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Flat Country Project

Draft Environmental Impact Statement

McKenzie River Ranger District, Willamette National Forest
Lane and Linn Counties, Oregon

Legal description for proposed units in Lane County; T.15S., R.6E., Sections 24, 25 & 36; T.15S., R.7E., Sections 19 through 22, 27 through 34; T.16S., R.6E., Sections 1, 11, 12, 13 & 14 T.16S., R.7E., Sections 1 through 11, 14 through 19; Willamette Meridian.

Legal description for proposed units in Linn County; T.14S., R.7E., Sections 33 & 34; T.15S., R.6E., Section 12 & 13; T.15S., R.7E., Sections 3 through 7, 15 through 18; Willamette Meridian.

Draft Environmental Impact Statement

Flat Country Project

Willamette National Forest

Lane and Linn Counties, Oregon

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Abstract: This Draft Environmental Impact Statement (DEIS) for the Flat Country Project contains the McKenzie River Ranger District's proposal to provide a sustainable supply of timber products, increase vegetative habitat complexity and hardwood composition along streams, actively manage stands to improve stand conditions (in terms of density, diversity, and structure), and sustainably manage the network of roads in the project area on 4,438 acres. The proposed project is located in the Willamette National Forest off Highway 126, east of the town of Blue River, Oregon. Three alternatives were analyzed in this DEIS; a no action alternative (Alternative 1) and two action alternatives (Alternatives 2 and 3). Alternative 2 proposes 4,438 acres of timber harvest treatments (including skips) and Alternative 3 proposes 1,302 acres of timber harvest treatments (including skips). Alternatives 2 and 3 both propose 2,305 acres of roadside hazardous fuels reduction treatment and 15 miles of road decommissioning. Alternative 2 also proposes 150 acres of meadow enhancement. Alternative 2 is the Forest Service's preferred alternative.

Reader's Guide

The Forest Service has prepared this Draft Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Draft 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.* Alternatives: 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 Final 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 McKenzie River Ranger District Office on the Willamette National Forest.

List of Acronyms

ACS.................Aquatic Conservation Strategy
ARP.................Aggregate Recovery Percentage
BE ....Biological Evaluation
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
DBH ....Diameter at Breast Height (4.5 feet above ground)
FEIS ....Final 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
DEIS................Draft Environmental Impact Statement
FL....................Flame Length
FM...................Fuel Model
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
GPS ....Global Positioning System
HUC ....Hydrologic Unit Code
IRA..................Inventoried Roadless Area
LAA ....Likely to Adversely Affect
LIDAR………..Light Detection and Ranging
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
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
NRHP...............National Register of Historic Places
NRIS ....Natural Resource Information System
NSO ....Northern Spotted Owl
NWFP ....Northwest Forest Plan
ODF ....Oregon Department of Forestry
OFRI ....Oregon Forest Resources Institute
OHV.................Off-Highway Vehicle
PETS ....Proposed Endangered Threatened and Sensitive species
PNW................Pacific Northwest
Q100.................100 Year Flood Flows
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
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 Objectives
WCS.................West Cascades South
WEPP...............Watershed Erosion Prediction Project model
WMU ....Wildlife Management Unit

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Summary

The McKenzie River Ranger District is proposing to provide a sustainable supply of timber products, increase vegetative habitat complexity and hardwood composition along streams, actively manage stands to improve stand conditions (in terms of density, diversity, and structure), and sustainably manage the network of roads on 4,438 acres in the Willamette National Forest. The proposed project is located off Highway 126, east of the town of Blue River, Oregon.

Purpose and Need

Provide a Sustainable Supply of Timber Products

The proposed project is needed to ensure the Willamette National Forest continues to provide a reliable supply of timber products and in doing so contributes to the stability of local, regional, and national economies and contributes to the annual Probable Sale Quantity (PSQ) target of the Forest. The proposed project would yield approximately 102 million board feet of timber products.

Actively Manage Stands to Improve Stand Conditions in Terms of Density, Diversity, and Structure

The proposed project is needed to improve stand conditions in terms of diversity, density, and structure, while providing benefits to vegetation, wildlife, and overall health of the forest.

Increase Vegetative Habitat Complexity and Hardwood Composition along Streams

Treatment of stands in some Riparian Reserves would accelerate the ability of the Riparian Reserves to meet Aquatic Conservation Strategy (ACS) Objectives and provide adequate ecological health across the watershed and aquatic ecosystems contained within them. The desired condition includes large conifers, complex habitat structure representative of that which would result from natural disturbance patterns, diverse species composition, snags and large wood on the forest floor, and future large wood for streams.

Sustainably Manage the Network of Roads in the Project area

The proposed project would manage our road system by identifying the minimum roads needed to meet resource and other management objectives adopted in the relevant land and resource management plan, to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, and to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance (36 CFR part 212, Subpart A).

Proposed Actions

The proposed harvest treatments include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Riparian Reserve treatments include: thinning, fall-and-leave gaps, and fall-and-leave instream wood. Meadow enhancement would include removal of trees, followed by pile burning. Post-harvest fuel treatments would include pile burning and post-harvest underburning. Roadside fuel breaks would include removal of small trees and pruning with subsequent pile burning. Transportation related activities would include temporary road construction, road maintenance, road decommissioning, and road storage.

Alternatives

The three alternatives that were analyzed in this DEIS were a no action alternative (Alternative 1) and two action alternatives (Alternatives 2 and 3). The alternatives vary by the amount of treatment and the specific prescriptions to be implemented (Table 1). Alternative 2 is referred to in this document as both the proposed action and preferred alternative.

Table 1. Comparison of Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning Outside Riparian Reserves	Acres	0	1,772	782
Thinning in Riparian Reserves	Acres	0	164	164
Shelterwood with Reserves	Acres	0	961	0
Gaps	Acres	0	323	133
Dominant Tree Release	Acres	0	119	50
Skips Outside Riparian Reserves	Acres	0	426	75
Skips in Riparian Reserves	Acres	0	673	98
Total	**Acres**	**0**	**4,438**	**1,302**
Estimated Gross Volume	**MMBF**	**0**	**~102**	**~14**
Post-Harvest Fuel treatments in Timber Harvest Units				
Pile & Burn (hand treatments)[1, 2]	Acres	0	1,318	811
Post-Harvest Underburn[1, 2]	Acres	0	2,021	318
Roadside Hazardous Fuels Treatments				
Pile & Burn/chip (mechanical and/or hand treatments)	Acres	0	2,305	2,305
Meadow Enhancement Unit (With Commercial Timber Harvest)				
Removal of encroaching small-diameter and commercially-harvestable trees, pile burning, and seeding	Acres	0	49	0
Meadow Habitat Enhancement (No Commercial Timber Harvest)				

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Removal of encroaching small-diameter trees, broadcast burning in selected areas, and seeding	Acres	0	101	0
Road Activities Associated with Harvest				
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	15.5	6.7
Roads Maintained	Miles	0	108.2	56.2
Road Decommissioning	Miles	0	15	15
Road Storage	Miles	0	4.7	4.7
Rock obtained from expanding existing quarries	Cubic Yards	0	20,000	20,000
Stream Culvert Replacement	Number	0	66	40
Acres by Harvest System				
Helicopter Harvest	Acres	0	17	7
Skyline Harvest	Acres	0	1,553	487
Ground-based Harvest	Acres	0	1,769	635
Harvest Associated Planting, Snags, and Downed Wood				
Planting in Regeneration Harvest	Acres	0	961	0
Planting in Gaps	Acres	0	151	62
Natural Regeneration in Gaps	Acres	0	172	71
Snag and Downed Wood Creation	Snags per acre and linear feet of large downed wood of decay classes I-II	0	Retain or create 1 to 4 snags per acre and at least 240 linear feet of downed wood on approximately 3,147 acres of harvest as mitigation, and 1,227 acres of snags and 1,300 acres of downed wood as enhancement	Retain or create up to 4 snags per acre and at least 240 linear feet of downed wood on approximately 1,227 acres for snags and 1,300 acres for downed wood as enhancement.
Subsoiling to Reduce Compaction				

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Subsoiling in Plantations	Acres	0	136	136
Gap and Fall-and-Leave Treatments in Riparian Reserves				
¼ Acre Gaps within Riparian Reserves in Secondary Shade Zone (Total)[1]	Acres	0	0.5	0
Fall-and-Leave to Add Wood to Stream Channels	Miles	0	5	0

1 - These acres are already accounted for in the above table under "Timber Harvest Treatments" and therefore are not included in the total.

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

Summary of Environmental Consequences

Table 2. Summary of Environmental Consequences

Resource	Alternative 1	Alternative 2	Alternative 3
Forest and Stand Structure	Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees harvested in the future would be reduced due to continued decline in diameter growth.	3,339 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth. Stands range in age from 29 years to 150 years.	1,129 acres treated to: reduce competition, increase tree growth and vigor, reduce mortality and risk of insect and disease attacks, and lower risk for stand replacing fires. Reduced densities would increase opportunities for regeneration of shade intolerant species such as Douglas-fir, sugar pine, and western white pine. The product value of trees in the future would increase with increased diameter growth. Stands range in age from 29 years to 80 years.
Fire and Fuels	No reduction in roadside fuels	Reduction of harvest created slash ≤3 inches diameter. This would improve firefighter and public safety during future wildfires, prepare units for planting, help to create snags, increase vegetation diversity to the project area and a secondary benefit of returning the natural	Same as alternative 2

Resource	Alternative 1	Alternative 2	Alternative 3
		disturbance process of fire. Roadside hazardous fuels treatments would help buffer wildfires in the wilderness.	
Soil Productivity	No effect	Nutrient availability and compaction would mitigated or enhanced to be within the standard and guidelines of the Forest Plan.	Same as alternative 2, on fewer acres.
Water Quality	Increased probability of road failures and chronic sedimentation from deferred road maintenance and reconstruction.	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, on fewer acres.
Rare Plants	No effect	No effect	No effect
Rare Fungi	No effect	Commercial harvest, broadcast burning, gaps, and regeneration harvest may negatively impact fungi propagation.	Same as alternative 2, on fewer acres.
Special Habitats	Habitat suitability for the pocket gopher (great gray owl prey) would decrease, which would reduce foraging opportunities for great gray owls.	Up to 150 acres of meadow habitat would be enhanced through the Bunchgrass meadow treatments. Bunchgrass meadow would be surveyed to protocol for great gray owl in compliance with Survey & Manage requirement in the Northwest Forest Plan.	Habitat suitability for the pocket gopher (great gray owl prey) would decrease, which would reduce foraging opportunities for great gray owls.
Invasive Plants	No effect	High risk of introduction and spread of non-native invasive plants.	Same as alternative 2, on fewer acres.
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 eventually result in unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage	Would reverse declining road conditions on an estimated 109 miles of road. Would reduce the open road density by 13.2 miles leaving stored and decommissioned roads in a hydrologically stable condition reducing the miles of road maintenance and reducing the risk of sediment delivery.	Would reverse declining road conditions on an estimated 57 miles of road. Would reduce the open road density by 2.9 miles leaving stored and decommissioned roads in a hydrologically stable condition reducing the miles of road maintenance and reducing the risk of sediment delivery.

Resource	Alternative 1	Alternative 2	Alternative 3
	associated with localized erosion.		
Air Quality	No effect	Effects on air quality from smoke emissions would not exceed state mandated policy.	Same as alternative 2
Heritage	No effect	Potential direct effects to potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey.	Same as alternative 2, on fewer acres.
Recreation	No effect. Potential benefits to scenic driving and dispersed camping due to improved road quality, opening closed roads and the replacement of the bridge on Forest Service Road 1980-204 would not occur.	Some indirect effects to developed and dispersed recreation sites and trails such as temporary increases in noise, dust and minor road delays may occur. Direct effects to trails would include loss of access to portions of trails during harvest activities and short term evidence of harvest activities adjacent to approximately 0.5 miles of trails within the project area. No direct effects to developed sites or inventoried dispersed campsites would occur.	Same as alternative 2, on fewer acres.
Economics	No contribution to the local economy, forest sector jobs, or the National Forest Fund (NFF) would result. If not replaced by another project, Alternative 1 could contribute to a continued decline in forestry and milling related jobs.	Approximately 102 million board feet of timber would be produced though these activities. This contributes to the local economy by providing forest sector jobs. It also contributes to the local economy via timber revenue through the National Forest Fund (NFF), and would result in revenue to county governments. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirectly related jobs and increased tax revenue to the government from those jobs.	Approximately 14 million board feet of timber would be produced though these activities. This contributes to the local economy by providing forest sector jobs. It also contributes to the local economy via timber revenue through the National Forest Fund (NFF), and would result in revenue to county governments. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirectly related jobs and increased tax revenue to the government from those jobs.

Resource	Alternative 1	Alternative 2	Alternative 3
Inventoried Roadless Area	Potential to lose or degrade meadow habitat over time.	Up to 150 acres of meadow enhancement within the Mount Washington West IRA.	Potential to lose or degrade meadow habitat over time.
Wilderness	No effect	Temporary deterioration of air quality (within state mandated limits) and noise during haul and harvest activity in units in close proximity to wilderness.	Same as alternative 2, on fewer acres.
Northern Spotted Owl **(Threatened and Management Indicator Species)**	No effect	Likely to Adversely Affect due to suitable habitat removal and downgrade on 3,068 acres of suitable habitat. Not Likely to Adversely Affect due to thinning of 333 acres of dispersal habitat, and removal of 99 acres of dispersal habitat. Not Likely to Adversely Affect due to noise disturbance. Roadside hazardous fuels treatments on up to 841 acres of suitable and 255 acres of dispersal habitat.	Likely to Adversely Affect due to downgrade of 75 acres of foraging habitat. Not Likely to Adversely Affect due to thinning of 274 acres of dispersal habitat. Not Likely to Adversely Affect due to noise disturbance. Roadside hazardous fuels treatments on up to 841 acres of suitable and 255 acres of dispersal habitat.
Northern Spotted Owl **(Critical Habitat)**	No effect	May Affect, Likely to Adversely Affect due to removal of 399 acres and downgrading of 496 acres of suitable habitat in Critical Habitat. May Affect, Not Likely to Adversely Affect due to thinning of 94 acres and removal of 71 acres of dispersal habitat in Critical Habitat. Roadside hazardous fuels treatments on up to 15 acres of suitable habitat in Critical Habitat.	May Affect, Not likely to Adversely Affect due to thinning of 33 acres and removal of 71 acres of dispersal habitat in Critical Habitat. Roadside hazardous fuels treatments on up to 15 acres of suitable habitat in Critical Habitat.
Bufflehead **(R6 Sensitive Species)**	No impact	No impact because no large potential nesting snags near lakes would be removed with the roadside hazardous fuels treatments at Melakwa and Scott Lakes	Same as alternative 2, on fewer acres.
American Peregrine Falcon **(R6 Sensitive and Management Indicator Species)**	No impact	No impact with seasonal restrictions applied	No impact with seasonal restrictions applied

Resource	Alternative 1	Alternative 2	Alternative 3
Northern Waterthrush **(R6 Sensitive Species)**	No impact	No impact due to no modifications to potential riparian nesting habitat. This species has not been documented on the McKenzie River Ranger District.	Same as alternative 2, on fewer acres.
Fisher **(ESA Proposed Threatened and R6 Sensitive)**	No Effect	No short-term effect with potential long-term beneficial impact. Fishers are unlikely to occur in the project area and the scale of the project, which would impact 5-24 percent of 4 hypothetical female home ranges, would not preclude them from reestablishing in the watershed, and effects to this species are unlikely to occur. In the long-term, potential Pacific Fisher habitat quality may benefit from year-round road closures, road storage and decommissioning, and possible large downed wood enhancement.	No short-term effect with potential long-term beneficial impact. No impact to stands over 80 years of age and thus, no high quality fisher habitat would be modified. In the long-term, potential Pacific Fisher habitat quality may benefit from year-round road closures, road storage and decommissioning, and possible large downed wood enhancement. Impacts somewhat reduced compared to Alt. 2.
Fringed Myotis and Townsend's Big-eared Bat **(R6 Sensitive)**	No impact	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing.	No Impact
Johnson's Hairstreak **(R6 Sensitive)**	No impact	May adversely impact individuals, but would not result in a loss of viability in the project area, nor cause a trend toward federal listing. Only a very small amount of western hemlock habitat would be affected by project activities and the proposed treatment areas currently have no identified dwarf mistletoe.	No Impact
Crater Lake Tightcoil **(R6 Sensitive and Survey and Manage Species)**	No impact	No impact because all suitable habitat would be protected with a minimum 30' no-harvest and no-burn buffer.	Same as alternative 2, on fewer acres.

