the five year period. Volume harvested on federal lands within the same time period averaged 21 MMBF. The Sweet Home Ranger District contributes about 8 MMBF per year to the Willamette National Forest target. The annual target of 8 MMBF equates to about 3% of the total annual harvest in Linn County. This project would contribute about 12.7 MMBF in Alternative 2, 8.4 MMBF in Alternative 3 and 15.8 MMBF in Alternative 4.

Affected Environment

Effects to the local economy, using employment statistics, can be estimated using State of Oregon Employment Department reports for the timber industry in Oregon. The analysis did not include an estimate of non-market amenity values due to the unpredictable nature of these values. Non-market values are required “only when excess demand exists for non-market goods (Forest Service Handbook 2409.18 32.24) or the project has detrimental effects on non-market output. For a comprehensive discussion of the social and economic considerations at the forest level, refer to the Willamette Forest Plan FEIS, Chapter III, pages 213-235 and Chapter IV, pages 119-130.

The latest numbers available in January of 2017 show that unemployment in Linn County was at 5.0%. Since 2005 the unemployment rate has ranged from 5.5% in September of 2007 to 14.9% in March of 2009. The overall trend in 2016 was downward from 6.0% in January to 5.0% in December. The wood product industry produces 6.5 jobs per MMBF of timber. This project would harvest 8.4 to 15.8 MMBF and create about 55 to 103 jobs. Jobs in the logging and wood product manufacturing industry in Linn County accounted for 2,284 of the 44,503 total jobs in Linn County according to the State of Oregon Employment Department. The average annual salary in Linn County was \$42,056 in the third quarter of 2016. The average annual salary for jobs in logging and wood product manufacturing was \$50,915.

Historically, the managed stands proposed for commercial harvest were logged under different standards and guidelines than typically used today. Approximately 50% of the units prescribed as skyline were originally ground-based yarded using a rubber tired or tracked skidder, sometimes on slopes greater than 50%. “High lead” logging (a skyline harvest system not commonly used today) was typically used for clear cut harvest. Partial suspension was not required. This system only works well in even aged management settings. A standing or live skyline yarding system is generally used today, and almost always used in commercial thinning stands. To best meet our current standards and guidelines, we must take a different approach to logging systems previously used in the managed stands. Opening new non-system roads to reach some of these previously harvested areas would substantially reduce ground disturbance. Helicopter logging was considered as an alternative to opening new non-system roads. This would require several helicopter landings with very little harvested timber volume flown to

each landing. Helicopter harvest systems are not currently economically viable with timber from previously managed stands. An average diameter of 16 inches is optimal for helicopter yarding systems with at least 25 thousand board feet (MBF) per acre to be removed and less than 50% canopy closure. The average canopy closure for thinned stands in this project would be greater than 50%, the average diameter would be 12 inches, and about 10 MBF per acre would be removed.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

The no action Alternative would not change the conditions or level of economic activity in the county. With no timber sale from this environmental assessment, no money would go to the county and no funding would be available for post-sale activities.

Alternative 2

Alternative 2, the proposed action, would produce an estimated 12.7 MMBF through 733 acres of commercial thinning, 31 acres of dominant tree gaps, and 101 acres of early seral creation through aggregate retention harvest. For the 35 treatment units on approximately 865 total acres, new temporary roads are required for about 2.1 miles and about 2.3 miles of temporary road would be reopened. The proposal utilizes skyline yarding systems for about 537 acres and ground-based systems for 328 acres. After accounting for all costs, including sale preparation and sale administration costs, Alternative 2 would result in a positive net present value (Table 51).

Table 51: Economic Efficiency Analysis (Alternative 2)

Present Net Value (PNV)			
Benefits (4% per year inflation)	Amount	Years Inflated	PNV
Timber volume 12,818 MBF (thousand board feet) ¹	\$7,024,264	6	\$8,887,935
Costs (4% per year inflation)	Amount	Years Inflated	PNV
Skyline system 7,747 MBF at \$250/MBF on 537 acres	\$1,936,750	6	\$2,450,607
Ground-based system 5,071 MBF at \$150/MBF on 328 acres	\$760,650	6	\$962,465
Open Existing Spur 2.3 miles at \$10,000/mile	\$23,000	3	\$25,872
New Temporary Spur 2.1 miles at \$25,000/mile	\$52,500	3	\$59,055
New Road Construction (<1 mile)	\$12,500	3	\$14,061
Haul and Scale at \$225.30/MBF (Average TEA Forest Service Region 6)	\$2,887,895	6	\$3,654,108
Slash Disposal (Fuels Planner)	\$257,698	7	\$339,113
Road Maintenance (Transportation Planner)	\$236,450	4	\$276,613
Road Reconstruction (Transportation Planner)	\$564,600	2	\$610,671
Essential KV	\$196,300	7	\$258,317
Summary	Amount or Value		
Total PNV Cost	\$8,650,883		
Net Present Value	\$237,052		
Cost to benefit ratio	1.03		

¹ \$548 value per MBF (five year average from the Oregon Department of Forestry for the Willamette Valley)

The existing transportation system consists of open system roads, closed system roads, and existing temporary roads from first entry harvest. The road network is adequate for the harvest of most of these

units. Many of the system roads, approximately 48 miles, would require pre-haul maintenance, such as blading and brushing, and/or reconstruction, such as culvert replacement or surfacing. Existing temporary roads would require more earthwork and sight distance clearing before they can be safely used as haul roads.

Alternative 3

Alternative 3 would produce an estimated 8.4 MMBF through 629 acres of commercial thinning and 39 acres of dominant tree gaps. For the 27 treatment units on approximately 668 total acres, new temporary roads are required for about 1.3 miles and about 2.0 miles of temporary road would be reopened. The proposal utilizes skyline yarding systems for about 429 acres and ground-based systems for 239 acres. After accounting for all costs, Alternative 3 would result in a lower net present value compared to Alternative 2; however, it would have the same cost to benefit ratio as Alternative 2 given the lower benefits and costs resulting from harvesting less timber volume on fewer acres (Table 52).

Table 52: Economic Efficiency Analysis (Alternative 3)

Present Net Value (PNV)			
Benefits (4% per year inflation)	Amount	Years Inflated	PNV
Timber volume 8,438 MBF (thousand board feet) ¹	\$4,801,222	6	\$6,075,078
Costs (4% per year inflation)	Amount	Years Inflated	PNV
Skyline system 5,472 MBF at \$250/MBF on 429 acres	\$1,368,000	6	\$1,730,956
Ground-based system 2,966 MBF at \$150/MBF on 239 acres	\$444,900	6	\$562,940
Open Existing Spur 2.0 miles at \$10,000/mile	\$20,000	3	\$22,497
New Temporary Spur 1.3 miles at \$25,000/mile	\$32,500	3	\$36,558
New Road Construction (<1 mile)	\$12,500	3	\$14,061
Haul and Scale at \$225.30/MBF (Average TEA Forest Service Region 6)	\$1,901,081	6	\$2,405,474
Slash Disposal (Fuels Planner)	\$206,836	7	\$272,182
Road Maintenance (Transportation Planner)	\$227,500	4	\$266,143
Road Reconstruction (Transportation Planner)	\$555,650	2	\$600,991
Essential KV	\$0	7	\$0
Summary	Amount or Value		
Total PNV Cost	\$5,911,803		
Net Present Value	\$163,275		
Cost to benefit ratio	1.03		

¹ \$569 value per MBF (five year average from the Oregon Department of Forestry for the Willamette Valley)

The existing transportation system consists of open system roads, closed system roads, and existing temporary roads from first entry harvest. The road network is adequate for the harvest of most of these units. Many of the system roads, approximately 46 miles, would require pre-haul maintenance, such as blading and brushing, and/or reconstruction, such as culvert replacement or surfacing. Existing temporary roads would require more earthwork and sight distance clearing before they can be safely used as haul roads.

Alternative 4

Alternative 4 would produce an estimated 15.8 MMBF through about 710.5 acres of commercial thinning, 54 acres of dominant tree gaps, and 101 acres of early seral creation through aggregate retention harvest. For the 35 treatment units on approximately 865 total acres, new temporary roads are required for about 2.1 miles and about 2.3 miles of temporary road would be reopened. The

proposal utilizes skyline yarding systems for about 537 acres and ground-based systems for 328 acres. Alternative 4 would harvest more timber volume on the same number of acres as Alternative 2, which would result a greater net present value and greater cost to benefit ratio compared to both Alternatives 2 and 3 (Table 53).

Table 53: Economic Efficiency Analysis (Alternative 4)

Present Net Value (PNV)			
Benefits (4% per year inflation)	Amount	Years Inflated	PNV
Timber volume 15,820 MBF (thousand board feet) ¹	\$8,716,820	6	\$11,029,558
Costs (4% per year inflation)	Amount	Years Inflated	PNV
Skyline system 9,300 MBF at \$250/MBF on 537 acres	\$2,325,000	6	\$2,941,867
Ground-based system 6,520MBF at \$150/MBF on 328 acres	\$978,000	6	\$1,237,482
Open Existing Spur 2.3 miles at \$10,000/mile	\$23,000	3	\$25,872
New Temporary Spur 2.1 miles at \$25,000/mile	\$52,500	3	\$59,055
New Road Construction (<1 mile)	\$12,500	3	\$14,061
Haul and Scale at \$225.30/MBF (Average TEA Forest Service Region 6)	\$3,564,246	6	\$4,509,908
Slash Disposal (Fuels Planner)	\$257,698	7	\$339,113
Road Maintenance (Transportation Planner)	\$236,450	4	\$276,613
Road Reconstruction (Transportation Planner)	\$564,600	2	\$610,671
Essential KV	\$138,381	7	\$182,100
Summary	Amount or Value		
Total PNV Cost	\$10,196,742		
Net Present Value	\$832,816		
Cost to benefit ratio	1.08		

¹ \$551 value per MBF (five year average from the Oregon Department of Forestry for the Willamette Valley)

The existing transportation system consists of open system roads, closed system roads, and existing temporary roads from first entry harvest. The road network is adequate for the harvest of most of these units. Many of the system roads, approximately 48 miles, would require pre-haul maintenance such as blading and brushing and/or reconstruction such as culvert replacement or surfacing. Existing temporary roads would require more earthwork and sight distance clearing before they can be safely used as haul roads.

Comparison of Alternatives

All action alternatives show a positive present net value (Table 54). The bid price would reflect the difference. The money from the bid premium would be used to fund post-sale activities within the timber sale area boundary and make payments to Linn County. In general 28% of the bid price would be used for payments to counties on Forest Service timber sales. A collection may also be made to fund sale preparation for the salvage component of future timber sales. Two to four sales may be prepared from the selected alternative.

Table 54: Economic Comparison of Alternatives

Alternative	Total PNV Value	Total PNV Costs	PNV	Benefit/Cost Ratio
2	\$8,887,935	\$8,650,883	\$237,052	1.03
3	\$6,075,078	\$5,911,803	\$163,275	1.03
4	\$11,029,558	\$10,196,742	\$832,816	1.08

Cumulative Effects

As stated in the summary at the beginning of the economic and social environment section, the majority of sales are sold to individuals and companies within Linn County. Therefore, the cumulative effects would be discussed at the county scale. The timber harvest and post-sale activities would be completed within two to seven years. The amount of jobs created would only represent a small portion of the potential job market for Linn County. The timber from the proposed action and future opportunities would provide timber sales at a scale that individuals and smaller companies that do not have a lumber mill interest can bid upon. Other districts on the Willamette National Forest usually sell to companies with a mill interest or employ more than 50 people. The sales on the Forest are typically over 5 million board feet while the Sweet Home Ranger District generally offers timber sales less than 5 million board feet. The purchasers that buy sales in Sweet Home would continue to have opportunities to compete for timber sales. Larger sales require more bonding and capital for investment. There is a beneficial cumulative effect to making these opportunities available for smaller businesses.

3.10 Recreation

Summary of Effects Analysis

Alternative 1 would have no direct, indirect or cumulative effects on Recreation resources. Alternatives 2, 3, and 4 would have short term direct adverse effects due to timber harvesting, log truck hauling, fuels treatments, and road decommissioning. Expected effects are disruptions to recreational visitors participating in a variety of activities including camping, hunting, off-highway vehicle use, and general dispersed recreation. Beneficial effects to scenic driving and dispersed use are likely to occur in the medium to long term due to maintenance of secondary roads and improved driving conditions.

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to recreation resources is the Trout Creek project area.

Affected Environment

The Trout Creek project area within the Sweet Home Ranger District is a popular destination for a wide range of both developed and dispersed recreation activities. The most popular activities include camping, hiking, hunting, fishing, whitewater boating, rock climbing, and scenic driving. There is also limited equestrian and winter recreation use. Scenic views of the South Santiam River and the adjacent forest are a meaningful recreational attraction. Developed recreational facilities, treatment units, and other recreational opportunities in the Trout Creek project area are displayed in Figure 46.

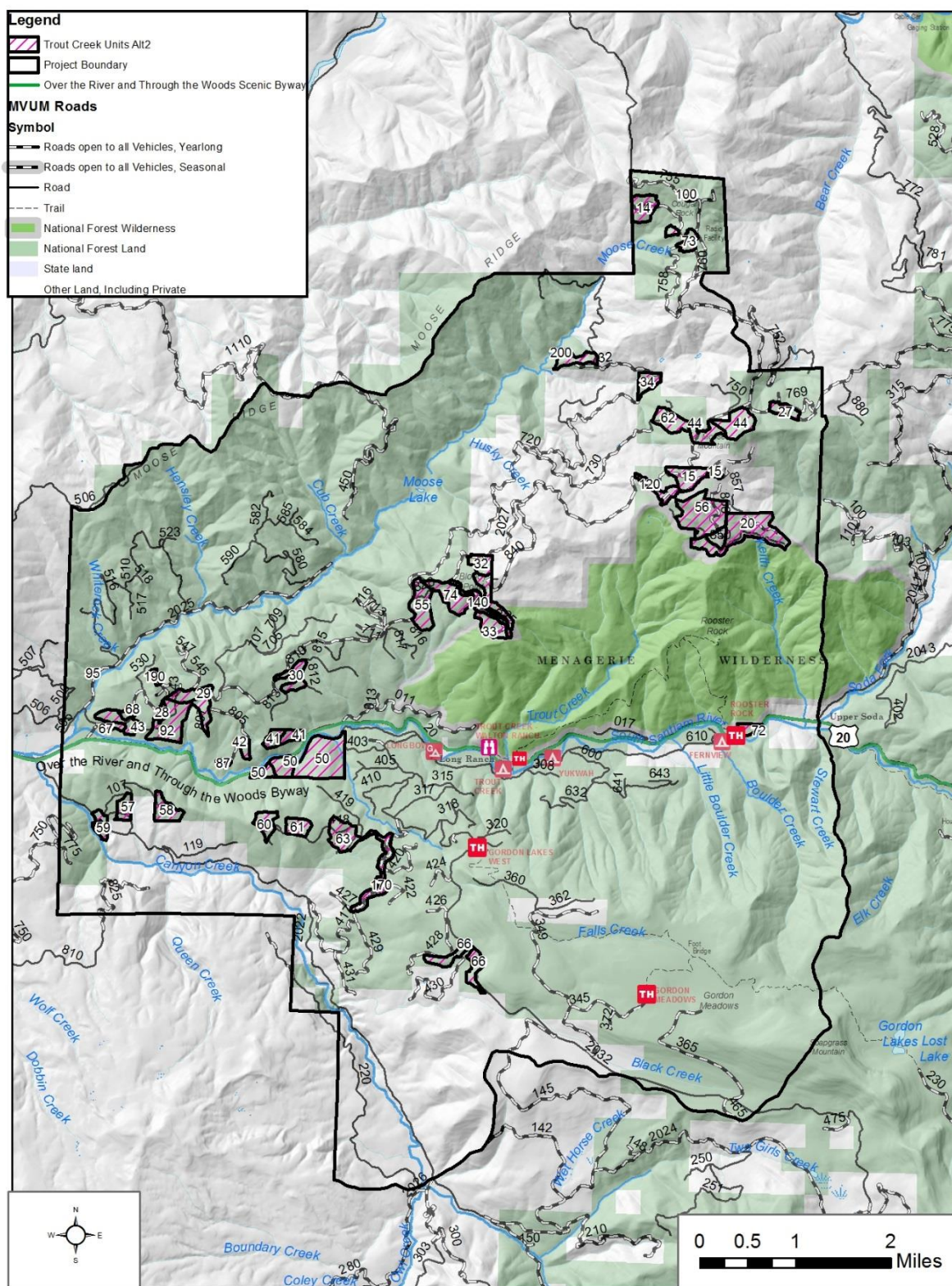
A segment of the state-designated Over the River and Through the Woods Scenic Byway is included within the project area. This byway is a 66 mile long scenic route from the Willamette Valley to McKenzie Pass that runs through the project area on state Highway 20 and is especially popular for viewing scenery and scenic driving during the summer months. Part of the historic Santiam Wagon Road also traverses the project area and is used for hiking, horseback riding, and mountain biking during the summer months.

Several developed sites in the affected area include the Longbow and Fernview Group Camps as well as Trout Creek and Yukwah Campgrounds. These sites are operated on behalf of the Willamette National Forest by the Linn County Parks and Recreation Department under a special use permit. Overnight camping for individuals as well as small and large groups is provided. Both the group camps and camp grounds are busy or full most weekends throughout the summer and have mixed occupancy during mid-week. They are closed in the winter.

A scenic overlook platform located up a short trail near the Trout Creek trailhead on Highway 20 provides middle distance views overlooking the historic Walton Ranch. In combination with the nearby Trout Creek Campground and Trout Creek trail into the Menagerie Wilderness, this area provides a multitude of recreation opportunities in close proximity to each other and is an area of relatively high activity during the summer months.

All but a small segment of the Menagerie Wilderness is located within the project area and provides opportunities for self-reliant primitive recreation including technical rock climbing on several challenging rock spires. Day hiking into the wilderness to view unusual rock formations is also popular.

Figure 46: Trout Creek Project Area Recreation Sites



Three hiking trails are included in the area: the Trout Creek and Rooster Rock trails located within the Menagerie Wilderness and the Gordon Meadows trail on the south side of the project area. The trails into the Menagerie are used throughout the year, but most frequently during the summer season. The Gordon Meadows trail receives use during the summer months when roads to the area are accessible.

Throughout the project area, dispersed sites provide undeveloped, informal opportunities along rivers, trails, and roads for visitors to camp, picnic, fish or hunt. These sites are intermittently used during the summer months for various recreational activities at lower elevations. Higher elevation sites have the heaviest visitation typically during hunting season. Hunters use preferred locations throughout the project area and use is most heavy during the opening weekends of big game seasons in the fall.

Often associated with hunting, off-highway travel with all-terrain vehicles (ATVs) and other high clearance vehicles is popular on open dirt roads throughout the project area. Many secondary roads in the project area are open to off highway vehicle (OHV) use. There are no designated motorized recreation areas.

The Fernview Summer Home Tract includes 10 recreational residences that are authorized under special use permits. They are located near the Fernview Campground along the South Santiam River. A few organized recreation events often occur each year that may include activities within the project area. There is growing interest in trail running and mountain biking events.

Recreational Opportunity Spectrum

The Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreational Opportunity Spectrum (ROS) (Willamette Forest Plan FEIS, page III-93). This system seeks to identify non-wilderness recreation settings of varying characteristics that range from remote, undeveloped areas to easily accessed highly developed sites. Settings are described in the following five ROS Classes: Primitive, Semi-primitive Non-motorized, Semi-primitive Motorized, Roaded Natural, and Roaded Modified. Primitive falls on the most unmodified natural environment end of the spectrum and Roaded Modified falls on the most substantially modified end of the spectrum. Within the Trout Creek project area, ROS classifications include Semi-primitive Non-motorized, Roaded Natural and Roaded Modified. Management activities proposed in these areas should be designed to be compatible with the corresponding ROS class and the desired setting and conditions for recreational activities.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Recreational use of National Forest system lands in the project area would remain unchanged with the No-Action alternative. Alternative 1 would have no direct or indirect effects on recreation within the project area. Beneficial effects to scenic driving and dispersed use that are likely to occur in Alternatives 2, 3, and 4 due to maintenance of secondary roads and improved driving conditions would not be realized in Alternative 1.

Alternatives 2, 3, and 4

Short term, direct adverse effects of proposed timber harvesting, log truck hauling, fuels treatments, and road decommissioning would include localized road closures limiting access and causing disruption

to recreational visitors to the forest. Logging activity, hauling, and fuels treatments would likely cause noise and dust or smoke disturbances in some instances.

Timber harvest, log hauling, and road decommissioning would have limited, short term direct adverse effects to developed recreation sites in portions of the project area. Effects would likely include increased noise during treatment periods and increased truck traffic. Harvest activity occurring in unit 50 would create increased truck traffic along the Gordon Road which is also the access route to the Longbow group camp. Decommissioning work on Forest Road 308 is likely to have noise affects to the nearby Yukwah campground. No effects are expected to the visitors driving the Over the River and Through the Woods Scenic Byway.

Unit 72 is likely to have noise affects to the Fernview Campground located directly across Highway 20. Due to unit 72 being adjacent to the Rooster Rock trailhead, access to the trailhead and parking area for hikers would be available during harvest activities due to design features included in this project and therefore would not result in adverse effects to recreational access at this location. There are no other effects to trails within the project area.

Units 20 and 56 include treatment activity along roads that provide recreational access to the north side of the Menagerie Wilderness. The design feature included in this project requires Forest Road 856 to remain open to public access while harvest activities occur would prevent adverse effects to recreational access in this area.

Road maintenance due to harvest activity on secondary roads in some locations in the project area would be likely to benefit conditions for visitors seeking scenic driving and dispersed recreation opportunities. This may indirectly result in increased dispersed recreational use in the longer term. Treatment activities in units away from the Highway 20 corridor may have short term indirect adverse effects to visitors engaged in dispersed recreation activities and OHV use due to restricted access, noise, dust and smoke. Design elements are included to provide safety signing to OHV and other road users when log hauling is occurring or if roads are temporarily closed.

Harvest activity may also have limited disruption to hunters in areas where harvest units are located and when harvest activities are occurring during hunting season. Design elements are included to limit effects to hunters during the busy opening weekends of hunting seasons. On other weekends during hunting season, truck traffic due to harvest activity may affect hunters accessing areas on the National Forest within the project area as well as on private lands that are accessed by National Forest haul roads.

This project proposes the expansion of an existing rock processing site located at the junction of Forest Road 2027 and Forest Road 820. Additionally a new rock pit, proposed for Forest Road 825, would eliminate an existing dispersed use site. Loss of this site would reduce an opportunity for camping, but there are other locations in the general area of this site that would provide a substitute location for dispersed use activities. For each pit, development and use would impact approximately 3 acres or less.

No effects are expected to occur to forest visitors that are horseback riding, visiting the forest for winter recreation, or fishing and whitewater boating on the South Santiam River. There are no significant differences in effects between Alternatives 2, 3, and 4.

All activities proposed in the Trout Creek project are consistent with the requirements for existing ROS classes within the project area. The desired condition for the setting and activities in the Semi-primitive Non-motorized, Roaded Natural, and Roaded Modified classes are maintained.

Cumulative Effects

Alternative 1 – No Action

Recreational use of National Forest system lands in the project area would remain unchanged with the No-Action alternative. Alternative 1 would have no cumulative effects on recreation within the project area.

Alternatives 2, 3, and 4

Two timber sales currently occurring in the project area (Owl Thin and Moe Thin) may slightly increase short term, adverse effects to dispersed recreation in the southern portion of the project area around the Canyon Creek road due to increased noise and traffic. No other effects are expected from past or current activities.

The Rec/Admin Fuels Treatment project at the Rooster Rock trailhead is a reasonably foreseeable future action that may incrementally add effects to this area if it were to occur at the same time as the treatment activities proposed for unit 72. However, design features included in both projects should prevent any direct detrimental effects.

3.11 Scenic Quality

Summary of Effects Analysis

Alternative 1 (no action) would have no adverse effects to scenery because no treatments would occur under this alternative. This alternative would also fail to reap benefits to scenery that would occur as a result of the proposed action.

Alternatives 2, 3, and 4 would not have negative long-term effects to scenery. Views from Panorama Point, a northern entrance to the Menagerie Wilderness, and infrequent points along Highway 20 may be slightly altered, but changes would be consistent with historical variation in the scenic character of the area. The proposed actions would provide benefits to scenery by maintaining visual variety (hardwoods), and protecting the sustainability of the valued scenic character through fuels treatments. The proposed actions would meet Visual Quality Objectives and be consistent with standards and guidelines set by the Forest Plan.

Scale of Analysis

The geographic scale used to assess direct, indirect, and cumulative effects to scenery is the project area with specific attention to the South Santiam Highway viewshed and Key Observation Points identified within the project area.

Methodology

ArcGIS 10-3-1 was used for GIS analyses and mapping in the winter and spring of 2017. Google Earth, field photography, and Adobe Photoshop were used for visualizations and simulations in the fall of 2016.

Affected Environment

Scenic Character

The historic range of conditions for the Trout Creek project area is characterized by a landscape mosaic with variation in vegetation size, age, and density resulting from a mixed severity fire regime. The landscape likely had more variety in vegetation than today, including more hardwoods (bigleaf maple, red alder, Oregon white oak, and madrone).

Today the project area is dominated by Douglas-fir and western hemlock with a mid to late seral closed canopy condition. Few pockets of hardwoods dot the landscape to provide minimal visual variety. Past logging activities and absence of mixed severity fire has created dense, uniform vegetation conditions. Views into the forest are limited due to the density of the stands. The project area is characterized by moderate to steep topography with some overlooking vistas, peaks and a few rocky outcroppings and cliffs.

Sustainability of Desired Scenic Character

Variation in existing vegetation (hardwoods) is limited by the lifespan of these species and the lack of habitat for younger hardwoods. Vegetation in its current dense, relatively even-aged state, is at a risk to large, high intensity fires that results from the lack of smaller, mixed severity fires that are the characteristic disturbance regime.



Visibility

The South Santiam Highway viewshed corridor runs through the project area (Figure 47). The Over the River and Through the Woods Scenic Byway (Highway 20) is found within this corridor and is considered a sensitive area for scenery management. Both through-drivers and forest visitors frequent this route. The majority of Menagerie Wilderness falls within the project area as well as segments of the Gordon Lakes, Trout Creek, and Rooster Rock trails. Developed campgrounds within the project area include Longbow Organization Group camp, Trout Creek campground, Yukwah campground, and Fernview campground. Due to the longer duration of viewing by hikers, climbers, and campers, views from these points would have a higher sensitivity level. Therefore, treatments apparent from these areas were considered carefully in the effects analysis.

Visual Management System (VMS)

The Visual Management System (VMS) is the primary means for planning and managing the Willamette National Forest's scenic resources. VMS was used to inventory and categorize landscape zones of relative scenic importance in the Forest Plan. The zones are based on attractiveness, and proximity to travelways and use areas. These zones are assigned one of five Visual Quality Objectives (VQOs) that represent relative degrees of acceptable alterations of the natural landscape (USDA Forest Service, 1974). The VMS methodology and Willamette National Forest Plan were created during an era and with the assumption that silvicultural treatments would be primarily regeneration harvest (clear-cuts). This inherent assumption in the methodology adds complexity to using the system when interpreting and evaluating modern commercial thinning treatments.

VQOs for the Trout Creek project area include preservation, retention, partial retention, modification, and maximum modification (USDA Forest Service, 1990). Project area VQOs are illustrated in Figure 48 and Figure 49 for Alternatives 2, 3, and 4 and are described in detail in Table 55.

Scenery Management System (SMS)

The Scenery Management System (SMS) is a methodology (1995) used by the Forest Service to provide an impact assessment of effects to scenic resources. This method aims to integrate social impacts to recreation visitors with physical impacts to the visitor experience. SMS ratings are described in terms of Scenic Integrity Levels, which describe existing conditions and the degree to which the landscape is perceived as visually intact or complete (USDA Forest Service, 1995). When a Forest Plan is revised using SMS, Scenic Integrity Objectives are developed. This analysis bridges VQOs in the Forest Plan to Scenic Integrity Levels that best match descriptions.

While the current Forest Plan is tiered to the VMS method, SMS has also been used in this analysis to facilitate the change in methodology. Table 55 describes the five VMS/SMS categories, associated SMS/Scenic Integrity Level categories, and the proposed treatment acres in each category for Alternatives 2, 3, and 4.

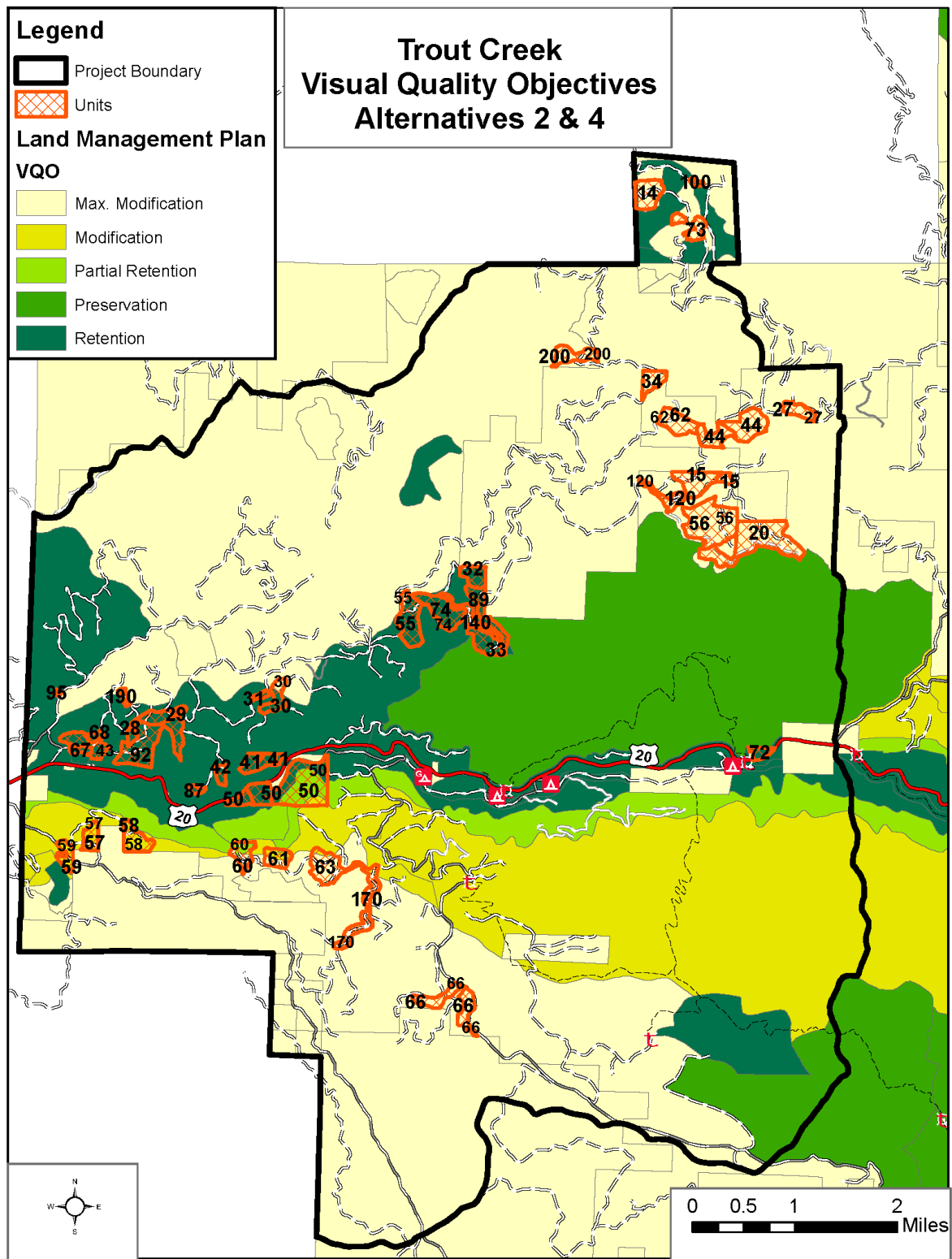


Figure 48: Visual Quality Objectives and Alternative 2 and 4 Units

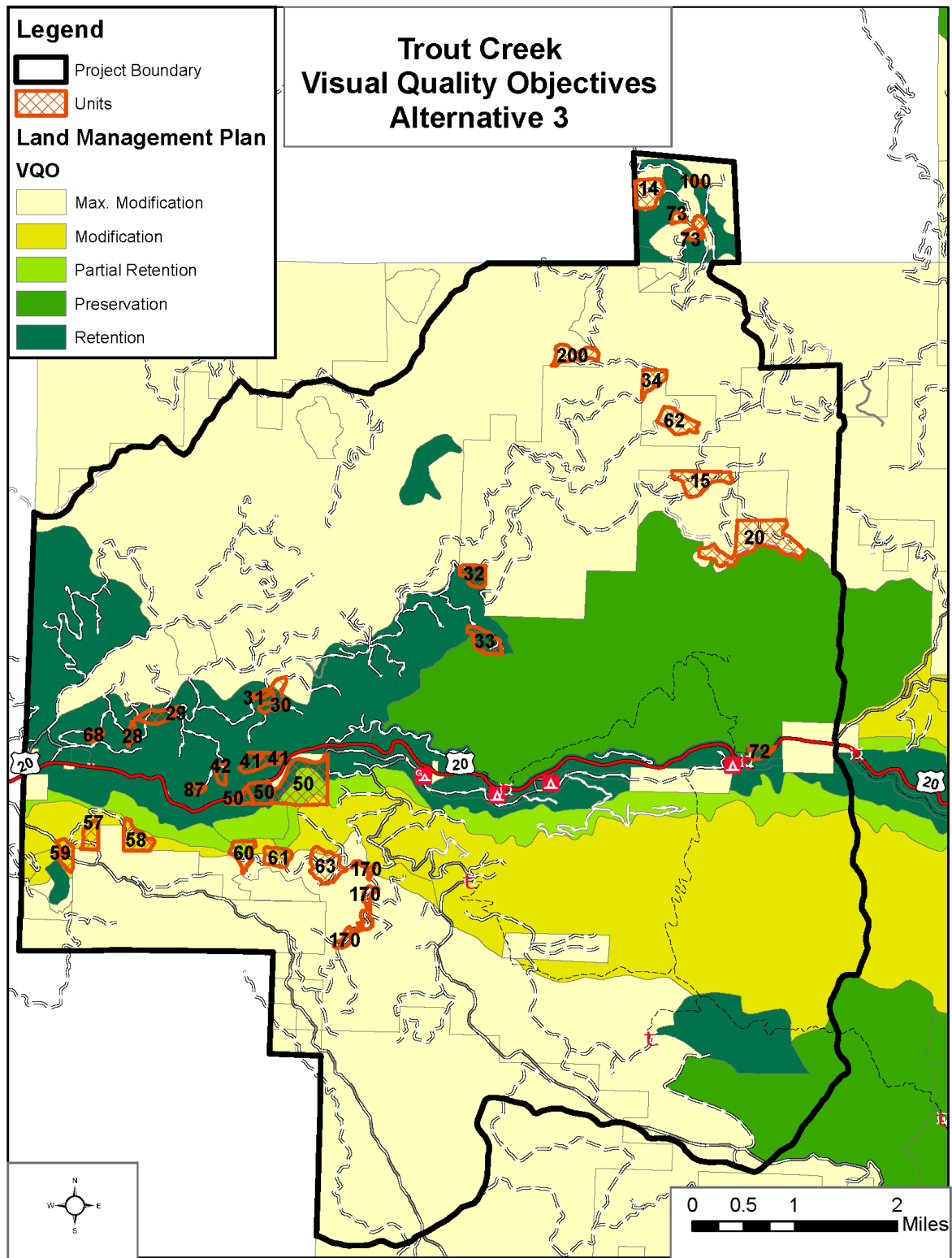


Figure 49: Visual Quality Objectives and Alternative 3 Units

Table 55: VMS/SMS Objectives and Proposed Treatment Acreage

(VMS) Visual Quality Objective	(SMS) Scenic Integrity Level	Proposed Treatment Acres in Alt. 2	Proposed Treatment Acres in Alt. 3	Proposed Treatment Acres in Alt. 4
Preservation: Provides for ecological changes only	Very High: Scenic character is intact with only minute if any deviations. The existing scenic character and sense of place is expressed at the highest possible level	0	0	0
Retention: In general, human activities are not evident to the casual forest visitor.	High: Scenic character appears intact. Deviations may be present, but must repeat the form, line, color, texture, and pattern common to the scenic character so completely and at such a scale that they are not evident.	604	283	604
Partial Retention: In general, human activities may be evident but must remain subordinate to the characteristic landscape.	Moderate: Scenic character appears moderately altered. Noticeable deviations must remain visually subordinate to the scenic character being viewed.	84	84	84
Modification: Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture and appear as natural occurrence when viewed in foreground or middle-ground distances.	Low: Scenic character appears moderately altered. Deviations begin to dominate the valued scenic character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.	115	112	115
Maximum Modification: Human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.	Very Low: Scenic character appears heavily altered. Deviations may strongly dominate the valued scenic character.	784	464	784

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no direct or indirect effects on scenery in the project area, and all VQOs would remain consistent with Forest Plan direction. Natural processes would continue unimpeded by management actions, and potential benefits to scenery such as improved views into the forest or sustained visual variety gained by hardwood treatments would not be realized. Long-term impacts to scenery may include less variety in the landscape that would otherwise be created by hardwood

treatments and thinning to encourage multiple age cohorts. The landscape would continue to veer further from its historic range of conditions characterized by now-absent mixed severity fire disturbances. The valued scenic character would also be further threatened in the long-term by increased threat of large, high intensity fires.

Alternative 2

Proposed treatments in Alternative 2 fall well under the thresholds set for disturbances in scenic-emphasis management areas in the Forest Plan (Table 56). Visual Quality Objectives would be met with the aid of design features. Assessments of Key Observation Points within and around the project area show that the majority of impacts to scenery would be minor and short-term or unapparent to the casual forest visitor. Impacts to views near a northern entrance to the Menagerie Wilderness frequently used by climbers would be apparent, but design features would be used to soften the effects of the treatment. Views from all campgrounds and the majority of trails within the project area would be unaffected. Rooster Rock trailhead would see minor, short-term impacts from fuels treatments and many proposed actions (fuel breaks and hardwood treatments) would provide a benefit to scenery by improving the sustainability of the valued scenic character.

Table 56: Scenic-Emphasis Management Area Thresholds

Management Area	Project area within Management Area	Recovered Stand Height ¹	Total Allowable Disturbed Area (%)	Alt. 2 Disturbed Area / (%)	Alt. 3 Disturbed Area / (%)	Alt. 4 Disturbed Area / (%)
11a- Scenic, Modification, Middleground	4,990 acres	4.5 ft.	24%	13 acres / <1%	15 acres / <1%	15 acres / <1%
11c- Scenic, Partial Retention, Middleground	608 acres	15-20 ft.	20%	0 acres / 0%	0 acres / 0%	0 acres / 0%
11d- Scenic, Partial Retention, Foreground	535 acres	10-15 ft.	14%	0 acres / 0%	0 acres / 0%	0 acres / 0%
11f- Scenic, Retention, Foreground	4,517 acres	10-15 ft.	10%	59 acres / 1%	9 acres / <1%	63 acres / 1%

Scenic Viewsheds

When considering the visual impact of vegetation management activities within the South Santiam Highway viewshed corridor, it is important to consider the distance at which different parts of the landscape are viewed. The Forest Plan outlines management areas that are specific to viewshed corridors and divides them by distance zones from which the areas would be viewed. In Table 56, the allowable areas of disturbance and minimum height for stand recovery are given for the scenic management areas. At the time the Forest Plan was written, “disturbances” were considered large scale or cumulative vegetative disturbances such as regeneration harvest, fire, or major road construction over the landscape. Management activities such as commercial thinning, understory habitat enhancement, fuels reduction, and riparian treatments in Alternatives 2, 3, and 4 would not be considered “disturbances.” Thinning to 20-40 residual trees per acre, aggregate retention for early seral habitat creation, and gaps one acre or greater in size are considered “disturbances” for the purpose of scenery impact assessment.