Resource	Alternative 1	Alternative 2	Alternative 3
Western Bumble Bee and Mardon Skipper (R6 Sensitive)	No impact	Beneficial impact due to 150 acre Bunchgrass meadow enhancement treatment. Potential benefit with 324 acres of gap creation and 961 acres of shelterwood treatments	Potential beneficial impact due to 133 acres of gap treatments
Sierra Nevada Red Fox (R6 Sensitive)	No impact	Benefits may occur in potential habitat above 4,000 feet due to increased stand diversity which would benefit the Sierra Nevada Red Fox and its prey. Roadside hazardous fuels treatments have both positive and negative impacts by reducing habitat quality in treated areas from understory cutting and burning, while reducing the risk of stand-replacing fires.	Same as alternative 2, on fewer acres.
Oregon Megomphix (Survey and Manage Species)	No impact	May impact suitable habitat due to harvesting on about 4,586 acres. Additional shorter-term impacts on 2,035 acres due to understory removal with roadside hazardous fuels treatments.	May impact suitable habitat due to harvesting on about 1,301 acres. Additional shorter-term impacts on 2,035 acres due to understory removal with roadside hazardous fuels treatments.
Red Tree Vole (Survey and Manage Species)	No impact	Would remove or thin about 1,935 acres of higher quality habitat in stands over 80 years of age. May impact about 2,838 acres of lower quality habitat. No impact to documented nest areas.	No impact to higher quality habitat. May impact about 1,278 acres of lower quality habitat.
Great Gray Owl (Survey and Manage Species)	No impact	May impact suitable nesting habitat. Harvest treatments would enhance foraging habitat, including about 150 acres of high quality meadow habitat, and create an additional 1,283 acres of open habitat in gaps and shelterwoods.	No impact to suitable nesting habitat. Harvest treatments would create about 183 acres of open foraging habitat in gaps and shelterwoods.

Resource	Alternative 1	Alternative 2	Alternative 3
Cavity Excavators **(Management Indicator Species)**	No impact	Snag abundance may initially decline on 3,051 acres but may increase with post-harvest snag mitigation, replacement, and enhancement. However, in the long term, thinning would lead to a loss of snags.	Snag abundance may initially decline on 75 acres but may increase with post-harvest snag enhancement. However, in the long term, thinning wouldlead to a loss of snags.
Elk and Deer **(Management Indicator Species)**	Continued decrease in forage quantity and quality over time. Elk would not benefit from increased forage and lower road densities.	Regeneration shelterwood harvest and small gaps should increase elk forage quality from “poor” to “higher-marginal” for about 20 years on approximately 1,283 acres. Meadow enhancement would improve forage quality from “higher marginal” to “higher” on about 150 acres. Thinning would improve forage on approximately 3,303 acres. Habitat security increased by reduction in open road density to 1.5 miles/square mile	Thinning and small gaps should increase elk forage quality from “poor” to “higher-marginal” for about 20 years on approximately 183 acres. Thinning would improve forage on approximately 1,118 acres. Habitat security increased by reduction in open road density to 1.5 miles/square mile
Pileated Woodpecker **(Management Indicator Species)**	No impact	Approximately 3,136 acres of older forest stands over 80 years would be degraded due to loss of large snags used for nesting and foraging.	No impact to higher quality habitat. Some large snags may still be lost due to roadside hazard tree falling. Some snags on about 1,301 acres of treated stands under 80 years may be lost.
Marten **(Management Indicator Species)**	No impact	Degrades approximately 516 acres of marten habitat in the preferred montane forest habitat type	No impact to higher quality habitat.
Bald Eagle **(Management Indicator Species)**	No impact	No impact	No impact
Northern Goshawk **(Landbirds preferring older forest habitat)**	No impact	Removes or degrades about 3,175 acres of dense canopy cover habitat between 80-149 years of age which has the preferred forest habitat structure	No impact
Purple Finch and Rufous Hummingbird **(Landbirds favoring shrub**	No impact	Potential beneficial impact due to the creation of approximately 1,283 acres	Potential beneficial impact due to the creation of approximately 183 acres of

Resource	Alternative 1	Alternative 2	Alternative 3
habitat in early-seral conifer stands)		of complex early-seral habitat lasting about 20 years and 150 acres of meadow enhancement intended to remain in an open condition in the long term.	complex early-seral habitat lasting about 20 years.
Olive-sided Flycatcher **(Landbirds favoring forest openings with large trees or snags)**	No impact	Potential beneficial impact due to the creation of approximately 1,283 acres of complex early-seral habitat lasting about 20 years and snag mitigation or enhancement at the rate of up to 4 snags per acre.	Potential beneficial impact due to the creation of approximately 183 acres of complex early-seral habitat lasting about 20 years and snag mitigation or enhancement at the rate of up to 5 snags per acre.
Upper Willamette River Chinook Salmon **(Evolutionarily Significant Unit)**	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to thinning within the Riparian Reserve along Scott Creek and Lost Creek. This is due to an increase in sediment delivery to streams associated with timber haul and road maintenance during the implementation of project activities.	Same as alternative 2, on fewer acres.
Upper Willamette River Chinook Salmon **(Critical Habitat)**	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to thinning within the Riparian Reserve along Scott Creek and Lost Creek. This is due to an increase in sediment delivery to streams associated with timber haul and road maintenance during the implementation of project activities.	Same as alternative 2, on fewer acres.
Upper Willamette River Chinook Salmon **(Essential Habitat)**	No effect	Adverse Affect. This effects determination is due to thinning within the Riparian Reserve along Scott Creek and Lost Creek. This is due to an increase in sediment delivery to streams associated with timber haul and road maintenance during the implementation of project activities.	Same as alternative 2, on fewer acres.

Resource	Alternative 1	Alternative 2	Alternative 3
Bull Trout **(Distinct Population Segment)**	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to the potential for sediment delivery to Anderson Creek from timber haul and maintenance activities on the 2657830 road.	Same as alternative 2, on fewer acres.
Bull Trout **(Critical Habitat)**	No effect	May Affect, Likely to Adversely Affect. This effects determination is due to the potential for sediment delivery to Anderson Creek from timber haul and maintenance activities on the 2657830 road.	Same as alternative 2, on fewer acres.
Rhyacophila chandleri & Rhyacophila leechi **(Caddisflies)**	No impact	May adversely impact individuals, but not likely to result in a loss of viability in the Flat Country Planning Area, nor cause a trend toward federal listing. This effects determination is due to the potential impacts on individuals by fall-and-leave treatments in unit 1590.	Same as alternative 2, on fewer acres.
Fluminicola virens **(Freshwater snail)**	No impact	No impact. *Fluminicola virens* is a freshwater snail that has not been documented on the McKenzie River Ranger District but has been documented on other ranger districts on the Willamette National Forest. Because it has not been documented on the ranger district no further analysis would take place. However, the Riparian Reserve strategy and PDFs would protect habitat for these species should they occur in the project area.	Same as alternative 2, on fewer acres.
Pacific lamprey	No impact	No impact. Pacific lamprey have been documented on the ranger district (South Fork McKenzie River below Cougar Dam), but have not been documented as far upstream as the Flat Country project area.	Same as alternative 2, on fewer acres.

Chapter 1 – Purpose and Need

1.1 Introduction

The McKenzie River Ranger District is proposing to provide a sustainable supply of timber products, actively manage stands to improve stand conditions, increase vegetative habitat complexity and hardwood composition along streams, and sustainably manage the network of roads in the project area on 4,438 acres in the Willamette National Forest.

The project area encompasses 74,063 acres of Forest Service land, east of Highway 126 near the community of McKenzie Bridge, Oregon (Figures 1 and 2). The Flat Country Project is located on the western slope of the Cascades, extending from Scott Mountain to the upper reach of the McKenzie River. Locally, this area is commonly known as the "Flat Country." The Flat Country Project is located within the Boulder, Kink, White Branch, and Lost Creek subwatersheds (6th field) of the Upper McKenzie River watershed. The project area is bounded on the west by Highway 126, on the south by Highway 242 and the eastern district boundary through the Mount Washington Wilderness (Figure 1).

Within the project area 74,063 acres are managed by the Willamette National Forest along with the remaining 28 acres managed by private citizens. The project area is composed mostly of a Douglas-fir and western hemlock overstory with an understory shrub component of vine maple, salal, dwarf Oregon grape, sword fern and Pacific rhododendron. There is a transition to the true fir/mountain hemlock zone above approximately 4,000 feet, in the eastern portion of the project area.

Fire has been a dominant disturbance in the project area. Records indicate 194 fires occurred in the Flat Country project area from 1970-2018. However, due to fire suppression, most fires were suppressed at less than five acres within a few days of ignition. Timber harvest, including thinning, partial cut, and regeneration harvest, has been the dominant disturbance in the project area over the last 100 years.

The project area is popular for several recreational activities including hunting, camping, hiking, horseback riding, fishing, bicycling, picnicking, berry picking, and mushroom harvesting. Numerous nearby developed recreation facilities, including campgrounds, day use areas, boat launches and rental cabins, provide a wide array of developed recreation options for visitors. An extensive trail system in the area supports a range of trail-oriented activities including multi-day backpacking trips, day hiking, horseback riding, mountain biking, and access to the Mount Washington Wilderness.

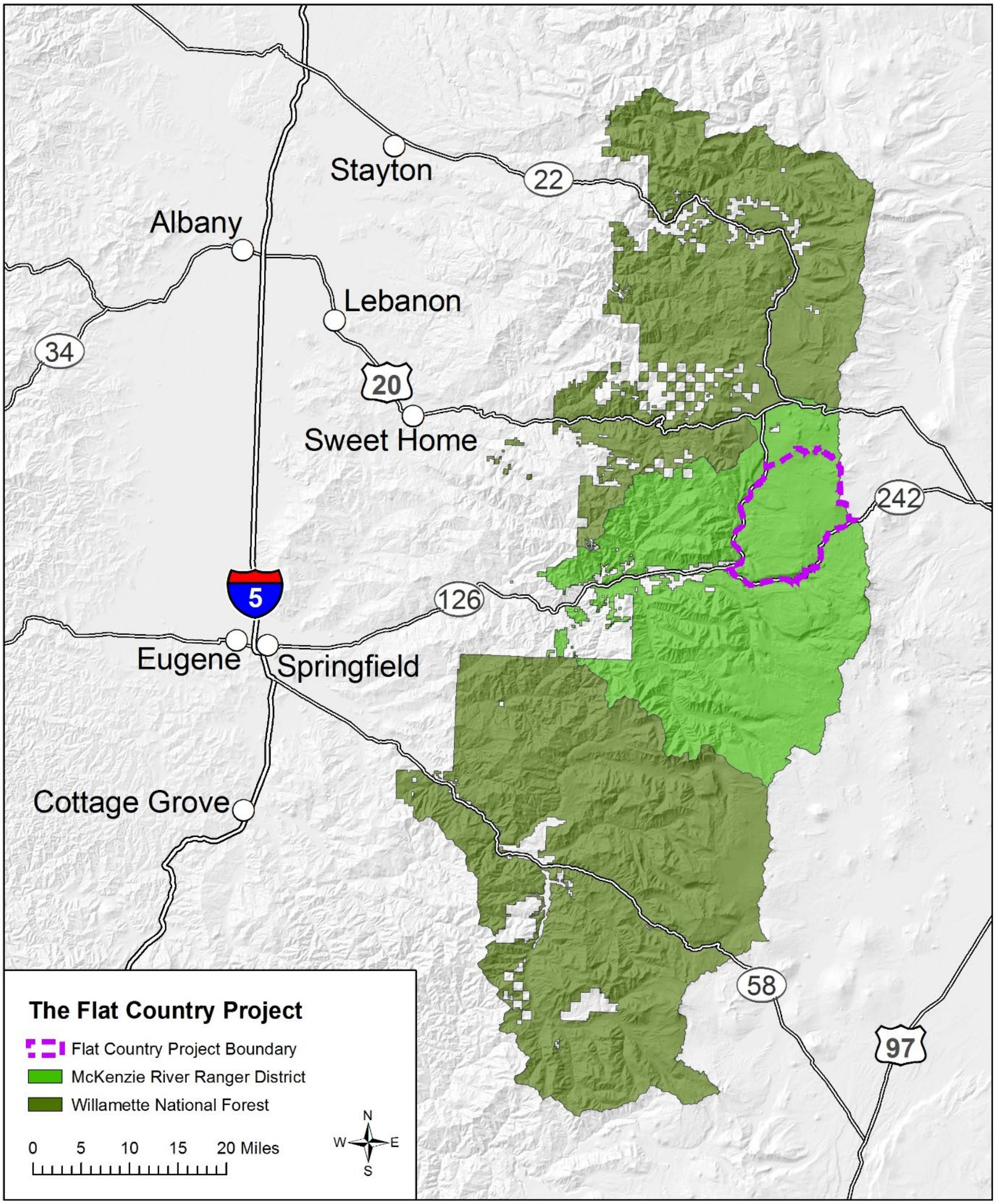

Figure 1. Map of the Flat Country Project Vicinity

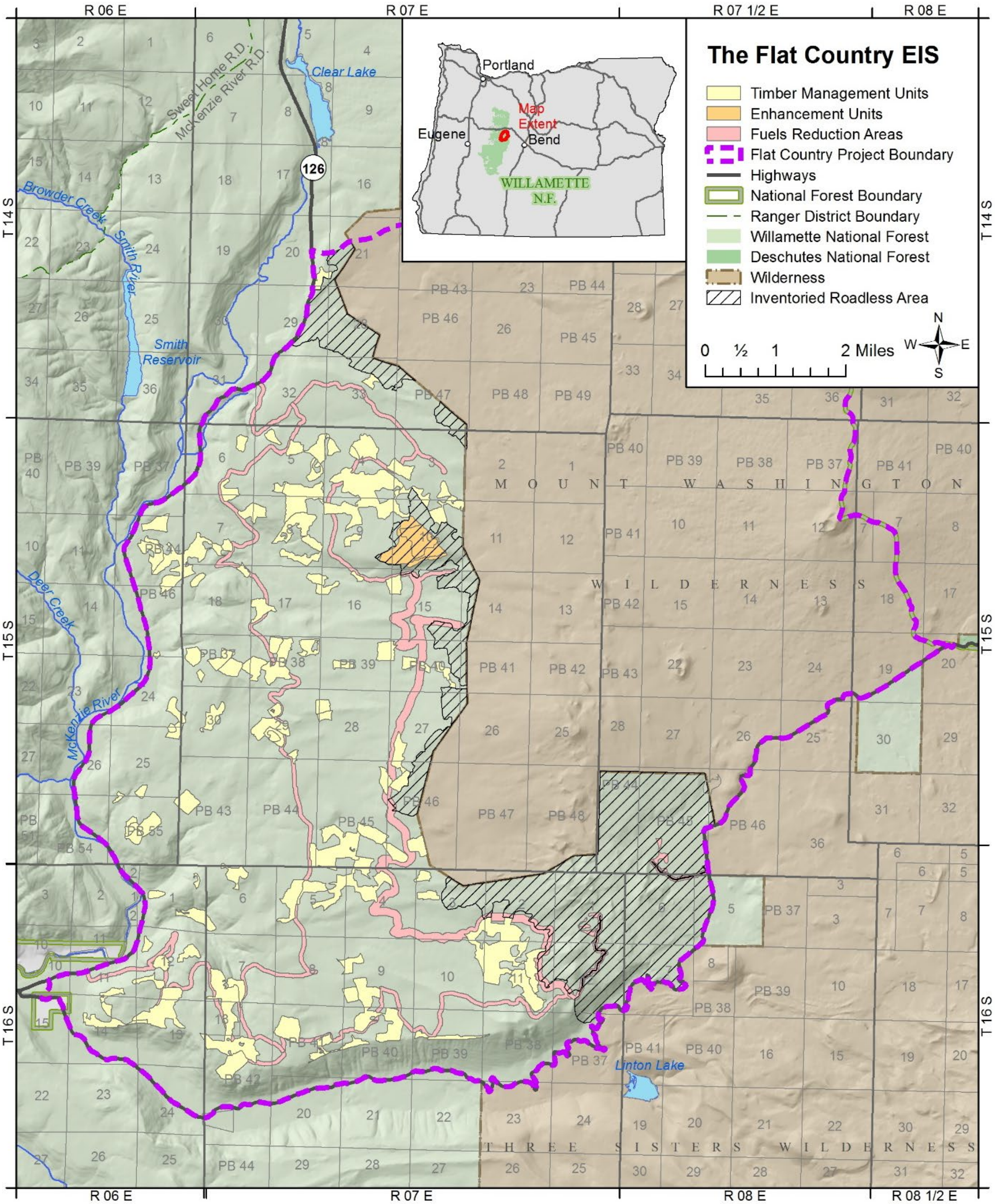

Figure 2. Map of the Flat Country Project Area

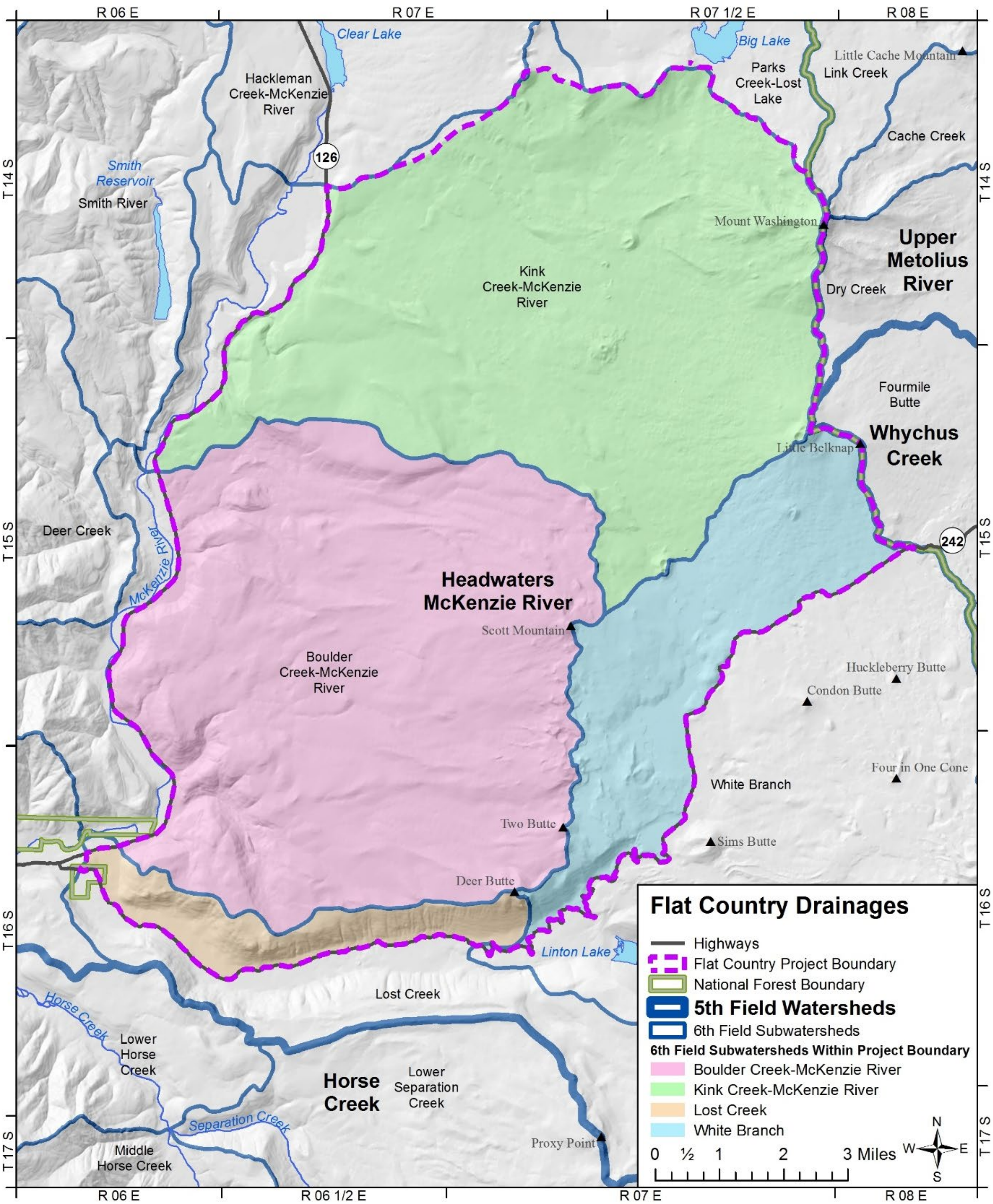

Figure 3. Map of the 6th Field Watersheds within the Flat Country Project Area

1.2 Purpose and Need for the Action

Provide a Sustainable Supply of Timber Products

Why Consider Taking Action: The proposed project is needed to ensure the Willamette National Forest continues to provide a reliable supply of timber products as directed by the laws and guidance outlined below, and in doing so contributes to the stability of local, regional, and national economies as well as the annual Probable Sale Quantity (PSQ) target for the Forest. The majority if the project area and treatment units are within the LRMP General Forest allocation, and Matrix allocation under the Northwest Forest Plan (see Management Direction Section 1.4).

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 as a whole. 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 (USDA Strategic Plan FY 2018-2022). 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.

Existing Condition: The current PSQ annual target for the Willamette National Forest is 111 million board feet (MMBF) as amended by the Approval of PSQ Estimates for Northwest Forest Plan Forests (1998).

Desired Condition: Through implementation of the proposed actions, the McKenzie River Ranger District would contribute approximately 102 MMBF to the Willamette National Forest PSQ target over about a five year period (approximately 25-30 MMBF/year).

Actively Manage Stands to Improve Stand Conditions in Terms of Density, Diversity, and Structure

Why Consider Taking Action: The stands proposed for harvest in the project area are overstocked or showing signs of mortality or reduced growth from competition. Overstocked stands occur when trees are closely spaced, resulting in a competition for resources. Closely spaced trees competing for resources generally result in decreased individual tree growth. Overstocked stands can also cause increased tree/stand stress, resulting in increased susceptibility to insect and disease outbreaks. Additionally, overstocked stands can increase the potential for high severity wildfires.

The proposed project would help improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands would increase growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. Stand vigor would also be increased as released trees develop into larger trees sooner, accelerating the development of some late successional characteristics, which is an emphasis in those stands within Critical Habitat for the northern spotted owl (Table 1). Tree species, age, and structural diversity would be maintained or enhanced.

The Stand Density Index (SDI), which is a quantitative measure of tree competition in a stand, ranges from 196 to 926 and averages 442 for all stands being considered for treatment in the Flat Country project area. In Douglas-fir, the maximum SDI (SDImax) is 595 (Reineke, 1933). As a stand reaches an SDI of about 149, or approximately 25 percent of SDImax, trees in the stand start to compete with each other. As SDI increases to around 357, or 60 percent SDImax, trees reach a point at which they start dying due to competition, or self-thinning (Long, 1985). Additional information about SDI is available under the heading Stand Vigor and Growth located in Section 3.1, Forest and Stand Structure.

Existing Condition: All stands proposed for harvest in the project area are overstocked, or showing signs of reduced growth from competition with an average SDI of 442, or 74 percent of SDImax. This condition is a result of planting densities employed after clearcut harvest in the past and fire suppression.

Desired Condition: Healthy, vigorous stands with an average SDI at or below 207. A level which maximizes individual tree growth before transitioning into maximizing stand growth which starts around an SDI of 208.

Based on the Upper McKenzie Watershed Analysis (McKenzie River Ranger District, 1995), the overall vegetation has shifted from a predominance of early-seral (0-30 yrs.) conditions in the early 1900's to a predominance of mid (31-80 yrs.) to late (>80 yrs.) seral conditions in the present time. This shift corresponds to the era of fire suppression that began in approximately 1910. Diversity at the landscape level is currently decreasing as a result of past timber harvest practices and the exclusion of fire. The natural mosaic pattern created on a landscape when fire is allowed to function naturally is being lost.

Increase Vegetative Habitat Complexity and Hardwood Composition along Streams

Why Consider Taking Action: The proposed project is needed to help restore the vegetative habitat complexity and hardwood composition along streams, while providing secondary benefits to wildlife and fisheries by improving habitat in second-growth stands and previously managed stands.

According to the NW Forest Plan, the Aquatic Conservation Strategy (ACS) "must strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitats. This approach seeks to prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds" (NW Forest Plan, p. B-9).

ACS objective (#8) specifically identifies maintaining and restoring the species composition and structural diversity of plant communities in riparian areas to provide thermal regulation, nutrient filtering, appropriate rates of erosion and channel migration, and to supply coarse woody debris (downed wood) sufficient to sustain physical complexity and stability (NW Forest Plan, p. B-11).

Existing Condition: Past logging practices and fire exclusion have resulted in dense, uniform species stands with few hardwood trees or understory shrubs throughout Riparian Reserves. As a result, these stands have low wildlife habitat complexity and low species diversity.

Desired Condition: The desired condition within Riparian Reserves includes the following: large conifers (NW Forest Plan p. B 31), complex habitat structure representative of that which would result from natural disturbance patterns; diverse species composition; snags and logs on the forest floor (NW Forest Plan, p. B-2); and future large wood for streams. The proposed project would help restore these stands to more desirable and healthy conditions by adding snags and downed wood in and near streams while also increasing the amount of hardwood trees, shrubs and forbs along streams to add both structural diversity and species diversity. Managing for hardwoods would also increase the diversity of the leaf litter in streams, adding to the amount of nutrients available to aquatic insects. The treatments proposed along the streams would increase dynamic fish habitats which are important contributors to thriving populations.

Sustainably Manage the Network of Roads in the Project Area

Why Consider Taking Action: To meet resource and other travel management objectives adopted in the relevant land and resource management plan and the 2015 Willamette National Forest Road Investment Strategy, to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, and to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance (36 CFR part 212, Subpart A).

Existing Condition: A managed road system consisting of more than the minimum roads needed to meet resource and other management objectives adopted in the relevant land and resource management plan. The potential for road failure, increased sedimentation, and unnecessary impacts on wildlife populations exist within the project area.

Desired Condition: A managed road system consisting of the minimum roads needed to meet resource and other management objectives adopted in the relevant land and resource management plan. This would result in a reduced road failure potential, decreased sedimentation, and reduced impacts on wildlife populations within the project area.

1.3 Proposed Actions

Proposed harvest treatments include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Riparian Reserve treatments include: thinning, fall-and-leave gaps, and fall-and-leave instream wood. Meadow enhancement would include removal of trees, followed by pile burning. Post-harvest fuel treatments would include pile and burn and post-harvest underburn. Roadside fuel breaks would include removal of small trees and pruning with subsequent pile burning. Transportation related activities would include temporary road construction, road maintenance, road decommissioning, and road storage.

A detailed description of the actions proposed under each alternatives are included in Chapter 2. A detailed description of proposed treatments and project activities is located in Appendix B.

1.4 Forest Plan and Management Direction

This Draft Environmental Impact Statement 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” and “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 Robinson-Scott Landscape Management Project Final Environmental Impact Statement (FEIS) and Record of Decision Record of Decision (ROD) (USDA Forest Service 1997).

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 illustrates the Forest Plan and Northwest Forest Plan management areas. Table 3 displays the Forest Plan management areas, Northwest Forest Plan land management areas and Inventoried roadless areas that exist in the project area, and the number of acres for the preferred alternative.

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

Forest Plan

Wildlife Habitat-Special Areas (9d) consists of areas allocated for 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.

Dispersed recreation (10e) consists of areas that have the objective to provide a broad spectrum of recreational activities. This area would provide users with a sense of solitude while providing conservation of unique biological values.

Scenic-Partial Retention Middleground (11c) consists of areas that have the objective to **c**reate 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. These goals would not be completely subordinate to the natural landscape and could be evident to the casual forest visitor.

Scenic Retention Foreground (11f) consists of areas that have the objective to **c**reate 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-Matrix Lands (MA 14a) consist of areas outside of other NWFP 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.

Northwest Forest Plan

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.