Gaps are proposed for approximately 8 acres and thinning to 20-40 residual trees per acre is proposed for about 5 acres in 11a- Scenic Modification, Middleground in Alternative 2. No treatments qualifying as “disturbances” are proposed in 11c- Scenic, Partial Retention, Middleground or 11d- Scenic, Partial Retention, Foreground. 11f-Scenic, Retention, Foreground includes about 5 acres of gaps, 2 acres of aggregate retention/early seral creation, and 52 acres of thinning to 20-40 trees per acre in Alternative 2. The proposed action is well below the thresholds of allowable disturbed area set for each management area.

Scenic, Retention, Foreground is found primarily along the north side of Highway 20 (Over the River and Through the Woods Scenic Byway) and to the west of the Menagerie Wilderness. Units 50 and 72 would be adjacent to Highway 20. A 344 foot no-harvest riparian buffer for the South Santiam River would extend into the unit where the road parallels the river. Other units along the highway are blocked by foreground vegetation or topography and would unlikely be noticed by the casual forest visitor driving through the project area. Treatments in Unit 50 would benefit scenery by maintaining the visual variety of the alder stand long-term. Unit 72 would affect the scenic quality from the Rooster Rock trailhead, and may be visible from Highway 20. The long-term benefits of providing a fuel break around the structure and trailhead area would likely outweigh short-term impacts to scenery. In order to soften impacts to scenery along the trailhead, no trees would be cut within 30 feet of the trail. Additionally, understory vegetation in roadside frontage zones would be maintained, and trees would be marked facing away from the road.

In Scenic, Retention, Foreground and Scenic, Partial Retention, Foreground, slash treatments of chipping/removal, chipping/dispersal, and piling/burning would be used to reduce impacts from views within the South Santiam Highway viewshed. Careful design and obliteration techniques for new temporary haul roads and landings that blend constructed features into the landscape would further reduce impacts of proposed actions.

Key Observation Points

Although the proposed actions meet scenic quality standards specified in the Forest Plan, it is prudent to also consider whether the treatments would be readily seen from Key Observation Points at vista points accessible by official trail or road within the project area. Valued and visually sensitive viewpoints were identified using knowledge of the project landscape and visibility assessment using ArcGIS and Google Earth.

Views from the Gordon Lakes, Trout Creek, and the majority of the Menagerie Wilderness would be unaffected by proposed treatments. Developed campsites within the project area including Longbow Organization camp, Trout Creek campground, Yukwah campground, and Fernview campground would also be unaffected.

Key Observation Points within the planning area and surrounding vicinity were identified as views from Rooster Rock trailhead, and vistas from Rooster Rock, and Panorama Point. An entrance to the Menagerie Wilderness from the north frequently used by climbers was also analyzed for effects to scenery. Figure 50 illustrates the key observation points identified within the planning area.

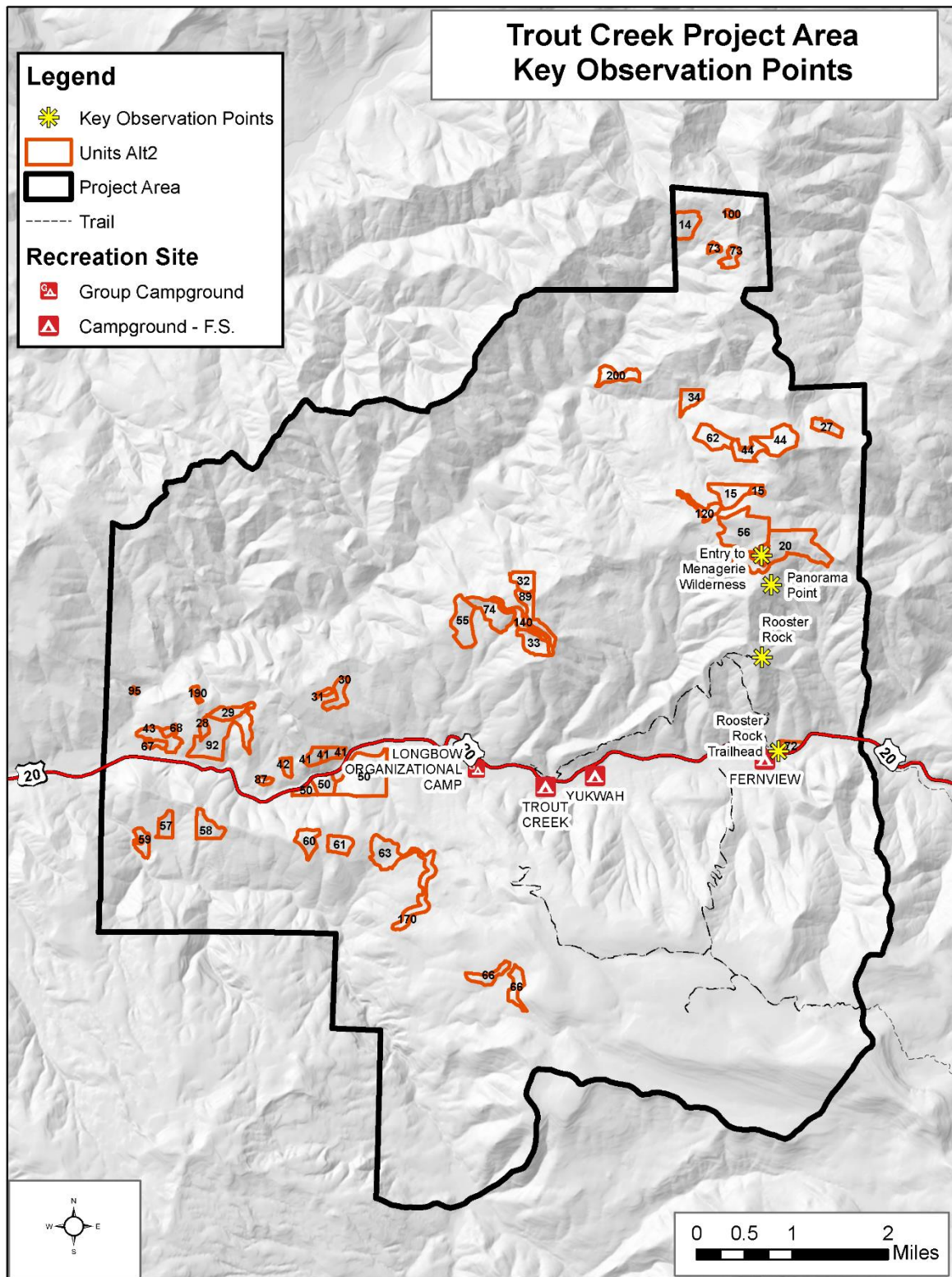


Figure 50: Trout Creek Project Area Key Observation Points

Iron Mountain and Jump-Off Joe were also assessed, but the distance and existing variation in the landscape would make any treatments very difficult to perceive from these vistas

Unit 72 encompasses the Rooster Rock trailhead (Figure 51). Proposed treatments include thinning to 50% canopy cover to favor hardwoods and for fuels reduction. Thinning would be noticeable, especially shortly after harvest. Long term benefits of the treatment for scenery would include opening views into the forest for trail users and providing variation in the landscape (less dense and more visible hardwoods as per the prescription). Design features to soften impacts to scenery include a no-cut buffer of 30 feet on either side of the trail and marking trees on the side facing away from the trail.



Figure 51: Conditions of Rooster Rock Trailhead, October 2016

Looking west from atop Rooster Rock, distance and existing variation in the landscape would make any treatments very difficult to perceive for the casual forest visitor. Looking north, views of Unit 20 would be blocked by trees in the foreground. Figure 53 is a photo displaying the conditions from Rooster Rock summit.



Figure 52: Photos taken from Panorama Point looking toward treatment area (Unit 20), fall 2016

Looking north from Panorama Point, Unit 20 would be noticeable to forest visitors, primarily climbers in the Menagerie Wilderness (Figure 52). Since the proposed treatment is designed to mimic the natural disturbance regime, namely mixed severity fire, the visual change would be close to the historic range of conditions. Treatments would differ from fire in the fewer number of snags created and the absence of significant traces of fire activity. The unit would be underburned, which would contribute some short-term evidence of fire. The existing rock outcroppings do provide the landscape with some visual absorption capability (the ability to accept human alterations without loss of character of scenic quality). To further enhance the creation of a natural appearing mosaic, design features for Unit 20 and Units 32, 89, and 140, which fall within Scenic, Retention, Foreground, would include softening edges by feathering unit and gap edges and leaving skips in organic, non-geometric shapes in a variety of sizes. Thinning adjacent to unit boundaries would remove taller, older trees and favor younger ones to reduce a vertical wall effect. Treatments would also avoid widely spacing trees that are silhouetted along the skyline. Figure 54 and Figure 55 replicate the view of Unit 20 before and after treatments.



Figure 53: Conditions from Rooster Rock Summit, November 2016

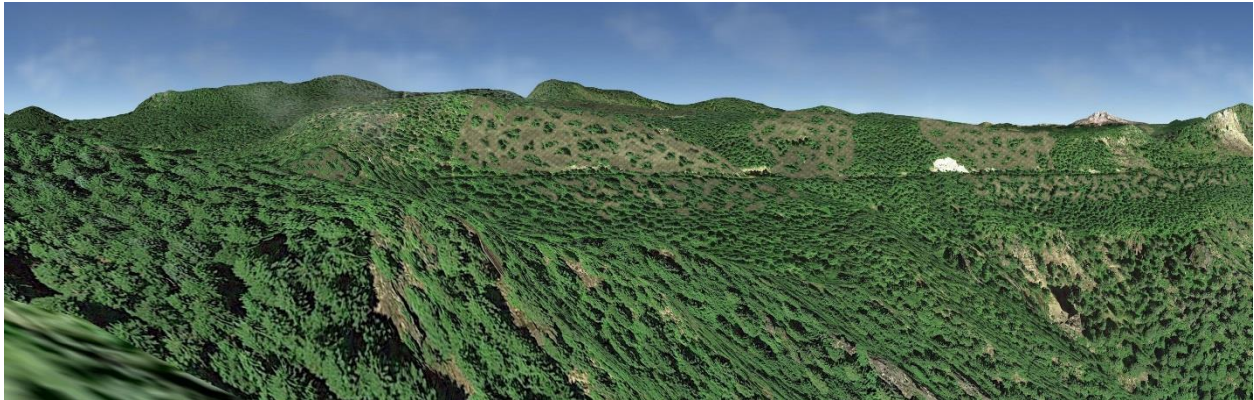


Figure 54: Google Earth and Photoshop simulation of proposed treatments (Unit 20) from Panorama Point looking north



Figure 55: Google Earth view from Panorama Point looking north

Proposed aggregate retention for early seral habitat creation of 47 acres in Unit 56 would also be apparent to climbers entering the Menagerie Wilderness. Impacts to scenery would be lessened by feathering the edges of the unit and using organic, non-geometric shapes for edges of the unit and aggregate retention areas.

Alternative 3

Proposed treatments in Alternative 3 would also fall well under the thresholds set for disturbances in scenic-emphasis management areas in the Forest Plan (Table 56), and Visual Quality Objectives would be met with the aid of design features. Few differences in impacts to scenery exist between the proposed action and Alternative 3. Most effects to scenery resulting from changes from the proposed action in Alternative 3 would likely be unperceived by the casual forest visitor. An exception is the aggregate retention for early seral habitat creation proposed for Unit 56 near a climber entrance to the Menagerie Wilderness in Alternative 2. This treatment is not included in Alternative 3.

Scenic Viewsheds

Gaps are proposed for approximately 10 acres and thinning to 20-40 residual trees per acre is proposed for about 5 acres in 11a- Scenic Modification, Middleground in Alternative 3. No treatments qualifying as “disturbances” are proposed in 11c- Scenic, Partial Retention, Middleground or 11d- Scenic, Partial Retention, Foreground. 11f-Scenic, Retention, Foreground includes about 9 acres of gaps in Alternative

3. The cumulative treatments qualifying as “disturbances” in Alternative 3 are all well below the thresholds set for each management area.

Key Observation Points

Effects to scenery and associated design features for most of the identified Key Observation Points would be similar to those addressed in Alternative 2. Any deviations would be minor and would be unlikely to be perceived by the casual forest visitor. Effects to scenery around Unit 56 (climber entrance into the Menagerie Wilderness) would be absent due to the removal of this unit in Alternative 3.

Alternative 4

Proposed treatments in Alternative 4 would also fall well under the threshold set for disturbances in scenic-emphasis management areas in the Forest Plan (Table 56), and Visual Quality Objectives would be met with the aid of design features. Few differences in impacts to scenery exist between the proposed action and Alternative 4. Effects to scenery resulting from changes from the proposed action in Alternative 4 would likely be unperceived by the casual forest visitor.

Scenic Viewsheds

Gaps are proposed for approximately 10 acres and thinning to 20-40 residual trees per acre is proposed for about 5 acres in 11a- Scenic Modification, Middleground in Alternative 4. No treatments qualifying as “disturbances” are proposed in 11c- Scenic, Partial Retention, Middleground or 11d- Scenic, Partial Retention, Foreground. 11f-Scenic, Retention, Foreground includes about 9 acres of gaps, 2 acres of aggregate retention/early seral creation, and 52 acres of thinning to 20-40 trees per acre in Alternative 4. The cumulative treatments qualifying as “disturbances” in Alternative 4 are all well below the thresholds set for each management area.

Key Observation Points

Effects to scenery and associated design features for all of the identified Key Observation Points would be virtually identical to those addressed in Alternative 2. Any deviations would be minor and would be unlikely to be perceived by the casual forest visitor.

Cumulative Effects

Cumulative effects for scenery result when the level of visual quality or scenic integrity drops below that of Visual Quality Objectives set in the Forest Plan. Past, present, and reasonably foreseeable actions including timber harvest, prescribed fire, road development, etc. affecting the integrity of the valued scenic character on USFS land in the project area would be relevant in a cumulative effects analysis for scenery.

Alternative 1 – No Action

No cumulative effects to Visual Quality Objectives or the valued scenic character of the project area would occur because Alternative 1 would not contribute any effects to scenery.

Alternatives 2, 3, and 4

No cumulative effects to Visual Quality Objectives or the valued scenic character of the project area would occur because actions with corresponding design features for Alternatives 2, 3, and 4 are anticipated to result in no impacts to scenery.

3.12 Wilderness

Summary of Effects Analysis

Alternative 1 would have no direct, indirect or cumulative effects to wilderness character in the Menagerie Wilderness. Alternatives 2, 3, and 4 would have both long term direct beneficial and long term indirect adverse effects to the natural quality of wilderness character in the Menagerie Wilderness. These alternatives would also have medium to long term direct adverse effects to the outstanding opportunities quality of wilderness character.

Beneficial effects include improved aquatic organism passage, improved prey for peregrine falcons, possible improved forage for terrestrial wildlife, and improved biological diversity in areas adjacent to the wilderness. Adverse effects include a high risk of the introduction of invasive species, disruption to northern spotted owls and peregrine falcons and their habitat, increased visible evidence of human activity, and increased sounds of human activity.

The beneficial effects to the Menagerie Wilderness are similar in each action Alternative. The adverse effects are greatest in Alternatives 2 and 4, with Alternative 3 having relatively less adverse effects.

There are cumulative adverse effects to the same qualities of wilderness character when there is the combination of timber harvest on private timberland adjacent to the Menagerie Wilderness and activities proposed in the Trout Creek project.

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to Wilderness is the Trout Creek project area and the entire Menagerie Wilderness and Middle Santiam Wilderness. The Menagerie Wilderness is located almost entirely within the boundary of the project area and has the potential to be affected. The Middle Santiam Wilderness is located northwest of the project area with the closest part of the project area being about two miles away. Due to the distance away from the project area of the Middle Santiam Wilderness, it is included in the scale of analysis because it could potentially be affected by the project. However, this analysis has determined that there are no effects from the project to the Middle Santiam Wilderness, so it is not further included in this section. In addition, temporal scales are used to assess direct, indirect, and cumulative effects to Wilderness. For the purpose of this analysis short term is defined as actions with effects lasting less than one year, medium term effects are those from one to five years in duration, and long term effects are those lasting greater than five years.

Affected Environment

The Wilderness Act and Forest Service Policy direct the Forest Service to manage Wilderness areas for the “preservation of their wilderness character”. Impacts to wilderness character can result from conditions and activities that occur both within Wilderness and beyond its boundaries. There are no activities proposed to occur inside the Menagerie Wilderness in the Trout Creek project. However, for the purposes of determining impacts to Wilderness, effects to wilderness character that originate from activities occurring outside Wilderness, but within the project area, are considered.

Wilderness Character

Wilderness character has up to five defining qualities:

- Untrammeled: Wilderness is essentially wild, unconstrained, unhindered and free from modern human control or manipulation. Indicators of impacts to the untrammeled quality include actions that intentionally manipulate the biophysical environment.
- Natural: Wilderness ecological systems are substantially free from the effects of modern civilization. Indicators of impacts to the natural quality include effects that occur to plants and animal species and communities, soil, air, water, and ecological processes.
- Undeveloped: Wilderness retains its primeval character and influence and is essentially without permanent improvements or modern human occupation. Indicators of impacts to the undeveloped quality include the presence of structures or installations and the use of motorized equipment or mechanical transport within Wilderness.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Visitors to Wilderness find outstanding opportunities for self-reliant, challenging, non-motorized, and non-mechanized primitive recreational experiences. Wilderness serves as a haven for self-discovery and rejuvenation and as a refuge from modern civilization. Indicators of impacts to this quality include remoteness from sights and sounds of human activity, presence of facilities that decrease self-reliance, and management restrictions on visitor behavior.
- Other features of value: This quality captures important elements or “features” of a particular wilderness that are not covered by the other four qualities. This quality of wilderness character has not yet been defined for the Menagerie Wilderness and is not considered in this analysis. (Landres et al., 2015, p. 33-61)

Wilderness Resource Spectrum Class

The Forest Service uses a land classification system to inventory and describe a range of management goals, desired future conditions, and standards and guidelines called the Wilderness Resource Spectrum (WRS) (Willamette National Forest Land and Resource Management Plan, 1990, p. A-1). Management areas are described in the following four WRS strata representing a range of ecological conditions and social settings: Pristine, Primitive, Semi-primitive, and Transition. Pristine falls on the most unmodified end of the spectrum and Transition falls on the most substantially modified end of the spectrum. Areas that are classified as Pristine are to be managed in a manner to protect wilderness character to the most rigorous extent. The majority of the area within the Menagerie Wilderness that is adjacent or closest to proposed activities within the project area is classified as Pristine. Figure 56 shows the WRS classes for the Wilderness in relation to the proposed activities.

Area Descriptions

The Menagerie Wilderness is 4,962 acres with elevations ranging from 1,600 feet to 3,900 feet. The landscape of the Menagerie Wilderness is dominated by mountainous terrain with dramatic rock spires that offer a challenging on- and off-trail technical rock climbing opportunities for visitors. Beneath the rock spires, it has thick forest of Douglas-fir, western hemlock, and western red cedar. This area is visited year-round, primarily by day-users. Two main hiking routes – the Rooster Rock Trail (2.1 miles in length) and the Trout Creek Trail (3.3 miles in length) – lead to a popular and prominent landmark named Rooster Rock which is located near to the center of the Wilderness. Panorama point, at the north end of the wilderness, can be reached without technical climbing and is a popular off-trail destination offering 360 degree views across the Menagerie view shed and beyond. Trout Creek and Keith Creek flow within the wilderness boundary.

The Menagerie Wilderness is partially bordered on the north side by private industrial timberland. Timber harvest activity occurs on these private lands which can be seen and/or heard from locations within the Wilderness. Within the view shed of the Menagerie Wilderness and looking beyond its borders, evidence from a range of recent and past harvest activity can be seen on both private and public land. Additionally, state Highway 20 is located along a large portion of the southern boundary of the wilderness. Road noise from vehicles travelling this highway can be heard from locations within the Wilderness. Visual or noise intrusions into the wilderness from logging activity on adjacent private lands or the highway are frequent occurrences. They are an existing and persistent effect to the wilderness character and the experience of visitors to the Menagerie Wilderness. These activities have been occurring since prior to the area's designation as wilderness. Despite these sound and visual intrusions, the Menagerie Wilderness offers a wilderness experience to visitors and provides intact habitat for a wide-range of botanical, terrestrial, and aquatic species. The locations of private land and Highway 20 are shown in Figure 56.

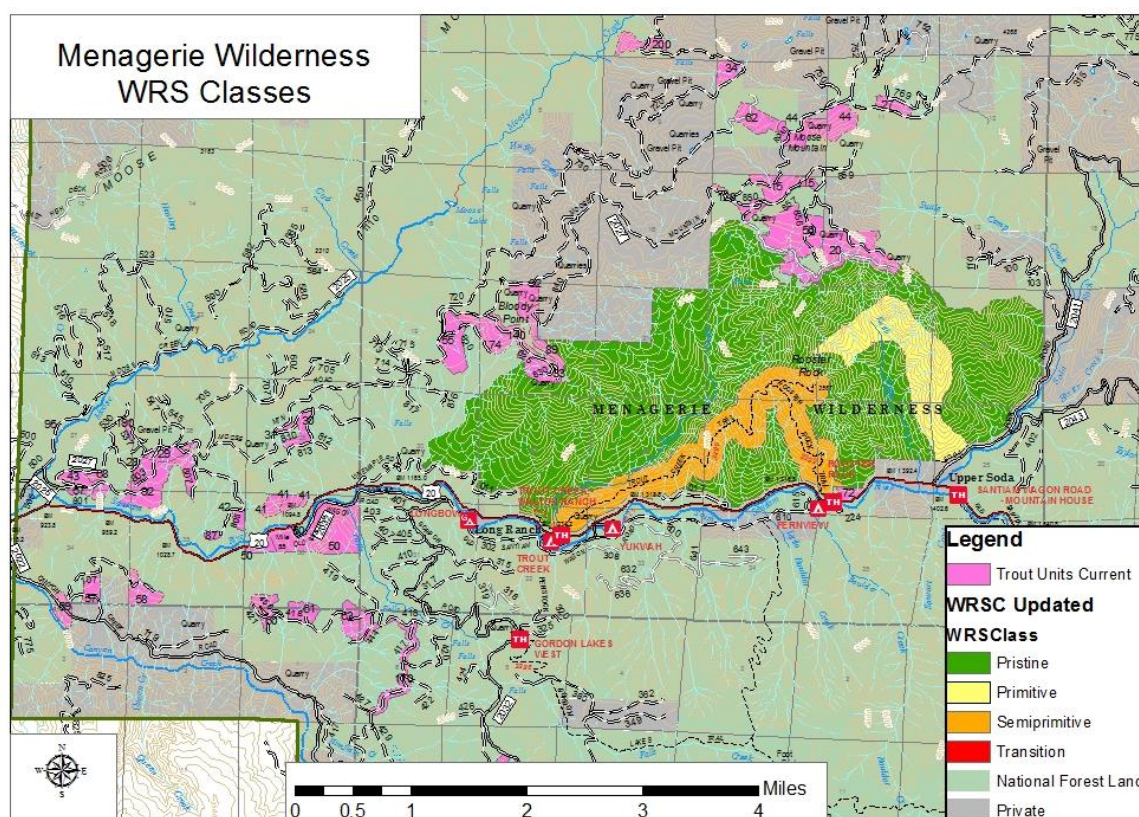


Figure 56: Wilderness Resource Spectrum classes for the Menagerie Wilderness

Environmental Consequences

Activities proposed in the Trout Creek project and its four alternatives are analyzed here for direct and indirect effects to the wilderness character of the Menagerie Wilderness. Activities unrelated to this project but that overlap in time or space and have effects to the Menagerie Wilderness are analyzed for cumulative effects. A summary of the environmental consequences of this project on wilderness character is provided below. Additional information regarding the analysis leading to these conclusions can be found in the Wilderness Resource Report located in the project record.

Direct and Indirect Effects

Alternative 1 – No Action

Wilderness character would remain unchanged in the Menagerie Wilderness with the No-Action alternative. Therefore, Alternative 1 would have no direct or indirect effect on Wilderness.

Alternatives 2, 3, and 4

Direct and indirect effects to Wilderness are shown below as related to the four qualities of wilderness character applicable to the Menagerie Wilderness.

Untrammelled

There are no proposed activities within the Menagerie Wilderness in this project. Therefore, there are no actions that would result in trammeling and no effects to the untrammelled quality of wilderness character.

Natural

Indicators and measures are used to determine effects to the natural quality of wilderness character due to activities proposed in the Trout Creek project and are displayed in Table 57. Effects are described below according to each indicator and measure.

Table 57: Indicators and measures for the natural quality

Indicator	Measures
Botanical resources	• Rare botanical species • Invasive species
Wildlife	• Birds of prey • Other terrestrial wildlife
Aquatic ecosystems	• Aquatic organism passage • In-stream large wood
Ecological processes	• Biological diversity

Indicator: Botanical resources

Measure: Rare botanical species

There are two known sites of rare botanical species within the Menagerie Wilderness. One is a lichen, *Pseudocyphellaria rainierensis*, and one is a fungus, *Ramaria araiaspora*. Both sites are in the interior of the Wilderness and would not be affected by the Trout Creek Project.

Measure: Invasive Species

The presence of non-native, invasive plants detracts from the natural quality of wilderness character. One weed species in particular poses a threat to the Menagerie Wilderness. This species is false brome (*Brachypodium sylvaticum*), a highly invasive grass native to Europe. It has a wide ecological amplitude and thrives under varying light and moisture conditions. Currently there are populations directly adjacent to the Menagerie Wilderness.

Activities associated with the Trout Creek project include logging with ground-based equipment, grapple piling fuels, and temporary road construction, all of which would generate a great deal of soil disturbance adjacent to the Wilderness. The seeds of false brome have a long awn and are easily tracked not only by boots and equipment but also by big game. Seeds are washed downstream from plants growing along creeks. Given the amount of soil disturbance associated with the Trout Creek project it is

likely that false brome would become present in the Menagerie Wilderness. The effect of false brome on the natural quality of wilderness character is detrimental and could be long term. It is imperative that the Wilderness be monitored for this species and newly forming sites be treated aggressively.

A risk assessment was completed to determine the risk of weed spread by alternative. Alternatives 2 and 4 rate very similarly with Alternative 4 having a slightly higher risk due to the increase in miles of road decommissioning. Both alternatives have a high risk of weed spread due to the greater level of ground disturbance and the current existence of weed populations in the area. Alternative 3 has a low to medium risk of weed spread due to reduced acres being harvested, reduced acres of ground-based equipment and reduced acres of grapple piling as compared to Alternatives 2 and 4. To help mitigate this risk, design criteria are included for this project in Chapter 2.07.

Indicator: Terrestrial wildlife

Measure: Birds of prey (northern spotted owls and peregrine falcons)

In Alternatives 2, 3, and 4, treatments adjacent to the Menagerie Wilderness may indirectly adversely affect birds of prey in the Wilderness. Several known birds of prey nest in the Wilderness. Peregrine falcons and northern spotted owls may experience short term noise disturbance through harvest activities, the use of machinery, or smoke resulting from prescribed burns. There would be short and long term negative impacts to northern spotted owls due to noise disruption and modification of owl habitat since the units overlap with several known nest home ranges adjacent to the wilderness. Removal of dispersal habitat in Alternatives 2, 3, and 4 would not restrict movement of spotted owl across the landscape or their ability to move in and out of the Menagerie Wilderness. As discussed in the Wildlife Section, no adverse effects to spotted owls within the wilderness (where all habitat is unaffected) is likely due to habitat modification outside the wilderness. There are no expected long term impacts to peregrine falcons. These impacts have the potential to effect the natural quality of wilderness character in the Menagerie Wilderness. The duration and intensity of these effects are difficult to predict and quantify.

There may be long term positive benefits due to more open habitat and increases in hardwood species which attract songbirds, a prey item for peregrine falcons. Proposed early seral creation may result in slightly different prey in and around the units adjacent to the Wilderness, but the overall prey base for birds of prey is not expected to decline in these areas. Some birds of prey selectively use open areas for hunting. Gaps, early seral creation and prescribed fire would create a mosaic of open areas interspersed with forested habitat that may improve foraging conditions. These treatments, together, may result in a beneficial or neutral effect to potential forage habitat.

Measure: Other terrestrial wildlife

The project may have some beneficial effects to other terrestrial wildlife species such as deer and elk due to increased openings and early seral forage creation. Deer and elk have large ranges and may travel in and out of the wilderness. Forage located outside of the wilderness may benefit these species. For a detailed analysis of effects to terrestrial wildlife, see the wildlife section in the Environment Analysis for the Trout Creek project.

Indicator: Aquatic ecosystems

Measure: Aquatic organism passage

The condition of aquatic ecosystems inside the Menagerie Wilderness can be generally represented by the presence or absence of aquatic passage barriers at road crossings outside the Wilderness. These barriers, generally created by culverts, prevent upstream migration of aquatic organisms that is

important for the life cycle of the organism and for the aquatic ecosystem in general. There are currently aquatic organism passage barriers on Hwy 20 at Keith Creek and on the Vine Maple Road that are blocking passage into the Wilderness. The only proposed action in the Trout Creek project that could affect the natural quality as indicated by aquatic organisms would be the decommissioning of the Vine Maple Road including the removal of an existing aquatic organism passage barrier (see aquatics section for details). This would benefit the natural quality of wilderness character for aquatics in the Wilderness.

Measure: In stream large wood

The condition of aquatic ecosystems inside the Menagerie Wilderness can be represented by the condition of the stream channels inside the Wilderness. Stream channels are partially characterized by the presence or absence of large wood in the stream. This indicator is the most easily manipulated by management and is most widely how aquatic ecosystems are compromised across the landscape.

There is potential for activities in two of the proposed units to remove potential future in stream large wood through timber harvest. However, no-harvest buffers have been prescribed that would protect over 90% of the future large wood on streams originating in these units (see aquatics sections for details). The streams in these units are small with little input to the Menagerie Wilderness as a whole. The Trout Creek project would not measurably affect in stream large wood in the Wilderness.

Indicator: Ecological Processes

Measure: Biological diversity

Ecological processes play a fundamental role in shaping the natural character of forest ecosystems by influencing plant growth, species composition and forest structure. There are numerous ecological processes that interact with forest ecosystems which influence biological diversity, including the water cycle, carbon cycle, and disturbances such as fire.

While wilderness is required by law to be managed to preserve its wilderness character, the relatively small size and location of the Menagerie Wilderness present challenges in meeting wilderness management goals. Given the proximity to private land and other resources at risk, fire suppression is a priority in the project area and in the South Santiam watershed, including the Menagerie Wilderness. The Forest Plan states that all lightning fires in the Menagerie Wilderness should be suppressed when resources outside of the Wilderness are threatened (Forest Plan, 1990, A-15-16). As a result, the fundamental role that fire plays within the Menagerie Wilderness is essentially removed from the forest ecosystem and the biological diversity of the Menagerie Wilderness has been degraded as forest composition and structure have become more homogeneous.

Taking no action (Alternative 1) would have no direct negative impacts to the natural quality of wilderness character. Fire suppression would continue to maintain uncharacteristically low levels of biological diversity in terms of forest species composition and structure.

Alternative 2 would result in the most biological diversity improvements in areas near the Wilderness of all the alternatives. While no treatments would occur within the wilderness, Alternative 2 would treat nearby units. These units currently provide the same ecological functions as most forested conditions in the Menagerie Wilderness. Commercial thinning and aggregate retention harvest followed by prescribed underburning and underplanting would mimic fire and help contribute some of the ecological functions that fire would normally provide in the absence of fire suppression. Insects and wildlife within the wilderness would benefit from a greater diversity of plant species and structure adjacent to the wilderness where they may forage resulting in an indirect long term beneficial effect.

Alternative 3 would have similar effects as Alternative 2, but to a lesser extent because no aggregate retention harvest would occur. Commercial thinning, prescribed underburning, and underplanting would occur and provide some level of increased diversity in forest structure and species diversity.

Alternative 4 would result in similar effects to the natural quality of wilderness character of the Menagerie Wilderness as Alternative 2. Alternative 4 would be more effective than Alternative 3 at mimicking mixed severity fire, but less effective than Alternative 2.

Undeveloped

There are no proposed activities within the Menagerie Wilderness in this project. Therefore, there are no actions that would result in development within the Wilderness and no effects to the undeveloped quality of wilderness character.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation

Indicators and measures are used to determine effects to the “Outstanding opportunities for solitude or a primitive and unconfined type of recreation” quality of wilderness character (referred to as the outstanding opportunities quality) due to activities proposed in the Trout Creek project and are displayed in Table 58. Effects are described below according to each indicator and measure.

Table 58: Indicators and measures for the outstanding opportunities quality

Indicator	Measures
Remoteness from sights and sounds of human activity outside the wilderness	• Visible human activity • Sounds of human activity
Availability of outstanding opportunities for primitive and unconfined recreation	• Recreational access

Indicator: Remoteness from sights and sounds of human activity outside the wilderness

Measure: Visible human activity

Four units in Alternatives 2 and 4 are located adjacent to the Menagerie Wilderness. Alternative 3 includes three units. Proposed activities in these units would be visible from locations within the Menagerie Wilderness and have the greatest potential to create effects. Visible human activities occurring outside the Wilderness that are visible from inside the Wilderness detract from the outstanding opportunities quality of wilderness character due to the reduced feeling of remoteness from the sights of human activity.

One unit is located in an area where visitors routinely enter and exit the Wilderness through unofficial routes and user trails. This unit includes land that is higher in elevation than the Wilderness boundary and is especially visible when viewed from inside the Wilderness due to topographic features. Effects to the outstanding opportunities quality due to visible human activity would be most severe from activities proposed to occur in this unit and it is therefore used as a representative reference point for determining effects.

The use of motorized equipment and other activities related to harvest activity in Alternatives 2 and 4 would be directly visible to visitors in the northern portion of the Wilderness during treatment activities. These harvest activities are expected to last for up to five years or more. After treatment is completed, visual evidence of human activity would be apparent on the landscape for many additional years, including evidence of roads, landings, tree removal, and other treatment activities. At some point in the future, the visible evidence of human activity would fade and the effects would be reduced and

eventually eliminated. These impacts would be a direct adverse effect to the outstanding opportunities quality of wilderness character for the medium to long term.

Alternative 3 eliminates units and reduces the treatment activities in others. It would therefore be likely to have a slightly reduced duration of adverse effect.

Measure: Sounds of human activity

To analyze effects to the outstanding opportunities quality from sounds of human activity created by proposed activities, topography was taken into consideration to determine those areas within the Wilderness that are likely to experience impacts. This sound shed analysis uses topographic features to predict where sound would travel from its point of origin. This analysis serves as a predictor of the likelihood that sound generated by activities would cause impacts within the receptor area due to topographical alignment or masking. Determination of which units show a likelihood of impacts are based on: the equipment used for a particular activity, proximity to Wilderness, and topographical alignment. View shed modeling was accomplished by determining which portions of proposed units have potential to look into the wilderness. Those areas were then digitally rasterized to create a 10 meter grid of viewpoints from which multiple view sheds were developed. These view sheds were then combined to create a summary view shed for each unit.

Two types of logging systems are proposed in this project as well as connected activities that include rock pit development and operation, and road decommissioning. Each of these activities have different potentials for impacts based on the distance noise caused by these activities would travel.

Resulting direct adverse effects to wilderness character from noise related to the proposed activities are summarized in three general categories: effects from ground-based harvest activities and non-commercial activities (including road decommissioning), effects from skyline harvest activities, and impacts from blasting activities. All of these effects would occur only during operations and would not persist beyond harvest activities with the exception of the operation of the proposed rock pit. These impacts are generally of short duration. However, if harvest activities for units that may impact wilderness character occur through multiple years, these effects become longer term with greater impact. Road decommissioning activities would have an accelerated implementation schedule, therefore, the period of impacts would be shorter in duration. Most recreation within the potentially impacted area occurs from approximately June 15th through October 15th. Most operations for the proposed project activities would likely occur during this same time period.

Sounds entering the Wilderness from ground-based, non-commercial and road decommissioning activities proposed in Alternative 2 would likely penetrate approximately a half mile within the Menagerie Wilderness. Units with ground-based harvest and non-commercial activities occurring would impact approximately 286 acres within the Wilderness. Road decommissioning activities would impact approximately 472 acres within the Wilderness with sounds of human activities.

Effects from skyline harvest activities proposed in Alternative 2 would have a larger impact. Direct adverse effects are expected to penetrate up to approximately 1.2 miles into the Menagerie Wilderness. Units that include any skyline activities are expected to impact approximately 816 acres. This distance and area of impact may be less due to damping from vegetative screening, but it is expected to occur to a notable extent. The areas potentially impacted by unit 20 activities receive a relatively large amount of the use that occurs in the Menagerie Wilderness. Impacts from blasting activities proposed in Alternative 2 have the least potential for effects to degrade the outstanding opportunities quality of wilderness character and visitors' experience of solitude. The sound shed model indicates that effects from noise can be expected in approximately 55 acres of the Menagerie Wilderness. These impacts come from the proposed development and operation of the rock pit. These would occur in areas with

little use by the public. Figure 57 shows the area that would potentially be effected by all proposed activities in Alternative 2 based on sound shed modelling. It is possible the actual distance affected would be less due to damping from vegetative screening.