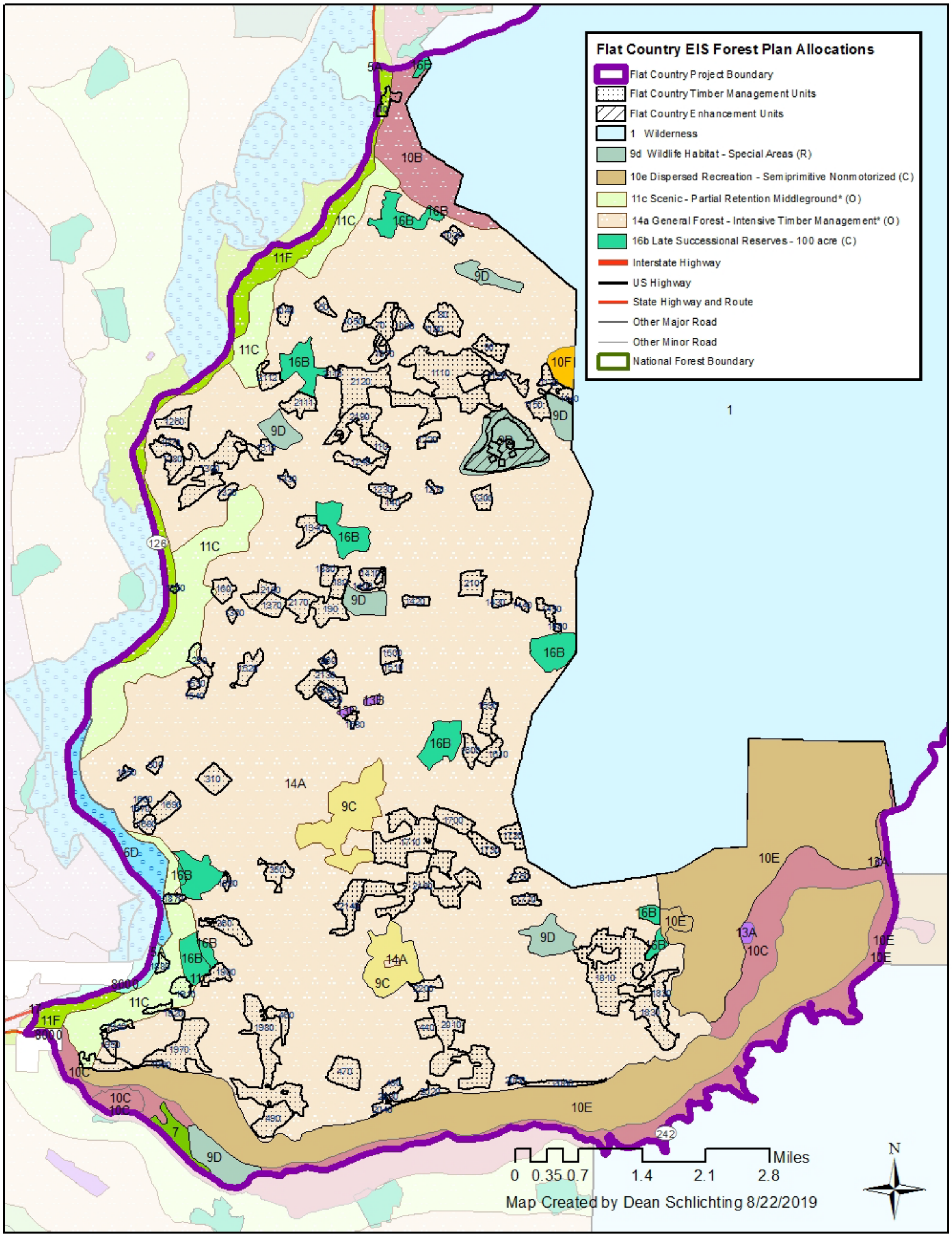

Figure 4. Map of Forest Plan and Northwest Forest Plan Management Allocations

Table 3. Management Allocations in the Flat Country Project Area

Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres in Project Area	Acres of treatment	Acres of Fuel break treatments
Wilderness (1)		36,214	0	0
Special Interest Areas (5A)	Matrix (14)	46	0	0
Wild and Scenic River - McKenzie River (6D)		351	0	0
Old-Growth Groves (7)		72	0	0
Marten Habitat Area (9C)		560	0	25
Special Habitat Areas (9D)		815	149	34
Dispersed Recreation-Semiprimitive Motorized Use with Timber Harvest (10B)		604	9	0
Dispersed Recreation-Semiprimitive Motorized Use with Timber Harvest (10B)	100-acre Late Successional Reserve (16B)	19	0	0
Dispersed Recreation – Semiprimitive Motorized Use, No Timber Harvest (10C)		1,616	0	84
Dispersed Recreation – Semiprimitive Nonmotorized Use, No Timber Harvest (10E)		5,012	0	70
Lakeside Areas - Wildlife Habitat and Recreation (10f)		69	0	0
Scenic Partial Retention Middleground (11C)	Matrix (14)	1,775	102	79
Scenic Partial Retention Middleground (11C)	100-acre Late Successional Reserve (16B)	85	0	23
Scenic Retention Foreground (11F)	Matrix (14)	733	20	14
Special Use Permit Area (13A)		23	0	10
Administrative Use Site (13B)		18	0	1
Max Modification (14A)	Matrix (14)	25,314	4,532	1,948
Max Modification (14A)	100-acre Late Successional Reserve (16B)	709	0	19
Inventoried Roadless Areas (IRA)	Mt. Washington, West and South	6,226	149	1980
Private Land		28	0	0
	Riparian Reserves (15)[1]	10,385	164	0
Total		**74,063**	**5,579**	**2,307**

1 – Riparian Reserves overlay other land allocations and are therefore not included in the Total Land Allocations

1.5 Tribal Consultation

Tribal consultation for the Flat Country project began in April 2017. The McKenzie River Ranger District consulted with the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of Warm Springs. On May 17, 2018 the Tribes received a consultation package that included information about the proposed project location, proposed actions, and the purpose and need for the project. A field trip with the Grand Ronde tribe was held on July 25th 2016. Another field trip was held with the Siletz tribe on September 21st 2016. Additionally the consultation invited the Tribes to provide any comments or concerns regarding the proposed project. No written response was received. In conversations on the field trip, the tribes provided vocal support for the project.

1.6 Public Involvement Efforts

Public involvement efforts during the development of the draft EIS included scoping letters and publication of the project on the Willamette National Forest Schedule of Proposed Actions website. Below is a timeline illustrating public involvement efforts for the Flat Country project:

- May 31st and June 8th 2017: Project presented at public open house meetings at the District and the Walterville firehouse.
- April 2018: Project published in the Willamette National Forest Schedule of Proposed Actions.
- May 22nd 2018: Scoping letter and background information mailed to members of the public, organizations, and state/federal agencies that have expressed interest in receiving information on District projects.
- August 11th 2018: Notice of Intent (NOI) to prepare an EIS published in the Federal Register
- October 4th, 2018: Public field trip to the Flat Country Project. A total of seven members of the public attended.
- August 27th 2019: Field review of Bunchgrass meadow enhancement with Oregon Wild and Charlie Halpern (Bunchgrass meadow research lead).

Members of the public, organizations, and state and federal agencies were invited to provide comments and concerns about the Flat Country project during the public scoping comment period from May 22nd through June 23rd, 2018. The scoping letter and relevant background information was emailed to approximately 350 individuals, including interest groups and organizations, elected officials and other state and federal agencies. A total of four letters were received in response to scoping; refer to section 1.8 Issues Derived from Public Comments to see the main points of these letters. Scoping comments received varied from those that wanted more clarification on proposed activities to specific suggestions for project implementation.

After the responses from scoping, a decision was made by the responsible official to elevate the analysis from an EA to an EIS due to the potential for controversy regarding the scope and scale of the project. On August 11, 2018, a Notice of Intent (NOI) to file an EIS was entered into the federal register. Additional comments were accepted from August 11th to September 10th 2018 and a total of five comment letters were received during this time. Scoping and NOI comments were used to help identify planning issues and develop alternatives and effects analysis for the DEIS.

All correspondence and comments are available in the project record at the McKenzie River Ranger District office, as well as the public reading room online (https://cara.ecosystem-management.org/Public//ReadingRoom?Project=53966).

1.7 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 the following 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, five key issues were identified from comments and questions:

- Key Issue #1: Maximize treatments within planning area
- Key Issue #2: Maintain an intact road system
- Key Issue #3: Refrain from harvesting older stands
- Key Issue #4: Refrain from regeneration harvest
- Key Issue #5: Eliminate all road construction

In response to Key Issue #1, an alternative was considered that would maximize treatment acres and volume by treating all stands reaching culmination, even in Critical Habitat Units (CHUs), as allowed by the Northwest Forest Plan. However, this alternative was eliminated because the Willamette National Forest determined that the purpose and need of the proposed project could be achieved while not regenerating within the CHUs (see section 2.4).

In response to Key Issue #2, the purpose and need includes sustainably managing the network of roads in the project area (see section 1.2). The desired condition is an intact and managed road system consisting of the minimum roads needed to meet resource and other management objectives adopted in the land and resource management plan and the 2015 Willamette National Forest Road Investment Strategy.

In response to Key Issues #3, #4 and #5, Alternative 3 was developed. Alternative 3 eliminates harvest treatments in stands over 80 years of age, eliminates regeneration harvest, and reduces temporary road construction.

Other issues raised included the risks roads and decommissioning pose to aquatic resources, as well as public notification before logging operations for the recreating public. These issues are addressed in the Project Design Features (Table 8) in Chapter 2.

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 treatment acres 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 are irrelevant to the decision being made, are conjectural, are not supported by scientific evidence, and/or are already decided by law, regulation, and other higher level decisions.

1.8 Decision Framework

The Responsible Official for this proposal is the District Ranger of the McKenzie River 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 and which alternative;
- What specific design features are needed;
- What specific project monitoring requirements are needed to ensure design features are implemented and effective; and
- 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; and
- How well the selected alternative responds to analysis issues.

Chapter 2 – Alternatives

This chapter describes and compares the alternatives considered for the Flat Country 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 responsible official.

Three alternatives have been analyzed for this project: Alternative 1 - No-Action; Alternative 2 – Preferred Alternative; and Alternative 3 - No regeneration harvest and no treatment in stands over 80 years old.

2.1 Alternative 1 – No Action

Alternative 1- No-Action assesses the current management situation of the affected environment as well as the future conditions should an action 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 no active land management would be implemented. The result would be no contribution to the sustainable supply of timber products, no active management of stands to improve stand conditions, density, diversity, and structure, no accelerated increase in vegetative habitat complexity and hardwood composition along streams, and no increase in efforts to sustainably manage the network of roads in the project area.

2.2 Alternative 2 – 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 4,438 acres in the project area (Figures 5, 6, and 7). Harvest treatments proposed include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Skips are areas within treatment units that are intentionally left untreated to benefit a resource, and maximize variability. Harvest treatments would yield an estimated gross 102 million board feet of timber. Post-harvest fuel treatments would include pile and burn and post-harvest underburn. Other activities include 150 acres of meadow restoration in the Bunchgrass meadow complex. Additionally there would be 2,305 acres of roadside hazardous fuels treatments. Approximately 15.5 miles of temporary road construction would occur and approximately 108 miles of existing road would be maintained under Alternative 2.

Alternative 2 proposes 150 acres of meadow enhancement in Bunchgrass Meadow. Bunchgrass Meadow is part of the Mount Washington West Inventoried Roadless Area and is identified in the Willamette National Forest Plan as a 9D land allocation. Management goals include protecting or enhancing unique wildlife habitats and botanical sites which are important components of healthy, biologically diverse ecosystems (Willamette National Forest Plan 1990). The Forest Plan 9D land allocation states that no programmed harvest shall be scheduled, however commercial harvests and vegetation treatments are permitted if necessary to meet established wildlife and botanical objectives. All restoration activities would occur without road construction, and harvest systems would be either over snow or by helicopter.

The goal of the Bunchgrass Meadow restoration project is to maintain one of the largest meadows in the Upper McKenzie Watershed, a habitat type that would sustain a broad array of plant and wildlife species. This meadow complex is diverse in terms of vegetative structure. The presence of forbs, grasses and landscape patchiness make this a unique feature to be managed in order to retain it on the landscape. Over time young conifer trees have established, and are encroaching on the meadow converting it to a forested environment. Research on the transition between meadow and forest and resulting changes in the understory has been conducted at Bunchgrass Meadow since 2005 (Halpern et al. 2019 in review). This research included experimental tree removal followed by prescribed burn treatments which showed that burning treatments results in much reduced meadow forb species diversity. Historic research plots, including controls, would be buffered by a minimum of 20 m to maintain site integrity and allow future research to continue.

We propose removing all trees under 30 inches DBH, and retain up to 20 trees per 5 acres above 30 inches DBH in selected treatment areas (49 acres). Priority areas are those that are currently open (101 acres), which contain the most meadow forb species, as well as any connectivity between open areas. For more information please see Botany and Wildlife sections.

Table 4 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 B. A detailed list of treatments for individual units is listed in Appendix C.

Table 4. Summary of Proposed Treatments and Connected Actions – Alternative 2

Proposed Activity	Unit of Measure	Alternative 2	Purpose & Need Addressed*
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1,772	1, 2
Thinning in Riparian Reserves	Acres	164	3
Shelterwood with Reserves	Acres	961	1, 2
Gaps	Acres	323	1, 2, 3
Dominant Tree Release	Acres	119	1, 2
Skips outside Riparian Reserves	Acres	426	2
Skips in Riparian Reserves	Acres	673	2, 3
Total	**Acres**	**4,438**	**1, 2, 3**
Estimated Gross Volume	**MMBF**	**~102**	**1**
Similar Actions			
Vegetation Enhancement Unit with Commercial Timber Harvest			
Removal of encroaching trees both small diameters and commercial harvest, pile burning, and seeding	Acres	49	3
Meadow Habitat Enhancement (No Commercial Timber Harvest)			

Proposed Activity	Unit of Measure	Alternative 2	Purpose & Need Addressed*
Removal of encroaching trees small diameters pile burning, and seeding	Acres	101	3
Connected Actions			
Post-Harvest Fuel Treatments in Timber Harvest Units**			
Pile & Burn (mechanical, and/or hand treatments)	Acres	1,318	3
Post-Harvest Underburn	Acres	2,021	3
Roadside Hazardous Fuels Treatments			
Pile & Burn/chip (mechanical and/or hand treatments)	Acres	2,305	-
Transportation			
New Road Construction	Miles	0	4
Temporary Road Construction	Miles	15.5	4
Roads Maintained	Miles	108.2	4
Road Decommissioning	Miles	15.0	4
Road Storage	Miles	4.7	4
Rock Obtained From Existing Quarries	Cubic Yards	20,000	na
Stream Culvert Replacement	Number	66	4
Harvest System			
Helicopter Harvest	Acres	17	na
Skyline Harvest	Acres	1,553	na
Ground based Harvest	Acres	1,769	na
Harvest Associated Planting, Snags, and Downed wood			
Planting in Regeneration Harvest	Acres	961	2
Planting in Gaps	Acres	151	2
Natural Regeneration in Gaps	Acres	172	2
Snag and Downed wood Creation	Snags per acre and linear feet of large downed wood of decay classes I-II	Retain or create 1 to 4 snags per acre and at least 240 linear feet of downed wood on approximately 3,147 acres of harvest as mitigation, and 1,227 acres of	2

Proposed Activity	Unit of Measure	Alternative 2	Purpose & Need Addressed*
		snags and 1,300 acres of downed wood as enhancement	
Gap and Fall-and-Leave Treatments in Riparian Reserves			
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)	Acres	0.5	2, 3
Fall and Leave to Add Wood to Stream Channels	Miles	5	2

* 1 - Provide a sustainable supply of timber products; 2- Actively Manage Stands to Improve Stand Conditions in terms of, Density, Diversity, and Structure; 3- Increase Vegetative Habitat Complexity and Hardwood Composition along Streams, and 4 -Sustainably Manage the Network of Roads in the Project Area

** These acres are already accounted for in "Timber Harvest Treatments" and therefore are not included in the total. Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device. Post-harvest fuel treatments methods may change depending on feasibility and funding.

Harvest treatments would occur in stands ranging from 29-150 years old. Approximately 1,129 acres proposed for harvest are in stands under 80 years old and 2,210 acres proposed for harvest are in stands over 80 years old. Table 5 provides a summary of forest age classes and treatment acres for Alternative 2.

Table 5. Summary of Forest Age Classes and Treatment Acres – Alternative 2

	<80 years old	80-120 years old	121-150 years old
Acres of Harvest Units (including skips)	1,302	923	2,213
Acres Proposed for Harvest	1,129	608	1,602
Average Age	41	108	138

Applies to timber harvest units only

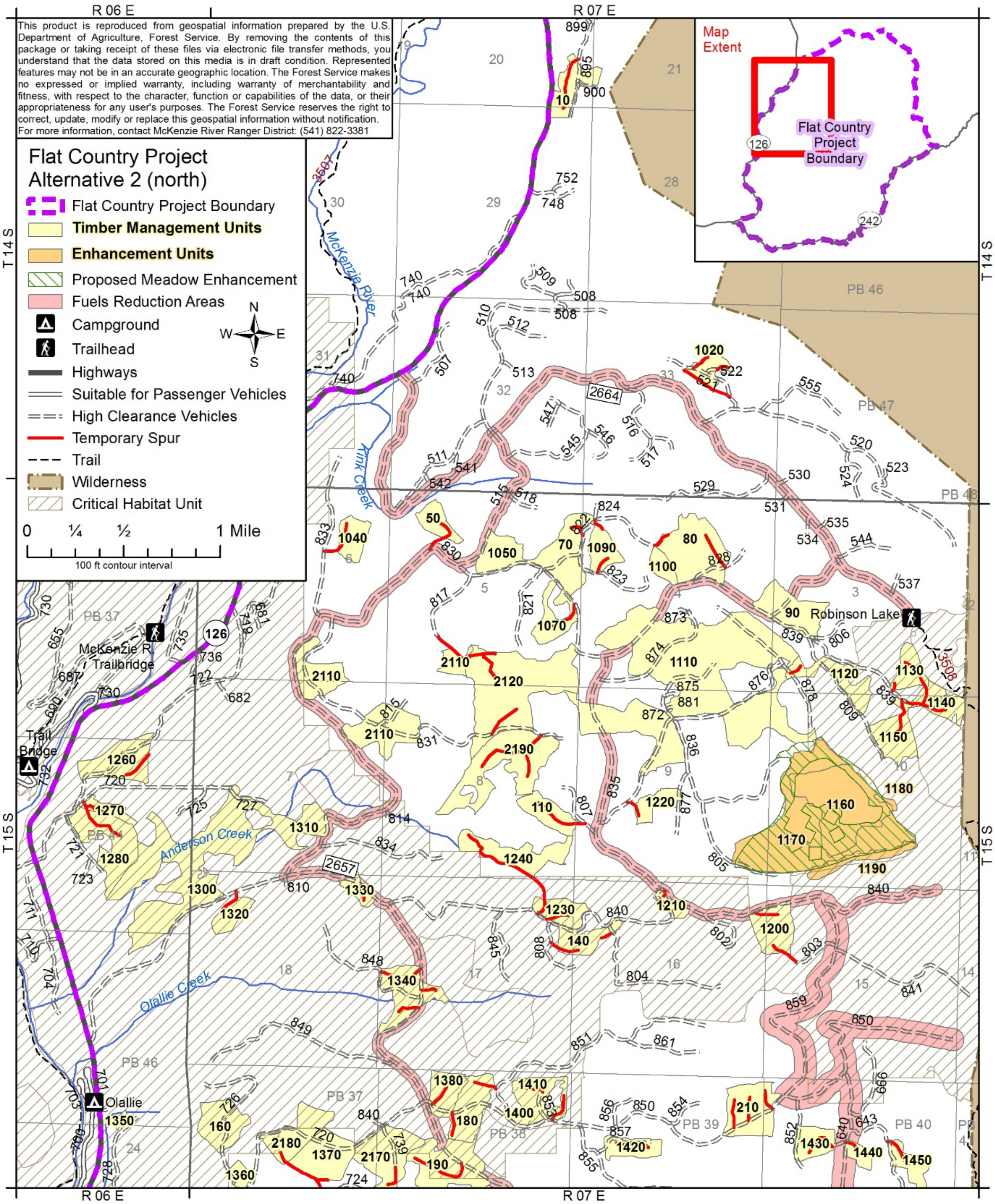

Figure 5. Map of Flat Country Alternative 2 (North)

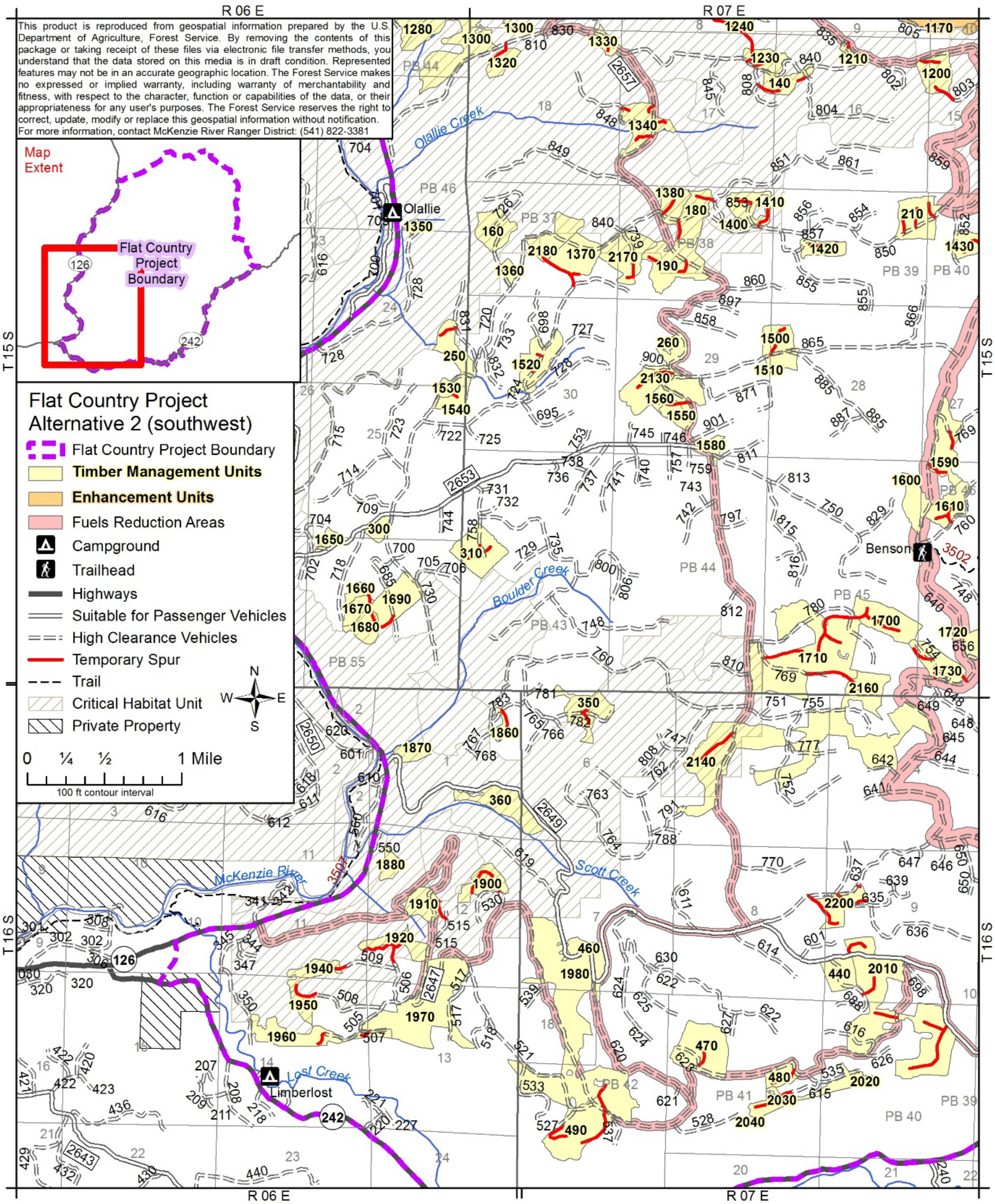

Figure 6. Map of Flat Country Alternative 2 (Southwest)

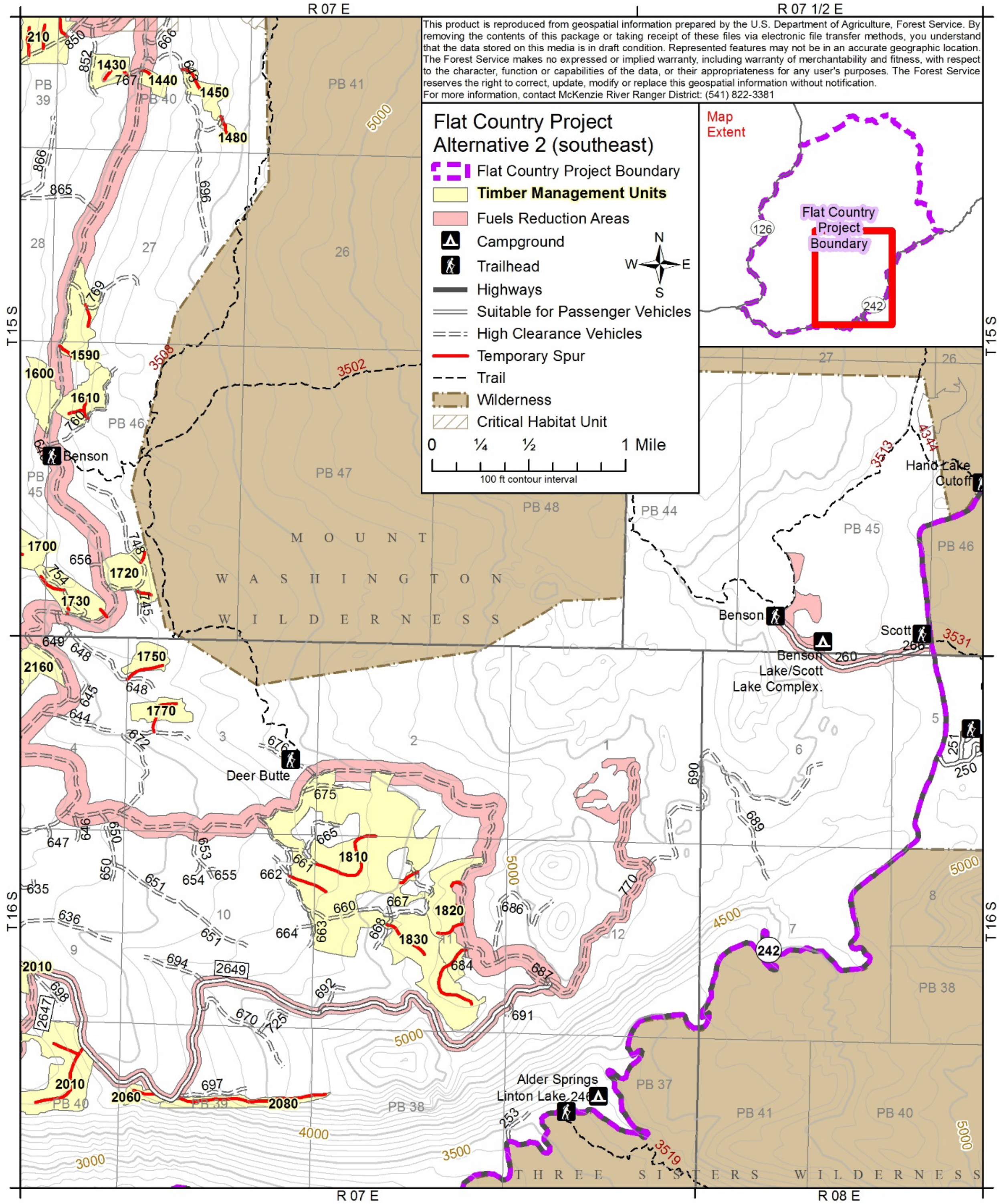

Figure 7. Map of Flat Country Alternative 2 (Southeast)

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

During the EIS scoping process, five key issues were identified from comments and questions:

- Key Issue #1: Maximize treatments within planning area
- Key Issue #2: Maintain an intact road system
- Key Issue #3: Refrain from harvesting older stands
- Key Issue #4: Refrain from regeneration harvest
- Key Issue #5: Eliminate all road construction

Alternative 3 was developed in response to Key Issues 3, 4, and 5. Alternative 3 eliminates harvest treatments in stands over 80 years of age, eliminates regeneration harvest, and reduces temporary road construction. Additionally, Alternative 3 differs from Alternative 2 in that any regeneration harvest proposed in stands under 80 years of age were changed to thinning treatments. Alternative 3 has fewer acres of commercial harvest when compared to Alternative 2.

Alternative 3 proposes to treat approximately 1,129 acres in the project area (Figures 8, 9, and 10). Harvest treatments proposed include thinning, gap creation, dominant tree release, and skips. Harvest treatments would yield an estimated gross 14 million board feet of timber. Post-harvest fuel treatments would include pile and burn and post-harvest underburn. Approximately 6.7 miles of temporary road construction would occur and approximately 57 miles of existing road would be maintained under Alternative 3.

Due to decrease in revenue expected from less timber harvest, and the expense of the enhancement activities, the Bunchgrass meadow enhancement is not part of Alternative 3.

Table 6 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 A. A detailed list of treatments for individual units is listed in Appendix B.

Table 6. Summary of Proposed Treatments and Connected Actions – Alternative 3

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed*
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	782	1, 3
Thinning in Riparian Reserves	Acres	164	2
Shelterwood with Reserves	Acres	0	-
Gaps	Acres	133	1, 2, 3
Dominant Tree Release	Acres	50	1, 3
Skips outside Riparian Reserves	Acres	75	3
Skips in Riparian Reserves	Acres	98	2, 3

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed*
Total	**Acres**	**1,302**	**1, 2, 3**
Estimated Gross Volume	**MMBF**	**~14**	**1**
Connected Actions			
Post-Harvest Fuel Treatments in Timber Harvest Units**			
Pile and Burn (mechanical and/or hand treatments)	Acres	811	3
Post-Harvest Underburn	Acres	318	3
Roadside Hazardous Fuels Treatments			
Pile and Burn/chip (hand treatments)	Acres	2305	-
Transportation			
New Road Construction	Miles	0	5
Temporary Road Construction	Miles	6.7	4
Roads Maintained	Miles	56.2	4
Road Decommissioning	Miles	15.0	4
Road Storage	Miles	4.7	2, 4
Rock Obtained Existing Quarries	Cubic Yards	20,000	4
Stream Culvert Replacement	Number	40	4
Harvest System			
Helicopter Harvest	Acres	7	-
Skyline Harvest	Acres	487	-
Ground based Harvest	Acres	635	-
Harvest Associated Planting, Snags, and Downed wood			
Planting in Regeneration Harvest	Acres	0	-
Planting in Gaps	Acres	62	3
Natural Regeneration in Gaps	Acres	71	3
Snags and Downed wood	Snags per acre and linear feet of large downed wood of decay classes I-II	Retain or create up to 4 snags per acre and at least 240 linear feet of downed wood on approximately 1,227 acres for snags and 1,300	2

Proposed Activity	Unit of Measure	Alternative 3	Purpose – Need Addressed*
		acres for downed wood as enhancement.	
Gap and Fall-and-Leave Treatments in Riparian Reserves			
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)	Acres	0	na
Fall and Leave to Add Wood to Stream Channels	Miles	0	na

* 1 - Provide a sustainable supply of timber products; 2 - Actively Manage Stands to Improve Stand Conditions, in terms of Density, Diversity, and Structure; 3 - Increase Vegetative Habitat Complexity and Hardwood Composition along Streams. And 4 - Sustainably Manage the Network of Roads in the Project Area

** These acres are already accounted for in the above table under “Timber Harvest Treatments” and therefore are not included in the total. Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device). Post-harvest fuel treatments methods may change depending on feasibility and funding.