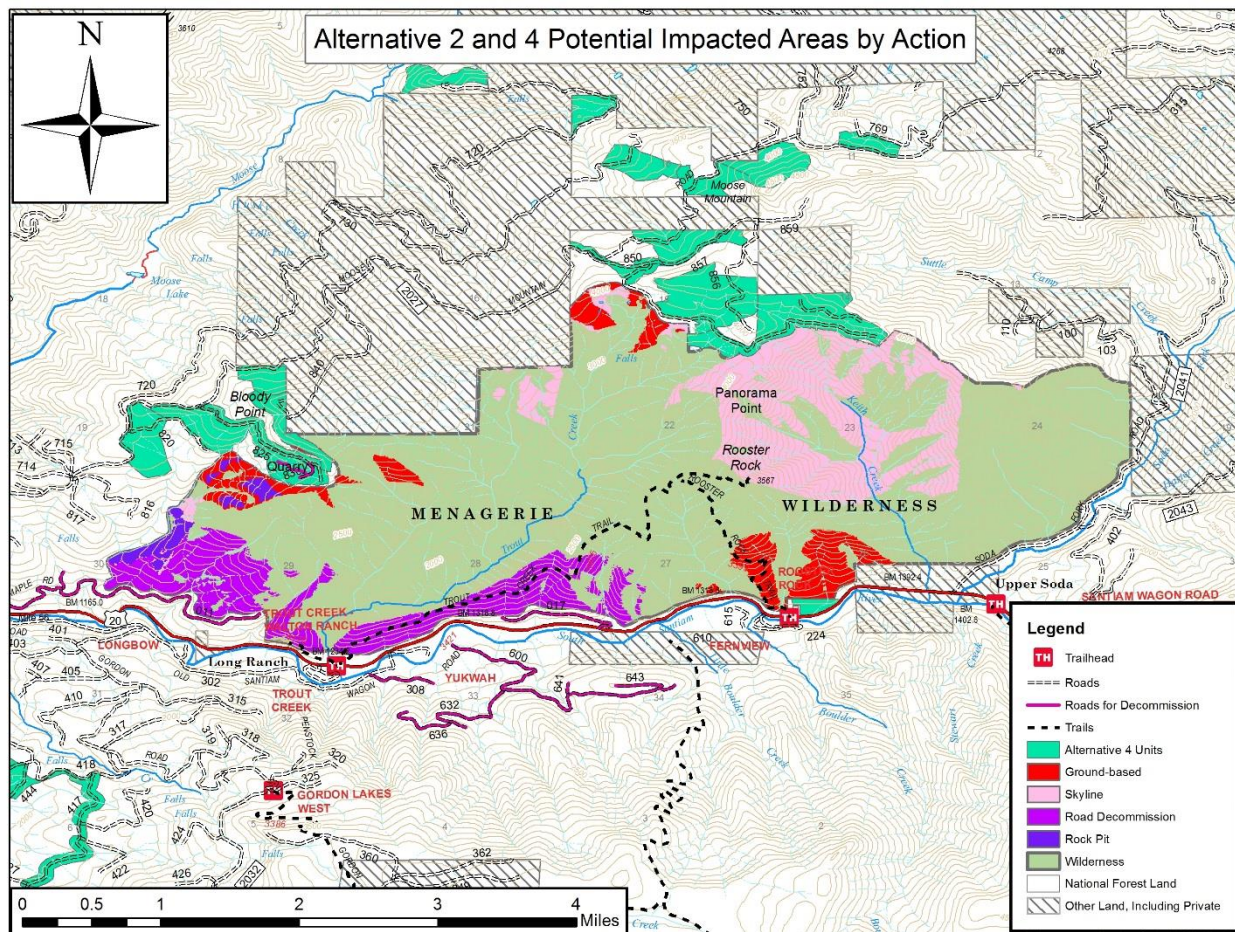


Figure 57: Wilderness potentially affected by activities proposed in Alternatives 2 and 4

Collectively, it is expected that all direct adverse effects due to the sounds of human activities caused by treatments proposed in Alternative 2 would impact approximately 29% (1,453 acres) of the wilderness landscape in the Menagerie Wilderness. This would result in diminished quality of outstanding opportunities for solitude during operations related to the proposed activities. However, the majority of the area (71%) would be unaffected by operations resulting in no effects. These effects to wilderness character would be intermittent in nature, both temporally and spatially. Impacts from noise created by operations would occur intermittently until all harvest and other activities are complete. Summer-time operations would likely have greater impacts on visitor experiences. This impact to the outstanding opportunities quality of wilderness character is independent of whether there are visitors present to hear the noise.

In comparison to Alternative 2, direct adverse effects from activities in Alternative 3 are substantially less due to fewer proposed treatment activities. Figure 58 shows the area that would potentially be effected by all proposed activities in Alternative 3 based on sound shed modelling. Effects from ground-based, non-commercial and road decommissioning activities would in combination likely penetrate

approximately a half mile within the Menagerie Wilderness. Units with ground-based harvest and non-commercial activities are expected to affect zero acres and not create effects. Road decommissioning activities would impact approximately 472 acres. This effected area would likely result in low numbers of visitors experiencing impacts because the affected areas do not experience large numbers of visitors.

Effects from skyline harvest activities would have a larger impact to visitor experience and the outstanding opportunities quality with sounds of human activity penetrating up to approximately 1.2 miles into the Menagerie Wilderness and impacting approximately 715 acres. Some of the areas potentially impacted by these activities are popular for visitation during peak season. Impacts from blasting activities are the same as in Alternative 2. Resulting direct adverse effects from activities proposed in Alternative 4 are essentially the same as Alternative 2. The only difference being that Alternative 4 proposes to harvest more timber volume, so the period of time which impacts would occur could be longer. Therefore, impacts would be greater.

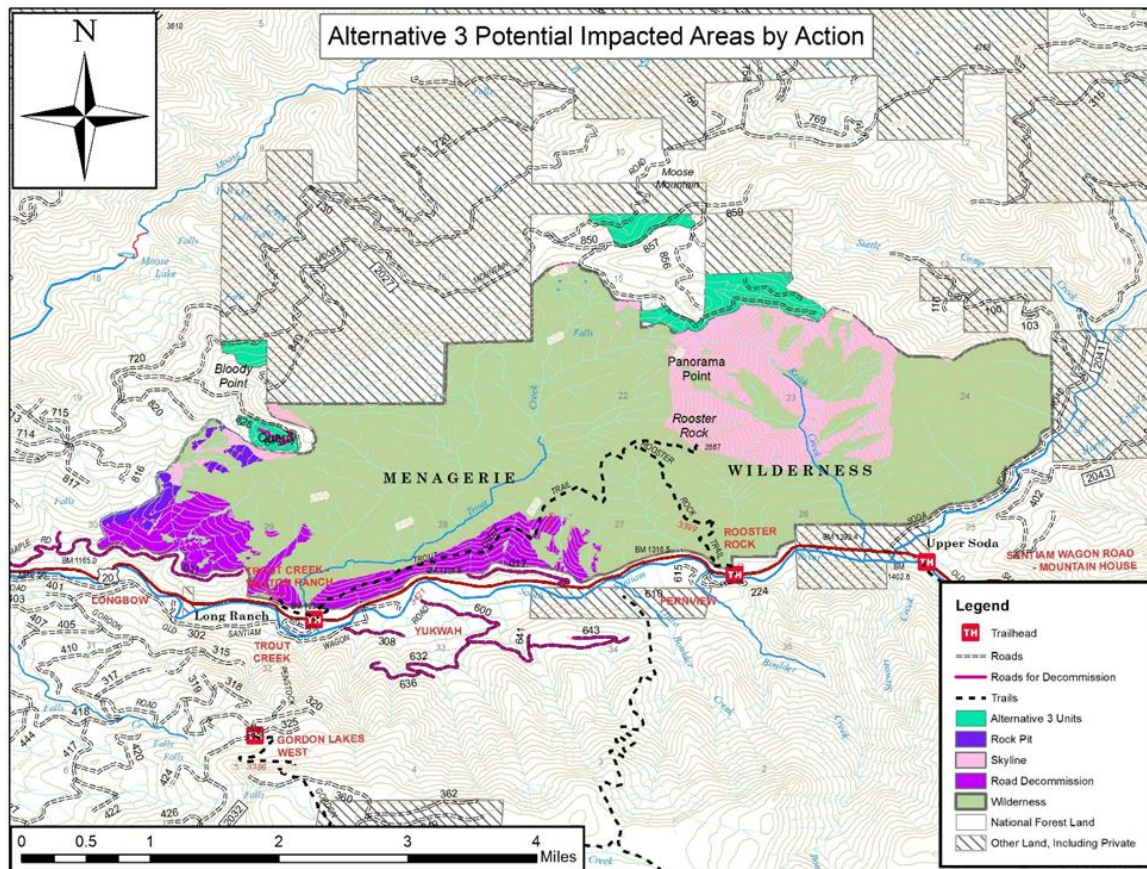


Figure 58: Wilderness potentially affected by activities proposed in Alternative 3

Indicator: Availability of outstanding opportunities for primitive and unconfined recreation*Measure: Recreational access*

The outstanding opportunities quality of wilderness character can be degraded by a reduction or elimination of recreational access from outside of wilderness in order for visitors to pursue primitive and unconfined recreation inside wilderness. Four units are adjacent to the Menagerie Wilderness and treatment activities in those units have the potential to effect recreational access due to the operation of heavy equipment in the area, areas being closed to public access while trees are felled and removed or when burning occurs, and elimination of existing trails, trailheads, or parking areas due to road construction or deconstruction.

One unit is located in an area where visitors to the Menagerie Wilderness routinely enter and exit the area through unofficial routes and user trails. Activities occurring in this unit have the greatest likelihood of impacting recreational access. Recreational access into the Menagerie Wilderness through the area included within this unit is seasonally closed to all entry from January 15 to July 31 in order to meet protected wildlife species management objectives. Visitors to the wilderness enter the area from August 1st until snow makes the access roads impassable in the fall or winter. This is also the timeframe when logging and prescribed fire activities in this unit can occur due to the same seasonal wildlife closure and the need for snow free access. Activities proposed in three other units have less likelihood of obstructing access due to their location, established patterns of recreational use, and existence of alternate access routes to the area. To mitigate these potential effects, design features are included in this project to maintain recreational access.

Comparison of Effects from Alternatives

Table 59 includes a summary of the effects to wilderness character of the Trout Creek project proposed alternatives.

Table 59: Summary of effects to wilderness character

Indicator	Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Untrammelled					
N/A	N/A	No Effect	No Effect	No Effect	No Effect
Natural					
Botanical resources	Rare botanical species	No Effect	No Effect	No Effect	No Effect
	Invasive species	No Effect	High risk of indirect long term adverse effects.	Low to medium risk of indirect long term adverse effects.	High risk of indirect long term adverse effect.
Wildlife	Northern spotted owl	No Effect	Direct short term disturbance due to noise.	Direct short term disturbance due to noise.	Direct short term disturbance due to noise.
	Peregrine falcon	No Effect	Indirect beneficial effect possible. Direct short term disturbance due to noise.	Indirect beneficial effect possible. Direct short term disturbance due to noise.	Indirect beneficial effect possible. Direct short term disturbance due to noise.

Indicator	Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	Other terrestrial wildlife	No Effect	Indirect beneficial effect possible.	Indirect beneficial effect possible.	Indirect beneficial effect possible.
Aquatic ecosystems	Aquatic organism passage	No Effect	Direct long term beneficial effect.	Direct long term beneficial effect.	Direct long term beneficial effect.
	In stream large wood	No Effect	No Effect	No Effect	No Effect
Ecological processes	Biological diversity	No Effect	Indirect long term beneficial effects.	Indirect long term beneficial effects possible, but less than Alternatives 2 and 4.	Indirect long term beneficial effects possible, but less than Alternative 2.
Undeveloped					
N/A	N/A	No Effect	No Effect	No Effect	No Effect
Outstanding opportunities for solitude or a primitive and unconfined type of recreation					
Remoteness from sights and sounds of human activity outside wilderness	Visible human activity	No Effect	Direct medium to long term adverse effects.	Direct medium to long term adverse effects.	Direct medium to long term adverse effects.
	Sounds of human activity	No Effect	Direct medium term adverse effects.	Direct medium term adverse effects.	Direct medium term adverse effects.
Availability of opportunities for primitive and unconfined recreation	Recreational access	No Effect	No Effect	No Effect	No Effect

As is indicated in Table 59, Alternative 1 has no effects to wilderness character since no activities are proposed.

Effects to wilderness character resulting from Alternative 2 include:

- beneficial direct long term effects to the natural quality due to improved aquatic organism passage
- possible beneficial indirect effect to the natural quality due to improved foraging conditions for peregrine falcons and some terrestrial wildlife
- possible beneficial indirect long term effect to the natural quality due to improved biological diversity in areas adjacent to the wilderness
- possible adverse indirect long term effect to the natural quality due to the high risk of the introduction of invasive species
- possible direct short term adverse impacts to the natural quality due to impacts to northern spotted owls from noise disturbance.
- possible direct short term adverse effect to the natural quality due to impacts to peregrine falcons from noise disturbance

- adverse direct medium to long term effect to the outstanding opportunities quality due to visible human activity occurring adjacent to the Wilderness
- adverse direct medium term (approximately 5 years) effect to the outstanding opportunities quality due to sounds of human activity occurring adjacent to the Wilderness

Alternative 3 shares all of the same effects compared to Alternative 2, with the exception of:

- reduced risk of increasing the probability of the introducing invasive species
- reduced amount of visible human activity occurring adjacent to the Wilderness
- reduced amount of sounds of human activity occurring adjacent to the Wilderness

Effects to wilderness character resulting from activities in Alternative 4 are very similar to Alternative 2, with only minor differences that may be slightly greater for the natural and outstanding opportunities qualities due to the increased amount of proposed activities which may have a slightly higher risk or longer duration of effects.

The areas within the Menagerie Wilderness where adverse effects are expected to occur are located mostly within the Pristine management area shown in Figure 56. The Pristine areas fall on the most unmodified end of the management spectrum. Areas that are classified as Pristine are to be managed in a manner to protect wilderness character to the most rigorous extent.

Cumulative Effects

Alternative 1 – No Action

Alternative 1, the No Action alternative, does not propose any activities in the Trout Creek project and has no effects. Therefore, there would be no cumulative effects from this alternative to the Menagerie Wilderness. Effects occurring due to activity on adjacent private timber land would continue and be unchanged.

Alternatives 2, 3, and 4

Cumulative effects are likely to occur to wilderness character in the Menagerie Wilderness resulting from activities in the Trout Creek project in combination with present and reasonably foreseeable future actions occurring in other projects and activities. Cumulative effects are expected to the natural and outstanding opportunities qualities. Effects are described below for indicators and measures affected for those qualities.

Natural

There are no cumulative effects expected for the wildlife, aquatic ecosystems, or ecological processes indicators.

Indicator: Botanical resources

Measure: Invasive Species

Ground-disturbing activities such as ground-based yarding systems used during timber harvest, road construction and reconstruction, vehicular traffic and recreation use contribute to the incremental increase in invasive weeds.

The impact of non-native invasive weeds on native plant communities is cumulative. The more disturbance and activity in any given area is subject to, the more the risk of invasive weed introduction, establishment, and/or expansion. Past road construction and maintenance, timber harvest (approximately 56,000 acres in the South Santiam watershed), and recreation use have resulted in numerous weed sites adjacent to the Menagerie Wilderness. Post-harvest monitoring and control measures in project design features would reduce these cumulative effects.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation

There are no cumulative effects expected for the availability of opportunities for primitive and unconfined recreation indicator.

Indicator: Remoteness from sights and sounds of human activity outside the wilderness

Measure: Visible human activity

A large portion of the northern boundary of the Menagerie Wilderness is located adjacent to private industrial timberland. It is expected that current and future timber harvest activity would occur on this land and some of it would be visible from within the Menagerie Wilderness. This activity, in combination with activities proposed in the Trout Creek and other projects, would cumulatively adversely affect the outstanding opportunities quality due to the reduced remoteness from the sights of human activity that would occur when the two activities are occurring simultaneously in time and space.

Measure: Sounds of human activity

Similar to the visible human activity measure, cumulative adverse effects due to the increased presence of sounds of human activity are expected when harvest activity occurs simultaneously in time and space on both private timberland and units treated in the Trout Creek and other projects. The outstanding opportunities quality of wilderness character would be additionally adversely effected when the two types of activities are combined.

3.13 Proposed Wild and Scenic River

Summary of Effects Analysis

Alternative 1 would have no direct or indirect effects of on the South Santiam River, which is eligible for Wild and Scenic River designation. Alternatives 2, 3, and 4 would have short to medium term direct adverse effects to the scenic quality of the river corridor in areas where timber harvest activities occur beyond 344 foot no-cut Riparian Reserve buffer. The impacts of these adverse effects would reduce with time, however, as brush and moss grows, making stumps less easily visible. Outstandingly Remarkable Values for the river remain unaffected and the river would retain its eligibility for inclusion in the national Wild and Scenic Rivers system. There would be no cumulative effects associated with any of the alternatives.

Scale of Analysis

The geographic scale used to assess direct, indirect, and cumulative effects to the South Santiam River is the Trout Creek project planning area as well as the portions of the river which extend upstream to its headwaters and downstream to the Willamette National Forest boundary from the project area. Four parcels of private land are included within the project area along the river corridor. The remainder of the river within the project area flows through National Forest System lands.

Affected Environment

The project area includes the portion of the South Santiam River which has been determined to be eligible for inclusion into the national Wild and Scenic Rivers System. Until suitability is determined, the area extending ¼ mile away from the river on both sides of the South Santiam River within the project area is to be managed to meet Wild and Scenic River (Recreation) Standards and Guidelines as outlined in Management Area 6c in the Willamette National Forest Land and Resource Management Plan (1990). The location of the South Santiam River and the river corridor is shown in Figure 59.

Outstanding Remarkable Values (ORVs)

Eligibility status of Wild and Scenic Rivers is determined by identification of the river's free flowing status and its "Outstandingly Remarkable Values" (ORVs) as defined by the Wild and Scenic Rivers Act. The ORVs identified for the South Santiam River segment within the project area are recreation, fisheries, prehistoric and historic values. Recreational values include developed campgrounds, fishing, scenery, trails, and day use activities. Winter steelhead runs up the Moose and Canyon Creek drainages are notable for fisheries. Prehistoric values include the river corridor being used as a major travel way for Indian tribes as well as encampment sites. Historic values include the Santiam Wagon Road which runs the entire segment of the river within the project area (Resource Assessment for Quartzville Creek and South Santiam River, Steve Couch, undated - approx. 1989).

The Resource Assessment also recognizes the readily available access to the river by road, the recreational developments along the river corridor, and the numerous dispersed recreation opportunities. These factors contribute to its recommended classification of "Recreation" for the segment of the river within the project area.

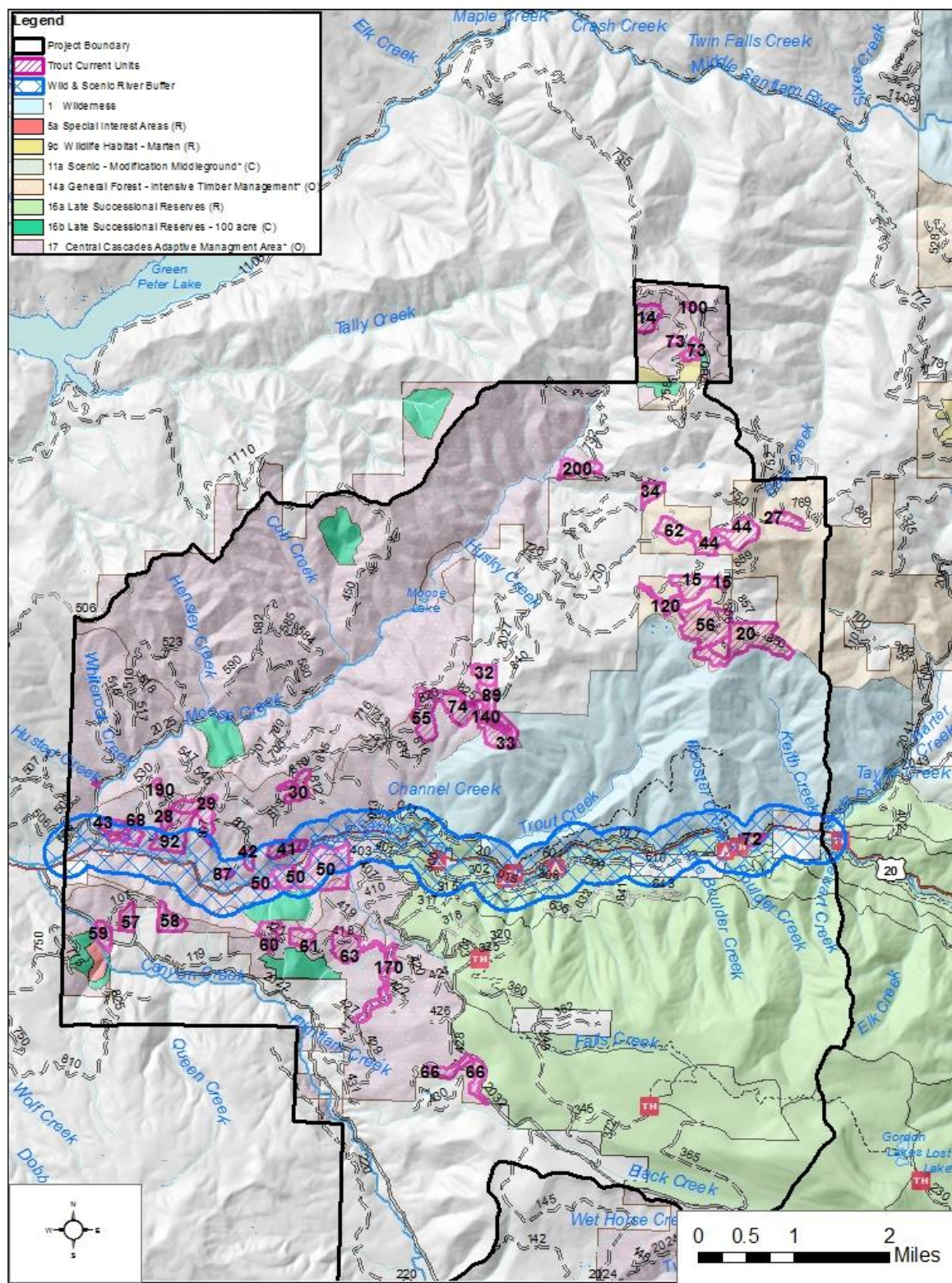


Figure 59: Location of South Santiam Wild & Scenic River corridor

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would result in no change to the condition of ORVs or eligibility status of the South Santiam River. There are no direct or indirect effects to Wild and Scenic Rivers resources.

Alternatives 2, 3, and 4

Alternatives 2, 3, and 4 include proposed timber harvest and road decommissioning activities within the ¼ mile corridor extending from both sides of the South Santiam River in units 41, 42, 50, 68, 72, and 87 and additionally in units 43 and 67 in Alternatives 2 and 4. Due to proposed mitigation measures, all activities are compliant with all standards and guidelines included in the Willamette National Forest Land and Resource Management Plan (1990) for Recreational Wild and Scenic Rivers segments (Management Area 6c). Standard and guide: “Stumps should be flush cut” (MA-6c-12), is specified in the LRMP. This action is required unless justifiable reason exists for not taking action, such as unacceptable hardship or expense (LRMP, 1990, p IV-45). Due to the high cost of flush cutting stumps when timber is harvested, this mitigation measure is considered an unacceptable expense and is not included. The expense of flush cutting stumps would result in an inability to fund other important projects such as the proposed road decommissioning.

The design measure for the Riparian Reserve requiring a 344 foot no-cut buffer along the river would reduce the effect of not flush cutting stumps in some units that are most visible from the river and in areas frequently visited by the public. In other areas throughout the half mile wide river corridor, stumps would be visible when viewed from areas near harvest activity. This would result in direct adverse short to medium term effects to the scenery of the river corridor for as long as stumps are visible where timber harvest activity has occurred in areas other than in the Riparian Reserve buffered areas. The duration of time that the stumps would be visible would likely vary from a few years to twenty or more, according to site specific conditions. Over time, the growth of brush and moss would make stumps less easily visible.

ORVs identified specifically for the South Santiam River (recreation, fisheries, prehistoric and historic values) would not be effected by proposed activities. Dispersed use access to areas located along roads planned for decommissioning may be reduced, but not to an extent that would significantly impact the diverse range of dispersed recreational and other use opportunities available within the river corridor.

There are no effects to ORVs, water quality, or the free flowing status of the South Santiam River; and therefore, no effects to its continued eligibility for inclusion in the national Wild and Scenic Rivers system.

Cumulative Effects

All land adjacent to the South Santiam River within the project area is either included in the national forest system or in one of four small private land parcels. Other than the activities proposed in this project, there are no activities proposed by the Willamette National Forest in past or reasonably foreseeable future projects in or beyond the project area that would have cumulative effects on the river’s ORVs or other qualities and it’s eligibility for inclusion in the national Wild and Scenic River system. We are not aware of any activates planned on the private parcels that would have an effect. Therefore, no cumulative effects are expected.

3.14 Inventoried Roadless Areas (IRA)

Summary of Effects Analysis

All of the alternatives would have no effect to Inventoried Roadless Areas (IRAs) and unroaded areas. No project activities are proposed in IRAs under Alternatives 2, 3, and 4. No project activities would impact unroaded areas adjacent to the IRAs or Menagerie Wilderness. Alternatives 2, 3, and 4 would result in a net reduction of system road miles in the project area, which would be a long term beneficial effect for unroaded areas outside of IRAs and wilderness.

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for IRAs is the Trout Creek project area, which is located in the following 6th field watersheds: Moose Creek, Bear Creek-Middle Santiam, Soda Fork, Trout Creek-Middle Santiam, and Lower Canyon Creek.

Affected Environment

IRAs are areas identified and mapped in accordance with the Roadless Area Conservation Final Rule (2001 Roadless Rule). IRAs are identified in the 2001 Roadless Area Conservation Rule in a set of inventoried roadless area maps (contained in Forest Service Roadless Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service), or any subsequent update or revision of those maps (36 CFR 294.11). These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of inventoried roadless areas. The 2001 Roadless Rule defines a roadless area as undeveloped areas that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the forest Service's Area Review and Evaluation (RAREII) process, subsequent assessments, or forest planning. An area of wilderness is further defined in the wilderness Act to mean an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. In other words, large areas not fragmented by roads or past management activities. Three IRAs are located in the Trout Creek project area: Moose Lake (4,898 acres); Gordon Meadows (9,463 acres); and Rooster Rock (223 acres). Rooster Rock is the only IRA located entirely within the Trout Creek project area. These IRAs are illustrated in Figure 60. No activities are proposed within these IRAs.

Unroaded areas are isolated areas of NFS lands that have no roads and no evidence of past management activities. These unroaded areas are not Wilderness, nor are they IRAs. There are no forest-wide or management area standards specific to unroaded areas in the Willamette Forest Plan or the Northwest Forest Plan. Unroaded areas are managed consistently with forest-wide standards and guidelines and by designated Forest Plan management area allocations. Despite having no forest-wide or management area standards specific to unroaded, they are considered here because unroaded areas that are adjacent to IRAs and the Menagerie Wilderness could be viewed as providing similar ecological functions or value as IRAs and wilderness despite falling within a different land management allocation (e.g., Matrix). Outside of designated IRAs and wilderness, unroaded areas in the Trout Creek project area

limited to relatively small areas (less than 300 hundred acres) that are bounded by forest roads and fragmented by managed stands.

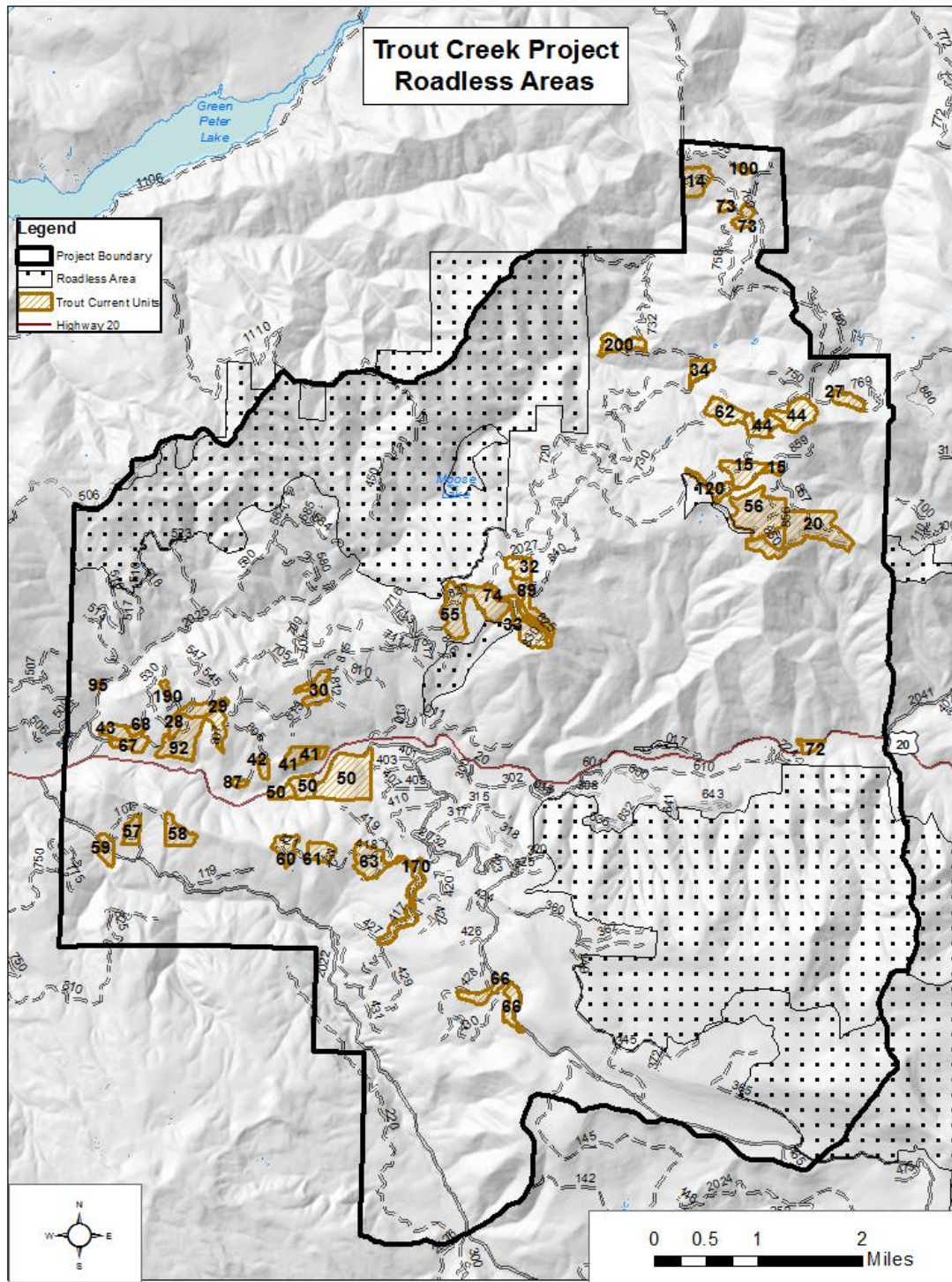


Figure 60: Roadless Areas in the Trout Creek project area

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No treatments would be implemented with selection of Alternative 1; therefore, no impacts to IRAs would occur.

Alternatives 2 and 4

Alternatives 2 and 4 propose a limited level of activity adjacent to IRAs. Units 55, 74 and 33 have a small portion of unit boundary bordering north end of the western Rooster Rock IRA. Units 56 and 120 border the eastern section of the Rooster Rock IRA. Overall, less than a mile of Rooster IRA boundary is in close proximity to the harvest units. Small portions of units 55, 74 and 200 are within a quarter mile of the Moose Creek IRA boundary. There are no harvest units in close proximity to the Gordon Mountain IRA.

No activities are proposed within the IRAs under Alternatives 2 and 4. Treatment activities in units near the IRAs would potentially result in short to medium term (about 5 years) evidence of human activity as viewed from the IRAs, but treatments would improve diversity and resiliency to disturbances in areas adjacent to the IRAs in the long term. Mimicking mixed severity fire in some units (e.g., unit 56) would increase landscape heterogeneity to levels closer to the historic range of variability in the vicinity of the IRAs. Overall, proposed treatments would have no effect to IRA designations within the Trout Creek project area.

The majority of the Trout Creek units adjacent to the IRAs and wilderness cannot be considered ecologically significant given their small size, past management, and proximity to roads; and therefore, are not well suited for being considered unroaded areas. It is likely that the 2001 Roadless Rule and the Wilderness Act did not incorporate these areas for the following reasons. Units 20, 33 and 200 are managed stands that share boundaries with roads or are bisected by roads. Units 55 and 74 are fire-origin units, but they have experienced some level of management in the past and are bisected and bounded by roads (only underplanting for diversity is proposed in these two units). Units 56 and 120 are also fire-origin units, but are bisected by existing roads. The only other Trout Creek fire-origin unit that could potentially provide a continuation of unroaded characteristics would be unit 44. However, this unit is bounded by a road along its northern boundary, and to the south there are multiple roads dissecting the unroaded area between it and the Menagerie Wilderness (Figure 60). Finally, Alternative 2 and 4 propose to decommission about 6 and 10 miles of road, respectively. Both Alternatives would construct less than one mile of new permanent system road in unit 50 near Highway 20, which would result in a net reduction of about 5 and 9 miles of system road in the project area. Therefore, Alternatives 2 and 4 would have a net beneficial effect on unroaded areas within the Trout Creek project area by decommissioning and removing existing roads from the system.

Alternative 3

In Alternative 3, no fire-origin units would be treated, which leaves only unit 33 adjacent to the Rooster Rock IRA and unit 200 within a quarter mile of the Moose Creek IRA. Therefore, Alternative 3 would have no effect to IRA designations within the Trout Creek project area. Alternative 3 proposes the same road decommissioning work as Alternative 4. Therefore, Alternative 3 would provide the same beneficial effects as Alternative 4 to unroaded areas outside IRAs and the Menagerie Wilderness (i.e., a net reduction of about 9 miles of system road in the project area).

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have no direct or indirect effects to IRA designations; therefore, there would be no cumulative effects.

Alternatives 2 and 4

Alternatives 2 and 4 would have no direct or indirect effects to IRA designations; therefore, there would be no cumulative effects.

Alternative 3

Alternative 3 would have no direct or indirect effects to IRA designations; therefore, there would be no cumulative effects.

3.15 Climate Change

The proposed action (Alternative 2) would treat approximately 1,670 acres in the project area. Harvest treatments proposed include commercial thinning, gap creation, aggregate retention (including early seral creation), meadow restoration, oak savannah restoration, alder treatment and skips. Fuels treatments include fuel breaks, mechanical treatments and post-harvest underburn. Non-commercial treatments include understory planting of native species, snag creation, fall and leave, and hazardous fuels reduction.

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 ± 4.5 gigatonnes 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, the 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 proposed action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible.

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%
- Energy production – 35%
- Agriculture – 12%
- Forestry and other land uses – 12%

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).

The Trout Creek Project does not fall within any of these main contributors of greenhouse gas emissions. Forested land would not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. US forests sequestered 757.1 megatons of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western United States. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which would have major effect on these forests' role in the carbon cycle (Joyce et al., 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al., 2014). Here specifically, the project proposes to improve stand conditions, diversity, density and structure with thinning, gaps, and early seral creation. Thinning the overstocked stands would make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire,

drought, insects/disease, or a combination of these disturbance types (Millar et al., 2007). This project is also consistent with options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al., 2014). The proposed action is consistent with these recommendations because it would improve stand conditions, diversity, density and structure, allowing the forest to adapt, persist and function better over time and into the future.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The proposed action (Alternative 2) falls into this category.

Specifically Required Disclosures

See Appendix A for a description as to how the action alternatives comply with applicable State and Federal Laws, regulations and policies.

3.16 Unavoidable Adverse Impacts

Implementation of any of the Alternatives, including the No-Action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions and Standards and Guidelines in Chapter IV of the Willamette Forest Plan, as amended the Northwest Forest Plan, and additional design features proposed in Chapter 2 of this document. These potential adverse environmental effects are discussed at length under each resource section.

3.17 Irreversible and Irretrievable Commitments of Resources

"Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

The soil and water protection measures identified in the Forest Plan Standards and Guidelines, design features in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed actions would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

With all action Alternatives (2, 3 and 4): Tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. Little irreversible loss of soil should occur due to extensive design features associated with timber harvest and prescribed fire (tractor harvest only on slopes less than 35%, skyline yarding with partial or full suspension to meet Forest Plan Standards and Guidelines, etc.).

3.18 Short-Term Effects versus Long-Term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). This includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requires of present and future generations of Americans (42 CFR § 101(a)).

The Forest Plan establishes a sustained yield of resource outputs while maintaining productivity of resources. The specific direction and mitigation measures included in the Forest Plan and Northwest Forest Plan ensure the long-term productivity of resources would not be impaired by the application of short-term management practices. Additionally, project Design Features (Section 2.7) were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Chapter 4 – List of Preparers

Alice Smith – Botanist

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Botanical and Wilderness Analyses

Education / Experience: B.S. and M.S. Botany and Plant Pathology, Oregon State University. 30 years of experience with the US Forest Service (Willamette and Wallowa-Whitman).

Allan Braun – District Silviculturist

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Vegetation Analysis and Silvicultural Prescription

Education / Experience: B.S. Forest Management: University of Wisconsin-Stevens Point. 13 years of experience in silviculture, timber sale layout, and forest inventory with USFS (Willamette, Chequamegon-Nicolet, Superior, Huron-Manistee, and Tongass; Pacific Northwest Research Station-Anchorage Forestry Sciences Lab).

Bradford Peterson – Wilderness and Recreation Manager

USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts

Contribution: Wilderness Analysis

Education/ Experience: B.S. Environmental Science: Humboldt State University. 16 years of experience with the US Forest Service (Willamette) as a Wilderness Ranger, Wilderness Manager.

Chris Donaldson – Fuels Specialist

USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts

Contribution: Fuels and Air Quality Analysis

Education / Experience: B.S. Anthropology, B.S. History: Southern Oregon University. 16 years of experience with the US Forest Service (Willamette, Rogue River-Siskiyou) in Fire Management. 2 years as an Assistant Fire Management Officer (Willamette).

Chris Sorensen – Natural Resources Staff Officer

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Economic Analysis for logging activities, Wilderness Analysis

Education/ Experience: Education/ Experience: B.S. Forestry (Ecological Restoration), Northern Arizona University; M.S. Forestry (Silviculture, Forest Carbon and Natural Resource Economics), Northern Arizona University. Planning Forester and Silviculturist 7 years (Stanislaus); Data Management Assistant, Southern Colorado Plateau Inventory and Monitoring Network, National Park Service 1 year; Research Assistant, Ecological Restoration Institute 3 years.

Danny Matthews – Transportation Planner

USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts

Contribution: Transportation Analysis

Education / Experience: B.S. Yavapai College. 7 years of experience with private sector engineering firms. 7 years of experience with the USDA (NRCS in Wyoming and USFS on the Willamette) as an engineering technician and transportation planner.

Emily Lauderdale – Natural Resource Specialist

USDA Forest Service, Willamette National Forest

Contribution: Scenic Quality Analysis

Education / Experience: B.A. German, Environmental Policy & Culture, Northwestern University; Master

of Landscape Architecture (MLA), University of Michigan. 2 years of experience with the US Forest Service in natural resources (Willamette).

Esmeralda Bracamonte – Wildlife Biologist

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Wildlife and Wilderness Analyses

Education / Experience: B.S. in Biology with emphasis in Zoology, Minor in Chemistry. 10 years of experience in natural resources management with US Forest Service (Angeles and Willamette).

Joanie Schmidgall – NEPA Planner

USDA Forest Service, Willamette National Forest, Detroit Ranger District

Contribution: Project Lead, Writer/Editor, NEPA Compliance

Education / Experience: B.A. Environmental Science and Geography, University of Oregon; Master of Forestry, Oregon State University. 1 year of experience in planning and 7 years of experience in forestry with the US Forest Service (Willamette).

Ken Loree – Lead Forestry Technician

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Logging Systems Analysis

Education/ Experience: 2 years at University of Oregon. 37 years of experience in forestry, timber sale layout, timber sale preparation, logging systems analysis and forest inventory analysis with the US Forest Service (Willamette).

Lance Gatchell– Hydrologist and Fish Biologist

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Aquatics and Aquatics conservation strategy, Wilderness Analysis

Education / Experience: MS in Bio-resource Engineering, Oregon State University. 10 years a District Hydrologist (Willamette) and 4 years as a District Fish Biologist/Hydrologist (Willamette).

Lizandra Nieves-Rivera – Forest Soil Scientist

USDA Forest Service, Willamette National Forest

Contribution: Soils Analysis

Education / Experience: B.S. Geology, University of Puerto Rico; Master of Soil Science Studies, University of Puerto Rico; Graduate Certificate in Geographic Information Sciences, Oregon State University. 4 years of soil, water conservations and earth science research for federal, state-local units, 3 years Geologist experience with the BLM, and 6 years of experience as a Soil Scientist with US Forest Service (Arapahoe and Roosevelt, Stanislaus, and Willamette).

Nikki Swanson – District Ranger

USDA Forest Service, Willamette National Forest, Sweet Home Ranger District

Contribution: Line Officer

Education/ Experience: Bachelors of Science (Biology Major and English Minor), University of Oregon; Masters of Fisheries Science, Oregon State University. One year as District Ranger. 24 years of experience in fisheries (2 years with the Eugene BLM and 22 years with the Willamette National Forest).