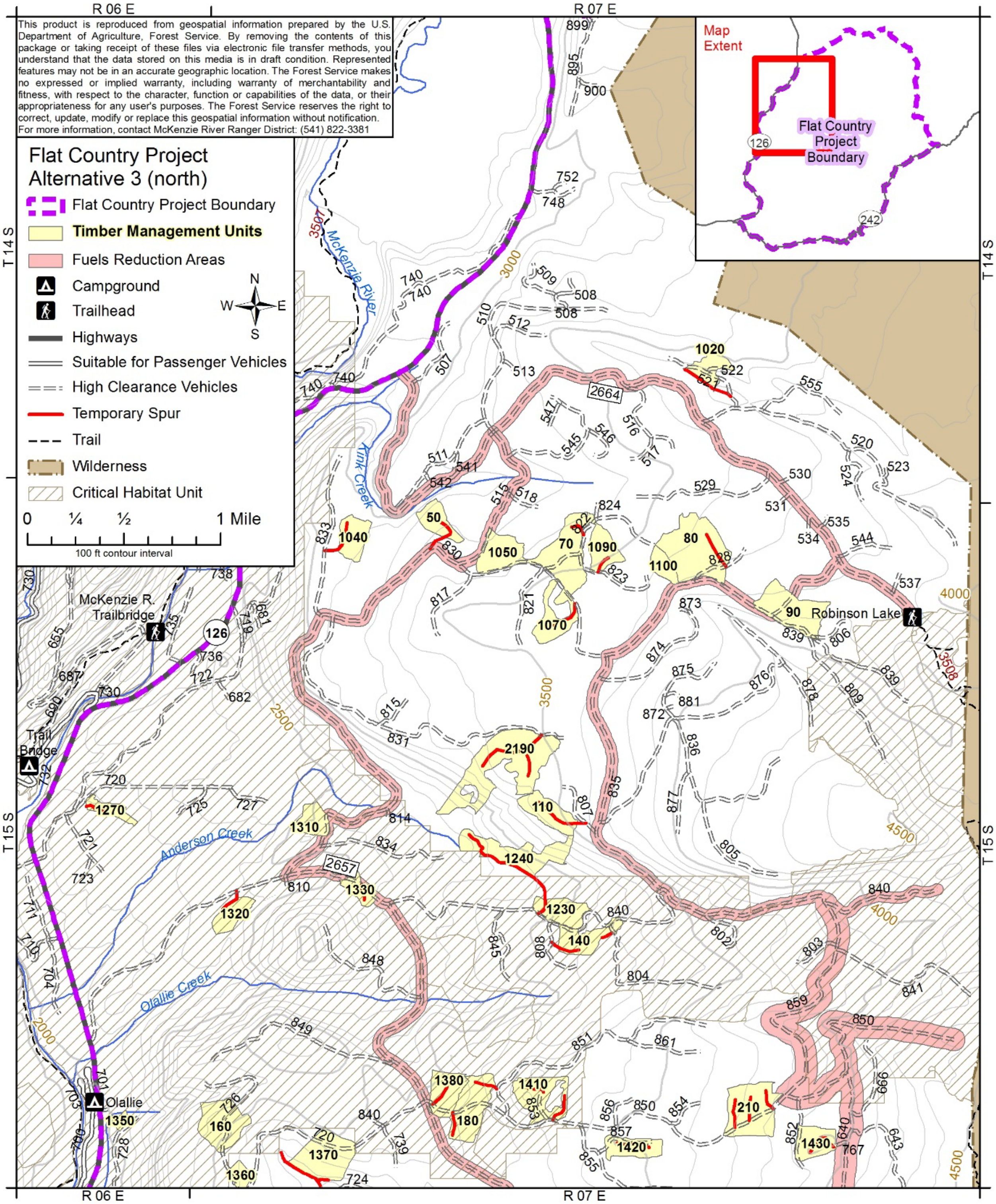

Figure 8. Map of Flat Country Alternative 3 (North)

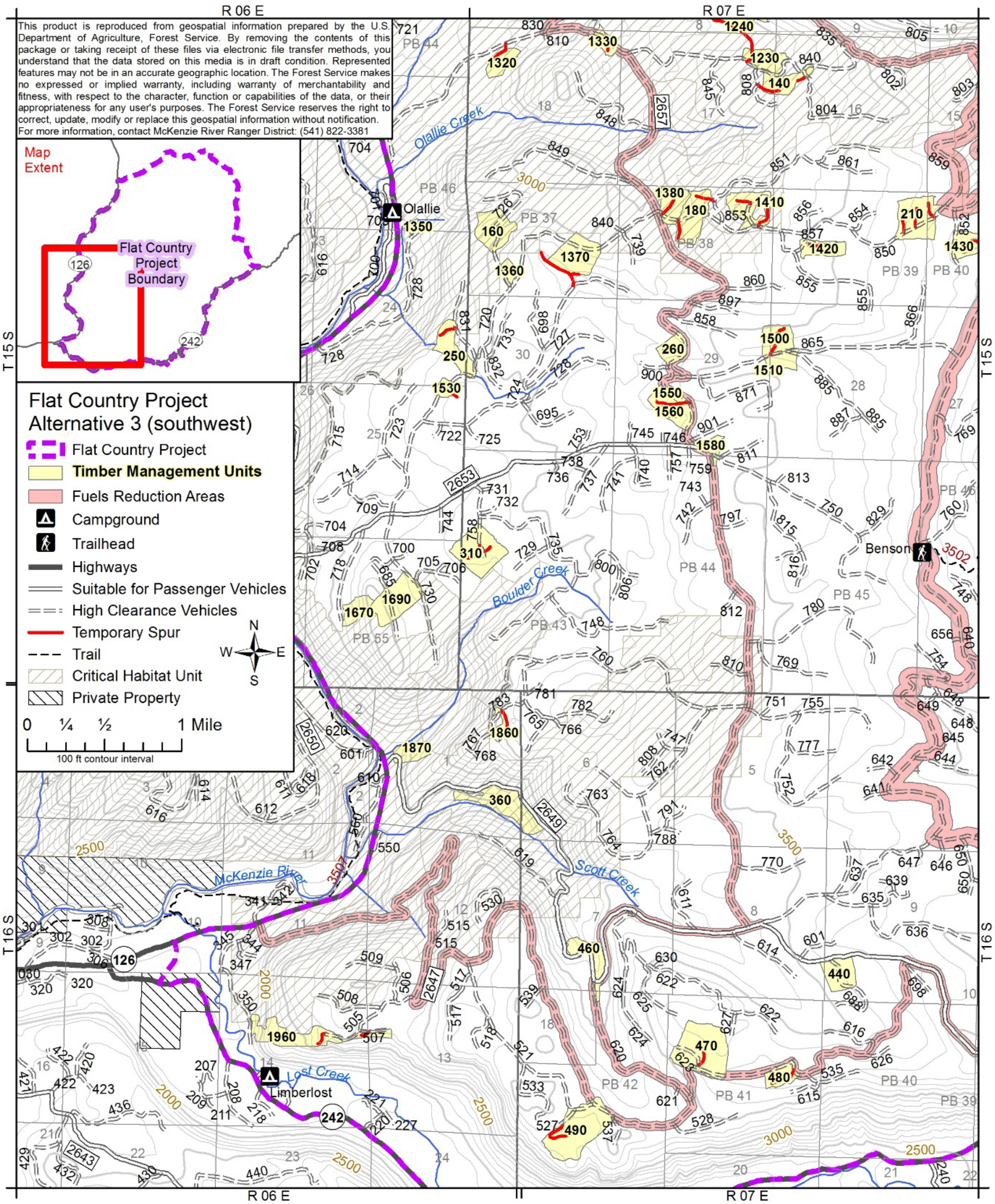

Figure 9. Map of Flat Country Alternative 3 (Southwest)

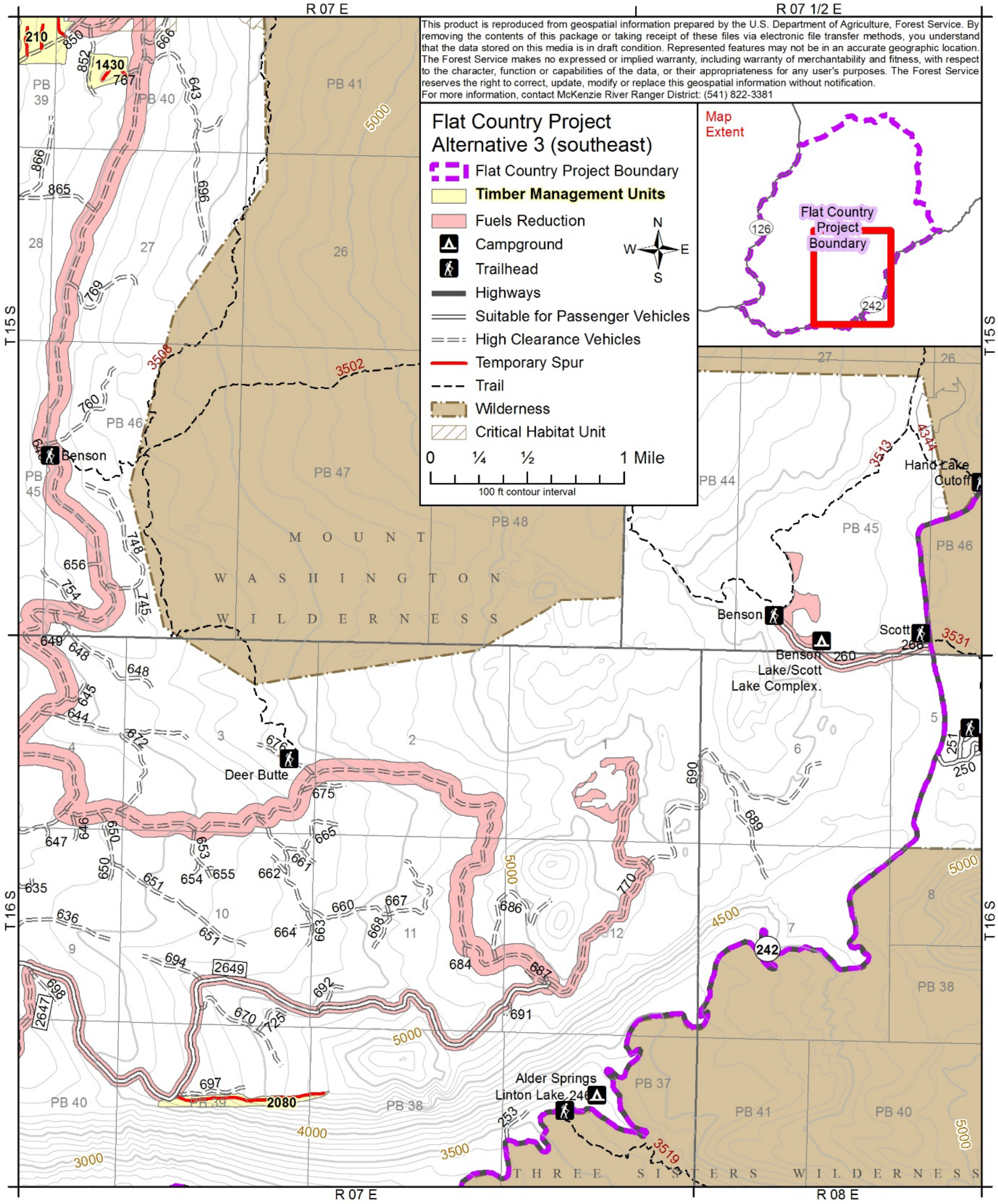

Figure 10. Map of Flat Country Alternative 3 (Southeast)

2.4 Alternatives Considered But Eliminated

An alternative that maximizes treatment acres and volume by treating all stands reaching culmination, even in CHU, as allowed by the Northwest Forest plan.

The original proposed action included 1,250 acres of regeneration harvest to more quickly achieve the desired age distribution in the landscape. In 2012, the US Fish and Wildlife Service released the final Critical Habitat designation for the Northern Spotted Owl, which included Critical Habitat Units (CHU) in numerous stands in the project area proposed for regeneration harvest. While the final CHU designation does give flexibility to achieve the project's purpose and need within CHUs, its primary purpose is to protect and improve existing habitat within the CHU. The Willamette National Forest determined that the purpose and need of the proposed project could be achieved while not regenerating within the CHUs. As such, the original proposed action was modified (see Alternative 2) to include only 961 acres of regeneration harvest rather than analyzing it as a separate alternative.

An alternative that does not harvest stands over 80 years and does not construct any new permanent or temporary roads.

Public comment identified a need to analyze an alternative with no harvest in stands over 80 years of age, with no new road construction. This alternative was determined to be not financially feasible. To address this concern we developed an alternative that does not harvest in stands over 80, but still uses temporary road construction.

2.5 Comparison of Alternatives

Table 7 summarizes and compares treatments and connected actions that would occur under each alternative.

Table 7. Comparison of Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning outside Riparian Reserves	Acres	0	1,772	782
Thinning in Riparian Reserves	Acres	0	164	164
Regeneration Harvest	Acres	0	961	0
Gaps	Acres	0	323	133
Dominant Tree Release	Acres	0	119	50
Skips outside Riparian Reserves	Acres	0	426	75
Skips In Riparian Reserves	Acres	0	673	98
Total	**Acres**	**0**	**4,438**	**1,302**

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Estimated Gross Volume	**MMBF**	**0**	**~102**	**~14**
Similar Actions				
Meadow Enhancement Unit (With Commercial Timber Harvest)				
Removal of encroaching trees both small diameters and commercial harvest, pile burning, and seeding	Acres	0	49	0
Meadow Enhancement Units (No Commercial Timber Harvest)				
Removal of encroaching trees small diameters pile burning, and seeding	Acres	0	101	0
Connected Actions				
Post-Harvest Fuel Treatments in Timber Harvest Units				
Pile & Burn (mechanical and/or hand treatments)[1]	Acres	0	1318	811
Post-Harvest Underburn[1]	Acres	0	2021	318
Roadside Hazardous Fuels Treatments				
Pile & Burn/chip (mechanical and/or hand treatments)	Acres	0	2305	2305
Road Activities Associated with Harvest				
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	15.5	6.7
Roads Maintained	Miles	0	108.2	56.2
Road Decommissioning	Miles	0	15.0	15.0
Road Storage	Miles	0	4.7	4.7
Rock Obtained Existing Quarries	Cubic Yards	0	20,000	20,000
Stream Culvert Replacement	Number	0	66	35
Acres by Harvest System				
Helicopter Harvest	Acres	0	17	7
Skyline Harvest	Acres	0	1,553	487
Ground-based Harvest	Acres	0	1,769	635

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Harvest Associated Planting, Snags, and Downed wood				
Planting in Regeneration Harvest	Acres	0	961	0
Planting in Gaps	Acres	0	151	62
Natural Regeneration in Gaps	Acres	0	172	71
Snag and Downed wood Creation	Snags per acre and linear feet of large downed wood of decay classes I-II	0	Retain or create up to 4 snags per acre and at least 240 linear feet of downed wood on approximately 3,147 acres as mitigation. An additional 1,227 acres of snags and 1,300 acres of downed wood are enhancement.	Retain or create up to 4 snags per acre and at least 240 linear feet of downed wood as mitigation. An additional 1,227 acres of snags and 1,300 acres of downed wood as enhancement.
Subsoiling to reduce compaction				
Subsoiling in Plantations	Acres	0	136	136
Gap and Fall-and-Leave Treatments in Riparian Reserves				
¼ Acre Gaps within Riparian Reserves in Secondary Shade zone (Total)[1]	Acres	0	0.5	0
Fall and Leave to Add Wood to Stream Channels	Miles	0	5	0
Key Issues 1, 2, 3, and 4				
Harvest treatments in stands over 80 years of age[1]	Acres	0	2,210	0
Shelterwood with Reserves	Acres	0	961	0
Temporary Road Construction	Miles	0	15.5	6.7
New, Permanent Road Construction	Miles	0	0	0

1 These acres are already accounted for in the above table under “Timber Harvest Treatments” and are not additional to the number above. Non-commercial gaps are enhancements which would occur after harvest.

2.6 Project Design Features

The project design features (PDFs) in Table 8 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.

Table 8. Design Features Common to Alternative 2 and Alternative 3

PDF #	Objective	Design Feature	Location
Forest Structure			
1	To meet stocking requirements as identified in the National Forest Management Act	Planting would be used in addition to natural regeneration. Planting would be done at 15’ X 15’ spacing, or about 194 trees per acre. The species mix should contain Douglas fir, Noble fir, western white pine, sugar pine, and western red cedar. The mix should be stratified with Douglas fir quantities higher in the lower elevations, noble firs in the higher elevations, and western red cedar in the higher elevations with higher levels of soil moisture.	All Shelterwood w/Reserves Units: 10, 300, 1110, 1440, 1450, 1480, 1520, 1650, 1710, 1810, 1820, 1830, 1970, 1980, 2010, 2030, 2040, 2060, 2120, and 2160
2	To enhance stocking levels and increase vegetative diversity	Native trees would be planted within areas in need of vegetation after treatment. If funding is available, native shrubs, forbs, and grasses may be planted in addition to trees.	Gaps in units: 80, 210, 310, 470, 1110, 1690, 1710, 1810, 1970, 1980, 2010, 2130, and 2190
3	To maintain structural diversity	During presale layout, trees that are identified as having unusual structure (such as broken tops, forks, epicormic branching, cavities, or sloughing bark) would be marked for retention.	All harvest units
4	To reduce impacts to Johnson’s Hairstreak Butterfly	During presale layout, any western hemlock trees that are identified as containing dwarf mistletoe would be marked for retention.	All harvest units
5	To minimize damage to residual trees during harvest	Residual stand and reserve trees would be protected to the best extent possible from harvest damage.	All harvest units
6	To protect integrity of the Inventoried Roadless Area(IRA)	Presale layout would ensure that the timber unit boundary does not encroach or overlap onto the IRA boundary, with the exception of enhancement units.	Units: 10, 1020, 1110, 1120, 1150, 1200, 1450, 1480, 1610, 1810, and 1820
7	To minimize impacts to the Riparian Reserves	Presale layout would ensure that the placement of gaps and Dominant Tree Releases are outside of Riparian Reserves. Units 1310 and 2380 would include 0.25 acre fall-and-leave gap creation in the second site potential tree height of the Riparian Reserves for the benefit of wildlife; these gaps are not part of commercial harvest activities.	All harvest units except Units 1310 and 2380
8	To meet green tree retention requirements associated with regeneration harvest	Four trees per acre of the average leave tree size would be retained for snag and downed wood enhancement, and the green tree retention guidance in Appendix I would be followed.	All Shelterwood w/Reserves Units: 10, 300, 1110, 1440, 1450, 1480, 1520, 1650, 1710, 1810, 1820, 1830, 1970, 1980, 2010, 2030, 2040, 2060, 2120, and 2160

PDF #	Objective	Design Feature	Location
Fire, Fuels, and Air Quality			
9	To reduce post-harvest fuels while maintaining downed wood following fuel treatments for effective soil and wildlife habitat conditions	Slash in harvest units would be treated according to Forest Plan Standards and Guidelines (FW-252 and FW-253) for acceptable post-harvest fuel loading	All harvest units with slash pile creation and/or underburn
10	To plan and implement prescribed fire following nationally-approved interagency standards.	The nationally-approved Interagency Prescribed Fire Planning and Implementation Procedures Guide shall be used for any activity involving prescribed fire.	All harvest units with slash pile creation and/or underburn
11	To maintain effective soil conditions	Severely burned areas should not exceed 10% of an activity area. Burn prescription parameters would strive to meet unit-specific overstory mortality objectives for wildlife	All harvest units with underburn
12	To maintain forest structure and wildlife objectives	Three to five hand piles per acre should be left unburned for wildlife habitat, except within 200 feet of a road or private property. The average size of these hand piles would be less than 6 feet tall and 5 to 7 feet in diameter.	All units with slash pile creation and all roadside hazardous fuels treatment areas
13	To comply with federal law, state law, and the Willamette Forest Plan for controlling air quality	The Oregon Smoke Management Plan and the Forest Plan Standards and Guidelines for air quality shall be followed, including fuel surveys and obtaining approval from the Oregon Department of Forestery prior to all prescribed burning and pile burning activities.	All harvest units and all roadside hazardous fuel treatment areas
Soils, Watershed, and Fisheries			
14	To promote long term slope stability	Trees on unstable slopes would not be harvested and would be left as skips in harvest units.	Units 90, 280, 320, 370, 380
15	To protect soil resources	All pre-bunching trails would be pre-located and pre-approved. Ground-based yarding should be limited to slopes less than 30%. Yarding equipment use may be approved on slopes from 30-40% on short pitches (< 50 ft.) based on site specific conditions. The upper limit for pre-bunching would be 45% slope.	All harvest units
16	To protect soil resources	Skyline yarding corridors would be approved by the sale administrator prior to felling. Skyline corridors would be as narrow as practical, typically no more than 12 feet wide, and spaced approximately 150 feet apart. The number of skyline corridors would be limited to no more than five per 1,000 linear feet of stream. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would	All harvest units with skyline operations

PDF #	Objective	Design Feature	Location
		be felled towards the channel, if possible, and left on site.	
17	To minimize soil compaction and soil disturbance	Predesignated skid trails and landings would be approved by the sale administrator before use. Skid trails would be located outside of no-cut buffers (except at stream crossing locations approved by the FS) and be located to provide breaks in grade to avoid concentrating runoff. Preexisting skid trails and temporary roads should be used before new skid trails are approved. Skid trails would be spaced a minimum of 50 feet apart for forwarder/processor operations. Skid trail width should not exceed 15 feet, with the average width no greater than 12 feet. The number of passes per trail should be minimized.	All harvest units and associated access
18	To minimize soil compaction and soil disturbance	Ground-based yarding equipment would travel on a slash mat. Where possible, slash mat depth should range from 6-18 inches depending on slope condition. Where ground-based equipment travel on a slash mat is not achievable, impacted areas should be scarified to a depth of 3-6 inches to reduce compaction at the discretion of the timber sale administrator, the district hydrologist or soil scientist, based on site specific conditions.	All harvest units
19	To reduce soil compaction for mitigation	All landings and temporary roads used during project activities would be subsoiled. “Munching” or bucket ripping to a depth of 18 to 24 inches would be the preferred style of subsoiling. Areas of disturbed soil would be seeded with native seed and covered with weed-free straw, mulch, or on-site slash following subsoiling activities.	All landings and temporary roads used during project activities
20	To reduce soil compaction for enhancement	All units that have existing compaction levels above 20% would undergo enhancement subsoiling. This would be achieved through “munching” or bucket ripping to a depth of 18 to 24 inches. Areas of disturbed soil would be seeded with native seed and covered with weed-free straw, mulch, or on-site slash following subsoiling activities.	Units 50, 160, 180, 210, 250, 260, 310, 440, 460, 480, 1040, 1070, 1100, 1230, 1270, 1380, 1410, 1420, 1430, 1530, 1550, 1580, 1690, 1700, 1860
21	To minimize soil displacement and maintain effective soil productivity	Material piling would occur by hand or with a grapple machine. Grapple piling activities would be limited to ground-based units where pre-bunching is allowed and in flat areas that were previously compacted.	All harvest units and associated access
22	To minimize soil displacement and maintain effective soil productivity	Where system roads are being decommissioned, disturbed soil should be seeded with native seed and covered with weed-free straw, mulch or on-site slash.	All system roads that are being decommissioned

PDF #	Objective	Design Feature	Location
23	To minimize soil displacement and maintain effective soil productivity	Prescribed fire and pile burns would minimize the residence time on the soil while meeting the burn objectives. Burning would be conducted when the duff and soil moisture conditions are high and where complete consumption of organic materials is not expected.	All prescribed fire and fuel treatment areas
24	To minimize soil displacement and maintain effective soil productivity	Fireline would be constructed with appropriate water drainage using natural contours and water bars to divert water.	All prescribed fire and fuel treatment areas
25	To minimize off-site movement of sediment into drainage courses	Temporary roads, skid trails and landings should be storm proofed with water bars or drain dips prior to extended periods of wet weather or predicted high precipitation events.	All harvest units and associated access
26	To minimize off-site movement of sediment into drainage courses	In general, water bar location should occur where local terrain facilitates effective drainage while avoiding soil disturbance and sediment delivery. Water bars would be constructed every 100 feet on grades <15% and every 50 feet on grades >15%. Water bars would 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.	All harvest units and associated access
27	To minimize off-site movement of sediment into drainage courses	The timber sale administrator would monitor wet weather haul, and as needed, consult resource specialists. Haul would be suspended prior to off-site movement of sediment into drainage courses.	All harvest units and associated access
28	To minimize off-site movement of sediment into drainage courses	Snow/frozen soil would only be operated on in the following conditions, with approval from the FS: 0 inches of frozen soil and at least 18 inches of packed snow, 4 inches of frozen soil and at least 9 inches of packed snow, or at least 6 inches of frozen soil. Over snow operations would be suspended or re-routed if thawing, soil exposure or uneven snow pack occurs during operations. During snow melt periods, drainage courses would be maintained for proper routing of runoff.	All ground-based harvest units and associated access
29	To minimize off-site movement of sediment into drainage courses	The following activities would be suspended during wet conditions: use of all ground-based equipment for yarding, processing, fuel treatment, or other project activities; log haul on roads not approved and maintained for wet weather haul; and the use, construction, reconstruction, or maintenance of landings or native surface roads. Wet conditions are defined as the observation of trenching, rutting, or pooling water, and the above activities should be suspended before precipitation or runoff	Entire project area

PDF #	Objective	Design Feature	Location
		results in off-site movement of sediment into drainage courses.	
30	To minimize off-site movement of sediment into drainage courses, maintain effective soil productivity, and reduce soil compaction for mitigation	If needed to protect natural resources, temporary roads used Oct 16 – May 14 should have surface rock applied prior to the wet season, as determined by the timber sale administrator. If surface rock depths exceed 4 inches, all rock that exceeds 4 inches after implementation would be scraped, reused, or stockpiled in areas agreed upon with the FS. Those landings and roads would then be subsoiled to a depth of 18-24 inches.	All ground-based harvest units
31	To minimize impacts to stream channels	Temporary stream crossings should include appropriately sized temporary culverts and be constructed with stable fill, with installation occurring during the dry season. At the conclusion of project activities all fill and temporary culverts would be removed, and the stream channel bottom and banks would be returned to a condition as close to pre-project conditions as practical.	Units 80, 1040, 1140, 1230, 1810
32	To minimize impacts to stream channels	Skyline yarding would not be allowed over Class 1 streams. Full suspension would be required when cable yarding (including lateral yarding) over Class 2 and 3 stream channels. Full suspension over Class 4 streams would occur whenever feasible, however, where full suspension is not obtainable, partial suspension would be required and yarding would be limited to when the stream is dry. Bump logs to protect the stream channel would be utilized as appropriate.	All harvest units with skyline operations
33	To reduce soil compaction directly adjacent to stream channels	Ground-based yarding equipment would not be permitted within 120 feet of Class 1 streams (i.e. streams with bull trout or spring Chinook salmon). Ground-based equipment and skid roads would not be permitted within 50 feet of any stream (fish-bearing to intermittent). These widths are required unless a change is approved by the district hydrologist or district fish biologist.	All harvest units
34	To minimize soil disturbance in no-cut riparian buffer areas	Fireline for underburning would not be constructed along no-cut riparian buffer areas. Fire would be allowed to back into these areas.	All harvest units
35	To protect riparian integrity	All existing downed wood would be retained within Riparian Reserves to maintain aquatic objectives.	All harvest units

PDF #	Objective	Design Feature	Location
36	To protect riparian integrity	Any tree felled into any Riparian Reserve no-harvest buffer would be left in place and not removed.	All harvest units
37	To protect riparian integrity	Waterbodies would be buffered from any roadside fuels reduction treatments as follows: Class 1: 120 feet Class 2: 75 feet Class 3: 60 feet Class 4: 30 feet Lakes/Ponds: 75 feet	Fuel treatment areas
38	To protect riparian integrity	Materials cut and piled for future burning would be located at least 15 feet from no-cut buffers.	Fuel treatment areas
39	To protect riparian integrity, stream flow, and water quality	Water used for fire treatments and dust abatement would be drafted from various water sources outside of Listed Fish Habitat. At all drafting locations, 90% of stream flow would be maintained. Water sources used by project operations would be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality.	Entire project area
40	To reduce contamination to aquatic areas	If lignosulfonate is used for dust abatement, one application would occur during the dry season (July/August/September) at a dilution rate of 50% lignosulfonate and 50% water. Lignosulfonate would remain on the road surface and not go over road edge. A 1-foot no-application buffer on the edge of gravel would be used if road width allows. Lignosulfonate would not be applied when raining and, when possible, a 3-day forecast of clear weather would follow application.	All haul routes
41	To minimize potential impacts to fish	Any project activity, such as culvert replacement, that must occur within flowing streams would comply with the Oregon Department of Fish and Wildlife seasonal restriction for instream work activities (July 1 – August 15 window). If a waiver to these dates is desired, the district fisheries biologist would need to review the proposal and seek a waiver if it is warranted.	All perennial streams with instream work
42	To minimize incidental take of ESA listed fish species	All the project design criteria found in the “Timber Management Treatments on the Willamette National Forest” programmatic biological opinion document (WCR-2018-8761) would be implemented.	Entire project area

PDF #	Objective	Design Feature	Location
Wildlife			
43	To avoid harm to active spotted owl nest sites and historic nest sites that may become reoccupied	Spotted owl surveys would continue until harvest implementation.	Spotted owl nest site numbers: 0826, 2838, 2421, 2408, 1738, and 2834
44	To protect known spotted owl habitat from roadside hazardous fuel treatments	Roadside hazardous fuels treatments would not occur in known spotted owl RA32 habitat, nest patches, or nest cores that are deficient in suitable habitat. A map would be provided to the district fuels manager prior to treatments and communication with the wildlife biologist would occur in the year of operation to ensure updates have been included.	Eight historic nest patches, RA32 habitat, and nest cores deficient in suitable habitat provided on implementation map
45	To retain trees that have the potential to be used as nest trees by spotted owls	Large conifers that have broken tops or large branches that were GPSed and mapped by the district wildlife biologist would be marked for retention by the presale layout crew.	Units with RA32 habitat: 10, 1110, 1220, 1260, 1280, 1300, 1340, 1400, 1590, 1660, 1900, 1910, 1920, 1970, 1980, 2110, 2120
46	To protect RA32 spotted owl habitat from harvest operations	RA-32 has been mapped by the wildlife biologist and a shapefile is available in the project file. If an activity would adversely affect the RA-32 habitat, a variance would be submitted for approval to USFWS prior to activities occurring.	Units with RA32 habitat: 10, 1110, 1220, 1260, 1280, 1300, 1340, 1400, 1590, 1660, 1900, 1910, 1920, 1970, 1980, 2110, 2120
47	To protect legacy trees and legacy snags from harvest operations	Legacy trees and legacy snags that were mapped and identified for retention by the district wildlife biologist would be protected. Placement of yarding corridors and landings to these trees and snags would be avoided. The shapefile is available in the project file.	Units with legacy tree retention: 10, 110, 160, 1220, 1230, 1240, 1400, 1440, 1450, 1650, 1680, 1720, 1730, 1750, 1900, 2190 Units with legacy snag retention: 110, 140, 1220, 1250, 1400, 1710, 2110, 2120
48	To protect occupied spotted owl nest patches from roadside hazard tree operations	Felling of large (>18 inches) roadside hazard trees would not occur during nesting season (March 1-July 15) within any occupied spotted owl nest patch. See district wildlife biologist for annual implementation map.	Roads in project area
49	To avoid noise disruption to potential spotted owl nesting activity from major roadwork	Major roadwork that lasts over 4 hours in one location (for example, culvert replacement) would not occur between March 1 and July 15 to avoid noise disruption to potential spotted owl nesting activity. This seasonal restriction may be	Roads in project area

PDF #	Objective	Design Feature	Location
		waived if the location and timeframe are reviewed by the district wildlife biologist and meet the criteria of the Biological Opinion for the spotted owl.	
50	To protect active documented raptor nests	Tree cutting, yarding, and burning would not occur from January 1-July 15 in units with documented active raptor nests.	Unit 490
51	To avoid disturbing potential great gray owl nesting activity in high quality habitat	Tree cutting, yarding, and burning would not occur from March 1-July 1 in Bunchgrass Meadow.	Bunchgrass Meadow enhancement units
53	To protect active red tree vole nests from prescribed fire	No prescribed burning shall occur within active red tree vole (RTV) habitat areas.	Unit 1970 (3 RTV areas) Unit 1980 (1 RTV area)
54	To reduce impacts to elk, deer and other wildlife along heavily travelled roads	A visual screen would be provided by limiting skid trails and skyline corridors entering roads to a spacing of no less than 200 feet along roads, where operable. Within 50 feet adjacent to the road, trees would be felled directionally away from the road to protect the non-merchantable trees and brushy hiding cover, where operable. This PDF does not apply within hazardous fuels reduction treatment areas.	Units: 440, 2010, 300, 1650, 2200, 1300, 300, 1650
55	To maintain high quality early-seral habitat conditions	Planting of created gaps greater than 0.2 miles away from a road should be minimized.	All harvest units
56	To protect existing large downed wood	All existing downed wood approximately > 12 inches in diameter regardless of decay class would be retained on site. The sale administrator would work with purchasers to minimize disturbance of existing downed wood.	All harvest units
57	To mitigate and enhance large downed wood levels in harvest units based on site specific conditions	After harvest and fuels treatments, up to 4 trees per acre (depending on unit specific needs) of the residual trees would be cut to mitigate and/or enhance downed wood in decay classes 1 and 2. Tree diameters would be of the average size merchantable trees in the unit. Full tree lengths should be used when possible.	All harvest units with large downed wood mitigation and/or enhancement (see Table 9)
58	To protect existing snags and to provide downed wood	Existing snags would be retained, except those needing to be felled for safety or operational purposes. Danger trees felled during operations would be left on site for large woody material.	All harvest units