Suzanne Cable – Recreation, Lands and Minerals Staff Officer

USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts

Contribution: Recreation, Wilderness, and Proposed Wild and Scenic River Analyses

Education / Experience: B.A. Environmental Studies, Brown University; M.S. Resource Conservation, University of Montana. Over twenty years of experience with the US Forest Service on eight national forests in five regions working in positions from Wilderness Ranger to Recreation, Lands and Minerals Staff.

Tony Farque – Archeologist*USDA Forest Service, Willamette National Forest, Sweet Home Ranger District*

Contribution: Heritage Resources Analysis

Education / Experience: BS Anthropology, University of Oregon; AA Forestry, Lane Community College.
38 years of experience with the US Forest Service (Willamette) as an archeologist in Cultural Resource Management.

Additional Support and consultation was provided by the following individuals during the development of this environmental impact statement:

Forest Service Employees	
Doug Shank, Geologist	Tiffany Young, Wildlife Biologist
Anita Leach, NEPA Planner	Jay Anderson, Logging Systems
Dean Mills, GIS	Ian-Huei Yau, GIS
Joe Doer, Forest Wildlife Biologist	Andrew Stratton, GIS

Chapter 5 – List of Agencies, Governments, Organizations, and Individuals Given Notice of Availability

The agencies, governments, organizations, and individuals listed below were notified of the availability of the Final Environmental Impact Statement (FEIS). A complete list of recipients, including names and contact information, is available in the Trout Creek project file at the Sweet Home Ranger District.

Agencies and Governments

Bureau of Land Management
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz Indians
Confederated Tribes of Warm Springs
Klamath Tribes
Linn County
Office of Senator Jeff Merkley
Office of Congressman Peter DeFazio
Office of Senator Ron Wyden
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
Oregon Department of Parks and Recreation
Oregon Department of Transportation
Sweet Home Chamber of Commerce
United States Army Corps of Engineers
United States Environmental Protection Agency
United States Fish and Wildlife Service

Organizations

American Forest Resource Council
Cascade Timber Company
Cascadia Wildlands Project
Chemeketans

Giustina Land & Timber

Giustina Resources

Northwest Youth Corps

Oregon Eagle Foundation, Inc.

Oregon Hunters Association

Oregon State University

Oregon Wild

Pacific Crest Trail Association

Rocky Mountain Elk Foundation

Rosboro Lumber Co.

South Santiam Watershed Council

Travel Oregon

Weyerhaeuser

Wild Earth Guardians

Individuals

Over 500 people, including interested parties, stakeholders, landowners, and individuals were notified of Draft Environmental Impact Statement 45-day comment period. A complete list of recipients, including names and contact information, is available in the Trout Creek project file at the Sweet Home Ranger District.

Appendix A – Compliance with Laws, Regulations and Executive Orders

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Trout Creek FEIS was prepared in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 –All proposed timber harvest units are planned to occur on suitable land. If regeneration harvest is implemented the sites would be capable of restocking within 5 years of harvest by either natural or artificial means. All units were considered for potential uneven-aged management. Proposed commercial thinning would increase the rate of growth of remaining trees. Some locations would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Design features have been identified to protect site productivity, soils, and water quality.

All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife. Critical habitat for threatened or endangered species would be protected through avoidance. The action alternatives would accelerate development of forest habitats that are currently deficient within the analysis area to enhance the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities that would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Forest Plan Consistency – Actions analyzed in the Trout Creek project are consistent with a broad range of Forest Plan Standards and Guidelines that have been discussed and disclosed throughout the document. The timber stand treatments associated with the project are consistent with the goals and management direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and Record of Decision. Road improvements are designed to be consistent with the 1994 Northwest Forest Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

Northwest Forest Plan Aquatic Conservation Strategy - The Aquatic Conservation Strategy (ACS) is an integral part of the Northwest Forest Plan and was developed to maintain and restore the ecological health of watersheds and aquatic ecosystems on public lands through implementation of four components: 1) Riparian Reserves 2) key watersheds 3) watershed analysis 4) watershed restoration. Based on the analysis presented in this FEIS and Appendix B, the ACS Objectives would be met in each alternative.

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act, as amended, October 1966 – Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation governing the treatment of historic properties (a.k.a. heritage or cultural resources) during project planning and implementation. Other legal framework considered the effects of its actions on heritage resources is listed below:

- 36 CFR800 (Protection of Historic Properties),
- 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and
- 36 CFR 296 (Protection of Archaeological Resources), and
- Executive Order 13007 – Sacred Sites

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project.

In accordance with this PA, an appropriate inventory and surveys were conducted in from 2014 to 2016, and documented under the “Cultural Resources Inventory Report for the Trout Creek Timber Sales”. Through project design, all known cultural sites in the Area of Potential Effect (the project area) were protected by avoidance, resulting in a determination of “Historic Properties Avoided” on June 7, 2017. Documentation was provided to SHPO and copies were retained on file in the Willamette National Forest and Sweet Home Ranger District Heritage files SHPO had no comments regarding the Forest Service finding. Documentation has been retained in the Forest and District Heritage files.

The Trout Creek Cultural Resource Inventory Report project file was reviewed by a Forest Heritage Specialist, and has resulted in a determination of Historic Properties Avoided under the terms of the current PA.

Should previously unknown cultural resource sites or object be discovered during project activities, contract provisions would provide protection. All activities in the vicinity of the find would cease immediately, while the Sweet Home Ranger District Archaeologist is notified to assess the find.

Clean Air Act Amendments, 1977 – The alternatives are designed to meet the National Ambient Air Quality Standards through avoidance of practices that degrade air quality below health and visibility standards. This project is consistent with by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments (See Section 3.16 and 3.17).

The Clean Water Act, 1987 – This act establishes a non-degradation policy for all federally proposed projects. Compliance with the Clean Water Act would be accomplished through planning, application and monitoring of Best Management Practices (BMPs). Based on the analysis presented in this FEIS, TMDL requirements for the South Santiam River would be met in each alternative (refer to Chapter 3.03).

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects and impacts of the proposed actions on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl, and for steelhead trout and spring Chinook salmon.

Endangered Species Act (ESA) formal consultation with the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon Upper Willamette River winter steelhead is currently in progress. The Biological Assessment prepared for the Trout Creek project found that the project “may affect, and is likely to adversely affect” Upper Willamette spring Chinook salmon and winter Steelhead. This analysis also found that there would not be any adverse modification of designated critical habitat for either species. On February 14, 2017, the Trout Creek project was presented to the NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” Consultation was formally initiated on February 17, 2017 by Forest Supervisor Tracy Beck, and will be completed prior to publication of the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Trout Creek project. The Forest Service will be required to comply with the terms and conditions provided by the NMFS in the Biological Opinion.

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was completed on August 4, 2017 and evaluated by the USFWS in the August 31, 2017 Biological Opinion (FWS reference 1EOW00-2017-F-0555) signed August 31, 2017.

Trout Creek project	May Affect and Likely to Adversely Affect the Northern Spotted Owl due to Habitat Modification from thinning in suitable owl habitat.
Trout Creek project	Not Likely to Jeopardize the Continued Existence of the Spotted Owl.
Commercial Thinning in Critical Habitat	May Affect and Likely to Adversely Affect Foraging, Nesting and Roosting Habitat in Critical Habitat due to its removal and downgrade.
Effects due to Disruption	May Affect and is Not Likely to Adversely Affect spotted owls. There are no harvest activities within the disruption distance proposed to occur during the critical breeding period.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – Essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act is designated in the same areas as identified as habitat for the Upper Willamette River Spring Chinook. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The species designated in the South Santiam River is spring Chinook salmon.

The Biological Assessment used for formal consultation with NFMS determined that the Trout Creek project “may adversely affect” Spring Chinook Salmon in the South Santiam River.

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Development of Rock Quarries would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Inventoried Roadless Areas and Wilderness – Wilderness and Inventoried Roadless areas are both located in the project area; however, no actions would occur in these areas.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the project area.

Survey and Manage Species – The action alternatives comply with the Northwest Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Pre-disturbance surveys were conducted and site management applied consistent with the January 2001 species list.

Management Indicator Species (Aquatic) – The Willamette Forest Plan recognized anadromous and resident salmonids as economically important species and designated them as management indicator species for riparian habitat and water quality. Salmonid fish are good indicators because they are predators in the stream ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition. The most widespread Management Indicator Species in the Trout Creek project is the cutthroat trout. Other species include the rainbow trout, Chinook salmon and steelhead trout. The Trout Creek project would maintain habitat conditions for aquatic management indicator species in the project area. Therefore, the Trout Creek project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.

Management Indicator Species (Terrestrial) – The Willamette Forest Plan recognized elk and deer as economically important species that are commonly hunted, and designated them as management indicator species for winter range. Designated management indicator species for old growth and mature conifers are pileated woodpecker, marten, and northern spotted owl. The bald eagle was selected as a management indicator species for old growth conifers near large bodies of water, and the peregrine falcon was selected as a management indicator species for cliff nesting habitat. The Trout Creek project would maintain habitat conditions for elk, deer, pileated woodpeckers, marten, bald eagles and peregrine falcons in the project area. The Trout Creek project would not contribute to a negative trend in viability for any of the terrestrial wildlife management indicator species.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Proposed harvest treatments would not occur within 100-year floodplains. Executive Order 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian areas, seeps, springs, and other wet habitats exist in the project area. These areas would be either avoided, or managed according to the amended Willamette Forest Plan Standards and Guidelines. Riparian Reserves would also be protected with design features. As a result, proposed treatments would be consistent with Executive Orders 11988 and 11990.

Executive Order 12898: Environmental Justice – Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of either action alternatives, there would be no disproportionately high and adverse human health or environmental effects on minority or low-income populations. Nearby communities would mainly be affected by economic impacts connected with contractors implementing harvest, road reconstruction, tree thinning, planting, and other fuels treatment activities. Racial and cultural minority groups could also be prevalent in the work forces that implement activities. Contracts contain clauses that address worker safety.

Executive Order 12962: Recreational Fishing – The June 7 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation and provide for more and better recreational fishing opportunities, and to develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and to develop a comprehensive Recreational Fishery Resources Conservation Plan. Proposed activities in the project area not affect recreational fisheries since there are no-cut buffers adjacent to fish bearing streams that would protect fish habitat. There are major streams in the project area closed to all recreational fishing, but fishing regulations are outside the scope of this project.

Executive Order 13186: Migratory Birds – Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for

managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU, 2008) between the Forest Service and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management, 2013). Effects to FS sensitive birds, federally ESA listed birds, birds that are Management Indicator Species and migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS, 2008) and that have habitat in the proposed treatment units are addressed in Chapter 3.

Seasonal restrictions are recommended in the Trout Creek Design Features (Chapter 2.7) to conduct hazard tree falling outside the critical nesting season, as well as tree felling, yarding and prescribed unit underburning on specific units to protect owls. This would minimize disturbances to nesting migratory birds and reduce the likelihood of harm to individual birds. Design features to retain existing snags where possible, and to retain live trees, create snags, and fall trees for dead wood sources would provide structural features migratory birds would use. There is a Design Feature (Chapter 2.7) to consider late winter or fall for prescribed underburning which would reduce impacts to nesting birds and their young.

Executive Order 13443: Facilitation of Hunting Heritage and Wildlife Conservation – August 17, 2007, Executive Order requires Federal agencies “to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.” The proposed creation and enhancement of early seral habitat in both action Alternatives in the project area would improve forage for game species and provide better hunting opportunities for the public.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the project area. The Oregon Department of Fish and Wildlife is responsible for management of fish and wildlife populations, whereas the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis and Brian Wolfer, a biologist with the agency, attend a 2014 public meeting.

Proposed harvest treatments within riparian areas have been designed to comply with “Sufficiency Analysis for Stream Temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards” (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in a “Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations” (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry,

and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon's Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for projects requiring use of mechanized equipment. Commercial thinning and some partial cutting units would involve both heavy and small machines for yarding logs during the implementation period. Projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy consumption. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to a supply of energy for the local community for home heating.

Appendix B – Evaluation for Consistency with the Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) of the NWFP was developed to protect the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Timber harvest is prohibited in Riparian Reserves unless it is needed to attain Aquatic Conservation Strategy Objectives (ACSOs). If one or more of the ACSOs are not being met, then silvicultural treatments can be used to achieve the objective(s). Thinning in Riparian Reserves in the Trout Creek project was proposed when needed for restoration of aquatic resources. Riparian Reserves silvicultural treatments in this project were used for even aged conifer managed stands.

What follows is a discussion of how the activities proposed in the action alternatives conform to the nine objectives of the ACS.

Objective #1 – Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

This project would enhance species diversity and stand complexity in managed stands to levels that are similar to conditions usually found in natural stands as a result of natural disturbance agents. Through time, this would restore diversity and complexity of the watershed and the aquatic systems to which species, populations, and communities have adapted.

Objective #2 – Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Riparian Reserves would maintain and restore spatial and temporal connectivity within and between watersheds. These areas allow for connectivity between ridge tops and valley bottoms where ephemeral and perennial streams are considered part of the riparian network.

This project would not create any sort of barrier to aquatic and riparian-dependent species. No new roads would be constructed that would create a barrier to aquatic organisms. Connectivity within and between watersheds would be maintained.

Treated acres within these Riparian Reserves would retain at least 50% canopy cover after harvest. Chemically and physically unobstructed routes critical to life history requirements would remain intact as a result of this prescription. In the outer portion of Riparian Reserves, spatial connectivity may be restored for some plant and animal species that cannot survive under dense canopy. An increase in insects and arthropods is expected to result from a development of a under story. This prey base increase is expected to benefit animal species.

Objective #3 – Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The physical integrity of the aquatic system would be maintained. Harvest systems are designed to protect all streams, banks, and bottom configurations in accordance with National Best Management Practices (BMPs) as outlined in the design criteria. Retention of 75-foot no-cut shade buffers on

perennial streams and 50-foot no-cut buffers on intermittent streams would maintain channel bank stability.

Objectives #4 – Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

No-cut buffers in Riparian Reserves would protect stream shade and stream banks from erosion. This would ensure stream temperatures and bank stability are maintained within the project area. Road work that has the potential to increase sediment in streams along the haul route would include mitigation measures as indicated in the design criteria. This would minimize road related impacts of sediment to streams.

Biological, physical, and chemical integrity of water quality would be maintained through implementation of national BMPs as prescribed in the design criteria for this project.

Objective #5 – Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Forests roads built in the past caused fills in stream channels that interfere with sediment movement downstream. Depending on how the fills block downstream sediment movement, there are various downstream effects that are generally negative. This project does not include increasing the number of stream crossings so would maintain the existing impacts of roads on the natural sediment regime. Road decommission and storage that removes high aquatic risk culverts and associated fills would improve natural sediment movement in several locations.

Riparian Reserves were designed to protect important water quality and riparian functions. The proposed no-harvest prescriptions would protect streams from any sediment impacts from harvest in the outer portion of Riparian Reserves.

Roads continue to contribute pulses of sediment at crossings throughout the project area. However, ongoing road maintenance activities have worked to eliminate many of these unstable fill situations. Since wet weather haul would be closely monitored, increases in sediment input to the streams are not expected to be measureable. Upsizing of culverts that are replaced with deferred maintenance activities as part of this project would benefit streams and contribute to more natural sediment regime in several locations.

Objective #6 – Maintain and restore in stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Implementation of a landscape design that is intended to restore vegetative structures, landscape patterns, and disturbance regimes to a more natural condition would result in watershed conditions that more closely resemble those under which historic stream flow conditions developed.

Potential adverse effects on the timing, magnitude, duration, and spatial distribution of peak and high flows are evaluated by managing the planning sub-drainages within the analysis area to Aggregate Recovery Percentage (ARP) levels that comply with the Willamette National Forest Land and Resource Management Plan (Willamette National Forest, 1990). Analysis for this project's proposed treatments showed no detrimental cumulative effects to peak flows.

The effects of climate change over the next century are likely to influence in-stream flows in the future. This project addressed the effects of climate change in Chapter 3.15.

Objective #7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The no-cut buffers in Riparian Reserves would provide more wood to streams over time. This would increase the ability of the streams to connect to their floodplains and help restore timing, variability and duration of floodplain inundation over time. Floodplains and wetland areas would be excluded from thinning treatments. Where thinning units occur adjacent to these features, ground-based equipment that could impact the soil, and result in reduced ground water recharge, is restricted to prevent compaction as described in the design criteria.

Objective #8 – Maintain and restore the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Plant communities in riparian areas would be maintained at the landscape scale by the implementation of stand level prescriptions that have no-harvest buffers in Riparian Reserves along streams and adjacent to wetlands. These buffers within the Riparian Reserves would provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Plant communities would be restored in some Riparian Reserves by creating uneven structure within stands with varied thinning intensities and no-thin areas to diversify homogenous stands. Reducing overstory tree density in selected outer portions of the Riparian Reserves within the project area as well as fall and leave treatments in near-stream areas would help widen the range of understory light and microhabitat conditions suitable for increasing plant diversity.

Objective #9 – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Implementation of the Trout Creek Project is intended to restore landscape processes, vegetative structures, and landscape patterns to more natural conditions, and would restore the ability of the landscape to create a rich variety of habitats for native species. Thinning is expected to increase the abundance of native herbs and shrubs because more light and nutrients would be available for growth. The increase in plant biomass is expected to lead to increased prey base (insects and arthropods) for animals associated with riparian areas.

Where project activities have potential to affect existing native plant and animal species within the project area, designation of buffered areas or use of specific project criteria would maintain intact populations. BMP's and design criteria are designed to minimize impacts to riparian dependent invertebrate and vertebrate species (i.e., seasonal restrictions, canopy cover requirements, and soil protection requirements). Adequate amounts of down woody debris would be retained on site. This project would not adversely affect the amount or distribution of these habitats or species that use these habitats and would likely improve habitat conditions for some species, allowing expansion of their distribution in the project area.

Appendix C – Past, Present and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its Alternatives would add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

The table below provides a summary of past, present, and reasonably foreseeable future actions that overlap in time and space with the Trout Creek project and could contribute cumulative effects to the resources in the project area.

Action	Agency	Description	Resources Affected
Past Actions			
Fall Thin Timber Sale (Canyon Creek EA)	USFS	This timber sale area overlapped with the Trout Creek project area. 193 acres of thinning and 1.9 mmbf. Originally sold in 2012. The sale was closed in 2015.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Girl Thin Timber Sale (Canyon Creek EA)	USFS	The haul route included the 2022 Road (Canyon Creek Road) in the Trout Creek project area. 205 acres and 2.4 mmbf. Originally sold in 2012. The sale was closed in 2016.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants

Action	Agency	Description	Resources Affected
Elbow Thin Timber Sale (Canyon Creek EA)	USFS	The haul route included FS Road 2022 (Canyon Creek Road) in the Trout Creek project area. 275 acres and 5.1 mmbf. Originally sold in 2011. The sale closed in 2016.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Pipe Thin Timber Sale (Canyon Creek EA)	USFS	The haul route included FS Road 2032 (Gordon Road) in the Trout Creek project area. 127 acres and 1.6 mmbf. Originally sold in 2012. The sale closed in 2014.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Moose Creek Large Wood Restoration Project (CE)	USFS	Trees were tipped into Moose Creek to improve hydrologic function and fish habitat.	Hydrology, Fisheries, Wildlife, Vegetation
Stewart Road Hydrologic Stabilization Project (CE)	USFS	Culverts were removed in abandoned road 2000-636 and 2000-632 to hydrologically stabilize the road and protect water resources. Road access was not changed.	Hydrology, Fisheries, Roads
Moose Creek Legacy Road project (CE)	USFS	Various roads in the Moose Creek subwatershed were storm proofed with waterbars and drivable drain dips over stream crossings. Road access was not changed.	Hydrology, Fisheries, Roads
Gordon Spurs road storage project (CE)	USFS	Several roads tributary to the Gordon Road (2032) were put in storage so they would not need maintenance by removing stream crossing culverts. Road access was not changed.	Hydrology, Fisheries, Roads
Canyon Creek road storage (Canyon Thin EA)	USFS	Several roads in the Canyon Thin planning area were put in storage so they would not need maintenance by removing stream crossing culverts. Road access was not changed.	Hydrology, Fisheries, Roads
Private Timber Harvest and Haul		Adjacent to the Wilderness, impact to wilderness character.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Present Actions			
Owl Thin Timber Sale (Canyon Creek EA)	USFS	The sale will be hauling in the Trout Creek project area down FS Road 2022 (Canyon Creek Road). 294 acres and 4.4 mmbf. The sale was sold in 2014 and will be completed in 2018.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Moe Thin Timber Sale (Canyon Creek EA)	USFS	The sale will be hauling down FS Road 2022 (Canyon Creek Road). 10.2 mmbf and 321 acres. The sale was sold in 2013. It will be completed in 2017.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Camas Prairie Meadow Restoration	USFS	Active management involves control of blackberries and shiny geranium. The prairie is burned in September very other year; it is scheduled to be burned in 2017.	Fuels, Vegetation Management, and Invasive Plants

Action	Agency	Description	Resources Affected
Cool Soda Unit 8	USFS	Due to similar haul route, Unit 8 from the Cool Soda Environmental Assessment (signed in May 2015) will be sold with a timber sale from Trout Creek.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Private Timber Harvest and Haul		Adjacent to the Wilderness, impact to wilderness character.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Reasonably Foreseeable Future Actions			
Private Timber Harvest and Haul		Private timber sales will harvest and haul about 15,038 MBF from 717 acres between 2017 and 2021 in the vicinity of Owl Ridge Road (300) and Gordon Road (2032).	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Jude Ridge Timber Sale	USFS	The sale will be hauling down FS Road 2041 (Soda Fork Creek Road). 2.3 mmbf and 234 acres. The sale will sold in 2017. It will be completed in 2020.	Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Rec/Admin Fuels Treatment	USFS	Treatment of hazardous fuels around the Cougar Repeater, Rooster Rock trailhead, Gordon Meadows 1 trailhead, and Gordon Lakes trailhead. Expected start date June 2017 with expected completion date of Oct 2018.	Fuels, Vegetation, and Recreation
Gordon Meadows Restoration	USFS	Conifer trees encroaching on the meadow will be removed or girdled. Fuels will be treated with prescribed fire.	Fuels, vegetation, invasive plants
Dispersed Use Management	USFS	Closure of the area 500 feet from either side of the Moose Creek Road (2025) to camping. Day use will be encouraged. Closure of the area 500 feet from either side of the Gordon Road (2032) up to the junction with the spur road to the Longbow Group camping area to camping. Day use will be encouraged.	Vegetation, Water, Recreation, Fisheries, Roads and Access Management

Appendix D – Road Treatment Proposals

Results of the Forest-level Travel Analysis Process (TAP), also known as the Willamette National Forest Roads Investment Strategy (2015), were analyzed at the project scale using field assessment and District roads analysis. Once signed, this decision designates the Minimum Road System (MRS) needed for public and administrative use. Final IDT results that would become part of the signed FEIS would amend the Forest Travel Management layer per Washington Office and Regional Office direction (Weldon 2012, Pena 2016).

AC	Analyze for Closure
AD	Analyze for Decommissioning
DR	Defer Maintenance
ML	Maintenance Level
MTC	Maintenance
RC	Remain Closed
RO	Remain Open
RIS	Road Investment Strategy
RTC	Reconstruction

Forest Service Maintenance Level definitions

Road Maintenance Level 5

Assigned to roads that 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. The appropriate traffic management strategy is “encourage.”

Road Maintenance Level 4

Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is “encourage.” However, the “prohibit” strategy may apply to specific classes of vehicles or users at certain times.

Road Maintenance Level 3

Assigned to roads open and maintained for travel by prudent drivers in a standard passenger cars. User comfort and convenience are low priorities. Roads in this maintenance level are typically low speed, single lane with turnouts, and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either “encourage” or “accept.” “discourage” or “prohibit” strategies may be employed for certain classes of vehicles or users.

Road Maintenance Level 2

Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles.

Road Maintenance Level 1

Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are “prohibit” and “eliminate.”

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 for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for non-motorized uses.

Road Status for within Trout Creek Project Area

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
1110000	6.05	Open	2	RO	2	RO	2	RO	2	
1110450	0.10	Closed	1	RC	1	RC	1	RC	1	
2000011	2.10	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000013	0.13	Open	2	RO	2	AD	-	RC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2000017	0.75	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000224	0.35	Open	2	RO	2	AD	-	AC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2000600	0.12	Open	2	RO	2	RO	2	AC	1	Road to remain open for resource administration.
2000610	1.80	Open	2	RO	2	RO	2	RC	1	Road to remain open for resource administration.
2000615	0.23	Open	2	RO	2	RO	2	DR	-	Road to remain open for access to summer homes
2000632	0.78	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000636	0.42	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000641	0.11	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000643	0.37	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2022000	15.56	Open	3	RO	3	RO	3	RO	3	
2022107	0.20	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.20.
	1.59	Open	2	AC	1	AC	1	RO	2	Analyze for closure 1.59 miles with a gate after use at MP 0.20.
2024145	3.82	Open	2	RO	2	RO	2	RO	2	
2025000	3.78	Open	2	RO	2	RO	2	RO	2	
2025500	1.48	Open	2	RO	2	RO	2	RO	2	
2025506	5.49	Open	2	RO	2	RO	2	RO	2	
2025507	0.69	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2025510	4.33	Open	2	RO	2	RO	2	RO	2	

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2025513	0.20	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2025516	0.11	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2025517	0.41	Open	2	RO	2	RO	2	RO	2	
2025518	0.12	Open	2	RO	2	RO	2	RO	2	
2025523	0.17	Open	2	AC	1	AC	1	RC	1	Road to be closed with berm/gate for resource protection.
2025580	1.94	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025582	0.69	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025584	0.08	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025585	0.21	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025590	1.01	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2026220	3.39	Open	2	RO	2	RO	2	RO	2	
2027000	17.06	Open	2	RO	2	RO	2	RO	2	
2027530	0.59	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027537	0.30	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but to remain on system for resource administration.
2027539	0.11	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027541	0.09	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027543	0.06	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but need access for helicopter landing.
2027545	0.63	Open	2	RO	2	RO	2	RO	2	
2027547	0.15	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027705	2.11	Open	2	RO	2	RO	2	AC	2	Road to remain open for resource administration.
2027707	0.59	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027709	0.21	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027711	0.24	Open	2	AC	1	AD	-	RO	2	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027713	0.44	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027714	0.21	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027715	0.31	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027716	0.13	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027720	5.76	Open	2	RO	2	RO	2	RO	2	

Appendix D – Road Treatment Proposals

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2027730	1.92	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.92.
	0.45	Open	2	AC	1	AC	1	RO	2	Analyze for closure 0.45 miles with a berm/gate after use at MP 1.92.
2027732	1.58	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.58.
	1.61	Open	2	AC	1	AC	1	RO	2	Analyze for closure 1.61 miles with a berm/gate after use at MP 1.58.
2027750	0.70	Open	2	RO	2	RO	2	RO	2	
2027755	6.38	Open	2	RO	2	RO	2	RO	2	
2027758	1.34	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027760	1.25	Open	2	RO	2	RO	2	RO	2	
2027765	0.30	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027769	0.31	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027775	1.04	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027801	0.30	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection to MP 0.30 after use.
	0.40	Open	2	AD	-	AD	-	AD	-	Decommission 0.40 miles after MP 0.30 after use.
2027803	0.47	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but to remain on system for resource administration.
2027805	1.44	Open	2	RO	2	RO	2	RO	2	
2027807	0.32	Open	2	RO	2	RO	2	AC	1	Road to remain open for resource administration.
2027810	1.13	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.
2027812	0.46	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.
2027813	0.66	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.
2027815	0.43	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027816	0.42	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027817	0.35	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027820	0.62	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027825	1.06	Open	2	RO	2	RO	2	RO	2	
2027830	0.17	Open	2	AD	-	AD	-	RO	2	Road would be decommissioned and taken off the system.
2027840	1.56	Open	2	RO	2	RO	2	RO	2	
2027850	1.60	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.60.
	0.75	Open	2	AC	1	AC	1	RO	2	Analyze for closure with berm/gate 0.75 miles after MP 1.60.
2027856	0.74	Open	2	AC	1	AC	1	RO	2	Road would be used then to be closed with berm/gate for resource protection.
2027857	1.10	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.10.
	0.85	Open	2	AC	1	AC	1	RO	2	Analyze for closure with berm/gate for 0.85 miles after MP 1.10.
2027859	0.37	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032000	14.81	Open	3	RO	3	RO	3	RO	3	

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2032308	0.10	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2032315	0.78	Open	2	RO	2	AD	-	RC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032317	0.52	Open	2	RO	2	AD	-	RO	2	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032318	0.53	Open	2	AC	1	AC	1	RC	1	Road to be closed with berm/gate for resource protection.
2032319	0.14	Open	2	RC	1	RC	1	RC	1	Road to be closed with berm/gate for resource protection.
2032320	0.48	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032325	0.04	Open	2	RO	2	RO	2	RO	2	Road to remain open to trailhead at MP 0.04.
	0.44	Open	2	AC	1	AC	1	RO	2	Analyze for closure 0.44 miles with berm/gate after trailhead at MP 0.04.
2032328	0.17	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032345	2.07	Open	2	RO	2	RO	2	RO	2	
2032349	1.49	Open	2	RO	2	RO	2	RO	2	
2032350	1.9	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032360	0.92	Open	2	RO	2	RO	2	RO	2	Road to remain open to for hydropower access.
2032362	0.63	Open	2	RO	2	RO	2	RO	2	
2032365	1.86	Open	2	RO	2	RO	2	RO	2	
2032372	0.21	Open	2	RO	2	RO	2	RO	2	
2032401	0.16	Open	2	RO	2	RO	2	RO	2	
2032403	0.52	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032405	0.57	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032407	0.10	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032410	0.48	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.48
	0.28	Open	2	RO	2	AD	-	RO	2	Road to remain open after 0.28 miles after MP 0.48 (Alt 2). Decommission and taken off system 0.28 miles after MP 0.48 (Alt 3 & 4).
2032417	3.20	Open	2	RO	2	RO	2	DR	-	
2032418	0.42	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.42. Access needed for cell phone tower.
	1.29	Open	2	AC	1	AC	1	RO	2	Analyze for closure with a gate after use for 1.29 miles after to MP 0.42. Access needed for cell phone tower.
2032419	0.56	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection to MP 0.56 after use.
	0.10	Open	2	AD	-	AD	-	AC	1	Decommission and take of system 0.10 miles after MP 0.56 after use.
2032420	0.84	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032421	0.39	Open	2	AC	1	AC	1	RO	2	
2032422	0.51	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032423	0.11	Open	2	AD	-	AD	-	RO	2	Road would be decommissioned and taken off the system.

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2032424	0.38	Open	2	RO	2	RO	2	RO	2	
2032426	0.26	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032427	0.17	Open	2	RO	2	RO	2	RO	2	
2032428	1.12	Open	2	RO	2	RO	2	RO	2	
2032429	0.77	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032430	0.29	Open	2	RO	2	RO	2	RO	2	
2032431	0.45	Open	2	RO	2	RO	2	RO	2	
2032444	0.33	Open	2	AC	1	AC	1	RO	2	Road would be used then to be closed with berm/gate for resource protection.
2032452	0.10	Open	2	AC	1	AD	-	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032456	0.11	Open	2	AC	1	AD	1	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)

Trout Creek Haul Roads and Anticipated Road Work Activities

Road	Haul Mileage			RCT	MTC	Cost per Mile	Estimated Total \$ (\$ with wet weather haul if permitted)			Remarks ¹
	Alt. 2	Alt. 3	Alt. 4				Alt. 2	Alt. 3	Alt. 4	
2022000	1.34	1.34	1.34	☒	☒	\$20,000	\$26,800 (\$71,242)	\$26,800 (\$71,242)	\$26,800 (\$71,242)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements and new culverts. Additional 4" of surface rock needed for wet weather haul.
2022107	1.79	1.79	1.79	☒	☒	\$20,000	\$35,800 (\$95,167)	\$35,800 (\$95,167)	\$35,800 (\$95,167)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Multiple culvert replacements and waterbar removal. Expand waste area 50'. Additional 4" of surface rock needed for wet weather haul.
2027000	12.18	12.18	12.18	☒	☒	\$20,000	\$243,600 (\$647,558)	\$243,600 (\$647,558)	\$243,600 (\$647,558)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch and fill repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027537	0.30	-	0.30	☒	☒	\$10,000	\$3,000 (\$12,950)	-	\$3,000 (\$12,950)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027720	4.30	4.30	4.30	☒	☒	\$15,000	\$64,500	\$64,500	\$64,500	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Fill repairs. No wet weather haul.

Road	Haul Mileage			RCT	MTC	Cost per Mile	Estimated Total \$ (\$ with wet weather haul if permitted)			Remarks ¹
	Alt. 2	Alt. 3	Alt. 4				Alt. 2	Alt. 3	Alt. 4	
2027730	2.37	2.37	2.37	☒	☒	\$20,000	\$47,400	\$47,400	\$47,400	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch and fill repairs. Culvert replacements. No wet weather haul.
2027732	2.60	2.60	2.60	☒	☒	\$20,000	\$52,000	\$52,000	\$52,000	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. No wet weather haul.
2027755	2.50	2.50	2.50	☒	☒	\$15,000	\$37,500	\$37,500	\$37,500	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. No wet weather haul.
2027760	1.25	1.25	1.25	☒	☒	\$15,000	\$18,750	\$18,750	\$18,750	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Fill repairs. No wet weather haul.
2027801	0.16	0.16	0.16	☒	☒	\$10,000	\$1,600 (\$6,907)	\$1,600 (\$6,907)	\$1,600 (\$6,907)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements and new culverts. Additional 4" of surface rock needed for wet weather haul.
2027803	0.47	0.47	0.47	☒	☒	\$15,000	\$7,050 (\$22,638)	\$7,050 (\$22,638)	\$7,050 (\$22,638)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch and fill repairs. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
2027805	1.30	1.30	1.30	☒	☒	\$15,000	\$19,500 (\$62,615)	\$19,500 (\$62,615)	\$19,500 (\$62,615)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
2027810	0.43	0.43	0.43	☒	☒	\$10,000	\$4,300 (\$18,561)	\$4,300 (\$18,561)	\$4,300 (\$18,561)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027812	0.29	0.29	0.29	☒	☒	\$10,000	\$2,900 (\$12,518)	\$2,900 (\$12,518)	\$2,900 (\$12,518)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027813	0.66	0.66	0.66	☒	☒	\$10,000	\$6,600 (\$28,489)	\$6,600 (\$28,489)	\$6,600 (\$28,489)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027825	1.06	1.06	1.06	☒	☒	\$15,000	\$15,900 (\$51,056)	\$15,900 (\$51,056)	\$15,900 (\$51,056)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Fill repairs. Culvert replacements. Rock pit development at MP 0.50. Additional 4" of surface rock needed for wet weather haul.

Appendix D – Road Treatment Proposals

Road	Haul Mileage			RCT	MTC	Cost per Mile	Estimated Total \$ (\$ with wet weather haul if permitted)			Remarks ¹
	Alt. 2	Alt. 3	Alt. 4				Alt. 2	Alt. 3	Alt. 4	
2027840	1.49	-	1.49	☒	☒	\$10,000	\$14,900 (\$64,317)	-	\$14,900 (\$64,317)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Fill repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2027850	2.35	2.35	2.35	☒	☒	\$20,000	\$47,000 (\$124,939)	\$47,000 (\$124,939)	\$47,000 (\$124,939)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. No wet weather haul.
2027856	0.64	0.64	0.64	☒	☒	\$10,000	\$6,400 (\$27,939)	\$6,400 (\$27,939)	\$6,400 (\$27,939)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. No wet weather haul.
2027857	1.95	1.95	1.95	☒	☒	\$15,000	\$29,250 (\$93,923)	\$29,250 (\$93,923)	\$29,250 (\$93,923)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. No wet weather haul.
2032000	3.32	3.32	3.32	☒	☒	\$15,000	\$49,800 (\$159,910)	\$49,800 (\$159,910)	\$49,800 (\$159,910)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2032417	1.55	1.55	1.55	☒	☒	\$20,000	\$31,000 (\$82,407)	\$31,000 (\$82,407)	\$31,000 (\$82,407)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2032418	1.71	1.71	1.71	☒	☒	\$10,000	\$17,100 (\$73,813)	\$17,100 (\$73,813)	\$17,100 (\$73,813)	Brushing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Fill repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2032419	0.56	0.56	0.56	☒	☒	\$20,000	\$11,200 (\$29,773)	\$11,200 (\$29,773)	\$11,200 (\$29,773)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2032421	0.39	0.39	0.39	☒	☒	\$10,000	\$3,900 (\$16,835)	\$3,900 (\$16,835)	\$3,900 (\$16,835)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
2032444	0.33	0.33	0.33	☒	☒	\$10,000	\$3,300 (\$14,245)	\$3,300 (\$14,245)	\$3,300 (\$14,245)	Clearing & Grubbing. Road rehabilitation. Ditch rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
TOTAL	47.29	45.50	47.29				\$801,050 (\$1,717,150)	\$783,150 (\$1,622,321)	\$801,050 (\$1,717,488)	

¹ Actual specific type of work or location may change prior to the sale of the Timber Contract. Anticipated work activities are only estimated.

Rock Pits

Rock Pit	Location	Proposal
Pits with proposed actions		
11 Mile	NFSR #2027000 MP 11.2	Expand already developed, active pit. Gap in unit 120 on top to provide for expansion. Production estimated at about 20,000 cubic yards.
Shank Pit (New)	NFSR #2027825 MP 0.50	New pit development. About 1200 feet of length and the development would move into the hill about two to three additional road widths for the first entry. Production estimated at about 40,000 cubic yards. Gap in unit 126 on top to provide for expansion.
Pits with no proposed action		
Beaver Trail	NFSR #2027711 MP 0.10	Closed. No Expansion or use.
Black Creek	NFSR #2032000 MP 8.6	Private Source.
Bloody Point	NFSR #2027825 MP 1.0	Active pit status but not good source for material. No expansion.
Bullion	NFSR #2032000 MP 5.2	Active pit status but not good source for material. No expansion.
Canyon	NFSR #2022000 MP 3.5	Private Source.
Canyon Creek	NFSR #2022000 MP 4.9	Private Source.
Falls Creek	NFSR #2032000 MP 4.7	Restored pit. Not good source for material. No expansion
Hensley Creek	NFSR #2025000 MP 2.4	Closed. No Expansion.
Longbow	NFSR #2000011 MP 0.79	Closed. No Expansion.
Moose Creek	NFSR #2025000 MP 2.1	Closed. No Expansion.
Moose Head	NFSR #2027000 MP 6.1	Closed. No Expansion.
Moose Mtn.	NFSR #2027000 MP 2.6	Closed. No Expansion.
Powder	NFSR #2027000 MP 3.0	Closed. No Expansion.
Soapcan	NFSR #2032000 MP 7.7	Unknown status. No Expansion.
Vine Maple	NFSR #2000011 MP 0.50	Closed. No Expansion.
Yukwah	NFSR #2000011 MP 0.20	Closed. No Expansion.

Temporary Roads

Unit	Open Temp Road (miles)		New Temp Road (miles)	
	Alt. 2/4	Alt. 3	Alt. 2/4	Alt. 3
15			0.05	0.05
20	0.68	0.68	0.23	0.23
27			0.06	
32	0.26	0.26		
33	0.16	0.16		0.02
42			0.09	0.09
44			0.06	
50	0.47	0.47	0.85	0.85
56			0.65	
62	0.30	0.30		0.05
63	0.10	0.10		
68				0.03
73	0.06	0.06		
89	0.30			
Total	2.33	2.03	1.99	1.31

Road Closures

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2022107	0.20	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.20.
	1.59	Open	2	AC	1	AC	1	RO	2	Analyze for closure 1.59 miles with a gate after use at MP 0.20.
2025507	0.69	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2025513	0.20	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2025516	0.11	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2025523	0.17	Open	2	AC	1	AC	1	RC	1	Road to be closed with berm/gate for resource protection.
2025580	1.94	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025582	0.69	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025584	0.08	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025585	0.21	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2025590	1.01	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027530	0.59	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027537	0.30	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but to remain on system for resource administration.
2027543	0.06	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but need access for helicopter landing.
2027547	0.15	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027711	0.24	Open	2	AC	1	AD	-	RO	2	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027713	0.44	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027714	0.21	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027716	0.13	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027730	1.92	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.92.
	0.45	Open	2	AC	1	AC	1	RO	2	Analyze for closure 0.45 miles with a berm/gate after use at MP 1.92.
2027732	1.58	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.58.
	1.61	Open	2	AC	1	AC	1	RO	2	Analyze for closure 1.61 miles with a berm/gate after use at MP 1.58.
2027758	1.34	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027765	0.30	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027769	0.31	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027775	1.04	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027801	0.30	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection to MP 0.30 after use.
	0.40	Open	2	AD	-	AD	-	AD	-	Decommission 0.40 miles after MP 0.30 after use.
2027803	0.47	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection but to remain on system for resource administration.
2027810	1.13	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2027812	0.46	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.
2027813	0.66	Open	2	AC	1	AC	1	AC	1	Road would be used then to be closed with berm/gate for resource protection.
2027815	0.43	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2027816	0.42	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027820	0.62	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2027850	1.60	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.60.
	0.75	Open	2	AC	1	AC	1	RO	2	Analyze for closure with berm/gate 0.75 miles after MP 1.60.
2027856	0.74	Open	2	AC	1	AC	1	RO	2	Road would be used then to be closed with berm/gate for resource protection.
2027857	1.10	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 1.10.
	0.85	Open	2	AC	1	AC	1	RO	2	Analyze for closure with berm/gate for 0.85 miles after MP 1.10.
2027859	0.37	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032318	0.53	Open	2	AC	1	AC	1	RC	1	Road to be closed with berm/gate for resource protection.
2032320	0.48	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032325	0.04	Open	2	RO	2	RO	2	RO	2	Road to remain open to trailhead at MP 0.04.
	0.44	Open	2	AC	1	AC	1	RO	2	Analyze for closure 0.44 miles with berm/gate after trailhead at MP 0.04.
2032328	0.17	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032350	1.9	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032403	0.52	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032405	0.57	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032407	0.10	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection.
2032418	0.42	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.42. Access needed for cell phone tower.
	1.29	Open	2	AC	1	AC	1	RO	2	Analyze for closure with a gate after use for 1.29 miles after to MP 0.42. Access needed for cell phone tower.
2032419	0.56	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection to MP 0.56 after use.
	0.10	Open	2	AD	-	AD	-	AC	1	Decommission and take of system 0.10 miles after MP 0.56 after use.
2032420	0.84	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032421	0.39	Open	2	AC	1	AC	1	RO	2	
2032422	0.51	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032426	0.26	Open	2	AC	1	AC	1	RO	2	Road to be closed with berm/gate for resource protection.
2032429	0.77	Open	2	AC	1	AC	1	DR	-	Road to be closed with berm/gate for resource protection.
2032444	0.33	Open	2	AC	1	AC	1	RO	2	Road would be used then to be closed with berm/gate for resource protection.
2032452	0.10	Open	2	AC	1	AD	-	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2032456	0.11	Open	2	AC	1	AD	1	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
Alternative 2 Proposed Closures				30.93 Miles						
Alternative 3/4 Proposed Closures						29.89 Miles				

Road Decommissioning

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2000011	2.10	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000013	0.13	Open	2	RO	2	AD	-	RC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2000017	0.75	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000224	0.35	Open	2	RO	2	AD	-	AC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2000632	0.78	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000636	0.42	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000641	0.11	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2000643	0.37	Closed	1	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2027539	0.11	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027541	0.09	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027547	0.15	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027707	0.59	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027709	0.21	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027711	0.24	Open	2	AC	1	AD	-	RO	2	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)

Road	Miles	Current		Alternative 2		Alternative 3/4		RIS		Remarks
		Status	ML	Status	ML	Status	ML	Status	ML	
2027713	0.44	Open	2	AC	1	AD	-	AD	-	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027715	0.31	Open	2	AD	-	AD	-	AD	-	Road would be decommissioned and taken off the system.
2027801	0.30	Open	2	AC	1	AC	1	AD	-	Road to be closed with berm/gate for resource protection to MP 0.30 after use.
	0.40	Open	2	AD	-	AD	-	AD	-	Decommission 0.40 miles after MP 0.30 after use.
2027817	0.35	Open	2	RO	2	AD	-	AD	-	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2027830	0.17	Open	2	AD	-	AD	-	RO	2	Road would be decommissioned and taken off the system.
2032308	0.10	Open	2	AD	-	AD	-	RC	1	Road would be decommissioned and taken off the system.
2032315	0.78	Open	2	RO	2	AD	-	RC	1	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032317	0.52	Open	2	RO	2	AD	-	RO	2	Road to remain open for resource administration. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032410	0.48	Open	2	RO	2	RO	2	RO	2	Road to remain open to MP 0.48
	0.28	Open	2	RO	2	AD	-	RO	2	Road to remain open after 0.28 miles after MP 0.48 (Alt 2). Decommission and taken off system 0.28 miles after MP 0.48 (Alt 3 & 4).
2032419	0.56	Open	2	AC	1	AC	1	AC	1	Road to be closed with berm/gate for resource protection to MP 0.56 after use.
	0.10	Open	2	AD	-	AD	-	AC	1	Decommission and take of system 0.10 miles after MP 0.56 after use.
2032423	0.11	Open	2	AD	-	AD	-	RO	2	Road would be decommissioned and taken off the system.
2032452	0.10	Open	2	AC	1	AD	-	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
2032456	0.11	Open	2	AC	1	AD	1	AC	1	Road to be closed with berm/gate for resource protection. (Alt 2) Road would be decommissioned and taken off the system. (Alt 3 & 4)
Alternative 2 Proposed Decommissioning				5.92 Miles						
Alternative 3/4 Proposed Decommissioning						10.17 Miles				

Appendix E – Detailed List of Project Activities

Commercial Treatments

AR	Aggregate retention harvest (i.e., early seral creation)
CC	Canopy Cover after thinning
GAPS	Gaps no larger than 1 acre in size
GB	Ground-based yarding
MBF	Thousand board feet
RRT	Riparian reserve thinning (acres also included in total thinning acres in THIN column)
SKIPS	Skips or areas not harvested
SKY	Skyline yarding
THIN	Intermediate thinning
TPA	Trees per acre retained in aggregate retention opening

Alternative 2

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
Managed Stands											
14	1963	42	22	7	10	0	10	0	32	667	THIN=50% CC AR=30% of unit area + 9 TPA
15	1958	54	35.5	10	6	2.5	10	0	44	742	THIN=50% CC AR=15% of unit area + 9 TPA
20	1958, 1983	130	27	4	36	0	67	31	32	1,558	THIN=50% CC (10 acres) & 30% CC (17 acres) AR=50% of unit area + 10 TPA
28	1985	9	6	3	0	0	3	6	0	60	50% CC
29	1984	25	20	7	0	0	5	20	0	170	50% CC
30	1984	26	19	7	0	0	7	19	0	162	50% CC
31	1984	5	5	0	0	0	0	5	0	68	50% CC
32	1968	27	24	1	0	2	1	10	16	394	50% CC
33	1968	35	28.5	9	0	2.5	4	5	26	294	50% CC
34	1957	25	19	7	0	0	6	8	11	285	50% CC
41	1965	34	21	0	0	0	13	0	21	408	50% CC
42	1985	11	10	<1	0	0	1	10	0	80	50% CC
50	1965	168	90	0	0	0	78	17	73	754	40 to 50% CC
57	1981	23	11	0	0	0	12	9	2	28	50% CC
58	1981	36	29.5	9	0	2.5	4	0	32	321	50% CC
59	1982	21	12	4	0	0	9	3	9	102	50% CC
60	1983	41	24	0	0	0	17	18	6	240	30% CC
61	1983	33	25	0	0	0	8	25	0	250	30% CC

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
62	1964	40	29	11	0	4	7	0	33	130	50% CC
63	1964	51	30	13	0	10	11	25	11	579	50% CC
68	1985	7	7	1	0	0	<1	0	7	70	50% CC
72	1965	14	8	5	0	0	6	8	0	304	50% CC
73	1963	65	23	5	0	0	42	0	23	295	50% CC
87	1985	6	2	1	0	0	4	2	0	20	50% CC
100	1965	5	4	0	0	0	1	0	4	102	30% CC
170	1952, 1975	34	18	0	0	0	16	18	0	249	30% CC
200	1976	49	26.5	5	0	2.5	20	0	29	347	50% CC
Subtotal		1,016	576	109	52	26	362	239	411	8,679	
Fire-Origin Stands											
27	1890	22	12	0	0	1	9	2	11	50	50% CC
44	1898	89	64	0	0	8	17	12	60	1,008	50% CC
56	1890	112	0	0	47	0	65	26	21	1,058	50% of unit area + 15 TPA
67	1883	9	0	0	2	0	7	0	2	70	70% of unit area + oak trees
89	1890	36	32	0	0	0	4	0	32	864	30% CC
120	1895	23	19	0	0	0	4	19	0	561	30% CC
140	1890	30	20	0	0	0	10	20	0	400	30% CC
170	1880	15	5	0	0	0	10	5	0	95	30% CC
190	1900	6	5	0	0	0	1	5	0	33	50% CC
Subtotal		342	157	-	49	9	127	89	126	4,139	
Total		1,358	733	109	101	35	489	328	537	12,818	

Alternative 3

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
Managed Stands											
14	1963	42	34	9	0	1	7	0	35	628	40 to 50% CC
15	1958	54	39.5	10	0	3.5	11	0	43	648	40 to 50% CC
20	1958, 1983	130	76	4	0	5	49	31	50	1,280	40-50% CC (59 acres) & 30% CC (17 acres)
28	1985	9	6	3	0	0	3	6	0	60	50% CC
29	1984	25	20	7	0	0	5	20	0	170	50% CC
30	1984	26	19	7	0	0	7	19	0	162	50% CC
31	1984	5	5	0	0	0	0	5	0	68	50% CC
32	1968	27	22	1	0	4	1	10	16	424	50% CC
33	1968	35	26	9	0	5	4	5	26	355	50% CC
34	1957	25	19	7	0	0	6	8	11	285	50% CC
41	1965	34	21	0	0	0	13	0	21	408	50% CC
42	1985	11	10	<1	0	0	1	10	0	80	50% CC

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
50	1965	168	90	0	0	0	78	17	73	754	40 to 50% CC
57	1981	23	11	0	0	0	12	9	2	28	50% CC
58	1981	36	27	9	0	5	4	0	32	369	50% CC
59	1982	21	12	4	0	0	9	3	9	102	50% CC
60	1983	41	24	0	0	0	17	18	6	240	50% CC
61	1983	33	25	0	0	0	8	25	0	250	50% CC
62	1964	40	29	11	0	4	7	0	33	130	50% CC
63	1964	51	30	13	0	10	11	25	11	579	50% CC
68	1985	7	7	1	0	0	<1	0	7	70	50% CC
72	1965	14	8	5	0	0	6	8	0	304	50% CC
73	1963	65	20	3	0	1	44	0	21	285	50% CC
87	1985	6	2	1	0	0	4	2	0	20	50% CC
100	1965	5	4	0	0	0	1	0	4	102	30% CC
170	1952, 1975	34	18	0	0	0	16	18	0	249	30% CC
200	1976	49	24.5	5	0	4.5	20	0	29	388	50% CC
Total		1,016	629	109	-	43	344	239	429	8,438	

Alternative 4

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
Managed Stands											
14	1963	42	22	7	10	0	10	0	32	667	THIN=50% CC AR=30% of unit area + 9 TPA
15	1958	54	30	10	6	8	10	0	44	852	THIN=50% CC AR=15% of unit area + 9 TPA
20	1958, 1983	130	27	4	36	0	67	31	32	1558	THIN=50% CC (10 acres) & 30% CC (17 acres) AR=50% of unit area + 10 TPA
28	1985	9	6	3	0	0	3	6	0	60	50% CC
29	1984	25	20	7	0	0	5	20	0	170	50% CC
30	1984	26	19	7	0	0	7	19	0	162	50% CC
31	1984	5	5	0	0	0	0	5	0	68	50% CC
32	1968	27	22	1	0	4	1	10	16	424	50% CC
33	1968	35	26	9	0	5	4	5	26	355	50% CC
34	1957	25	19	7	0	0	6	8	11	285	50% CC
41	1965	34	21	0	0	0	13	0	21	408	50% CC

Unit	Year of Origin	Unit Acres	Harvest Prescription Acres					Logging System Acres		Volume (MBF)	Retention Level
			THIN	RRT	AR	GAPS	SKIPS	GB	SKY		
42	1985	11	10	<1	0	0	1	10	0	80	50% CC
50	1965	168	90	0	0	0	78	17	73	754	40 to 50% CC
57	1981	23	11	0	0	0	12	9	2	28	50% CC
58	1981	36	27	9	0	5	4	0	32	369	50% CC
59	1982	21	12	4	0	0	9	3	9	102	50% CC
60	1983	41	24	0	0	0	17	18	6	240	30% CC
61	1983	33	25	0	0	0	8	25	0	250	30% CC
62	1964	40	29	11	0	4	7	0	33	130	50% CC
63	1964	51	30	13	0	10	11	25	11	579	50% CC
68	1985	7	7	1	0	0	<1	0	7	70	50% CC
72	1965	14	8	5	0	0	6	8	0	304	50% CC
73	1963	65	23	5	0	0	42	0	23	274	50% CC
87	1985	6	2	1	0	0	4	2	0	20	50% CC
100	1965	5	4	0	0	0	1	0	4	102	30% CC
170	1952, 1975	34	18	0	0	0	16	18	0	249	30% CC
200	1976	49	24.5	5	0	4.5	20	0	29	388	50% CC
Subtotal		1,016	562	109	52	41	362	239	411	8,948	
Fire-Origin Stands											
27	1890	22	11	0	0	2	9	2	11	67	50% CC
44	1898	89	59	0	0	13	17	12	60	1210	50% CC
56	1890	112	0	0	47	0	65	26	21	3572	50% of unit area + 4 TPA
67	1883	9	0	0	2	0	7	0	2	70	70% of unit area + oak trees
89	1890	36	32	0	0	0	4	0	32	864	30% CC
120	1895	23	19	0	0	0	4	19	0	561	30% CC
140	1890	30	20	0	0	0	10	20	0	400	30% CC
170	1880	15	5	0	0	0	10	5	0	95	30% CC
190	1900	6	5	0	0	0	1	5	0	33	50% CC
Subtotal		342	151	-	49	15	127	89	126	6,872	
Total		1,358	713	109	101	56	489	328	537	15,820	

Non-Commercial and Fuel Treatments

GP Post-harvest grapple pile and burn
 UB Post-harvest underburn
 RR Treatment acres include Riparian Reserve acres

Alternative 2

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
Managed Stands						
14	42	0	10	Plant huckleberries in aggregate retention area.	No	10
15	54	0	16	Underburn a portion of the thinning area to create snags.	No	10

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
20	130	0	63	Restore dry meadow area. Cut and pile sub-merchantable conifers, burn piles and meadow.	No	2
28	9	6	0	None	No	0
29	25	20	0	None	No	0
30	26	0	19	Thin maple sprouts to favor dominant maple stems. Possibly allow firewood collection of cut stems.	Yes	3
31	5	0	5	None	No	0
32	27	10	0	None	No	0
33	35	0	31	Fall and leave thinning in alder patch in Riparian Reserves, underplant to western redcedar and bigleaf maple to promote long-lived tree species for stream shading.	Yes	1
34	25	8	0	Fall and leave (staying above 70% canopy cover) in Riparian Reserves to promote stream structure.	Yes	5
41	34	0	0	None	No	0
42	11	10	0	None	No	0
50	168	0	0	None	No	0
57	23	9	0	None	No	0
58	36	0	0	None	No	0
59	21	3	0	Fall and leave thinning in area below cliff band that is not feasible to log.	No	3
60	41	0	24	None	No	0
61	33	0	25	None	No	0
62	40	0	0	None	No	0
63	51	0	36	Create snags in snag creation gaps.	No	4
68	7	0	0	None	No	0
72	14	8	0	Plant hazel.	Yes	8
73	65	0	0	None	No	0
87	6	2	0	Fall and leave thinning in area cut off by wetland from logging operations. Underplant alder area with Oregon ash and western redcedar to promote long-lived species.	Yes	2
100	5	0	0	Cut back existing huckleberry to encourage new sprouts; plant more huckleberry if needed.	No	4
170	34	18	0	Pre-commercial thin by clearing 14 feet around existing hardwood stems. 35-foot no-cut buffer on perennial streams. No buffer on intermittent streams.	Yes	7
200	49	0	0	None	No	0
Subtotal	1,016	94	229			59
Fire-Origin Stands						
27	22	2	0	None	No	0
43	35	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	35
44	89	12	0	None	No	0
55	153	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	59
56	112	0	47	None	No	0
66	53	0	0	Underplant incense cedar (shade tolerant species) for diversity.	No	53
67	9	0	2	Fall and leave to release existing oak trees from conifer competition (55 trees in Riparian Reserves).	Yes	1
74	53	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	53
89	36	0	0	None	No	0
92	103	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	103

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
95	2	0	0	Snag creation and/or fall and leave to release existing oak and madrone trees from conifer competition (5 trees in Riparian Reserves).	Yes	2
120	23	19	0	None	No	0
140	30	20	0	None	No	0
170	15	5	0	None	No	0
190	6	5	0	Planting Tall bugbane restoration.	No	5
Subtotal	741	63	49			311
Total	1,757	157	278			370

Alternative 3

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
Managed Stands						
14	42	0	0	Plant huckleberries in gap.	No	1
15	54	0	10	Underburn a portion of the thinning area to create snags.	No	10
20	130	0	2	Restore dry meadow area. Cut and pile sub-merchantable conifers, burn piles and meadow.	No	2
28	9	6	0	None	No	0
29	25	20	0	None	No	0
30	26	0	19	Thin maple sprouts to favor dominant maple stems. Possibly allow firewood collection of cut stems.	Yes	3
31	5	0	5	None	No	0
32	27	10	0	None	No	0
33	35	0	31	Fall and leave thinning in alder patch in Riparian Reserves, underplant to western redcedar and bigleaf maple to promote long-lived tree species for stream shading.	Yes	1
34	25	8	0	Fall and leave (staying above 70% canopy cover) in Riparian Reserves to promote stream structure.	Yes	5
41	34	0	0	None	No	0
42	11	10	0	None	No	0
50	168	0	0	None	No	0
57	23	9	0	None	No	0
58	36	0	0	None	No	0
59	21	3	0	Fall and leave thinning in area below cliff band that is not feasible to log.	No	3
60	41	0	24	None	No	0
61	33	0	25	None	No	0
62	40	0	0	None	No	0
63	51	0	36	Create snags in snag creation gaps.	No	4
68	7	0	0	None	No	0
72	14	8	0	Plant hazel.	Yes	8
73	65	0	0	None.	No	0
87	6	2	0	Fall and leave thinning in area cut off by wetland from logging operations. Underplant alder area with Oregon ash and western redcedar to promote long-lived species.	Yes	2
100	5	0	0	Cut back existing huckleberry to encourage new sprouts; plant more huckleberry if needed.	No	4
170	34	18	0	Pre-commercial thin by clearing 14 feet around existing hardwood stems. 35-foot no-cut buffer on perennial streams. No buffer on intermittent streams.	Yes	7
200	49	0	0	None	No	0

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
Total	1016	94	162			51

Alternative 4

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
Managed Stands						
14	42	0	10	Plant huckleberries in aggregate retention area.	No	10
15	54	0	16	Underburn a portion of the thinning area to create snags.	No	10
20	130	0	63	Restore dry meadow area. Cut and pile sub-merchantable conifers, burn piles and meadow.	No	2
28	9	6	0	None	No	0
29	25	20	0	None	No	0
30	26	0	19	Thin maple sprouts to favor dominant maple stems. Possibly allow firewood collection of cut stems.	Yes	3
31	5	0	5	None	No	0
32	27	10	0	None	No	0
33	35	0	31	Fall and leave thinning in alder patch in Riparian Reserves, underplant to western redcedar and bigleaf maple to promote long-lived tree species for stream shading.	Yes	1
34	25	8	0	Fall and leave (staying above 70% canopy cover) in Riparian Reserves to promote stream structure.	Yes	5
41	34	0	0	None	No	0
42	11	10	0	None	No	0
50	168	0	0	None	No	0
57	23	9	0	None	No	0
58	36	0	0	None	No	0
59	21	3	0	Fall and leave thinning in area below cliff band that is not feasible to log.	No	3
60	41	0	24	None	No	0
61	33	0	25	None	No	0
62	40	0	0	None	No	0
63	51	0	36	Create snags in snag creation gaps.	No	4
68	7	0	0	None	No	0
72	14	8	0	Plant hazel.	Yes	8
73	65	0	0	None	No	0
87	6	2	0	Fall and leave thinning in area cut off by wetland from logging operations. Underplant alder area with Oregon ash and western redcedar to promote long-lived species.	Yes	2
100	5	0	0	Cut back existing huckleberry to encourage new sprouts; plant more huckleberry if needed.	No	4
170	34	18	0	Pre-commercial thin by clearing 14 feet around existing hardwood stems. 35-foot no-cut buffer on perennial streams. No buffer on intermittent streams.	Yes	7
200	49	0	0	None	No	0
Subtotal	1,016	94	229			59
Fire-Origin Stands						
27	22	2	0	None	No	0
43	35	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	35
44	89	12	0	None	No	0
55	153	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	59

Unit	Unit Acres	Fuel Treatment Acres		Non-Commercial Treatments		
		GP	UB	Description	RR	Acres
56	112	0	47	None	No	0
66	53	0	0	Underplant incense cedar (shade tolerant species) for diversity.	No	53
67	9	0	2	Fall and leave to release existing oak trees from conifer competition (55 trees in Riparian Reserves).	Yes	1
74	53	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	53
89	36	0	0	None	No	0
92	103	0	0	Underplant western redcedar and incense cedar (shade tolerant species) for diversity.	Yes	103
95	2	0	0	Snag creation and/or fall and leave to release existing oak and madrone trees from conifer competition (5 trees in Riparian Reserves).	Yes	2
120	23	19	0	None	No	0
140	30	20	0	None	No	0
170	15	5	0	None	No	0
190	6	5	0	Planting Tall bugbane restoration.	No	5
Subtotal	741	63	49			311
Total	1,757	157	278			370

Appendix F – Response to Comments on the Draft Environmental Impact Statement (DEIS)

Introduction

The Sweet Home Ranger District provided the public with a 45-day comment period for the Trout Creek Project Draft Environmental Impact Statement (DEIS). The comment period began on December 29, 2017 and ended on February 12, 2018. Seven letters were received from members of the public, federal officials, and public interest organizations.

Content Analysis

A standardized content analysis process was conducted to analyze the public letters received on the DEIS. Content analysis is designed to extract comments from each letter received, evaluate similar comments from different letters, and identify topics of concern. Additionally, content analysis ensures that every comment is considered fairly and accurately represents the breadth and depth of the public's viewpoints. All letters and comments have been treated equally. They are not weighted by status of respondents or organizational affiliation and it does not matter if an idea was expressed by hundreds of people or a single person.

During the content analysis process, each letter was assigned a unique tracking number. Content analysts then read letters in their entirety and proceeded to identify discrete comments within them. Each letter may have contained anywhere from one to fifty comments.

How to Use This Comment Response Document

While all comments were reviewed and considered, only specific written comments as identified in 36 CFR 218.2 received a detailed response in the document below. Examples of specific written comments include those comments that provided new information; identified a new issue; identified a new way to meet the purpose and need; pointed out a flaw in the analysis; or identified a different source of credible research. General statements of support, opposition, or alternative preferences; comments outside the scope of the project; comments pertaining to issues already decided by law, regulation or policy; or comments already addressed in the Draft Environmental Impact Statement (DEIS) are not included.

In some cases, comment may have been summarized or paraphrased and similar comments may have been grouped into public concern statements. Pages, chapter, or sections cited within the response to comments refer to the Trout Creek Final Environmental Impact Statement (FEIS) unless otherwise noted.

A complete record of all letters, including names and addresses of individuals, agencies, and organizations that submitted a letter during the 45 day comment period, is available online in the Trout Creek EIS Public Reading Room at (<https://cara.ecosystem-management.org/Public/ReadingRoom?Project=46279>) or in the project file located at the Sweet Home Ranger District.

Commenter	Comment	Resource Topic	Response
Reed Wilson, Benton Forest Coalition	1) Modify Alternative 3: The modifications to Alternative 3 we propose are 1) setting a diameter cut limit in thinning units, 2) maintaining 60% canopy cover in CHU units, 3) substituting incense cedar and western red cedar for western white pine and sugar pine in replanting, and 4) planting clumps of chinquapins (associated with golden hairstreaks) in thinning units.	Silviculture	1. All units have a 35" DBH limit which is designed to protect remnant old-growth trees. In managed stands, no old-growth remnant trees were noted during silviculture reconnaissance. 2. In Alternative 3, no units in CHU would be prescribed for thinning that goes below 40% canopy cover. A thorough analysis of the effects of this project to the spotted owl and its habitat has been conducted, including a Biological Assessment that was sent to the USFWS for consultation, and the resulting Biological Opinion (USFWS 2018) which has been documented in the Trout Creek EIS. All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan and the Revised Critical Habitat for the Northern Spotted Owl Final Rule (USFWS 2012a) where dispersal owl habitat is generally characterized as stands with trees at least 11 in dbh and a minimum 40 percent canopy cover meet this baseline condition for northern spotted owl dispersal habitat. 3. Western white pine and sugar pine are native species that have been affected by an invasive disease, blister-rust. The Forest Service has developed disease-resistant seedlings from traditional breeding of native trees found to be resistant in Oregon. Seedling stock would adhere to state of Oregon seed zones to ensure that seedlings are adapted to the planting site. Both western white pine and sugar pine are drought-resistant, and would increase the diversity of drought-resistant species on the landscape, increasing resilience to current and future drought-disturbance. 4. Chinquapin is likely to be found only on the driest, droughty sites. On these sites it is already present in most managed stands, as it is adapted to disturbances such as fire and logging. This is evidenced by its ability to sprout vigorously following disturbance. Management would benefit chinquapin by increasing the amount of light to existing trees/shrubs, creating new sites for it to seed into (such as gaps), and causing stem sprouting in any trees inadvertently damaged during logging. Chinquapin would be expected to persist and increase without assistance on appropriate sites, making planting unnecessary.

Commenter	Comment	Resource Topic	Response
Reed Wilson, Benton Forest Coalition	2) Avoid logging in stands over 80. While some younger plantations resulting from clear-cuts may be overcrowded and lack diversity and structure, the negative impacts of logging are well documented, from the fragmentation of habitat to soil degradation to carbon release to destructive scenic impacts that negatively affect Oregon's economy. Allowing older stands to progress naturally toward old growth characteristics while retaining biomass will benefit habitat for forest dependent species, retain more carbon, and enhance recreational opportunities. We ask that the District not only drop the older fire-origin stands in the Trout Creek project, but refrain from planning timber sales in stands over 80 years of age in future projects	Silviculture	Stands selected for treatment were filtered through a series of management restrictions and legal side boards. Those stands which made it through the filter were then evaluated as to how they would or would not help achieve the purpose and need of the project. Stand age is a metric that is easy to understand. However, it does not provide a complete picture about stand development, composition, characteristics, or location. Relative Density Index (RDI) is a metric used to describe a stand regardless of age; RDI is about density and competition. In the fire-origin stands proposed for treatment (stands over 80 years of age), the average age is 130 years old with a range of 127 to 137 years old. The fire-origin stands proposed for harvest in the Trout Creek project have an average RDI of 57% (DEIS pg. 76) which is well above the 40% threshold where management is recommended to reduce competition (DEIS pg. 74). Location was also an important factor in selecting stands for treatment, particularly with fuelbreak objectives. Fuel breaks are strategically placed along roads and ridgetops where fire management has a greater chance of success. Location also was important in selecting some stands with hardwood habitat objectives. For example, Oregon white oak is located in only a few stands in the project area, with the only mature grove that is not associated with rock outcrops located in a fire-origin stand. In an effort to better achieve the purpose and need of the project, location and RDI rather than stand age was used to identify stands for treatment. Mitigation measures would be used to minimize any negative effects of logging.
Reed Wilson, Benton Forest Coalition	3) The assumption that replanted western white pine and sugar pine will thrive in thinned harvest units is questionable. The District seems to be proposing the replacement of existing disease resistant stands “in the Western Cascades... minor losses due to insects and unspecified causes” pg 142 DSEIS, with pines bred or genetically engineered to be resistant to blister rust. Experimental approaches to modifying species diversity should be undertaken on a limited scale, and only in plantations, not in fire-origin stands.	Silviculture/ under planting	Western white pine and sugar pine are native species that have been affected by an invasive disease, blister-rust. The Forest Service has developed disease-resistant seedlings from traditional breeding of resistant native trees found in Oregon. Seedling stock would adhere to state of Oregon seed zones to ensure that seedlings are adapted to the planting site. Both western white pine and sugar pine are drought-resistant native species, and would increase the diversity of drought-resistant species on the landscape, increasing resilience to current and future drought-disturbance. They would be planted in gaps and aggregate retention units where light conditions are appropriate for them to become part of the overstory.
Reed Wilson, Benton Forest Coalition	4) If citizen surveyors hadn't climbed old growth trees in three older units at Trout Creek, red tree vole populations that should have been protected would be isolated or extirpated, especially since the District had proposed removing up to 85% of the trees. At the same time the District is citing forest health and biological diversity in its purpose and need, we find it highly	Red Tree Voles/Silviculture	Units 44, 56, and 120 have been excluded from the trout Creek project due to the presence of Red Tree Voles. See the Record of decision (ROD) for final decision rational and acres. Also, see response to comments #2 and #37.

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	objectionable that the Forest Service and the BLM continue to target older forests for commercial extraction, especially when older forests represent islands of diversity and refugia for forest dependent species in a sea of previously logged public and private lands.		
Reed Wilson, Benton Forest Coalition	5) Avoid aggregate retention: Aggregate retention, or variable retention harvest (VRH), as it is also known, is highly controversial: 1. From a habitat standpoint, aggregate retention harvests function as dispersed clear-cuts rather than dispersed aggregates, expose forest dependent species to predation, and impede the exchange of genetic material and dispersal for juveniles. 2. In a recent class on Forest Resource Management at OSU's College of Forestry, Dr's Jerry Franklin and Norman Johnson lectured on the destructive aspects of clearcutting. 3. In an editorial published in the Corvallis Gazette Times on 2/3/2016, Dr's Franklin and Johnson criticized the Salem BLM for excessive clearcutting in the design of the 4. Rainbow Ridge timber sale, a VRH project. 4. The White Castle timber sale, another VRH project by the Roseburg BLM, was occupied by protesters for six months, and withdrawn as a result of successful litigation by environmental advocacy groups.	Silviculture	Aggregate retention harvest has been successfully implemented for over two decades in forests around the world, including boreal forests in Scandinavia, aspen forests in the Great Lakes, eucalypt forests in the South Pacific, and locally in the Pacific Northwest in Douglas-fir forests (Baker et al, 2016). 1. Aggregate retention harvest is not designed to provide habitat for forest-dependent species in the short term. It is designed to provide habitat for early seral species such as many neotropical migrant birds, ungulates, and their associated predators, among others (DEIS pg. 87). Complex early seral habitat makes up a little over 1% of NFS land in the South Santiam fifth-field watershed, where the project area is located (DEIS, pg. 75). Historically, about 8% of the watershed would have been complex early seral habitat (DEIS pg. 75), demonstrating a need for increasing the amount of this habitat. The aggregates can provide refugia for forest-dependent plants and insects (Baker et al, 2016), but the DEIS doesn't suggest that they provide suitable habitat for all forest-dependent species. The aggregates are designed to provide greater structural complexity to the regenerating stand, which would make it better future habitat for forest-dependent species than traditional clearcut treatment. 2. Aggregate retention harvest is proposed, not traditional clearcutting. Aggregate retention harvest would create more complex early seral habitat due to keeping both aggregate and dispersed retention, prescribed burning to encourage shrub sprouts and establishment of forbs, and low density tree planting that would prolong the duration of the early seral habitat. Clear-cuts, such as those on private forest land, are designed to meet economic objectives, and so leave little retention, use herbicides to reduce shrub and forb competition to seedlings, and plant at high densities with fast-growing stock. This simplifies the early seral habitat on private land and decreases its duration.
Reed Wilson, Benton Forest Coalition	6) Harvest units 56 and 120, with a healthy snag component, interspersed old growth trees with cavities that harbor red tree voles and flying squirrels (two were encountered by climbers in 120), Douglas fir, hemlock, western red cedar, red alder, bigleaf maple, grand fir, madrone, noble fir and silver fir, and a healthy understory of vine maple, Oregon grape, salal and other species cannot be described as having "limited structural	Red Tree Voles	Units 56 and 120 have been dropped from inclusion in the Trout Creek project.

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	complexity and low tree species diversity” or lacking “dominant trees with full crowns and large branches” (DEIS, pg 22).		
Reed Wilson, Benton Forest Coalition	7) We note that the District included in the DEIS photos of overstocked plantations to rationalize aggressive thinning, but only one photo of a fire-origin stand taken from a nearby road that fails to illustrate the diverse nature of the ecosystem.	General	Many photos were taken of the project area and photos were selected for the document that best represented general stand conditions. There are a variety of photos included in the project record that are available for the public to view. Photos are one snapshot in time and there will always be some variation. Maps are included in the document and we welcome the public to view the Trout Creek project on their own. The public was also offered several opportunities to see the project on various field trips held over the last several years.
Reed Wilson, Benton Forest Coalition	8) The Willamette National Forest should expand efforts to conserve spotted owl habitat. Spotted Owl Recovery Plans generated by Fish and Wildlife have been largely ineffectual. Spotted Owl populations continue to plummet by the rate of approximately 4% per year. Owl populations in nine out of eleven study areas have declined. Spotted Owls are highly mobile. Relying on Recovery Plan recommendations to retain percentages of canopy cover within certain distances of previously documented nest sites while commercially logging viable habitat violates the intention of the Endangered Species Act that agencies must work not only to maintain populations, but to help them recover. In a rare reversal of current trends, six new spotted owl nest sites were recently detected in the Myrtle Creek project area (Roseburg BLM). All six nest sites were in areas unknown to be occupied by spotted owls, and potentially spotted owls could reinhabit stands in the Trout Creek project area, especially those with broken top trees and cavities suitable for nesting.	Spotted Owls	NSO surveys were conducted during nesting season in 2014, 2015, and 2016 in accordance with survey protocols established by USFWS within the Trout Creek project area in order to determine the presence of owls. No harvest is being proposed in nest patches. Harvest restrictions during nesting season will be imposed on units near owl sites in order to avoid take. This project is not expected to jeopardize the continued existence of the spotted owl.
Reed Wilson, Benton Forest Coalition	9) The Willamette National Forest, and the Sweet Home District, should refrain from generating timber sales in all older stands, especially those with interspersed legacy trees in an effort to help the owl recover and to maintain healthy populations of prey species.	Spotted Owls	The analysis concluded that this project may affect and is likely to adversely affect the northern spotted owl; however, given the amount of suitable habitat and functional home ranges that would remain after implementation, proposed actions would not preclude meeting recovery goals for spotted owls and the landscape would still support nesting spotted owls and dispersal post-treatment. See response to comments #1 and #2
Reed Wilson, Benton Forest Coalition	10) Thinning impacts red tree vole populations by reducing canopy cover, and also impacts flying squirrel populations (Wilson, Forsman 2013). If both red tree vole and flying squirrel	Red tree Voles/Spotted Owl	The analysis concluded that proposed activities are expected to occur outside of known red tree vole active sites and such proposed activities may impact individuals of the population by reducing canopy cover, connectivity and canopy complexity. In the active red

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	populations are reduced, spotted owl populations will continue to decline.		tree vole areas, dispersal would be difficult and suitable habitat would be restricted to riparian and suitable habitat corridors until the area recovers to mature stand conditions. Therefore, project activities may impact individuals or their habitat temporarily, but the actions would maintain species persistence and viability. In units under 80 years of age proposed for moderate thinning with approximately 40% canopy retention are expected to close their canopies back to pre-harvest conditions within 7-10 years, which would allow recovery of flying squirrel habitat conditions. Units with heavier thin treatments and lower canopy retention near 30% would need approximately 10-15 years to reclose their canopies back to pre-harvest conditions. Habitat downgrade or removal of suitable may provide indirect beneficial effects to spotted owls because such treatments are expected to accelerate the growth of retained trees and could accelerate the rate at which some structural characteristics appear (e.g., large side limbs, greater crown ratios). While opening of the canopy may provide less suitable habitat conditions for the flying squirrel prey, leaving down wood and creating piles would improve habitat conditions for other prey species such as woodrats.
Reed Wilson, Benton Forest Coalition	11) The Willamette National Forest should increase efforts to protect red tree vole populations. We appreciate the Sweet Home District establishing buffers for documented red tree vole nests as required, and are especially encouraged to be notified by the District that units 44, 56, and 120 will be withdrawn to protect red tree vole populations. However, despite healthy populations detected in the project area, red tree voles across their range are still in danger of extirpation, often from insufficient management policies, and we encourage the Forest to continue to offer protection for the following reasons: 1. Voles are afforded zero protection on private lands. 2. The BLM will no longer be required to survey for red tree voles in the future. 3. Both the Forest Service and the BLM are routinely applying non-high priority status for voles in sixteen different watersheds, and logging their habitat. 4. Except in cases where volunteers conduct surveys, vole populations are buffered only when stands meet survey protocol. Agencies routinely age stands with scattered old growth trees by a younger cohort to avoid the requirement to survey, even though the older trees may	Red Tree Voles	Pre-disturbance surveys for red tree voles were conducted in accordance with standards and guidelines, along with other habitat protection measures from the Northwest Forest Plan, to provide a reasonable assurance of persistence of this species. Units were dropped or buffered where red tree vole activity was found in accordance with management recommendations for this species (USFS and BLM, 2000). The analysis concluded that proposed activities are expected to occur outside of known red tree vole active sites and such proposed activities may impact individuals of the population by reducing canopy cover, connectivity and canopy complexity. In the active red tree vole areas, dispersal would be difficult and suitable habitat would be restricted to riparian and suitable habitat corridors until the area recovers to mature stand conditions. Therefore, proposed actions may impact individuals or their habitat temporarily, but the actions would maintain species persistence and viability. See response to comment #9.

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	harbor vole nests. The North Fork Overlook Project (Salem BLM) is a prime example. The BLM classified stands as under 80 years of age despite the presence of over one hundred old growth firs within thinning units, and refused to buffer red tree vole nests documented by volunteers. Only a lengthy court battle by environmentalists, concerned with persistence, and the persistence of spotted owls, led to the preservation of habitat. And this was in an LSR ostensibly created to protect Survey and Manage species. 5. Survey and Manage protects documented populations: it does not protect habitat. When viable habitat is surveyed and found unoccupied, it is logged, even though voles could reinhabit those stands. Since the inception of the Northwest Forest Plan, vole habitat in Oregon has been constantly and incrementally shrinking, and that process is going on year after year. 6. Red tree vole habitat is severely fragmented across the range. According to a recent study by Forsman and Swingle, the average size of a red tree vole habitat block is just two percent of what it was one hundred years ago. Most red tree vole populations today exist in small isolated patches of older forest, and have limited opportunities for genetic exchange and the dispersal of juveniles. 7. Even in blocks of suitable habitat, vole populations may be spotty or nonexistent. In the Hwy 46 project (Detroit Ranger District), citizen surveyors climbed 71 trees. Over 90% were broken top old growth trees, with cavities and platforms suitable for red tree vole nests, yet climbers located only one inactive nest. In the Flat Country project (McKenzie District), contract climbers in 2017 located red tree vole nests in only one harvest unit, even though other units contained trees up to 8 feet dbh.		
Reed Wilson, Benton Forest Coalition	12) Define spatial heterogeneity. The phrase “spatial heterogeneity” occurs 34 times in the DEIS in justifying the Purpose and Need for this project, yet the DEIS fails to clearly define spatial heterogeneity, other than repeatedly stating the need to “mimic mixed severity fire”, and as a means of achieving “complex early seral habitat”, which in itself is defined as achieving spatial heterogeneity (we appreciate the circular logic).	Silviculture	Spatial heterogeneity is defined as having a wide variety of habitats available to meet the needs of various plant and animal species, from forest specialists to early seral specialists. This habitat would range from openings to closed-canopy forest. In this project, mimicking the range of mixed severity fire severities (low severity where few trees are killed, to high severity where most trees are killed, with a range of moderate severities in between) at a scale comparable to historic mixed severity fire size would achieve spatial heterogeneity at the landscape scale (DEIS, pgs. 79, 83, 86, 87, &

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			91). Landscape scale refers to mimicking the size of historic mixed severity fire events (obtained from several studies that reconstructed fire history in the nearby H.J. Andrews Experimental Forest) by having a set of units in close proximity to each other where treatments are prescribed by considering how a mixed severity fire event may have burned through the area (DEIS pg. 79). Complex early seral habitat is emphasized as this habitat is in short supply in the South Santiam fifth-field watershed where the project area is located (DEIS pgs. 75 & 83). Currently on NFS lands it makes up a little over 1% of the area in the South Santiam fifth-field watershed, where the project area is located, as compared to 8% historically. Historic seral stage distribution compared to post-treatment seral stage distribution shows how spatial heterogeneity is affected by the project in the South Santiam fifth-field watershed (DEIS, pg. 96). The elements of complex early seral habitat are used to demonstrate how we're creating this habitat at the level of individual aggregate retention harvest areas (DEIS pg. 87), while landscape scale refers to mimicking the size of historic mixed severity fire events (obtained from several studies that reconstructed fire history in the nearby H.J. Andrews Experimental Forest) by having a set of units in close proximity to each other where treatments are prescribed by considering how a mixed severity fire event may have burned through the area (DEIS pg. 79). In the context of the definition of complex early seral habitat, spatial heterogeneity is used at the stand level and is reflected in the patterns of aggregate retention in harvest areas, using topography as a guide in placing the aggregates (DEIS pg. 87). The reason for creating complex early seral habitat is because it's rare as compared to historical levels, while the definition of complex early seral habitat is used to ensure that we've included all of its elements in the aggregate retention harvest areas. While it's true that snags can be felled to protect worker safety during logging, in the aggregate retention treatment, snags are created after logging is completed from a portion of the dispersed retention and wouldn't be affected by logging safety requirements (DEIS pg. 86).
Reed Wilson, Benton Forest Coalition	13) If achieving "spatial heterogeneity" is a key element in the Purpose and Need, then the DEIS should illustrate it: 1) visually through charts, graphs, ground photos and aerial photos, and	Purpose and Need	Figures on DEIS pgs. 87 and 91 display what spatial heterogeneity would look like in the context of mixed severity fire, and displays the differences in spatial heterogeneity when all three fire severities are present as compared to having two fire severities present. The table

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	2) on a variety of scales – harvest unit, section, watershed, district and landscape.		on DEIS pg. 96 displays how the project affects spatial heterogeneity in the form of seral stages in the South Santiam fifth-field watershed where the project area is located. Photos on DEIS pgs. 205 and 206 show conditions after prescribed burning, which would be a tool used to create spatial heterogeneity.
Reed Wilson, Benton Forest Coalition	14) As requested in our scoping comments, the District should clearly inform the public of conditions in the project area by including satellite images or aerial photos of harvest units and individual watersheds within the project area, including adjacent private lands, so the public can understand the degree to which the landscape has been altered. In short, the District sidesteps the requirement for an adequate cumulative effects analysis by ignoring the impacts of previous harvest on both public and private lands: “The cumulative effects analysis is based on NFS lands, as management on private lands cannot be accurately predicted”, page 72	Cumulative effects	While there are no satellite images or aerial photos included in the document, we have these on file with the project record and available at the Sweet Home Ranger District if requested by the public. Google Earth is also a readily accessible tool for viewing satellite images on the landscape. Section 3.01 (Forest Stand and Structure) of the document discussed current stand conditions in detail in the project area. Appendix C of the document discloses Past, Present and Future actions that overlap in time and space with the Trout Creek project. Every one of these are taken into consideration and analyzed by each specialist assigned to the project and included in their cumulative effects analysis. Adjacent private landholdings provide the Sweet Home Ranger District with information about activities on their lands. This is not something they are required to disclose. It is a speculation based on harvest trends, but is subject to change without notice, and therefore, cannot be accurately predicted.
Reed Wilson, Benton Forest Coalition	15) List the species dependent on early seral habitat. Categorize these species by their degree of mobility and adaptability. List the Survey and Manage species associated with early seral habitat and describe their dependence on early seral habitat.	Wildlife	Great grey owls is the only survey and manage wildlife species found in the project area which uses open spaces, such as early seral, to forage. Please refer to the FEIS Chapter 3 for discussion and analysis of this species.
Reed Wilson, Benton Forest Coalition	16) Prioritize recreational opportunities. Benton Forest Coalition appreciates the analysis of scenic impacts in the DEIS, but the Willamette National Forest should acknowledge the economic impacts of degrading scenery through commercial harvests in our publicly owned forests. According to the Tourism Oregon website, tourism in Oregon is a 10.5 billion dollar industry, directly generates 105,000 jobs, and indirectly supports 56,500 jobs. Economic health stems from environmental quality, and communities with ready access to significant natural features and scenery attract high tech industry and growth. Benton Forest Coalition asks that scenic impacts in our public forests be avoided by minimizing harvest levels, avoiding aggregate retention, avoiding commercial harvest adjacent to a wilderness area, and dropping unit 72 next to a popular trailhead.	Recreation/scenic quality	Activities proposed in the Trout Creek project would result in short term changes to existing scenery within the viewsheds in and near the project area. Current scenic conditions reflect the evidence of a past history of a heavily managed forested landscape. Proposed activities will result in changes to the existing scenery, but are within the range of historical variation due to forest management and natural disturbance events. With time, scenic character within affected viewsheds will continue to change as short term effects from projects activities fade. Design features are included in the project to minimize short term effects, including key observation points and the Rooster Rock trailhead near unit 72. The remainder of the scenic retention objective area along the scenically sensitive Over the River and Through the Woods Scenic Byway will have few effects the will only occur for short duration. Proposed activities and related design features are consistent with forest plan direction and meet prescribed visual quality objectives.

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Nicholas Sobb NEST	17) I am advocating for the selection of alternative 1 until all stands that are 80 years or older have been adequately surveyed for red tree voles. In the summer of 2017, myself and about 10 other NEST members conducted red tree vole surveys in units that were not surveyed. These units were not surveyed because they were above 3500 feet. Our surveys showed that red tree voles do exist in the area above 3500 and that there were important populations.	Alternative selection/ Red Tree Voles	Pre-disturbance surveys are not required because units are located in the Northern Mesic Zone, Western Cascades above 3500 elevation and Quadratic Mean Diameter (QMD) is below 16” therefore, “the stand is not considered to be composed of suitable habitat that may potentially contribute to a reasonable assurance of persistence and surveys are not required.” (USDA, USDI 2012)
Nicholas Sobb NEST	18) Units 89 and 140 contain suitable habitat that could contain tree voles. The biologist knows that red tree voles exists in stands above 3500 feet yet did not have them surveyed even after we proved that red tree voles exist in the project area above 3500 feet.	Red Tree Voles	Unit 140 was ground surveyed in accordance to protocol. No RTV activity was found during ground surveys. Surveys were not required in Unit 89 and thus was not surveyed.
Nicholas Sobb NEST	19) The USFS shouldn't have to rely on volunteer climbers to find tree voles in a project area (if it's known that they exists above 3500). Once it was proven that tree voles existed in the project area above 3500 feet, all suitable units should have been surveyed by contract climbers who could have spent the proper amount of time and effort locating tree voles.	Red Tree Voles	The Survey Protocol for Red Tree Voles document (USDA, USDI, 2012) states that if stands do not meet the habitat description then these stands are “.....not considered to be composed of suitable habitat that may potentially contribute to a reasonable assurance of persistence and surveys and surveys are not required.” Units above 3500 feet in elevation the project area did not meet the habitat description.
Nicholas Sobb NEST	20) Also we find it disconcerting that the draft EIS comes out at a time when there is no access to the units. How can we look at the units and make proper comments we they cannot even be accessed at the moment?	General	While the draft EIS was published in December 2017, the Trout Creek project has been in the planning and analysis stage for several years. The first public field trip to view the project area was in the summer of 2014. The project was scoped for public input in January of 2017, at which time, detailed unit maps and project area were made available and published online. If new information regarding the location of RTV nests surfaces in the future, modifications will be made to the project accordingly.
Bill Richardson Rocky Mountain Elk Foundation	21) RMEF supports and recommends the implementation of Action Alternative 4.	Alternative selection	Thank you for your comment and for the support of the Trout Creek project. Competing demands placed upon the Forest Service dictate that we make decisions for the responsible management of ecosystems and resources that fulfill the mission of the Forest Service and meet the requirements of laws and regulations. Every effort has been made to develop and choose an alternative that best responds to the purpose and need, desired conditions, objectives, public and agency concerns, recent data and maintains key resource values. Implementing Alternative 2 will make more progress in moving the area towards desired conditions for vegetation, fuels and habitat. A modified version of Alternative 2 may also be selected which could include not only modifications to the Proposed Action, but also aspects of other Alternatives. The reasoning behind the final decision will be explained in detail in the Record of Decision.

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Bill Richardson Rocky Mountain Elk Foundation	22) RMEF concurs with and supports the Purpose and Need for the Trout Creek project...The DEIS clearly indicated that even the most aggressive Action Alternative 4 is inadequate to the task of restoring complex early seral to the landscape...More active forest management is needed to eliminate the deficit in complex early seral habitat.	Early seral habitat	Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements, whereas other species thrive in middle age or old forests. Early seral habitat (defined as less than 20 years old) is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades. Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the South Santiam River watershed than in the past. A small amount of early seral habitat is present in surrounding rock outcrops at higher elevations and there are very few open meadows in the project area. A 2012 Gradient Nearest Neighbor analysis of all ownerships shows that about 5 percent of the South Santiam 5th field watershed is early seral habitat. Historically the South Santiam River watershed contained about 8 percent of early seral (GNN, 2012). Aggregate retention harvest is proposed to create complex early seral habitat. Aggregate retention harvest would create more complex early seral habitat due to keeping both aggregate and dispersed retention, prescribed burning to encourage shrub sprouts and establishment of forbs, and low density tree planting that would prolong the duration of the early seral habitat. Clear-cuts, such as those on private forest land, are designed to meet economic objectives, and so leave little retention, use herbicides to reduce shrub and forb competition to seedlings, and plant at high densities with fast-growing stock. This simplifies the early seral habitat on private land and decreases its duration. Currently on NFS lands complex early seral habitat makes up a little over 1% of the area in the South Santiam fifth-field watershed, where the project area is located, as compared to 8% historically. This is due to changes in forest management on NFS lands over time, including increasingly effective fire suppression and reduced regeneration harvest. Fire suppression and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and

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			diverse quality early seral habitat in the South Santiam River watershed than in the past. There will likely be future opportunities to create complex early seral habitat in future projects in the area. As young managed stands that were not ready for treatment in the Trout Creek project become economically viable in the future, projects would likely be proposed in the area.
Bill Richardson, Rocky Mountain Elk Foundation	23) We suggest that the decline of deer and elk can be taken as an indicator of the likely condition of other early seral species in the Trout Creek project area.	Early seral species	Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the South Santiam River watershed than in the past. A small amount of early seral habitat is present in surrounding rock outcrops at higher elevations and there are very few open meadows in the project area. A 2012 Gradient Nearest Neighbor analysis of all ownerships shows that about 5 percent of the South Santiam 5th field watershed is early seral habitat. Historically the South Santiam River watershed contained about 8 percent of early seral (GNN, 2012). The Trout Creek project proposes to increase early seral which may benefit deer and elk species.
Bill Richardson Rocky Mountain Elk Foundation	24) Given that no other entries are foreseen, why not increase the size of the Trout Creek Project to fully accomplish the purpose and need for the project?	Project boundary	The Sweet Home Ranger District will be re-entering the Trout Creek project area in the future. The project boundary was established at the inception of the Trout Creek project in 2014. Since then consultation has taken place with FWS and NOAA Fisheries as well as surveys by the various specialists who have contributed to this document and prepared reports detailing their findings. Increasing the project size would cause these consultations and surveys to be repeated in the new project area and extend the project timeline. In the future, The Sweet Home Ranger District will be looking at large scale project planning areas.
EPA	25) We are rating the DEIS with a Lack of Objectives (LO) because we have no identified any potential environmental impacts requiring substantive changes to the proposal. Thank you to the Forest Service for the work involved to develop this DEIS. We agree with the DEIS that the difference between current landscape conditions and desired future conditions create the need for restoration...Given a clear need for restoration, we support the project propose to improve forest resiliency and	General/ Purpose and Need	A copy of the EPA rating system for the DEIS will be made available as part of the project record.

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	sustainability, maintain and enhance habitat diversity, manage the road system, and restore hydrologic functioning.		
EPA	26) Based on our review of the DEIS, we note that Alternative 3 would not allow for any landscape-scale treatments focused on mimicking mixed severity fire. There is a compelling need to improve the condition and amount of both complex early seral habitat and late seral habitat within the project area, and Alternative 3 would not achieve those objectives. Among the action alternatives, we find Alternatives 2 and 4 to be environmentally preferable to Alternative 3.	Alternative selection	Alternative 2 is the preferred Alternative and the Forest Service also agrees that it best accomplishes the objectives of the Proposed Action and the Purpose and Need.
Wild Earth Guardians	27) We support the evaluation of impacts from forest roads, the incorporation of the Willamette National Forest's Travel Analysis Report (Road Investment Strategy), and are generally supportive of the proposed road actions. One missing component in the comparison is the inclusion of the risks and benefits data by road segment from the RIS. This is important, for example, to see if road management recommendations address the risks and benefits of that particular road.	Road Investment Strategy	This information is available as part of the project record on file at the Sweet Home Ranger District.
Wild Earth Guardians	28) We support the alternative that maximizes road decommissioning (9-10 miles), minimizes use of temporary roads (1.3 miles built, 2 miles re-opened) and fixes needed roads (46 miles and 248 culverts). It is unclear why 1 mile of new road is being added to the system when the Forest Service should be reducing its overall road footprint.	New road construction	The (less than) 1 mile of new road will need to be designed as such due to the terrain to access the proposed unit 50. This new road will have a financial investment during the design and construction and the road will be needed long term for future resource administration. Please see Appendix D for a detailed descriptions of proposed Road Treatments.
Wild Earth Guardians	29) We would be remiss if we didn't also point out that 9-10 miles decommissioning out of 161 miles is only a 6% reduction in the overall system in this area. There is potential to do more but applaud this step, especially if all of the aquatic risks are eliminated in this project area, as claimed in the DEIS.	Road decommissioning	The Trout Creek team looked at each road in the project area and made a decision on its status. In road by road analysis we more than doubled the proposed miles of road decommissioning (see the difference between the Proposed Action (Alternative 2) and the two developed alternatives). The aquatic risk roads analysis done for Canyon Thin in 2009 covered the same roads and recommendations were incorporated and expanded. We were limited in the amount of road decommissioning due to a number of factors, land allocation being a main one. We are using road storage as a tool to reduce the open road miles and limit the impacts of ongoing use. Many of the roads in the project area are Cost Share roads and used to access private lands. Consider when calculating the percentage of decommissioning, extent of this cost share road system on Sweet

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			Home Ranger District and the fact that we cannot decommission cost share roads.
Wild Earth Guardians	30) The Forest Service should have clearly articulated one of the statements of purpose to include its duty to identify the minimum road system.	Purpose and Need	The Purpose and Need for the Trout Creek project were developed before direction was received from the Regional Forester in September of 2016 to include the MRS in the Purpose and Need. A full analysis identifying the MRS was completed for the Trout Creek project in the Spring of 2017 and included with the DEIS and FEIS. The MRS will be a part of the Purpose and Need for future large scale projects.
Wild Earth Guardians	31) 36 C.F.R. §212.5(b)(1). The Forest Service should identify the minimum road system for particular forest segments by analyzing whether a proposed project is consistent with the relevant portions of the travel analysis report (road investment strategy) and consider the minimum road system factors under 36 CFR 212.5(b)(1) for each road the agency decides to keep as part of the specific project. We recognize that the Willamette National Forest did incorporate the Road Investment Strategy and is taking actions to move towards a minimum road system, but it's not clearly stated in the DEIS that for this area, this is the minimum road system. There is a mention in Appendix D and a simple modification would be to also include this in the DEIS: "Once signed, this decision designates the Minimum Road System (MRS) needed for public and administrative use." (DEIS, Appendix D, p. 279).	Roads, minimum road system	Once signed, this decision designates the Minimum Road System (MRS) needed for public and administrative use for this project area. This is reflected in the FEIS in Appendix D.
Wild Earth Guardians	32) The rule refers to all roads, not just National Forest System roads. In this area, there are unauthorized roads that should have also been considered. The rules define a road as "[a] motor vehicle travel way over 50 inches wide, unless designated and managed as a trail. The forest must assess these proposed actions in relation to the risks and benefits analysis in the Travel Analysis Report ("Road Investment Strategy"), as well as the factors for a minimum road system, with the goal of minimizing adverse environmental impacts.	Roads	Unauthorized, non-system roads are not inventoried.
Wild Earth Guardians	33) The Willamette National Forest should avoid using temporary roads, especially those located near the boundaries of wilderness and inventoried roadless areas. If avoidance is impossible, they should be immediately reclaimed after use. We do encourage the Willamette National Forest to take one more look at these temporary roads and be certain that they are needed. At minimum, we ask that the	Temporary roads	Temporary road decommissioning is a required design feature of the proposed project (see Table 14 in Section 2.07). Funding for decommissioning of temporary roads and enhancement of existing roads is secured through the timber sale contract. In order to fulfill the requirements in the timber sale contract, roads must be decommissioned when harvest and haul operations are complete.

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	Willamette National Forest restore these segments as soon as the project activities are completed. Because the DEIS simply says temporary roads will be addressed after hauling operations are completed, with no timeline, these statements are empty. The Forest Service should set a timeline for using and addressing temporary roads, including project design criteria that the contractor must adhere to as set forth in any final timber sale contract.		We do avoid constructing or reconstructing temporary roads wherever possible as this is an added cost to a purchaser. A complete analysis of Effects to Wilderness and Inventoried Roadless Areas can be found in Sections 3.12 and 3.14 of the FEIS
Wild Earth Guardians	34) We also have concerns with some temporary road segments that appear to be very close to the wilderness boundary and inventoried roadless areas. - Unit 56 or 20 appears to have a temporary road right next to the Menagerie Wilderness (DEIS map, p. 197) - Unit 89 or 140 also appears to have a temporary road right next to the Menagerie Wilderness (DEIS map, p. 197) - Unit 65, 74, 32 – though the map on p. 255 does not have the temporary roads overlaid with the IRA's, there could a small section of a temporary road in unit 32? (DEIS map, p. 255)	Roads/wilderness	Unit 56 has been dropped from inclusion in the Trout Creek Project. Some units do have temporary roads proposed in close proximity to wilderness or inventoried roadless areas. These roads will be decommissioned when harvest related activities are complete. A complete analysis of effects to wilderness and inventoried roadless areas can be found in Sections 3.12 and 3.14 of the FEIS. There will be no temporary roads build in Inventoried Roadless Areas.
Wild Earth Guardians	35) The "Scale of the Analysis" section on page 192 could benefit from some editing. It's confusing as to what the 2003 roads analysis included, what the travel analysis for the project was, and how all this ties into the RIS and requirements from Subpart A.	Roads analysis	The 2003 Analysis was the previous broad analysis completed at the forest level to identify the key roads for access to the forest and establish a minimum road system. The RIS was a new forest level analysis. The two were used as tools to produce a travel analysis for this project area included in this EIS.
AFRC	36) It is refreshing to see some level of regeneration harvest proposed on the Trout Creek project and urge the District to select and implement the alternative that considers this silvicultural practice. The 101 acres of regeneration harvest is a small but important step toward progressing to a balanced silvicultural regime and ensuring the long-term sustainability of the District's timber supply. AFRC believes that the Sweet Home District should select and implement the alternative that best meets the stated purpose & need. It seems to us that alternative 4 meets the purpose & need better than what is identified as the preferred alternative in the EIS. We would like the Sweet Home District to consider the impacts disclosed in their own document and ask themselves which alternative really meets the purpose & need to the highest level.	Purpose and Need/ Alternative selection	Thank you for your comment and for the support of the Trout Creek project. Competing demands placed upon the Forest Service dictate that we make decisions for the responsible management of ecosystems and resources that fulfill the mission of the Forest Service and meet the requirements of laws and regulations. Every effort has been made to develop and choose an alternative that best responds to the purpose and need, desired conditions, objectives, public and agency concerns, recent data and maintains key resource values. Implementing Alternative 2 will make more progress in moving the area towards desired conditions for vegetation, fuels and habitat. A modified version of Alternative 2 may also be selected which could include not only modifications to the Proposed Action, but also aspects of other Alternatives. The reasoning behind the final decision will be explained in detail in the Record of Decision.
AFRC	37) We would also like the Sweet Home District to recall the scope of this project when it was initially conceived in 2014. Since this time, well over half of the proposed treatment units were deferred for multiple reasons. What remains is a shell of the	General project scope	We strive to treat every unit we bring forth in scoping, however as surveys and analysis occur, several units are dropped from commercial harvest due to various factors such as Survey and Manage species, Riparian Reserves, economics, and logging

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	original project. In this context, we believe that maximum treatment of what little does remain is warranted.		systems. At this point we have dropped 1,902 acres of stands from commercial harvest. Due to new information on Survey and Manage species and sale economics/logging systems, we will be dropping an additional 342 acres of stands from commercial harvest in the project decision. This change will be reflected in the Record of Decision document.
AFRC	38) We understand that the Forest Service must take necessary precautions to protect their resources; however, we believe that in many cases there are conditions that exist on the ground that are not in step with many of the restrictions described in Forest Service EA's and contracts (i.e. dry conditions during wet season, wet conditions during dry season). Consistent and steady operation time throughout the year is important for our members not only to supply a steady source of timber for their mills, but also to keep their employees working. The ability to yard and haul timber in the winter months will often make the difference between sales selling and not. We are glad to see that District has prepared a document that is permitting the haul of timber products during the winter months.	Wet season haul	Design Features have been developed to allow maximum flexibility for winter operations while protecting resources such as soil and water. Winter and wet weather haul will be permitted under the conditions outlined in Table 14 in the Design Features in Section 2.07 of the FEIS.
AFRC	39) We would like the Forest Service to shift their methods for protecting resources from that of firm prescriptive restrictions to one that focuses on descriptive end-results; in other words, describe what you would like the end result to be rather than prescribing how to get there. Developing a contract that firmly describes how any given unit shall be logged may inherently limit the abilities of certain operators. We feel that there are several ways to properly harvest any piece of ground, and certain restrictive language can limit some potential operators. Though some of the proposal area is planned for cable harvest, there are opportunities to use certain ground equipment such as fellerbunchers and processors in the units to make cable yarding more efficient.	Logging/ harvest systems	See response to comment #38 above. The Purpose and Need (Section 1.03) describes the current condition and desired condition in the project area. Consultation has taken place with FWS and NOAA Fisheries as well as surveys by the various specialists who have contributed to this document and prepared reports detailing their findings. Even though we prescribe and appraise for a certain logging system, we allow flexibility in harvest implementation as long as the effects to the various resources within the project area do not increase. Purchasers may work with sale administrators for contract modifications concerning logging systems and feasibility.
Oregon Wild/ Cascadia Wildlands	40) We continue to have concerns with logging mature forests over 80 years old because as stands mature, there ecological harms of logging increase, and the ecological benefits decrease, which means the ecological harms outweigh any alleged ecological benefits. The NEPA analysis needs to disclose and	Silviculture	The Multiple-Use Sustained-Yield Act (MUSY) of 1960 declares that the purposes of the national forest include outdoor recreation, range, timber, watershed and fish and wildlife. MUSY also directs the Secretary of Agriculture to administer national forest renewable surface resources for both multiple uses and sustained yield. Furthermore, MUSY defines Multiple Use as the —management of

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	weight these trade-offs the Trout Creek DEIS does not do an adequate job of this.		all the various renewable surface resources of the national forests... to best meet the needs of the American people and Sustained yield as —achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the renewable resources of the national forest without impairment of the land's productivity. No hierarchy stating timber is more or less important or age is identified in MUSY, and limiting the age to 80 years and younger would not best meet the purpose and need as identified in Section 1.03. A No Action (Alternative 1) was analyzed in the Trout Creek project. Included in the analysis of the Proposed Action (Alternative 2) and other Action Alternatives (Alternatives 3 and 4) are design features to reduce the impact of logging (Table 14).
Oregon Wild/Cascadia Wildlands	41) We do not think it is appropriate that matrix objectives for timber production should trump ecological restoration objectives, because there is significant new information undermining the reasons behind matrix objectives. As explained in more detail below: barred owls are occupying tens of thousands of acres of suitable spotted owl habitat that the NWFP assumed would be available to spotted owls; the wood products industry does not stabilize local communities, rather it tends to have a destabilizing influence; climate change mitigation goals require that we take very opportunity to maintain and increase carbon storage in forests; climate change adaptation goals require that we hang onto the existing mature forests that we have because it may be more difficult to retain and replace them as the climate changes; logging has a greater adverse impact of dead wood habitat than previously recognized because dead wood standards are out-of-date and more green trees need to be retained to meet the long-term needs of wildlife, etc.	Silviculture/wildlife	There is 522 acres of the Matrix allocation proposed for commercial harvest (DEIS pg. 18). These harvests would be consistent with management direction set forth in the NWFP. Ecological considerations are incorporated into the proposed treatments: See response to comments #43, #44, #46, #49 and #59.

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Oregon Wild/ Cascadia Wildlands	42) Logging in natural stands is typically not necessary unless there are very specific and clearly defined restoration needs that can be met without significant trade-offs of other important values. It will be useful to bring trade-offs to light as this process moved forward. We do not see a compelling rationale for logging natural stands, especially in light of the need to retain and rebuild forest carbon stores to address climate change. The DEIS also does not adequately address trade-offs involved in logging mature stands, and riparian reserves. See Heiken, Doug. 2009. The Case for Protecting Both Old Growth and Mature Forests, Version 1.8. Oregon Wild and Heiken, D. 2013. Riparian Reserves Provide Both Aquatic & Terrestrial Benefits - A Critical Review of Reeves, Pickard & Johnson (2013).	Silviculture	Additionally, see response to comments #2 and #40.
Oregon Wild/ Cascadia Wildlands	43) Logging for "health and vigor." Health and vigor are not ecologically based goals for forest management. Foresters are unfortunately trained to view forests as tree farms and manage for health and vigor of trees and stands, instead of managing for the whole ecosystem that includes a balance of tree growth and mortality. Managing stands for health and vigor has serious trade-offs. Many wildlife actually depend on dead and dying trees, and for many decades forests across the landscape have been managed with a goal to suppress these natural and beneficial forest attributes. This comment remains pertinent. Stands that foresters view as lacking health and vigor are often just experiencing natural mortality events that (i) thin the forest for free, (ii) eventually increase health and vigor of surviving trees, and (iii) retain and recruit high quality habitat components from dead and dying trees. Logging sacrifices the dead wood element and makes the forest less healthy because it has too much vigor and not enough decadence. The DEIS does not fully address this reasonable opposing viewpoint. See Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001)	Silviculture	The Trout Creek project does not claim that healthy trees are the only component of a healthy forest, and we agree that a healthy forest encompasses many other aspects such as snags and down wood. This is why structural complexity is also a part of the purpose and need statement that contains health and vigor. Units include areas that will remain untreated (Skips) in order to both protect important features and to provide variety in the density within the stand; leaving some of the area overstocked with dense stand conditions. There are many important processes in a forest system, including density dependent mortality, and other bio-physical forces that drive important change in forest systems. These events occur at various scales across a forest and landscape and these distributions vary over time. They do not occur on every acre or in all stands at all times. At the stand level, the density management described increases stand health and vigor; accelerates development of structural complexity, and provides wood products to the local economy. While this is achieved through the reduction of density, it also lowers the level of density-related mortality in harvested areas. Live and dead tree structures are important for a healthy forest, and areas within the stand are left as skips to provide for this process at the stand level. In addition, there are many unmanaged stands in the 96% of the project area that would remain untreated, and at the even larger landscape scale, that will continue to provide density-dependent mortality (for example, Wilderness Areas, Inventoried Roadless Areas, and late successional stands in Late Successional Reserve allocations).

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Oregon Wild/Cascadia Wildlands	44) Logging to create and enhance early seral habitat. There is no shortage of early seral habitat. There is already plenty of early seral habitat on non-federal lands and in fire areas on federal lands, and within heavily thinned patches included as part of the FS and BLM's recent (and widespread) thinning efforts in young stands. We urge the FS to consider alternative ways to avoid and minimize the trade-offs involved in creating new early seral from exiting mid- or late-seral stands. Early seral habitat can be enhanced through a variety of means that do not require sacrificing mature forests. Existing early seral habitat in very young plantations can be heavily thinned to increase the persistence of early seral conditions. Early seral habitat can be enhance if fires on federal land can be managed differently (before, during, and after fire). Forest practices on non-federal lands can be adjusted to enhance early seral values (e.g., retention of more live and dead wood, less dense replanting, reduced herbicide use). The FS can embed patches early seral habitat (e.g., small structure-rich gaps) within young stand thinning prescriptions. The FS also needs to recognize the contradiction when managing for both early seral habitat and fuel reduction, because early seral habitat is a more hazardous fuel condition compared to stands of tall trees that hold most of the fuel high above the ground and out of the way of the flames. Science also shows that canopy reduction increases fire hazard by making the stand hotter, dryer, and windier, and stimulating the growth of future ladder fuels. The DEIS did not consider alternatives ways of meeting early seral habitat goals that do not require sacrificing mature forest. The DEIS also did not consider the fact that regen logging creates sub-optimal early seral habitat because, unlike natural disturbance, much of the structure has been removed on the back of log trucks.	Silviculture/ wildlife /fire	Complex early seral habitat makes up a little over 1% of NFS land in the South Santiam fifth-field watershed, where the project area is located (DEIS, pg. 75). Historically, about 8% of the watershed would have been complex early seral habitat (DEIS pg. 75), demonstrating a need for increasing the amount of this habitat. When including private industrial forest lands, the amount of early seral habitat is 5%, with the bulk of that being non-complex early seral habitat. This is still below the historic average, even including non-complex early seral habitat on private land. Aggregate retention harvest is proposed to create complex early seral habitat. Aggregate retention harvest would create more complex early seral habitat due to keeping both aggregate and dispersed retention, prescribed burning to encourage shrub sprouts and establishment of forbs, and low density tree planting that would prolong the duration of the early seral habitat. Clear-cuts, such as those on private forest land, are designed to meet economic objectives, and so leave little retention, use herbicides to reduce shrub and forb competition to seedlings, and plant at high densities with fast-growing stock. This simplifies the early seral habitat on private land and decreases its duration. We acknowledge on DEIS pg. 86 that creation of complex early seral habitat through logging doesn't exactly mimic fire disturbance. However the aggregate retention treatment does provide all of the elements of complex early seral habitat, while simultaneously meeting objectives to provide forest products to local economies and to increase tree species diversity. The management of portions of the National Forests for more than one objective is neither contradictory, nor mutually exclusive. While dense homogenous stands of young conifers do generally pose a greater fire risk than older stands with canopies separated from the forest floor, this fuel type does not represent the early seral conditions the project seeks to create. In both aggregate retention areas and the proposed fuels breaks, one of the primary goals is the establishment of a large hardwood component in future stand structure that will provide both quality early seral habitat and an effective barrier to fire spread. In this instance the management for both early seral habitat and fuels reduction goals do not conflict, but rather complement each other.

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			Due to the amount of private land in the project area the ability to allow future fires to play their natural role on the landscape is limited, if not impossible, requiring the use of different silvicultural prescriptions and prescribed fire to replicate the effects of fire disturbance. While thinning does allow for additional light and wind to penetrate the canopy, over time as trees fill in the canopy again closes in, with larger more fire resistant trees. The science that shows thinned stands have increased fire hazard is linked to thinning's that were not followed by slash treatment. Science finds thinning followed by prescribed fire and surface fuels treatments are the most effective way to control fire spread in a stand, acknowledging that under extreme weather conditions vegetation modification may not have an impact on fire behavior. Also please see response to comment #22
Oregon Wild/ Cascadia Wildlands	45) Regen Harvest is Inconsistent with Fuel Reduction Objectives Part of this project is to reduce fuels and create fuel breaks. The FS must carefully consider the fact that regen harvest conflicts with these objectives.	Fuels	This project does not propose any traditional regeneration harvest. Units proposed for aggregate retention harvest and hardwood fuel break creation will be followed by post-harvest slash treatments to decrease fuel loadings and planting of hardwoods to reduce susceptibility to tree torching and crown fire.
Oregon Wild/ Cascadia Wildlands	46) The DEIS indicates that the FS plans to replant conifers after regen logging. This will create dense homogeneous fuels conditions close to the ground. This is more hazardous than retaining taller trees that hold most of the fuel high off the ground. Retaining dense tree canopy also helps maintain a cool-moist-less-windy microclimate that is more favorable to low or moderate fire, and also helps suppress the growth of future surface and ladder fuels. "Large blocks of old-growth forests – rather than large contiguous blocks of young growth or highly simplified forests – are the best scenario for reducing catastrophic wildfire." Jerry Franklin, David Perry, Reed Noss, David Montgomery, Christopher Frissell. Simplified Forest Management To Achieve Watershed And Forest Health: A Critique. National Wildlife Federation. http://www.coastrange.org/documents/forestreport.pdf.	Silviculture/Fuels	Reforestation of aggregate retention harvest areas is a Forest Plan requirement that comes from the National Forest Management Act. In order to prolong the duration of complex early seral habitat, this planting would occur at the minimum level necessary to meet the Forest Plan requirements. The planting would also meet objectives to increase tree species diversity through planting of western white pine, sugar pine and incense cedar. The planting would increase the amount of drought-tolerant species in the project area in preparation for predictions of increase severity, frequency, and duration of future droughts. Aggregate retention harvest areas will be followed by prescribed fire, the most effective way to treat surface fuel loading and reduce the severity and intensity of future fires. While dense plantations can pose an elevated fire risk, these areas are proposed to be stocked at the minimum necessary levels, so as to avoid dense homogenous fuel conditions. Additionally areas that have been identified as critical areas likely to be used in suppressing future fires on the landscape have been proposed for hardwood fuels breaks, breaking up the continuity of conifers across the landscape and creating less flammable vegetation types generally resistant to torching or

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			crowning. Under extreme weather events fire in the western cascades is often driven more by factors such as relative humidity, wind speed and direction, and atmospheric stability.
Oregon Wild/Cascadia Wildlands	47) We found forests with higher levels of protection had lower severity values even though they are generally identified as having the highest overall levels of biomass and fuel loading.	Fuels/Silviculture	This study looked at forestlands in relatively frequent fire return intervals and traditional low severity fire regimes stating that “The categories selected from the Biophysical Settings map were ponderosa/Jeffrey pine and mixed-conifer forest types with relatively frequent-fire compared to other forest types with different fire regimes such as high-elevation forests and many coastal forests not studied herein.” Fire in the western cascades has historically been mixed severity with extreme fire events driven more by weather conditions than fuels. The goal of the project is to replicate this disturbance type, while managing areas adjacent to private land to be more defensible from fire through post-harvest surface prescribed fires and creation of hardwood fuel breaks.
Oregon Wild/Cascadia Wildlands	48) There is no compelling justification for removing or downgrading suitable nesting, roosting, foraging habitat for the threatened northern spotted owl. The effects analysis for spotted owls is inadequate. The DEIS says how many acres of owl habitat would be affected and how long it would take to develop habitat after logging but the analysis lacks any information about how removal and downgrading of suitable habitat would interact with other risk factors and increase cumulative risks for the threatened northern spotted owl. The information in the DEIS is not sufficient to support the conclusion that Alternative 2 is “not expected to jeopardize the continued existence of the spotted owl.” We just don’t know whether that is true unless more of the issues and concerns below are thoughtfully addressed in the EIS.	Wildlife	Effects of the various proposed actions for the Trout Creek project were addressed by the Willamette Planning Province Level I Terrestrial Team (2017) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the FY2018 Biological Opinion (BO) (FWS Reference Number 01EOFW00-2017-F-0555). The USFWS, after reviewing the current status of the spotted owl, the environmental baseline for this action area, the effects of the proposed action, together with cumulative effects, concurred with the LAA (Likely to adversely affect) determination and concluded that the proposed action “...is not likely to jeopardize the continued existence of the spotted owl.” This BO fulfills the Forest Service’s legal requirement with respect to Section 7 of ESA for the Trout Creek Project. This EIS incorporates by reference this BO, as well as the Biological Assessment. In response to cumulative effects, the baseline condition for the Trout Creek analysis accounts for past activities that affected owl habitat in the project area and assumes that none of the private land is suitable for owl habitat. The ongoing harvest under the Canyon Thin EA and the future thinning Jude Ridge project are all in stands less than 80-years old and not in suitable owl habitat. There are no other reasonable foreseeable actions that would remove or downgrade suitable owl habitat in the project area.
Oregon Wild/Cascadia Wildlands	49) Logging suitable habitat will increase adverse competitive interactions with barred owls.	Wildlife	Competition with barred owls has been found to be an important threat to northern spotted owls (USFWS 2011). In western Oregon, both species prefer forests older than 120 years of age. The larger and more aggressive barred owls can displace spotted owls where

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	Based on well-established species/area relationships the agencies need to protect more suitable owl habitat is needed to ensure that these two owl species can co-exist, and to decrease the likelihood of competitive exclusion. The impact of the barred owl on the spotted owl was barely considered when the Northwest Forest Plan was approved in 1994. One of the implications of barred owls competition and the overall decline of the spotted owl is that the agencies may need to protect all the remaining mature and old growth forest habitat in order to increase the chances that spotted owls and barred owls can co-exist. In order to retain options while this issue is being sorted out the agency must consider protecting all remaining old forest.		they establish territories (Wiens 2012). Wiens (2012) has recommended retaining conifer forests older than 120 years of age as a method to reduce interspecific competition between the owl species. Where barred owls occur, he has found that spotted owl survival significantly declines as the percent of forests >120 years of age in the general home range drops below 35 percent. The barred owl occurs throughout the Willamette National Forest. Recovery Action 32 was developed to address the threat from barred owls. Treatments will not take place in stands that meet the criteria of Recovery Action 32 (USFWS 2011). Interspecific competition between barred and spotted owls is a complex situation that is difficult to quantify. Wiens (2012) has developed a predictive relationship of 6-month survival based on the proportion of old (>120 years) forest in the home range. Two owl home ranges would be affected by the removal and/or downgrade of suitable habitat in stands over 120 years of age. A loss of 24 acres (MSNO NEW13) and 30 acres (MSNO 4460) represents only a 0.8 and 1.0 percent, respectively, change in the proportion of old forest habitat in a 1.2-mile radius home range. Based on the information provided by Wiens (2012), this small decrease in old forest habitat would not produce a measurable change in spotted owl survival nor a meaningful increase in competition with barred owls.
Oregon Wild/ Cascadia Wildlands	50) Reliance on spotted owl habitat models is now quite suspect, because any acre of suitable spotted owl habitat could be occupied by barred owls and effectively unavailable to spotted owls, so any spotted owl habitat model that assumed anywhere near full occupancy of suitable acres is effectively invalid and should not be relied upon for NEPA or ESA consultation, that is until a model is developed that can confidently predict whether a given area of suitable habitat is more likely to be occupied by spotted owl vs barred owl. Right now we are not anywhere close to that level of confidence.	Wildlife	Owl surveys in accordance with USFWS protocols were conducted to determine location of northern spotted owls within the project area. No models were used.
Oregon Wild/ Cascadia Wildlands	51) The DEIS does not address the fact that fuel reduction objectives conflict with owl habitat objectives. Fuel reduction efforts adversely affect spotted owl habitat characteristics. "Research conducted within and adjacent to the South Cascades LSR network indicates that spotted owls avoid suitable NRF that has been 'degraded'. This effect appears to last for decades."	Wildlife	With the federally threatened status of the northern spotted owl, wildlife biologists and others who work for the US Forest Service spend a considerable amount of time working in support of its recovery. A thorough analysis of the effects of this project to the spotted owl has been conducted, including a Biological Assessment that was sent to the USFWS for consultation, and the resulting Biological Opinion (USFWS 2018) which has been documented in the Trout Creek EIS. All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan.

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Oregon Wild/ Cascadia Wildlands	52) The DEIS does not address the potential effect of climate change in terms of longer fire seasons; larger and more intense fires; increased tree mortality from fire, insects, and drought stress, consequently altered regional vegetation patterns and climate patterns; and maybe most significantly, uncertainty whether suitable habitat can be regrown from altered young stands in an altered climate regime. Climate change also brings uncertainty in terms of the frequency and duration of inclement weather during the owl breeding season.	Climate Change	The Proposed Action proposes to treat 1,670 acres, or roughly 5% of the entire project area. The project is designed to increase resiliency and forest resistance to climate change such as, effects of climate change such as (listed on page 262 of the FEIS). Effects to the suitable spotted owl habitat in the Trout Creek project are insignificant. Thinning treatments helps residual trees be more resilient because they then have less competition for nutrients, water and light. The cumulative effects of this project, in addition to any future potential effects of climate change are negligible at the project and landscape level. For further analysis, see the FEIS Chapter 3, Wildlife Section 3.04.
Oregon Wild/ Cascadia Wildlands	53) The DEIS does not address the effects of BLM RMP Revisions that weaken the regional reserve network	Other	The BLM RMP Revisions are out of the project scope and are not part of the analysis included in the Trout Creek Project.
Oregon Wild/ Cascadia Wildlands	54) The DEIS does not address new information indicating that spotted owl dispersal habitat should be managed for “at least 80%” canopy cover. Based on our study, we recommend that managers should pursue a strategy that exceeds the canopy cover guidelines recommended by Thomas et al. (1990) when managing dispersal habitat for spotted owls. Based on our estimate of mean canopy closure (66%), and our estimate of mean canopy cover from overlaying a dot grid on the same areas (approx. 14% larger), we recommend that the target for canopy cover in stands managed for dispersing spotted owls should be at least 80%.”)	Wildlife	With the federally threatened status of the northern spotted owl, wildlife biologists and others who work for the US Forest Service spend a considerable amount of time working in support of its recovery. A thorough analysis of the effects of this project to the spotted owl and its habitat has been conducted, including a Biological Assessment that was sent to the USFWS for consultation, and the resulting Biological Opinion (USFWS 2018) which has been documented in the Trout Creek EIS. All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan and the Revised Critical Habitat for the Northern Spotted Owl Final Rule (USFWS 2012a) where dispersal owl habitat is generally characterized as stands with trees at least 11 in dbh and a minimum 40 percent canopy cover meet this baseline condition for northern spotted owl dispersal habitat. The habitats referred to as dispersal in the DEIS and the consultation for this project are relatively young stands that provide some overstory cover for owls to fly through but provide limited foraging or roosting opportunities. When considering the needs of spotted owls for dispersal, the suitable habitat (including foraging, roosting and nesting habitat) must also be considered since these habitats also provide for dispersal. The habitat that you reference as dispersal in the Sovern et al. (2015) study evaluates stand conditions where dispersing owl roost (i.e. “Roost habitat use and selection by NSO during natal dispersal”). The sites, which contain older and larger trees, are considered part of the suitable habitat by our consultation and to maintain such habitat requires maintaining at

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			least 60% canopy. Over 22,900 acres of suitable habitat would be left untreated in the Project Area to provide for the needs of both roosting owls and natal dispersal. Due to the cessation of large-scale clearcutting, there has been a 20% net increase (about 82,260 acres) in dispersal habitat on the Willamette National Forest from 1990 to 2012 (cite 2015 monitoring report). Within the Western Cascades of Oregon, there was a net gain of 122,200 acres (3.4% gain) of dispersal habitat on federal lands (Davis et al. 2016). An analysis of dispersal-capable landscapes found no loss of landscape connectivity in the interior of federal lands within the Western Cascades of Oregon (Davis et al. 2016). There has been no loss in landscape connectivity for spotted owls in a wide corridor through the Cascade Range from the Canadian border south into northern California which includes the entire length of the Willamette National Forest. Potential barriers to owl movement occur to the west of the Forest adjacent to the Willamette Valley and to the east of the Forest in the area of the B&B Fire on the Deschutes NF (Davis et al. 2016: Figure 9-p.33) but the Trout Creek Project does not occur in these areas. The ability of owls to disperse across the project area will be maintained by the project.
Oregon Wild/ Cascadia Wildlands	55) The agencies can no longer rely on the 1994 Northwest Forest Plan FSEIS because there is significant new information that could alter the results of the previous analysis. Judge King’s August 2006 decision in ONRC Action v. US Forest Service makes clear that the agency must carefully consider and explain the potential relevance and significance of new information on the spotted owl within the context of the timber sale under consideration. In view of heightened concern for the future status of the spotted owl caused by continued habitat loss from logging and fires, barred owl competition, West Nile Virus, Sudden Oak Death syndrome, and global climate change, all remaining suitable habitat should be protected. In other words, conservation of mature & old-growth forest should be favored because spotted owls are able to compete nearly equally with barred owls in landscapes with a high proportion of old forest.	Wildlife	With the federally threatened status of the northern spotted owl, wildlife biologists and others who work for the US Forest Service spend a considerable amount of time working in support of its recovery. A thorough analysis of the effects of this project to the spotted owl has been conducted, including a Biological Assessment that was sent to the USFWS for consultation, and the resulting Biological Opinion (USFWS 2018) which has been documented in the Trout Creek EIS. All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan. While the proposed project would remove suitable and dispersal habitat for the northern spotted owl, the project was designed to mitigate impacts and avoid take: no habitat removal within the 300 meter nest patches, thinning in dispersal habitat which may allow these stands to better develop future habitat structures, and no suitable or dispersal owl habitat removal or downgraded within the 0.5 mile nest cores.

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Oregon Wild/ Cascadia Wildlands	56) Given the requirements of RA-32...Agencies must prepare NEPA analysis which considers the full potential of suitable habitat quantity and quality and its mediating influence on the interactions between spotted owls and barred owls. Maintaining a subset of suitable habitat as recommended by the recovery plan is one option, but the agencies must consider the full benefits of protecting all suitable habitat, not just a subset, and providing additional mitigation in matrix areas such as managing the matrix to enhance habitat for owl prey species. If we provide more suitable habitat, the population potential increases, and the risk of extinction decreases. The most rational way to respond is to protect remaining suitable habitat, expand and restore the reserve system to provide more suitable habitat to increase the likelihood that the two owl species can co-exist.	Wildlife	All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan. Recovery Action 32 of the 2011 “Revised Recovery Plan for Northern Spotted Owls” identified a need to maintain older, more structurally complex multi-layered conifer forests containing large-diameter trees, high amounts of canopy cover, and decadent components such as broken-topped trees, mistletoe, large snags, and fallen trees (USFWS, 2011). Guidance for identifying such stands was developed for the Willamette National Forest with review by US Fish and Wildlife Service and Bureau of Land Management (Doerr, 2012). Recovery Action 32 habitat is a subset of the higher quality suitable habitat and does not include dispersal or non-habitat. No Recovery Action 32 habitat occurs in the proposed treatment units. The removal of suitable owl habitat, 130 acres, or less than one percent at the landscape scale, is trivial and not expected to jeopardize the continued existence of the spotted owl.
Oregon Wild/ Cascadia Wildlands	57) In view of the continued decline of Spotted Owls in most study areas, it would be wise to preserve as much high quality habitat in late-successional forests for Spotted Owls as possible distributed over as large an area as possible. This recommendation is comparable to one of the recovery goals in the final recovery plan for the Northern Spotted Owl (USDI Fish and Wildlife Service 2008), but we believe that a more inclusive definition of high quality habitat is needed.	Wildlife	Recovery Action 32 of the 2011 “Revised Recovery Plan for Northern Spotted Owls” identified a need to maintain older, more structurally complex multi-layered conifer forests containing large-diameter trees, high amounts of canopy cover, and decadent components such as broken-topped trees, mistletoe, large snags, and fallen trees (USFWS, 2011). Recovery Action 32 habitat is a subset of the higher quality suitable habitat. No Recovery Action 32 habitat occurs in the proposed treatment units. A more inclusive definition is outside the scope of this project and the only LSR treatments are proposed in unit 72 (14 acres).
Oregon Wild/ Cascadia Wildlands	58) The DEIS says “At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability” This is not accurate. DecAID does not make any recommendations. It just provides information. DecAID also cautions that the data for reference stands may not be representative because there is not much data from recent wood-rich post-disturbance landscapes, which many wildlife evolved to use and thrive within. The FS also has a duty to maintain viable populations of wildlife, so meeting the 50-80% tolerance levels for snag dependent wildlife should be carefully considered.	Dead wood	This has been changed in the FEIS to reflect a more accurate statement. In an effort to mitigate for changes in course woody debris (CWD) a post-treatment snag and down assessment would occur at the stand level and CWD creation would be implemented in stands with less than 2 large snags or 3 to 5 down logs per acre on average. The assessment would account for snags lost to hazard tree removal and for snags created through logging damage and underburning. Assessing post-treatment snag levels would help meet minimum desired levels and avoid excessive snag creation in the event that logging activities or underburning result in higher than expected mortality.

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Oregon Wild/ Cascadia Wildlands	59) The agencies need to get creative and learn to mimic natural disturbance which would always leave behind lots of dead trees. Logging that leaves behind only a few snags per acre is an unusual disturbance event. The agencies need to learn to share the bounty of the forest with the forest itself.	Dead wood	Several treatments in the project are designed specifically with dead wood in mind. For example, the treatment in unit 56 in Alternative 2 would thin the stand to 60 trees/acre, and after harvest 45 trees/acre (of the 60 trees/acre left) would be turned into snags. In the treatment of Unit 63, a portion of the proposed gaps are being excluded from harvest, and after harvest most of the trees in the excluded gaps would be turned into snags. In unit 15, a portion of the unit would be underburned following thinning harvest with the purpose of creating snags in fire-intolerant species (this was added to the unit prescription based on a suggestion brought up during a field trip from a member of Oregon Wild's staff). In aggregate retention areas, fire-intolerant species such as hemlock and silver fir would not be harvested, and are designed to be turned into snags with the site preparation prescribed burn. In addition, post-harvest snag creation occurs in all treated units as funding allows.
Oregon Wild/ Cascadia Wildlands	60) The DEIS needs to better represent the effects of action and no action alternatives. The DEIS includes numerous graphs that compare the current and reference conditions but not the effects of action and no action. The effects section has no quantitative or graphical disclosure of effects on snag and dead wood habitat. The DEIS says that post-harvest snag creation will mitigate for adverse effects on snag habitat, but this is highly misleading. All green trees removed from the forest are future snags that will never be recruited in the forest as they would be naturally (or under a non-logging scenario). The DEIS says that logging may benefit habitat for flickers because they prefer large snags. This is misleading because logging, especially in stands over 80 years old will have significant long-term adverse effects on future recruitment of large snags.	Dead wood	Graphs comparing the effects of no actions and actions have been added to Chapter 3 under the wildlife section of the FEIS. Also, see response to comment #43, #59, and #76. The DEIS states that there may be benefits to treating the older stands above 80 years of age to Northern flickers since they prefer large snags, forest edges, and open forest habitat, all of which would be created by the silviculture treatments. Additionally, harvest in these stands would degrade 218 acres, or less than 1%, of this habitat in the project area, a minor amount. Therefore, it's expected that the population viability of cavity excavator species in the project area and South Santiam watershed would be maintained. In addition, the project would not contribute to any loss of viability of these species at the larger forest scale.
Oregon Wild/ Cascadia Wild lands	61) The DEIS discussion of the effects of logging on snags is flawed because it focuses on the effects of logging on existing snags, instead of focusing on the process of creating snags. To clearly and explicitly address the issue of "snag dynamics" the NEPA analysis can start by reading and responding to the snag dynamics white paper on the DecAID website which says "To achieve desired amounts and characteristics of snags and down wood, managers require analytical tools for projecting changes in dead wood over time, and for comparing those	Snag creation	The "process of creating snags" is outside the scope of this analysis. However, as stated in Chapter 3 of the DEIS under the wildlife section, many of the plantations proposed for thinning in the alternatives have few, if any, large snags present currently, so few large snags are expected to be lost in those areas. Trout Creek design features includes the creation of snags in the regeneration units and protects existing snags where possible. In addition, post-harvest snag and down wood creation is proposed in thinning units as part of the Post Sale Activities Plan. Also see response to comment #58.

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	changes to management objectives such as providing dead wood for wildlife and ecosystem processes” and includes “key findings” and “management implications” including “The high fall rate (almost half) of recent mortality trees needs to be considered when planning for future recruitment of snags and down wood.		
Oregon Wild/ Cascadia Wildlands	62) The agency must address the dynamics of snag habitat over time, by ensuring that recommended snag levels are maintained over time given typically high rates of snag fall and low rates of snag recruitment following fire. These dynamics are not accounted for in the DecAID advisor. The agency often misuses the DecAID decision support tool by looking at only a snap-shot in time.	Snags	Graphs comparing the effects of no actions and actions on snags have been added to Chapter 3 under the wildlife section of the FEIS.
Oregon Wild/ Cascadia Wildlands	63) The Forest Service cannot provide any assurance that its plans and projects will assure viable populations of native wildlife that depend on dead trees. The Forest Service does not know how many snags are necessary to support viable populations of cavity associated species. The Forest Service has provided no credible link between DecAID tolerance levels, potential population levels, and/or viable populations. The Forest Service has also failed to reliably quantify existing and projected habitat for snag associated species.	Wildlife/ dead trees	The effects of the Trout Creek project on wildlife species were analyzed in Chapter 3 of the FEIS. The analysis followed all applicable legal requirements, including NFMA, NEPA and ESA (Appendix A: Compliance with Law and Regulations and Executive Orders).
Oregon Wild/ Cascadia Wildlands	64) If the goal is to restore high quality old forest habitat, the agencies must respect this dynamic by recognizing that dead wood recruitment requires (1) “surplus” biomass and (2) it's a process that takes time, so managers should ensure that middle-aged stands accumulate biomass and begin to recruit and accumulate snags and dead wood. The low of dead wood in middle aged stands is not universal or necessarily desirable, and since many young stands were deprived of the legacies they normally enjoy, it would be advisable to start accumulating snags and dead wood as soon as possible, not wait for mature stages. The federal forest agencies now recognize that current methods and assumptions concerning snag habitat standards are outdated, and the old snag standards do not ensure enough snags to meet the intent of the standard, yet the agencies have not adjusted their management plans to account for this new information nor have they developed new standards that are consistent with the latest scientific information.	Dead wood/ snags	See response to comments #43, #59, #65, and #76.

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Oregon Wild/ Cascadia Wildlands	65) There is general consensus that the biological potential model does not provide adequate nesting, roosting, or foraging structure for cavity excavating birds (Bull et al. 1997, Johnson and O'Neil 2001). This suggests the current direction of managing for 100 percent population levels of primary excavators may not represent the most current knowledge of managing for cavity nesters. Existing models have focused on terrestrial vertebrate species that are primary cavity excavators. The number of snags needed to support bird feeding, escape from predators, and other life functions, is different than, and likely higher than, the number of snags needed to support nesting, so the agencies' existing "potential population" snag standards are arbitrary and capricious. New science indicates that meeting the needs of cavity excavators need requires retaining far more snags than managers realize. There is evidence that retaining more than the minimum number of snags has significant benefits for cavity dependent species.	Wildlife/ snags	Silviculture prescriptions require all coarse woody debris be retained in all units and removed only if deadwood poses a safety concern or for operational purposes. A post-harvest snag and down wood creation is proposed in treatment units as part of the Post Sales Activity Plan in accordance with Forest Plan standards and guidelines (2 snags per acre and/or 240 linear feet of logs per acre) where applicable.
Oregon Wild/ Cascadia Wildlands	66) The DEIS says that post-harvest snag creation will mitigate for adverse effects on snag habitat, but this is highly misleading. All green trees removed from the forest are future snags that will never be recruited in the forest as they would be naturally (or under a non-logging scenario).	Snags/ green trees	The effects of the Trout Creek project with regards to wildlife species that depend on snags were analyzed in Chapter 3 of the FEIS. The analysis followed all applicable rules and legal requirements relating to these areas. Also, see response to comment #43 and 58.
Oregon Wild/ Cascadia Wildlands	67) The agencies need to prepare an EIS to consider a replacement methodology for maintaining species and other values associated with dead wood. The agencies should stop harming dead wood habitat until they have a legal plan to conserve associated species over the long-term.	Dead wood	Preparing an additional EIS and legal plan to address dead wood is out of the scope of the Trout Creek project.
Oregon Wild/ Cascadia Wildlands	68) Current snag-retention guidelines for most North American plant community types fall between 1 and 8 snags/ha. Thus, most current U.S. National Forest guidelines generally converge on the recommendation to retain 6–10 trees/ha, as do guidelines for Washington State, the Ontario Ministry of	Snags	The effects of the Trout Creek project with regards to wildlife species that depend on snags were analyzed in Chapter 3 of the FEIS. The analysis followed all applicable rules and legal requirements relating to these areas. See response to comment #43, #59, and #76.

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	Natural Resources, the U.S. Army Corps of Engineers, and many other land management agencies. It has been acknowledged that snag guidelines should be sensitive to forest type and forest age because “the wildlife species that use snags are influenced by the stage of forest succession in which the snag occurs” and by the breakdown stage of the snag (Thomas et al. 1979). The bottom line is that current management at both the plan and project level does not reflect all this new information about the value of abundant snags and down wood. The agency must avoid any reduction of existing or future large snags and logs (including as part of this project) until the applicable management plans are rewritten to update the snag retention standards.		
Oregon Wild/ Cascadia Wildlands	69) The DEIS addresses inventoried roadless area but does not consider potential impacts to un-inventoried roadless areas that may be ecologically significant and worthy of conservation. The agency cannot limit its analysis of roadless areas to inventoried areas >5,000 acres, because smaller roadless areas that were not inventoried are ecologically relevant and potentially significant. The NEPA analysis must reflect the growing scientific evidence (cited in the Oregon Wild comment letter) indicating the significant value of roadless areas smaller than 5,000 acres and larger than 1,000 acres.	Roadless areas	These unroaded areas are not Wilderness nor are they Inventoried Roadless Areas. There are no forest-wide or management area standards specific to unroaded areas in the Willamette Forest Plan or the Northwest Forest Plan. Unroaded areas are managed consistent with forest-wide standards and guidelines and by designated Forest Plan management area allocations. There are no treatments planned in Inventories Roadless Areas in the Trout Creek project. We address effects to IRA's in the IRA Section of the EIS (Section 3.14)
Oregon Wild/ Cascadia Wildlands	70) The purpose and need lack precision. As we noted during scoping, the purpose and need includes a lot of words lacking rigorous definitions, e.g., forest health, complexity, diversity, sustainable, heterogeneity, resiliency, integrity, etc. Many of these terms are vague and unscientific. If project objectives are not clear, it is difficult to monitor and evaluate success and failure. The agency should be more explicit in describing the ecological goals they are seeking and the trade-offs inherent in reaching those goals.	Purpose and Need	As stated in the DEIS and FEIS, the Purpose and Need of the Trout Creek project is to: 1) Encourage stand health, vigor, species diversity and structural complexity in the Matrix, Adaptive Management Area (AMA), and Riparian Reserves; 2) Contribute a variety of sustainable forest products to local markets; 3) Increase spatial heterogeneity, including complex early seral habitat, at a landscape scale by mimicking mixed severity fire; 4) Improve fire resiliency and strategically manage hazardous fuels in high risk areas that could adversely affect the integrity of privately owned lands, Late Successional Reserves (LSR), Matrix, AMA, and Riparian Reserve lands; 5) Enhance and create hardwood habitat and diversity. Some terms will be added to the glossary of the document to help with clarity.

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Oregon Wild/Cascadia Wildlands	71) The NEPA analysis must recognize that natural processes are still in operation, so human intervention may not be necessary. The scoping notice says over-stocked stands are susceptible to drought, insects, and disease. These natural processes should be viewed as solutions, not problems. Some trees die and others survive and thrive, that creates a desired mix of live and dead trees serving a wide variety of habitat needs. Logging will emphasize live trees, sacrificing dead trees, and providing a less complete suite of benefits for diverse wildlife. If mortality is so bad, the FS should count logging mortality as a negative effect too. How many trees will die from logging versus natural processes? Why is logging mortality better than natural mortality? Commercial logging is demonstrably worse than natural mortality because it involves significant disturbance of soil and non-target vegetation, AND it removed the valuable habitat elements (both live and dead) represented by the trees that are being removed.	General	See response to comments #43 and #59. A non-action alternative was analyzed. Skips are in place to allow areas of non-management to sustain on the landscape.
Oregon Wild/Cascadia Wildlands	72) Regen does not mimic natural disturbance. The purpose and need for regen logging to create early seral habitat is based on the idea of mimicking mixed severity fire. This does not make sense because logging is a poor surrogate for natural disturbance. Regen logging does not mimic natural disturbance because it removes the vast majority of the habitat structure, such as snags and large down wood, that early seral wildlife depend on. The agency must avoid any suggestion that natural disturbance reset stand age to zero, or that regen logging mimics stand replacing disturbance. This is an oversimplification of forest ecology. All disturbances are not created equal: harvest results in net biomass loss (live and snag). Natural disturbances result in flux between live and dead pools. Although many existing silvicultural systems have been designed to mimic stand-scale natural disturbances, McRae et al. (2001) and Palik et al. (2002) remind us that natural	Silviculture/regeneration harvest	See response to comment #44 and #59. While this paper focuses on Canadian forests on a country-wide scale and is not applicable to the project area, McCrae et al. (2001) include this statement in their conclusion: “Although our review shows that wildfire and harvesting may differ considerably in their ecological effects, we believe that it is still possible to promote emulation silviculture by tailoring forestry operations after desirable effects of fire in forest ecosystems.” The aggregate retention harvest and snag creation proposed would be a step in this direction. Additionally, this paper assumes that prescribed burning is not typically done post-harvest. In proposed aggregate retention harvest areas, prescribed burning would be the primary site preparation/fuel treatment used. Actually putting fire on the ground would ameliorate many of the deficiencies brought forward in the paper, as stated by the authors: “As well, for microsite management we do not exclude the use of prescribed burning as a means to improve the outcome of ecosystems after clearcutting, although prescribed burning is made complicated by various contingencies at the operational level.” We are able to plan for those contingencies and use prescribed burning to further emulate fire disturbance.

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	disturbances are inherently different from those of silviculture. One difference, of course, relates to the amount of carbon removed from the site when harvesting a forest. Removals tend to be much greater with harvesting than for fire, for example. Fire tends to create a complex mosaic of forest types and ages on the landscape. Forest harvesting, as commonly practiced, tends to simplify forest composition and structure.		Palik et al. (2002) include this statement in their publication: "Reducing structural disparity between managed and unmanaged forests is key to sustaining biodiversity because of linkages that exist between structural elements, forest biota, and ecosystem processes." The aggregate retention harvest seeks to reduce the structural disparity between managed and unmanaged forests.
Oregon Wild/ Cascadia Wildlands	73) Many bird species benefit from fire that leaves a rich mix of plants and complex structure of snags and dead wood, but regen harvest removes the complex structure and truncates the early seral vegetation by planting conifers. The quality of habitat that results after fire often depends on the successional stage of the forest pre-disturbance, because much of this structure is carried over after the fire into the future forest. Logging removes most of the trees and with it the structural legacies that bind the past and future forests. Compared to their historic populations, species associated with these early-successional conditions have increased in abundance.	Wildlife/ early seral creation	See Response to Comment #44, #46, #59, #72, and #76.
Oregon Wild/ Cascadia Wildlands	74) Regen harvest to create early seral forest is not needed. To evaluate the "need" for early seral habitat, the Forest Service should be looking at the bigger picture instead of just looking at the South Santiam Watershed. There are many places where there is an over-abundance of early seral habitat (e.g., private lands, the Sisters Ranger District). Places like the South Santiam currently serve different habitat priorities in the grand scheme. Logging proponents say that regen harvest of mature forest is needed to enhance early seral forest which is in short supply, but this assertion is not well supported. The creation of early-successional conditions as a result of logging has produced a different pattern on the landscape than the pattern that likely would have resulted solely from natural disturbance. Patches of early-successional forest are now more evenly distributed across the landscape, and sizes of patches are smaller. This pattern may have resulted in a more	Early seral creation	See response to comment #44. Both excessively small and large boundaries for analyzing seral stages could distort the current conditions on the landscape. The South Santiam fifth-field watershed was used for seral stage analysis on the recommendation of ecologists with the Forest Service Northwest Oregon Ecology Group (personal communication with Jane Kertis). The project attempts to mimic the size and pattern of historic mixed severity fire events (obtained from several studies that reconstructed fire history in the nearby H.J. Andrews Experimental Forest) by having a set of units in close proximity to each other where treatments are prescribed by considering how a mixed severity fire event may have burned through the area (DEIS pg. 79). We are not seeking to mimic the conditions produced by past logging practices or current logging practices on private industrial forest.

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	widespread distribution of early-successional species than in the past.		
Oregon Wild/Cascadia Wildlands	75) Furthermore, there are many ways of enhancing early-seral habitat without sacrificing mature forests, for instance, we could: • Modify the way we fight fire and how we react after fire, e.g., leave areas to recover naturally after fire instead of salvage logging and replanting which more closely resembled industrial clearcutting; • Modify practices on non-federal lands to encourage greater retention of live and dead trees during harvest, tolerate slower conifer re-establishment and greater diverse of native vegetation, e.g., discourage herbicide spraying to control competing native vegetation; • Embed structure-rich “gaps” (e.g. patches of very heavy thinning) in our young stand thinning projects. See Miller, Randall. 2014. Practitioners Approach to Early Seral Habitats on Lands Managed Primarily for Older Forest, or There is More to Healthy Forests than Conifer Trees. Siuslaw NF • Extend the early seral character of existing very young stands that are starting to become dominated by conifers.	Early seral creation/Silviculture	Complex early seral habitat creation is tied into the objective to mimic mixed severity fire. High severity areas of mixed severity fire events would cover from tens to hundreds of acres. The suggestions provided would not mimic the scope of high severity areas of mixed severity fire disturbance. Gaps are components of thinning treatments, and while they may contribute early seral habitat, gaps of an acre or two are unlikely to make significant gains in complex early seral habitat in a 100,000 acre watershed, especially considering that 42% of watershed acres are in Wilderness Areas, Inventoried Roadless Areas, and Late Successional Reserves (this figure excludes overlapping acres of Inventoried Roadless Areas and Late Successional Reserves) where management for early seral habitat and gaps is prohibited or constrained. Also, the small size of gaps are unlikely to provide habitat for the full range of early seral dependent flora and fauna that rely on it due to increased edge effects as compared to larger openings. This would be akin to suggesting that all late-successional species should be able to maintain viable populations on a landscape consisting only of small patches of forest habitat. Current young stands on NFS lands account for most of the existing complex early seral habitat in the South Santiam fifth-field watershed. Maintaining these stands as early seral habitat would not result in an increase in early seral habitat, which means the deficit of habitat would still exist. This is also not economically feasible in many instances, as these treatments cost hundreds of dollars per acre to implement. In many of the stands it may not fit with management allocation objectives, especially in Matrix allocations.
Oregon Wild/Cascadia Wildlands	76) Modelling by Harris (2000) suggests that 12 or more green trees need to be retained during regen harvest for every snag we want to recruit at any given time during the rotation.	Green tree retention	This paper focuses on snag dynamics in the western larch/ponderosa pine/Douglas-fir forest type of western Montana, a type that doesn’t exist on the west side of the Cascades. The paper states: “Mean values, used here for quantitative purposes, are not to be interpreted as management prescriptions, particularly on the relatively small spatial scales often used by practicing foresters.” Nine to ten green trees/acre would be retained as dispersed retention, and at least 15% of each unit would be retained as aggregate retention, with many units much higher than 15%. This

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			level of retention meets or exceeds standards and guidelines in both the Willamette LRMP and NWFP.
Oregon Wild/ Cascadia Wildlands	77) One of the primary restoration objectives we keep hearing for these projects is the need to restore complex early seral forest. This may well be an important goal. However, this goal needs to be validated and if valid, alternative means of meeting the goal must be explored. With a little thought and creativity one can see that many ways to increase rare early seral habitat without sacrificing rare mature & old-growth forests. There is widespread recognition that early seral forest is produced in abundance on non-federal lands (through industrial clearcutting). Current industrial forest practices does not produce high quality or long-lasting early seral forest. It is also true, but not widely recognized that the absolute abundance of early seral forest on non-federal lands might partially mitigate for its lack of quality. An honest assessment of the early seral shortage must account for the quantity, quality and functionality of all these early seral forest elements.	Early seral creation	See response to comment #44.
Oregon Wild/ Cascadia Wildlands	78) Climate change may increase early seral. We continue to think that conserving mature forests is more important than creating early seral forests. Efforts to artificially enhance early seral should recognize that climate change might take care of this for us, and in fact might make it much harder to hang on to the mature forests we have. We can expect more fire as a result of climate change.	Early seral/ climate change	It is entirely possible that climate change may increase the number of fire starts. However, that can't be predicted or planned for, and the need for more complex early seral habitat exists in the current moment. See response to comment #48. In addition, the project area will continue to be a priority for fire suppression due to the interspersed of private land and for protection of Late Successional Reserve allocations. This reduces the likelihood that there will be an increase in actual acres burned large enough to make up for the deficit in complex early seral habitat, even if fire starts increase.
Oregon Wild/ Cascadia Wildlands	79) Mature And Old Growth Forests Must Be Protected. While Oregon Wild often supports thinning in dense young stands, we recognize important differences in the effects of logging, and the need for logging, as stands become older and/or less dense. The normal processes of forest succession require that stands begin to accumulate biomass in the form of live and dead wood. Logging in older stands (or repeated logging entries in some younger stands) will truncate that important ecological process.	Old Growth	See response to comments #2, #40, #43, #49, #52, #57, #59, and #60. Although some mature stands are proposed for logging, no "old growth" stands are proposed in the Trout Creek project. PNW-447 (USDA 1986) provides criteria for defining old growth and has been used for this project. A programmatic NEPA analysis of the NWFP is outside the scope of this document. The Forest Service is committed to using the best available science in analyses and land management practices.

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	The agency can no longer justify continued logging of mature & old-growth forest forests based on the outdated land allocations in the NWFP FEIS. Things have changes since 1994, including but not limited to public opinion has taken away the public license to log old growth; the agencies' standards for providing dead wood habitat are outdated and inadequate, the agencies need to protect additional habitat in order to increase the chances that spotted owls can co-exist with the newly invading barred owls; anthropogenic stresses need to be reduced in order to buffer old growth ecosystems from the expected increased stress of climate change; and we need to maintain carbon stores in mature & old-growth forest forests in order to mitigate global warming. The agency can no longer tier to the NWFP EIS, because the cumulative impacts of logging mature forests has not been subjected to a programmatic NEPA analysis that reflects all of the new information that has arisen since 1994.		
Oregon Wild/ Cascadia Wildlands	80) There is a significant regional deficit of late-successional and old growth forests, and until that deficit is addressed the agency should focus on restoration instead of commodity extraction. Before doing more regen harvest, the agency should address the backlog of needed young stand management. The older forests can wait, while the dense young stands, if not timely treated, can suffer potentially irreversible consequences (e.g., crown recession, instability, stand-level competitive stress).	Regeneration harvest/ old growth	On NFS lands in the South Santiam fifth watershed, the current percentage of late-successional forests exceeds the historic average. The Trout Creek project would, at most, result in a reduction of late-successional forest of 0.2%, which would still leave it above the historic average (FEIS pg. 96). All managed stands suitable for thinning in the project area have either been previously thinned or are included in the Trout Creek project. There is no backlog of managed stands with thinning needed in the project area.
Oregon Wild/ Cascadia Wildlands	81) There is a tremendous unmet need for thinning. The Willamette National Forest's FY 2003 Monitoring and Evaluation Report says "Accomplishments of thinning, release, and fertilization totaled 8,513 acres. Accomplishments are well below predicted plan. A significant backlog of plantations in need of thinning is building on the Forest." Further corroboration of the problem is found in the Willamette NF, South Pyramid EA (March 2006) which said that only 10% of pre-commercial thinning needs are being met in the watershed around the South Pyramid timber sale.	Silviculture	See response to comment #80. Pre-commercial thinning does not help meet the objective of providing forest products to local economies.
Oregon Wild/ Cascadia Wildlands	82) The Agency should consider significant new information since the NWFP was adopted which highlights the importance of protecting mature & old-growth forests to meet the need for carbon storage to mitigate climate change, the need to protect additional habitat to increase the chances that the barred owl and spotted owl can co-exist, and new science indicating a	Economics/ climate change	A thorough analysis of the effects of this project to the spotted owl has been conducted, including a Biological Assessment that was sent to the USFWS for consultation, and the resulting Biological Opinion (USFWS 2018) which has been documented in the Trout Creek EIS. All applicable laws and standards are being followed, including those in the 2011 Northern Spotted Owl Recovery Plan.

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	need to protect additional green trees to ensure adequate long-term recruitment of snags and dead wood. Another aspect of new information is that the market for wood products is quite depressed as a result of the inter-related financial, housing, and wood bubbles, so there is little justification for sacrificing public forests to produce wood products. Withholding wood from the market may help improve prices for owners of non-federal timber who rely on selling some trees for income.		We do not have any official direction to help the spotted owl and barred owl co-exist. We are not aware of any new science based suggestions how to improve the co-existence of the owls.
Oregon Wild/ Cascadia Wildlands	83) Given that fact and the many species of terrestrial and aquatic species that are listed as threatened and endangered, the agencies should stop logging all mature and old-growth forest and shift their energy to restoration. All logging, including thinning stands of any age, include some adverse impacts and trade-offs. Some impacts of logging are unavoidable, so there is no such thing as a logging operation that is 100% beneficial. Depending on how thinning is done thinning can have adverse impacts such as soil disturbance, habitat disturbance, carbon removal, spreading weeds, reduced recruitment of snags, road-related erosion and hydrologic impacts, moving fuels from the canopy to the ground, creating a hotter-drier-windier microclimate that is favorable to greater flame lengths and rate of fire spread, etc. Some of these negative effects are fundamentally unavoidable, therefore all thinning has negative effects that must be compensated by beneficial effects such as reducing competition between trees so that some can grow larger faster, increased resistance drought stress and insects, increasing species diversity, possible fire hazard reduction, etc. No logging in stands over 80. The authors of the Northwest Forest Plan took all this into account and determined that 80 years is a useful place to draw the line between forests that are likely to benefit from silviculture and those that are likely to experience net negative consequences.	Mature forests	See response to comments #2, #40, #43, and #80. Chapter 3 of the DEIS and FEIS discuss effects, both beneficial and adverse, as well as the tradeoffs of the proposed actions in the Trout Creek Project. Additionally, Table 2 – Summary of Environmental Consequences, displays these effects.
Oregon Wild/ Cascadia Wildlands	84) There is social importance to trees over 80 years of age. Conservation of mature & old-growth trees helps achieve social goals. The social importance of conserving large trees is often under-appreciated.	Old growth	Although some mature trees are proposed for logging, no “old growth” stands are proposed in this project. PNW-447 (USDA 1986) (I lifted this from a project on McKenzie. Is this accurate for Trout? If not, what did we city, if anything, that helped us define old growth) provides criteria for defining old growth which has been used in this project. The Fire Origin stands over 80 years old have a diameter

Commenter	Comment	Resource Topic	Response
	The agency must protect mature forests because they are the best candidates to grow and develop into old-growth habitat in the shortest time frame. Cutting mature forests is not needed for ecological reasons. Cutting mature forest will remain controversial and socially unacceptable. We do not need to log mature forest to provide jobs. We do not need to log mature forest to prop up the economy.		limit of 35 inches, which will preserve the “legacy” trees in those stands. No Inventoried Roadless Areas (IRAs) or designated Wilderness is within the project area.
Oregon Wild/Cascadia Wildlands	85) Logging in riparian reserves older than 80 years. The no-harvest buffers described in the DEIS seem appropriate for stands under 80 years old, but not for mature stands older than 80 years. We could not find a clear disclosure in the DEIS whether logging will occur in riparian reserves stands over 80 years. The DEIS says “The units in this project include approximately 320 acres in older naturally established stands where existing condition of Riparian Reserves indicate complexity and diversity, and no need for treatment to attain ACSOs.” However, we are unsure if this describes all of the stands over 80 years or some of them.	Riparian reserves	There are no commercial treatments proposed in the Riparian Reserves in stands over 80 years of age.
Oregon Wild/Cascadia Wildlands	86) Weigh the trade-offs associated with logging in riparian reserves. The DEIS analysis considers the effect of logging on recruitment of instream wood, but fails to disclose the adverse effects of logging on recruitment of wood in the outer part of the riparian reserves. There are significant benefits to ACS Objectives from abundant dead wood throughout the riparian reserves, not just instream. The FS must not terminate its analysis of effects in riparian reserves at the stream edge	Riparian reserves/dead wood	For a detailed discussion of the effects of logging on wildlife species and deadwood please see Chapter 3 of the FEIS. Timber harvest in all alternatives would reduce future snags; however, all natural stand units would retain some legacy trees. Silviculture prescriptions also require that snags and coarse woody debris be retained in all units, including riparian reserves, and removed only if deadwood poses a safety concern or for operational purposes. Post-harvest snag and down wood enhancement in selected thinning units, including stands treated in Riparian Reserves, would improve stand structure conditions and mitigate some effects of treatments. A post sale activity plan will be developed to address wildlife snag trees in all harvest units as part of this project. Specifically, approximately 9 acres of snag and down wood creation will be proposed in the Riparian Reserves in Units 33 and 34. The fall and leave treatments would provide down wood for nutrient recycling, habitat for aquatic and terrestrial species, gaps for diversity of structure, and recruitment for vegetation diversity.
Oregon Wild/Cascadia Wildlands	87) A key issue is whether narrow buffers are adequate to protect wildlife, such as amphibians, that may be associated with streams, but also venture away from the water. Many riparian species rely on unimpeded successional processes that accumulate abundant dead wood <i>near</i> streams,	Riparian Reserves away from streams	Riparian Reserves being treating are single story overstocked plantations of Douglas-fir. They are not in natural condition. For a detailed discussion of the effects of logging on wildlife species and deadwood please see Chapter 3 of the FEIS.

Commenter	Comment	Resource Topic	Response
	but not necessarily <i>in</i> streams. Logging within and adjacent to riparian reserves will capture mortality, truncate wood recruitment processes, and deprive wildlife of the abundant dead wood they need. Likewise, reducing stream buffers and allowing clearcut edges directly abutting inner riparian buffers will eliminate one source of down wood that would otherwise fall into the buffer. Protecting an outer <i>buffer-on-the-buffer</i> helps maintain natural levels of wood recruitment at least within the inner buffer, though the outer buffer itself would still suffer from depleted dead wood levels due to edge effects.		We are not reducing stream buffers and allowing clearcut edges directly abutting inner riparian buffers
Oregon Wild/ Cascadia Wildlands	88) The agency often claims that logging in riparian reserves is necessary to improve attributes other than large wood. However, these benefits are often minor and transitory, and do not outweigh the significant long-term adverse effect of logging on recruitment of dead wood. The agency must focus on the most significant contributions of vegetation toward ACS objectives and the most significant effects of logging on the ACS objectives. If the agency intends to log in riparian reserves to increase some nebulous goal like “vegetation diversity and complexity,” then please explain why the biophysical indicators for the ACS objectives (set forth below) do not include any mention of vegetation diversity or complexity. See the Jazz Thinning Preliminary Analysis, 2011. The effects of logging on dead wood are significant and long term, adversely affecting a core function of the reserves, while the purported benefits to vegetation diversity are minor and transitory, and affect secondary purposes of the reserves. Large wood in streams has been reduced due to a variety of past and present timber harvesting practices and associated activities. Many riparian management areas on federal lands are inadequate as long term sources of wood.	Riparian reserves/ dead wood	The Riparian Reserves we are treating are single story overstocked plantations of Douglas fir. They are not in natural condition. While it is true that thinning reduces the future down wood recruitment, the Aquatic Conservation Strategy does not differentiate which Objectives are more important. They are all equally important. Vegetative diversity has the potential to have long term beneficial effects to biodiversity. Loss of large wood in streams due to past practices is discussed in the aquatics section of the FEIS. Over time long term sources of wood will be established by the Riparian Reserves.

Commenter	Comment	Resource Topic	Response
Oregon Wild/Cascadia Wildlands	89) The effects of thinning on crown development are not very significant. Stimulating the development of a diverse understory is often used as a justification for thinning, but this may not be justified in stands older than about 40 years. It is also worth noting that where understories are well-stocked, mid-story development can be enhanced by focusing on treating the understory itself rather than killing canopy trees.	Thinning treatments	Van Pelt & Sillett (2008) demonstrate that Douglas-fir (which makes up the majority of stocking in stands with Riparian Reserve thinning) responds vigorously to disturbance that increases light by growing epicormic branches and expanding its crown. The PowerPoint presentation referenced states as a key finding that “Hemlock-DF canopies respond quickly to thinning” and that “Tree crowns become longer and denser”. In addition the presentation states “ Thinning maintains and promotes live crown size” and “Unthinned stands lose live crown” which is supported by slide #24 in the presentation which shows a modeled stand which starts at approximately a 54% crown ratio, when left unthinned the crown ratio drops to about 37% and widely thinned maintains a greater than 50% crown ratio. DEIS pg. 84 states: Thinning has a positive effect on understory plant richness (after a recovery period of about five years following harvest operations), as well as understory tree establishment and growth (Bailey and Tappeiner, 1998; Muir et al., 2002; Chan et al., 2006). The studies cited include stands up to 100 years old. In addition, the effect of thinning in stands greater than 40 years in age has been studied in Ares et al (2010) and Davis and Puetzman (2009), with both finding positive effects of thinning on understory plants. The effects on thinning on understory development are disclosed in Chapter 3 of the EIS and supported by peer reviewed literature. In Riparian Reserves areas proposed for thinning in the project area, understories are typically not well stocked due to overstory canopy cover limiting growth and establishment of understory trees (DEIS pg. 78).
Oregon Wild/Cascadia Wildlands	90) Don’t make the mistake of assuming that thinning is always consistent with the ACS because it helps grow large trees faster. First, thinning captures mortality and actually delays recruitment of large wood. Second, the agencies often misinterpret the Northwest Forest Plan ROD by confusing accelerated attainment of ACS objectives with ACS compliance. The NWFP ROD actually says that silviculture in riparian reserves is generally prohibited, and allowed only “if needed to attain” ACS objectives, not (as implied by the EA) if needed to “accelerate” ACS objectives. This is a common “group-think” misinterpretation of the ACS. The appropriate evaluation is to ask “will ACS objectives eventually be met without intervention?” If the answer is “yes,” then silviculture is technically not allowed. Confusion may stem from the fact that	ACS/Thinning	Our analysis of Riparian Reserve thinning requires there is a need to treat the stand in order to attain ACSOs. There is no thinning in stands over 80 years of age in the Riparian Reserves in the project. Need for treatment is based on achieving diversity as in the upland portion of the unit.

Commenter	Comment	Resource Topic	Response
	the ACS also has a “do not retard” standard, but this is separate from the “if needed” test, and is itself a criteria to limit active management, not an excuse to reject the no action alternative. The “do not retard” standard cannot be interpreted to require active management whenever and wherever it would accelerate attainment of ACS objectives. That would lead to all kinds of problems, such as cumulative impacts, unintended consequences, and sacrificing some aquatic objectives in the pursuit of others. Oregon Wild is not absolutely opposed to treatment of riparian reserves but we want to avoid the slippery slope of just assuming “it’s all good” without careful analysis and justification.		
Oregon Wild/ Cascadia Wildlands	91) The USFS and BLM should include all sizes of wood in describing environmental baseline conditions and in analyzing the effects of its proposed actions, not just pieces of wood that are greater than 24 inches in diameter and greater than 50 feet in length. The USFS and BLM should adjust their tree diameter targets based on stream size. Databased curves are available for both functional-sized and key pieces of wood (e.g., Fox and Bolton 2007). The USFS and BLM should leave more thinned trees on the ground in riparian areas, particularly close to streams, on floodplains, and on steep side slopes where some trees are likely to slide down into streams, than are required to meet wildlife needs. In order to insure adequate recruitment of conifer wood to streams, the USFS and BLM should measure riparian buffers from the outer edge of streamside hardwood forests, where present. The USFS and BLM should work with NMFS to develop reliable methods of wood recruitment modeling and procedures that could be used routinely in ESA section 7 consultations to promote decisions based on data instead of concepts and generalizations from the scientific literature.	Wood/ riparian areas	We do use all sizes of wood in baseline conditions We do not have tree diameter targets We are proposing fall and leave treatments in selected areas in Riparian Reserves. We measure Riparian Reserves and buffer distances based on LRMP. The consultation we do with NMFS includes effects to down wood and it’s potential to effect listed fish habitat See response to comment #90 above

Commenter	Comment	Resource Topic	Response
Oregon Wild/Cascadia Wildlands	92) Recommendations related to thinning in riparian reserves must be reconsidered in light of new information showing that logging does NOT increase the recruitment of functional wood, and the minor increase in very large live trees comes at great cost in terms of a significant reduction in recruitment of functional wood in medium and large size classes (smaller than “very large.”)	Riparian areas/aquatic species	See response to comment #90 for reasons for treating Riparian Reserves
Oregon Wild/Cascadia Wildlands	93) Thinning vs. other treatments. Key points: • Thinning is most beneficial in dense young stands. Existing literature and stand development theory suggest that the greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g. large trees, large dead trees, spatial structural and compositional heterogeneity, etc.) comes in dense uniform plantations less than 80 years and especially less than 50 years old. • Accurate assessments of thinning effects requires site-specific information. The NEPA analysis needs to provide a site-specific, quantitative analysis to show that silviculture is needed to meet ACS objectives in these riparian reserves. • Conventional [i.e., commercial] thinning generally produces fewer large dead trees. Thinning with removal of trees (conventional thinning) will generally produce fewer large dead trees across a range of sizes over the several decades following thinning and the life-time of the stand relative to equivalent stands that are not thinned. • Nonconventional [i.e., non-commercial] thinning can substantially accelerate dead wood production. • Effects of thinning on instream wood needs to be placed in a watershed context. • The ecological effects of thinning needs to be placed in a watershed context. • Using a variety of treatments is also consistent with the tenets of adaptive management in situations where the outcomes of treatments are uncertain.	Thinning	See response to comment #89 and #90

Commenter	Comment	Resource Topic	Response
Oregon Wild/ Cascadia Wildlands	94) New Information Requires Modification of Matrix Objectives. This project is based on part on the need to produce timber to meet RMP objectives. There is a trade-off between ecological objectives and timber objectives, and new information indicates that these trade-offs are becoming more acute. Before sacrificing older forests in order to produce timber, the agency needs to carefully consider new information developed since the Northwest Forest Plan was adopted in 1994. Several significant new developments indicate a need to increase emphasis on conservation and restoration of more mature & old-growth forests, and reduced emphasis on Matrix objectives such as timber production from logging of mature & old-growth forests. When we bring all these lines of evidence together one realizes that since the NWFP and the matrix land allocation was adopted there are many more reasons to protect forests and fewer reasons to log them. This needs to be considered in a new EIS. Since these significant new issues were not properly considered in the Northwest Forest Plan FEIS, the agency needs to address them in project level NEPA analyses. Since these significant new issues were not properly considered in the Northwest Forest Plan FEIS, the agency needs to address them here.	NWF Plan, Matrix	The Trout Creek project is required to follow the regulations and guidelines for matrix land allocations in the northwest forest Plan. The Forest Stand and Structure Section 3.01, describes seral stages and how this project is moving the project area towards historic reference conditions on the landscape. Peer reviewed science published after the adoption of the NWFP was considered to develop the proposed action (for example Vose 2016, see literature cited in the Forest and Stand Structure section 3.01). Based on this science, the proposed treatments would improve health and vigor, increase species diversity and structural complexity moving the project area towards a structural condition on the landscape that more in alignment with historic conditions there is an abundance of science that was considered that followed the NWFP and based on this science, the proposed action is addressing the purpose and need identified in Chapter 1. The lack of open mid-seral and open canopy, late-seral forest structure in the project area. The Trout Creek project aims to accelerate the development of old growth conditions (see page 84 in the Forest and Stand Structure section 3.01). See the Record of Decision document for the final acres of treatment in the Matrix. Alternative 2 proposes to treat 539 acres in the project area. Additionally, please see responses to comments #2, #40, #41, #43, #55, #59, #79, and #83.
Oregon Wild/ Cascadia Wildlands	95) Disclose and Mitigate Trade-offs Land management inevitably involves trade-offs among competing uses of the public lands. The agency must avoid portraying the effects of the proposed action in uniformly positive terms, while describing the effects of no action in uniformly negative terms. NEPA requires disclosure of the trade-offs among competing uses. The agency should look for tools to help illuminate and transparently resolve trade-offs. “An integrated planning process focuses on multiple-objective planning rather than single-objective planning from the beginning of the project. It favors a transparent and interactive process that offers opportunities for understanding ecosystem complexity,	General	Chapter 3 of the DEIS and FEIS discuss effects, both beneficial and adverse, as well as the tradeoffs of the proposed actions in the Trout Creek Project. Additionally, Table 2 – Summary of Environmental Consequences, displays these effects. The Multiple-Use Sustained-Yield Act (MUSY) of 1960 declares that the purposes of the national forest include outdoor recreation, range, timber, watershed and fish and wildlife. MUSY also directs the Secretary of Agriculture to administer national forest renewable surface resources for both multiple uses and sustained yield. Furthermore, MUSY defines Multiple Use as the —management of all the various renewable surface resources of the national forests... to best meet the needs of the American people and Sustained yield as —achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the renewable resources of the national forest without impairment of the land's productivity.

Commenter	Comment	Resource Topic	Response
	stakeholder positions, and clear articulation of decision trade-offs and benefits.		



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL REVIEW
AND ASSESSMENT

February 12, 2018

Joanie Schmidgall, NEPA Planner
Sweet Home Ranger District
4431 Highway 20
Sweet Home, Oregon, 97386

Dear Ms. Schmidgall:

The U.S. Environmental Protection Agency has reviewed the U.S. Forest Service Trout Creek Project Draft Environmental Impact Statement (EPA Region 10 Project Number: 17-0002-AFS/CEQ Number 20170244).

The EPA's comments are provided pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR § 1500-1508) and Section 309 of the Clean Air Act. Section 309 directs the EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Our review of the DEIS considered the expected environmental impacts and the adequacy of the EIS in meeting the procedural and public disclosure requirements of the NEPA. We are rating the DEIS with a Lack of Objections (LO) because we have not identified any potential environmental impacts requiring substantive changes to the proposal. Thank you to the Forest Service for the work involved to develop this DEIS. A copy of the EPA rating system for DEISs is attached.

The DEIS analyzes a no action alternative and three action alternatives, which would implement silviculture treatments to encourage forest health, species diversity and structural complexity, provide forest products to local markets, increase spatial heterogeneity, improve fire resiliency in high risk areas, and enhance and create hardwood habitat and diversity. The Trout Creek project area is approximately 37,344 acres in size. Alternative 2, the Proposed Action/preferred alternative, proposes 1,670 acres of treatment (including skips), as well as road work; including the decommissioning of six miles of road, and the replacement of 260 culverts. Alternative 3 proposes 1,016 acres of treatment (including skips). Alternative 4 proposes 1,670 acres of treatment, but a greater volume of harvest than Alternative 2.

We agree with the DEIS that the differences between the current landscape conditions and desired future conditions create the need for restoration. The DEIS usefully describes how currently uncharacteristic forest composition, structure and density have increased the potential for widespread, severe and/or stand replacing fires, susceptibility to water stress, nutrient deprivation, insect outbreaks and diseases. Given a clear need for restoration, we support the project purpose to improve forest resiliency and sustainability, maintain and enhance habitat diversity, manage the road system, and restore hydrologic functioning.

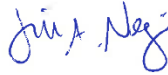
Based on our review of the DEIS, we note that Alternative 3 would not allow for any landscape-scale treatments focused on mimicking mixed severity fire. There is a compelling need to improve the condition and amount of both complex early seral habitat and late seral-open habitat within the Trout Creek project area, and Alternative 3 would not achieve those objectives. Among the action alternatives analyzed, we find Alternatives 2 and 4 to be environmentally preferable to Alternative 3.

In particular, we highlight and appreciate the activities analyzed within Alternative 2, the Proposed Action, as activities which effectively serve the project's purpose and need:

- Planning for variable and uneven retention patches to mimic natural patterns of non-uniform clumps and openings;
- Well thought-out riparian restoration treatments and commitment to no ground-based equipment near perennial streams;
- Adherence to the Northwest Forest Plan (NWFP) Temperature TMDL Implementation Strategy¹ for water quality limited streams; and,
- The plan to collaborate with interested Tribes, including the Klamath Tribes, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of Warm Springs.

Thank you for this opportunity to provide comments on the DEIS. If you have any questions, please contact Teresa Kubo of my staff at (503) 326-2859 or kubo.teresa@epa.gov, or contact me at (206) 553-0248 or nogi.jill@epa.gov.

Sincerely,



Jill A. Nogi, Manager
Environmental Review and Sediment Management Unit

Enclosure:

1. U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements

¹ *Northwest Forest Plan Temperature TMDL Implementation. Strategy Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy. May 25, 2012*

**U.S. Environmental Protection Agency Rating System for
Draft Environmental Impact Statements
Definitions and Follow-Up Action***

Environmental Impact of the Action

LO – Lack of Objections

The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns

EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections

EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory

EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Appendix G – Changes from Draft to Final Trout Creek Project EIS

The following changes have been made to the Trout Creek Project DEIS to FEIS.

FEIS Page	Location	DEIS	FEIS
18	Section 1.02 Forest Plan and Management Direction Roads Analysis	Identify Minimum Road System based on Forest-level Travel Analysis Report (TAR) known as the Willamette National Forest Road Investment Strategy (RIS, 2015). It is a forest level analysis completed in 2015. This TAR included recommendations for a road system that could be maintained to protect resources and provide access for administrative and public use for the long term. National and regional direction instructed Forests to analyze these recommendations at the project level. Please refer to Appendix D for more detailed information concerning the roads analysis and anticipated road work activities.	In 2015, to comply with Subpart A of the Travel Management Rule (66 Fed. Reg. 3206 (2001); 36 C.F.R part 212), the Willamette National Forest analyzed the benefits, risks and costs of the entire road system, incorporated stakeholder input and developed a Travel Analysis Report (TAR). This analysis is called the "Willamette National Forest Road Investment Strategy" (RIS, 2015) and provides recommendations that should be implemented in order to protect resources, provide reliable access for administrative and public use, and reduce fiscal costs over the long term. Another obligation of the rule is to identify the minimum road system needed for safe and efficient travel and for the protection, management, and use of National Forest system lands. National and regional direction instructs Forests to complete this next step through NEPA analysis and also further analyze the [RIS] recommendations at the project level and incorporate into decisions. Please refer to Appendix D for more detailed information concerning the Road Investment Strategy and anticipated road activities in this project area."
34	Section 1.06 Public Involvement Efforts	While preparing this DEIS for publication, the Forest Service was made aware that interested individuals are conducting red tree vole surveys in proposed treatment units located above 3,500 feet in elevation. Pre-disturbance surveys were not required or conducted by the Forest Service in units above 3,500 feet (Forest Plan, 2001). Forest Service specialists are currently validating results as they are provided. Should active red tree vole nests be confirmed, additional red tree vole protections would be required, which may result in changes to unit boundaries and treatment acres. Similarly, ongoing northern spotted owl surveys may result in additional changes to unit boundaries and treatment acres. Changes to the project will be tracked, updated, and considered prior to the publication of the final EIS and draft Record of Decision.	While preparing the DEIS for publication, the Forest Service was made aware that interested individuals were conducting red tree vole surveys in proposed treatment units located above 3,500 feet in elevation. Pre-disturbance surveys were not required or conducted by the Forest Service in units above 3,500 feet (Forest Plan, 2001). Forest Service specialists used the data provided by the interested individuals to confirm the location of additional red tree vole nests above 3,500 feet. The deciding official took them into consideration when making the decision as described in the Draft Record of Decision (DROD). Changes to the project will be tracked, updated, and reflected in the publication of the DROD.

34	Section 1.07 Consultation with other Agencies United States Fish and wildlife Service and National Marine Fisheries Service. Upper Willamette River Chinook salmon and Upper Willamette River Steelhead.	Endangered Species Act (ESA) informal consultation with the National Marine Fisheries Service (NMFS) for Upper Willamette River (UWR) spring Chinook salmon and UWR Winter Steelhead is currently in progress. The Biological Analysis prepared for the Trout Creek project found that the project “may affect, and is likely to adversely affect” UWR spring Chinook salmon and UWR Winter Steelhead. On February 14, 2017, the Trout Creek project was presented to the NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” The Biological Analysis was submitted for formal consultation on February 17th, 2017 by the Forest Supervisor. A Biological Opinion was prepared for the Trout Creek Project on August 31, 2017. Consultation will be completed prior to publication of the Final Environmental Impact Statement (FEIS) and Draft Record of Decision (DROD) for the Trout Creek project. The Forest Service will be required to comply with the terms and conditions provided by NMFS in the Biological Opinion.	Endangered Species Act (ESA) formal consultation with the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon Upper Willamette River winter steelhead is complete. The Biological Assessment prepared for the Trout Creek project found that the project “may affect, and is likely to adversely affect” Upper Willamette spring Chinook salmon and winter Steelhead. This analysis also found that there would not be any adverse modification of designated critical habitat for either species. On February 14, 2017, the Trout Creek project was presented to the NMFS and they concurred with the effects determination of “may affect, is likely to adversely effect.” Consultation was formally initiated on February 17, 2017 by Forest Supervisor Tracy Beck. The Biological Opinion was issued to Tracy Beck on January 9, 2018 (NMFS no. WCR-2017-6494). The Forest Service is required to comply with the terms and conditions provided by the NMFS in the Biological Opinion.
34	Section 1.07 Consultation with other Agencies Environmental Protection Agency	During project scoping, the EPA submitted a list of recommendations for analysis and project design. This letter was reviewed and recommendations incorporated as appropriate. Per Forest Service regulations, this DEIS will be filed with the EPA’s Office of Federal Activities in Washington, DC, who will publish a notice of availability in the Federal Register.	During project scoping, the EPA submitted a list of recommendations for analysis and project design. This letter was reviewed and recommendations incorporated as appropriate. The EPA received a copy of the DEIS and rated the project “Lack of Objectives (LO) identified no potential environmental impacts requiring substantive changes to the project. Per Forest Service regulations, this FEIS will be filed with the EPA’s Office of Federal Activities in Washington, DC, who will publish a notice of availability in the Federal Register.
	Table 14		Unit acres updated throughout table.
56	Table 14 Wilderness		Protection of Wilderness Character: mitigate impacts from commercial harvest. (addition)
58	Table 14 Scenic Quality		No staging of equipment on the Rooster Rock Trail and avoid the trail when considering the placement of logging systems in Unit 72. (addition)
170-172	Section 3.04 Wildlife		FSVeg Tolerance Levels Analysis and Figures 34 and 35 (addition).

193	Section 3.06 Roads and Access Scale of Analysis		In 2015, to comply with Subpart A of the Travel Management Rule (66 Fed. Reg. 3206 (2001); 36 C.F.R part 212), the Willamette National Forest analyzed the benefits, risks and costs of the entire road system, incorporated stakeholder input and developed a Travel Analysis Report (TAR). This analysis is called the “Willamette National Forest Road Investment Strategy” (RIS, 2015) and provides recommendations that should be implemented in order to protect resources, provide reliable access for administrative and public use, and reduce fiscal costs over the long term. Another obligation of the rule is to identify the minimum road system needed for safe and efficient travel and for the protection, management, and use of National Forest system lands. National and regional direction instructs Forests to complete this next step through NEPA analysis and also further analyze the [RIS] recommendations at the project level and incorporate into decisions. Please refer to Appendix D for more detailed information concerning the Road Investment Strategy and anticipated road activities in this project area. (addition)
279	Appendix C – Past, Present and Reasonably Foreseeable Future Activities		Unit 8 of Cool Soda added to Present Activities.
291	Appendix D – Road Treatment Proposals		Separate tables detailing Road Closures and Road Decommissioning added.
369	Glossary		Advanced Regeneration, Forest Health, Spatial Heterogeneity added

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Glossary

Advanced Regeneration	Small trees, usually less than 1 inch in diameter, which are growing under mature trees prior to planned harvest activities.
Air Quality	The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations. Used instead of "air pollution" when referring to programs.
Allochthonous Energy Sources	Allochthonous energy sources are those derived from outside the stream system, that is, from the terrestrial environment. Leaves, twigs, fruits, etc. are typical forms that enter the water by direct litterfall or lateral leaf blow.
Ambient Air Quality	Defined under the Clean Air Act as the air quality outside of industrial site boundaries.
Area to Protect	An area where harvesting or any other activities, such as staging of equipment, will not occur. These areas will not be included as part of a unit and will be identified on timber sale contract maps.
Arterial Road	A forest road that provides service to large land areas and usually connects with other arterial roads or public highways. (FSH 7709.54, no longer in print)
Autochthonous Energy Sources	Autochthonous energy sources are those derived from within the stream system. During photosynthesis, for example, primary producers form organic carbon compounds out of carbon dioxide and inorganic matter. The energy they produce is important for the community because it may be transferred to higher trophic levels via consumption.
Canopy	The uppermost spreading branchy layer of a forest.
Canopy Base Height	The height above the ground of the first canopy layer where the density of the crown mass within the layer is great enough to support vertical movement of a fire. Low canopy base heights have been shown to initiate crown fire behavior.
Canopy Bulk Density	Canopy bulk density (CBD) describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit.
Canopy Cover	Canopy cover is a measure of the percentage of ground covered by a vertical projection of the tree canopy.
Canopy Closure	Canopy closure is the proportion of the sky hemisphere (measured from all angles) obscured by vegetation when viewed by a single point. Closure is affected by tree heights and canopy widths and takes into account light interception and other factors that influence microhabitat.
Chain	A standard measurement equal to 66 feet.
Class I Airsheds	Geographic areas designed by the Clean Air Act subject to the most stringent restrictions on allowable increment of air quality deterioration. Class I areas include Forest Service wildernesses and nation memorial parks over 5,000 acres, National Parks exceeding 6,000 acres, international parks, as well as other designated lands.
Cohort	A group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance.
Condition Classes	A function of the degree of departure from historical fire regimes. Condition class 1 is within or near historical conditions; class 3 is significantly altered from historical regimes.
Contiguous	In close proximity to or near.

Core Area	0.5 mile (radius circle) around a known or predicted owl site, which delineates the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham and Noon (1997) defined the core area as that portion of a northern spotted owl home range that received disproportionately high use for nesting, roosting and access to prey; they suggested that 60-70% of owl reproducing season activity occurred in about 20% of the home range. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among owls, Thrailkill (pers. com.) determined that Bingham and Noon 1997, Wagner and Anthony 1999, Franklin et al. 2000 and Irwin et al. 2004 collectively suggested a core area of about 500 acres.
Collector Road	A forest road that serves smaller land areas than an arterial road. Usually connects forest arterial roads to local forest roads or terminal facilities. (FSH 7709.54, no longer in print)
Critical Habitat	The critical habitat designation is conducted by the U.S. Fish and Wildlife Service and is based on the current status and recent scientific research on northern spotted owl populations. Critical habitat was identified for specific areas within the geographical area occupied by the species at the time it was listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection. For the northern spotted owl, these features include particular forest types that are used or likely to be used by northern spotted owls for nesting, roosting, foraging, or dispersing habitat. In addition, the best available information was used to identify those areas that are otherwise determined to be essential to the conservation of the species. A habitat network was identified that meets the following criteria: 1) Ensures sufficient habitat to support stable, healthy populations across the range, and also within each of the 11 recovery units; 2) Ensures distribution of northern spotted owl populations across the range of habitat conditions used by the species; 3) Incorporates uncertainty, including potential effects of barred owls, climate change and wildfire disturbance risk; and 4) Recognizes that these protections are meant to work in concert with other recovery actions, such as barred owl management.
Crop Trees	Trees which are considered suitable to meet long term management objectives for an analysis area. These may also be referred to as healthy or manageable trees. This may include both the physical make-up of the tree as well as the species.
Cycle	As applied to uneven-aged management, it is the time interval between harvest entries. It should be noted that harvest entries in uneven-aged management are to leave residual levels of growing stock which should not need treatment for at least one cycle length.
Desirable Species	Any species of plant or animal which is considered to be compatible with meeting management goals and objectives.
Discounted Cost	Value of all cost associated with a project over its lifetime multiplied by a discount rate to determine the costs at today's worth.
Discounted Revenue	Value of all revenue associated with a project over its lifetime multiplied by a discount rate to determine the value today.
Net Present Value	Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.
Disturbance	Events that disrupt the stand structure and/or change resource availability or the physical environment (Oliver, 1996).
Diameter at Breast Height (DBH)	Diameter of a tree measured 4.5 feet up from the ground on the uphill side.
Early Seral	Plants which inhabit a disturbed site within the first few years subsequent to the disturbance.
Early Seral Habitat	A forest structural condition that lasts 15-20 years after a human disturbance such as timber harvest, or natural disturbance such as wildfire. This structural condition can provide valuable wildlife habitat components including grasses, flowering forbs, hardwoods, and dead wood habitat structures.

Emissions	A release of combustion gases and aerosols into the atmosphere.
Fire Behavior	The manner in which a fire reacts to the influences of fuel, weather, and topography.
Fire Intensity	The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is Btu per second per foot (Btu/sec/ft) of fire front. Also, the rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.
Fire Regime	A function of the historical frequency of fire and the degree of severity of those fires.
Fire Regime Condition Class	Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. Based on the coarse-scale national data, they serve as generalized wildfire rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk).
Fire Severity	Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.
Flame Length	The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.
Forest Health	Resilience, recurrence, persistence and biophysical processes which lead to sustainable ecological conditions.
Fuel Class	Part of the National Fire Danger Rating System (NFDRS). Group of fuels possessing common characteristics. Dead fuels are grouped according to 1-, 10-, 100-, and 1000-hour time lag, and living fuels are grouped as herbaceous (annual or perennial) or woody.
Fuels	Vegetative matter, dead or alive, that burns in a fire. It is broadly characterized by the following categories: • Surface or ground fuels are within a foot or so of the ground surface. • Ladder fuels exist when you have a continuous vertical arrangement of fuel that allows fire to easily go from ground level into the tree canopy. • Crown fuels are the tree limbs and leave that can burn with enough heat and/or wind. • Live fuels are the green (live) herbs and shrubs.
Fuel Models	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
Group Selection	A stand management method in which silviculturists identify groups of trees which need to be removed from a stand of trees in order to meet management objectives.
Habitat Modification	Habitat Downgraded: Refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat; Habitat Removed: Refers to silvicultural activities that 1) Alter spotted owl suitable habitat such that it no longer supports nesting, roosting, foraging, and dispersal (i.e., suitable habitat becomes non-habitat after treatment) or 2) Alter spotted owl dispersal habitat so that the habitat no longer supports dispersal (i.e., dispersal habitat becomes non-habitat after treatment).
Home Range	An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2 miles (radius circle) around a known or predicted owl site (Thomas et al., 1990; USDI et al., 2008).
Hyporheic Flow	Hyporheic flow is the mixing of shallow groundwater and surface beneath and alongside a stream bed.
Incidental Take (ESA)	Take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity.

Individual Tree Selection	A stand management method in which silviculturists identify individual trees that need to be removed from a stand of trees. In this method, specific types, sizes, or qualities of trees are identified for either removing from the stand or remaining in the stand.
Initial Attack	The fire suppression effort that takes place as soon as possible following a wildland fire report.
Invasive Weed	Refer to Noxious Weeds.
Known Owl Site	A site that was or is occupied by a pair or resident single as defined by the survey protocol (1990-2012). The specific site location is determined by the unit biologist based on the best and/or most recent information.
Ladder Fuels	Fuels that provide vertical continuity between the ground and tree crowns which create a pathway for a surface fire to move into the overstory tree crowns.
Local Road	A forest road that connects terminal facilities with forest collector, forest arterial or public highways. Usually forest local roads are single purpose transportation facilities. (FSH 7709.54, no longer in print)
Macrophyte	A macrophyte is an aquatic plant that grows in or near water and is emergent, submergent, or floating. In lakes and streams macrophytes provide cover for fish and substrate for aquatic invertebrates, produce oxygen, and act as food for some fish and wildlife.
Mechanical Thinning	Reducing the number of trees in a stand using a factor which is independent of tree quality. The use of spacing for thinning is one type of mechanical treatment. For example, the closest tree to the points of a 15-foot by 15-foot grid would be left, regardless of tree quality.
Microbes	A microbe is a microscopic organism, which may be a single cell or multicellular organism. Microbes are very diverse and include all the bacteria and archaea and almost all the protozoa. They also include some members of the fungi, algae, and animals such as rotifers.
Motor Vehicle Use Map (MVUM)	A map reflecting designated roads, trails and areas on an administrative unit or a Ranger District of the National Forest System. (36 CFR 261.2)
Multi-Cohort	A stand with two or more age classes or cohorts.
Nest Patch (or Stand)	300 meters (radius circle) around a known or predicted owl site, where a spotted owl would be likely to select a nest tree. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest.
Net Present Value	Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.
Noxious Weeds (Invasive species)	Non- native plants listed by the State that generally have either economic or ecosystem impacts, or are poisonous to wildlife and/or livestock. They aggressively invade disturbed areas such as fires, road sides, and construction areas.
Obligate Predator	When the word is used as an adjective, obligate means "by necessity" (the antonym is facultative) and is used mainly in biology. An obligate predator is an organism whose survival is dependent on a diet consisting of animal flesh. In the case of aquatic insects these organisms would primarily eat other insects.
Off-Highway Vehicle (OHV)	Describes all those vehicles designed for off-highway use and which are classified as one of four classes of ATV in Oregon. (OHV Guide, 2014)
Particulate Matter	Known as particle pollution or PM, is a microscopic complex mixture of extremely small particles and liquid droplets and contains a "number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). Fine particles, such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller (EPA website)

Percentile Weather	The weather conditions that can be expected of X% of the days during a fire season. The standard percent is Low (0%-15%), Moderate (16%-89%), High (90%-96%) and Extreme (97%+). For example, low percentile weather is the average suite of weather conditions that would occur less than 15% of the time.
Periphyton	Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in most aquatic ecosystems. It serves as an important food source for invertebrates, tadpoles, and some fish.
Phytophagous	Feeding on plant material. This term is typically used when referring to insects.
Predicted Owl Site	An area able to support resident spotted owls (i.e., a potential breeding pair) as determined by the USDI et al. (2008) northern spotted owl occupancy template. This is used for determining effects to spotted owls where survey data are insufficient.
Prescribed Fire Burn Plan	A plan required for each fire application ignited by management. Plans are documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire will be conducted (a prescription). Plan content varies among the agencies.
Prescribed Fire	Fire which is planned and used as a tool to meet specific management objectives.
Primitive Unconfined Recreation	From the Wilderness Act of 1964 and which describes the concept of freely accessed recreational opportunities with minimal interruption to such activity either physically, socially or due to administrative actions implemented by a land management agency such as seasonal closures, group size restrictions, fees, permitting systems or other restrictions.
Probability of Ignition (POI)	The chance that a firebrand will cause an ignition when it lands on receptive fuels.
Problem Fire	Problem fires are wildfires that, because of extreme fire behavior, present a high risk to human safety and loss of forest resources.
Rate of Spread (Fire Behavior)	The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.
Redd	A fish nest made of gravel, consisting of a depression hydraulically dug by a fish for egg deposition (and then filled) and associated gravel mounds.
Remnant trees	Large to giant-diameter trees within younger-aged stands, that lived through past natural fire disturbances, or were retained after logging. Amounts and distribution of remnant trees within younger stands may be highly variable.
Road	A motor vehicle route over 50 inches wide, unless identified and managed as a trail. (36 CFR 212.1)
Road Decommissioning	Activities that result in the stabilization and restoration of unneeded roads to a more natural state. (36 CFR 212.1)
Rotation	A pre-determined time frame in which an even-aged forest stand will reach maturity and be harvested.
Sag Pond	A sag pond is a body of water collected in the lowest parts of a depression formed either near the head scarp of rotational landslides or between two strands of an active strike-slip fault. Hidden Lake sits on a deep seated earthflow and is technically a sag pond.
Salvage	Activity, usually removal or chipping, of material killed by a disturbance event such as insects, fire, wind, etc. Where possible, this material is used as some form of forest product of commercial value, such as firewood, pulp, and/or chips.

Seral Stages	Seral stage describes the phase of development of a plant community. Early seral species are those species you would expect to find on a site soon after a major disturbance, like fire. These are species such as pines, Douglas- fir, snowbrush, fireweed, etc. They are generally shade intolerant species. Late seral are the species that can come in under a fully developed vegetative canopy, such as true firs, prince's pine, lichens, etc.
Silviculture	The theory and practice of directing forest establishment, composition, and growth for the production of forest resources to meet specific management objectives. The word is derived from the Latin word <i>silva</i> , which means "forest" and from <i>cultura</i> , which means "to develop and care for." So, it is the development and caring for the forest.
Silviculturist	One, who plans, assists in and supervises the implementation of silviculture projects. The Silviculturist determines (prescribes) the vegetative treatments necessary to meet the objectives for vegetation on a given site.
Site	A specific location where management activity is considered, planned, or operating.
Site Potential	The specific ability of a site to grow vegetation. It includes the soil, topographic, and climatic conditions that determine the resources available for growing vegetation.
Site Preparation	The removing or rearranging of vegetation or woody debris to meet specific management objectives. Most often it is used to describe the process(es) used to expose mineral soil areas suitable for planting or seeding desirable species of plants.
Slash	Debris resulting from such natural events as wind, fire, or snow breakage; or such human activities as road construction, logging, pruning, thinning, or brush cutting. It includes logs, chunks, bark, branches, stumps, and broken understory trees or brush.
Smoke Sensitive Receptor Areas (SSRA)	Area in which smoke from outside sources is intolerable, for reasons such as heavy population, existing air pollution, or intensive recreation or tourist use.
Soundscape	Geographic region as defined by the audible sounds associated within it.
Spatial Heterogeneity	A property generally ascribed to a landscape or to a population. It refers to the uneven distribution of various concentrations of each species or habitats within an area. A landscape with spatial heterogeneity has a mix of concentrations of multiple species, either plants or animals.
Spotted Owl Suitable Habitat	Consists of forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90%); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly.
Spotted Owl Foraging Habitat	Generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS, 2011c, p. A-10).
Spotted Owl Dispersal Habitat	At a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS, 2011c, p. A-10). It consists of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40% and conifer trees greater than or equal to 11 inches average dbh with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (in which case it would be classified as suitable habitat). Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. However, in this document, dispersal habitat generally refers to stands that are 40-79 years old.

Stand	A group of trees of similar canopy structure, species composition, and/or size growing on a continuous area. A stand is distinct from neighboring stands in structure, growing conditions, or management objectives. Stand age for this project is averaged and based on trees of commercial size which is seven inch DBH and greater.
Stand Density Index (SDI)	A relative density measure based on the relationship between mean tree size and number of trees per unit area in a stand (Reineke, 1933).
Stand Dynamics	The changes in forest stand structure with time, including stand behavior during and after disturbances (Oliver, 1996).
Stand Structure	The physical and temporal distribution of trees and other plants in a stand (Oliver, 1996).
Stratum	A distinct layer of vegetation within a forest community; canopy layer.
Stream Classes	Class 1 and 2 = perennial fish bearing streams; Class 3 = perennial non-fish bearing streams; Class 4 = intermittent, seasonally flowing streams.
Suppression	All the work of extinguishing or confining a fire beginning with its discovery.
“Take” of ESA listed species	Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.
Thinning	Any cutting or removal of vegetation (trees, brush, etc.) resulting in a reduction of competition for water, light, and/or nutrients between individual plants. Commercial thinning refers to removing material that has an established dollar value on the open market and can be sold with at least a minimal net value sufficient to pay for the thinning activity.
Torching	The burning of the foliage of a single tree or a small group of trees, from the bottom up. Also, single tree torching is one tree and group torching is more than one tree often a patch of multiple trees torching.
Treatment	A term used to broadly refer to the management actions made to meet management objectives. It may include thinning, cutting of undesirable trees, prescribed fire, salvage, or any manipulation of the vegetative conditions. In addition, intentionally excluding a portion of a stand from harvest is a management action, or treatment.
Trees per Acre (TPA)	The number of trees on an acre of land.
Underburn	Using prescribed fire under the canopy of an existing stand of trees.
Undesirable Species	Any species of plant or animal which is NOT considered to be compatible with meeting management goals and objectives.
Vegetation Recovery	Period of time that allows for sufficient re-growth in harvested areas to make evidence of harvest activity largely unnoticeable to the casual observer.
Woody Debris	Dead pieces of woody vegetation such as stems, limbs, or leaves which are on a site.

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