PDF #	Objective	Design Feature	Location
59	To mitigate and enhance snag levels in harvest units	After harvest and fuel treatments, up to 4 trees per acre (depending on unit specific needs) would be used for snag mitigation and/or enhancement. Tree diameters would be of the average size merchantable trees in the unit.	All harvest units with snag mitigation and/or enhancement (see Table 9)
61	To minimize potential conflict between hunters and contractors behind closed gates	Project activities would not be allowed behind closed gates beginning the Friday before Elk Rifle Season and ending the Friday after it; only emergency vehicles would be allowed.	All project activities
62	To protect individuals of federally Threatened, Endangered, or proposed Threatened or Endangered species	If an individual of a T&E or proposed T&E species is discovered in future field work or during activities associated with this project, and the potential for adverse impact exists, project modifications would be pursued in consultation with USFWS.	All project activities
63	To protect individuals of FS Region 6 Sensitive species	If an individual of a FS Region 6 Sensitive species is discovered in future field work or during activities associated with this project, and the potential for adverse impact exists, project modifications would be pursued.	All project activities
Botany			
64	To reduce the introduction of weeds	All road construction and logging equipment shall be cleaned and inspected prior to entering the area.	All harvest units
65	To reduce the introduction of weeds	Soil and rock free of slash, debris, and invasive plants would be used for construction of temporary roads. Quarries that may be used (including private) would be surveyed by the district botanist for invasive plants prior to use. If high priority invasive species are found, infested rock would not be used. The district botanist would be consulted prior to expansion in Chinook Quarry and Pebble Quarry.	Entire project area
66	To reduce the spread of weeds	Presale should avoid putting gaps in areas with existing weed infestations. See weeds map in project file.	Entire project area
67	To reduce the spread of weeds	Existing weed infestations would be treated within the project area and along haul routes prior to ground disturbing activities to reduce the risk of spread of high priority noxious weeds into disturbed areas. Integrated pest management practices would be used (i.e. manual, mechanical, chemical, or cultural).	Entire project area
68	To reduce the spread of weeds	Fuel treatments should avoid burning and piling on existing weed infestations. See weeds map in project file.	All fuel treatment areas

PDF #	Objective	Design Feature	Location
69	To reduce the introduction and spread of weeds	Equipment should work in non-infested areas and then move to infested areas (FS would provide a map to purchaser). If the purchaser elects to move from an infested area to a non-infested area, equipment shall be washed prior to leaving the infested area.	All harvest units
70	To reduce the establishment and spread of weeds	High priority noxious weeds would be surveyed and treated after ground disturbing activities are complete to prevent newly created bare ground from being colonized by noxious weeds.	Entire project area
71	To reduce the establishment and spread of weeds	System roads to be closed or decommissioned would be surveyed and treated for invasive plants prior to closing.	Entire project area
72	To reduce the introduction and spread of weeds	Disturbed areas (culverts, road shoulders, closed/obliterated roads, landings, skid trails) should be re-vegetated with weed free native seed to compete with invasive plants as soon as possible. Weed free mulch or straw would be used if necessary.	Entire project area
73	To protect known Special Habitats	Dry meadows, rock outcrops and talus would be protected by avoiding direct impact (directionally falling and yarding away from special habitat). No skidding, yarding, gaps, or temporary road construction would be allowed through special habitats. No buffer would be required.	Units 1140, 1710, 360, 1820
74	To protect known Special Habitats	Mesic meadow special habitats would be protected with a 100 foot no-cut, no-entry buffer.	Units 1080,1770
75	To protect known Special Habitats	Sedge meadows, wet meadows, and wetlands special habitats would be protected with a 150-foot no-cut, no-entry buffer.	Units 490, 1030, 1040, 1250, 1270, 1300, 1810, 1830
76	To protect known Special Habitats	Ponds would be protected with a 180-foot no-cut, no-entry buffer.	Units 490, 1980
77	To minimize negative impacts to Special Habitats from enhancement activities	After enhancement implementation in Special Habitats, revegetation would occur in areas impacted by temporary roads and/or burn piles. This would be done using native grasses, forbs, or other appropriate meadow species.	Units 1160,1170, 1180, 1190, 1760
79	To protect known populations of Sensitive and S&M species	A 150-foot no-harvest no-entry buffer would be implemented on Listed R6 Sensitive and Survey and Manage Species occurring in harvest units or fuel treatment areas. See district botanist for map.	Harvest Units 190, 1110,1130, 1260, 1280, 1300, 1310, 1440, 1680, 1710, 1730, 1810, 1820, 1870, 1880, 1920, 1970, 1980, 2010, 2020, 2111, 2120, 2130, 2160, 2170, 2180

PDF #	Objective	Design Feature	Location
			Fuel Treatment areas: 1820, between units 1920 and 1970, between units 260 and 190, between units 1430 and 1440, near unit 1580
Roads			
80	To reduce off-site movement of sediment into drainage courses	For all road work, Best Management Practices (BMPs), including placement of sediment barriers, provision of flow bypass, and other applicable measures, would be included in the contract provisions as necessary to control off-site movement of sediment.	Entire project area
81	To reduce off-site movement of sediment into drainage courses	For any culvert replacement at a perennial stream crossing, a specific dewatering plan would be included with the contract design provisions.	Entire project area
82	To reduce off-site movement of sediment into drainage courses	All road reopening, reconstruction and temporary road building would occur when soils are relatively dry to avoid potential surface erosion of exposed soil.	Entire project area
83	To reduce off-site movement of sediment into drainage courses	On segments of decommissioned roads in between fill removals, water bars would be built to divert surface drainage or the road surface would be decompacted by subsoiling to a depth of 18-24 inches to ensure water infiltration.	Entire project area
84	To protect road infrastructure	All required prehaul road maintenance would be completed prior to any haul activities.	Entire project area
85	To protect road infrastructure	At the completion of harvest and associated activities, reopened roads would be closed (stored) and new temporary roads would be decommissioned. Closed roads and decommissioned roads would be placed in a hydrologically stable condition and closed to vehicle travel to reduce potential for surface erosion and sedimentation.	Entire project area
Heritage Resources			
86	To protect identified heritage resources	All National Register of Historic Places eligible and potentially eligible sites would be avoided during all project activities. For example, gaps would not be placed directly adjacent to special management areas (SMAs). Fire hand line would be allowed only along the outside edge of SMA boundaries. Presale crews, road engineers, the timber sale administrator and the FMO/AFMO would coordinate with the district archaeologist to ensure protection	See district archaeologist

PDF #	Objective	Design Feature	Location
		of the known cultural sites throughout the full term of the project activities.	
87	To protect unidentified heritage resources in high probability areas	All post-harvest subsoiling on slopes 25 percent or less would be coordinated with the district archaeologist. For any subsoiling required in the timber sale contract, the district archeologist would have 5 business days to provide a determination to the timber sale administrator.	Entire project area
88	To protect unidentified heritage resources	Activities outside of the original units would be coordinated with the district archaeologist prior to initiation.	Entire project area
89	To protect unidentified heritage resources	If any newly identified cultural resource is discovered during operations, ground disturbing operations would stop and the district archeologist would be notified immediately.	Entire project area
Recreation and Scenic Quality			
90	To minimize visual impacts from timber activities to trails and high priority dispersed recreation sites	Within 100 ft. of trails and high priority dispersed recreation sites, trees would be marked on the side facing away from these recreation assets, stumps would be low- or flush-cut at an angle facing away, and timber sale boundary markers would be removed after harvest activities have concluded.	Trails: Units 1130, 1140 High Priority Dispersed Recreation: Units 1830, 1810, 1720, 1730
91	To minimize visual impacts from fuel treatment activities to areas with a Visual Quality Objective designation of "Preservation" and key recreation resources	The district fuels specialist would coordinate with the district recreation specialist on the implementation of fuel treatments (including location of piles, flush cutting trees, and timing) in MA10E to ensure that visual quality objectives are met.	All fuel treatment units overlapping FS road 260, Scott Lake Campground, Hand Lake Trail #4344, and the area SW of Road #2649 and NE of Unit 1810
92	To retain trees that contribute to trail visual quality	Presale would coordinate with the district recreation specialist about a tighter tree spacing layout within 200 ft. of trail #3508 and the location of landing sites for unit 1720.	Units 1140, 1720
93	To maintain safe public access to popular trailheads	No haul would be allowed on weekends or federal holidays beginning Memorial Day weekend and ending after Labor Day weekend on the main roads to Robinson Lake TH and Tenas Lake TH. The sale administrator would provide notice to the district recreation specialist as soon as possible prior to harvest operations that could cause traffic delays on these roads	Roads #2664, #2649, #640

PDF #	Objective	Design Feature	Location
		so that this information can be shared via the front desk staff and postings in the field.	
94	To maintain the quality of high priority dispersed recreation sites	The sale administrator would coordinate with the district recreation specialist in advance if equipment storage or decking sites need to be located at high priority dispersed recreation sites. Coordination would result in clean-up to maintain the quality of these sites.	Deer Butte: 44 11’ 03.52’’ N 121 55’ 09.16’’ W Irish Lake: 44 11’ 56.71’’ N 121 55’ 24.09’’ W Unnamed pond on road 640: 44 13’ 02.24’’ N 121 57’ 51.44’’ W

2.7 Required and Recommended Snag and Downed Wood Creation Common to Alternatives 2 and 3

Alternatives 2 and 3 have the same requirements and recommendations for snag and downed wood creation (Table 9). Snags would be created by girdling, sawtopping, underburning and/or inoculation. The treatment priority for each unit depends on harvest treatment, land allocation, Critical Habitat, proximity to spotted owl sites, wildlife usage, and the amount of existing snags and large downed wood in Riparian Reserves. Downed wood habitat enhancement within selected Riparian Reserve units is discussed in section 3.3.5. Snag and downed wood creation beyond what is required by the Northwest Forest Plan is dependent on funding availability.

Required Snag and Downed Wood Creation: The Northwest Forest Plan requires that currently unmanaged stands proposed for regeneration harvest (including shelterwood with reserves) have the creation of at least two snags per acre and at least 240 linear feet of large downed wood (S&G, C-40), or 2 trees, per acre.

The Northwest Forest Plan also requires that lodgepole pine stands proposed for harvest (including thinning) have the creation of an additional 0.12 snags per acre, in order to provide for full population potential of black-backed woodpecker (S&G, C-46). These additional snags need to be at least 17 inches DBH, or the largest available, and in the hard decay stage. If these requirements cannot be met, then harvest must not take place. Lodgepole pine stands are located above 4,000 feet elevation in the Flat Country project area.

Recommended Snag Creation for Replacement: Some units in older stands have recommended snag creation for replacement purposes. Numbers shown in the replacement column are also intended to display a second priority for snag creation based on stand age and to help balance out longer term snag habitat loss.

Recommended Snag and Downed Wood Creation for Enhancement: Some units that have low or moderate levels of existing snags and/or downed wood have recommended snag and/or downed wood creation for enhancement purposes. These units have trees at least 14 inches DBH. Enhancing snag and/or downed wood levels in these units would benefit a broad range of wildlife and plant species, including cavity excavators (see section 3.5.3). In contrast, no enhancement is recommended in units where the current abundance of snags and large downed wood already appears to be at moderate to high levels (above six snags and six downed trees per acre, counting only those in the hard decay classes 1-2).

Monitoring Snags and Downed Wood: Post-harvest and burn monitoring would take place and if the recommended numbers displayed are already present, no additional wildlife tree and large down wood creation is necessary.

Existing hard snags and downed wood that meet the minimum diameter and length requirements (which vary depending on average stand diameter) will be counted towards the target densities in Table 9.

For wildlife tree creation, the first number in column 4 is the required number of snags that will be created. Columns 5 and 6 are a replacement and enhancement recommendation.

It should be noted that a “0” shown in a specific column indicates that no additional creation is needed, and does not refer to the final desired habitat condition, i.e. providing additional wildlife trees or large down trees is beneficial for deadwood habitat purposes.

Table 9. Requirement, Replacement, and Enhancement Snag and Large Downed Wood Creation for Alternatives 2 and 3

Unit	Average Stand Age	Land Allocation/ Critical Habitat (CH)/other criteria	Wildlife Tree Creation per Acre Requirement	Wildlife Tree Creation per Acre Replacement	Wildlife Tree Creation per Acre Enhancement	Large Downed Wood Creation per Acre Requirement	Large Downed Wood Creation per Acre Enhancement
10	106	Matrix, Shelterwood	2	0	0	2	0
50	34	Matrix	0	0	2	0	1
70	36	Matrix	0	0	2	0	2
80	32	Matrix	0	0	1	0	1
90	32	Matrix	0	0	0	0	1
110	79	Matrix	0	0	2	0	2
140	43	Matrix, CH	0	0	4	0	4
160	31	Matrix, CH	0	0	4	0	4
180	33	Matrix, CH	0	0	2	0	2
190	109	Matrix, CH	0	4	0	0	2
210	35	Matrix	0	0	0	0	1
250	29	Matrix	0	0	1	0	2 clumped in riparian
260	34	Matrix	0	0	0	0	0
300	149	Matrix, Shelterwood	2	0	0	2	0
310	37	Matrix	0	0	1	0	1
350	143	Matrix, CH	0	4	0	0	4
360	42	Matrix, CH	0	0	4	0	4
440	31	Matrix	0	0	0	0	2
460	39	Matrix	0	0	1	0	1
470	34	Matrix	0	0	2	0	2
480	31	Matrix	0	0	2	0	2
490	41	Matrix	0	0	2	0	2
1020	33	Matrix	0	0	2 most on ridgetop	0	2
1040	32	Matrix	0	0	0	0	0
1050	32	Matrix	0	0	1	0	2
1070	32	Matrix	0	0	4	0	2
1090	36	Matrix	0	0	1	0	1
1100	32	Matrix	0	0	1	0	1
1110	136	Matrix, Shelterwood	2 western half, 2.12 eastern half	2	0	2	2
1120	141	Matrix, CH	0.12	4	0	0	4
1130	133	Matrix, CH	0	4	0	0	4
1140	138	Matrix, CH	0.12	4	0	0	4
1150	146	Matrix, CH	0.12	2	0	0	2

Unit	Average Stand Age	Land Allocation/ Critical Habitat (CH)/other criteria	Wildlife Tree Creation per Acre Requirement	Wildlife Tree Creation per Acre Replacement	Wildlife Tree Creation per Acre Enhancement	Large Downed Wood Creation per Acre Requirement	Large Downed Wood Creation per Acre Enhancement
1160 1170 1180	79	9D Special Habitat Area, Bunchgrass Meadow, minor edge acres in CH	2	3	5	0	10
1200	146	Matrix, CH	0	4	0	0	2
1210	118	Matrix, CH	0	0	0	0	2
1220	139	Matrix	0	4	0	0	4
1230	29	Matrix, CH	0	0	2	0	2
1240	64	Matrix	0	0	2	0	2
1260	138	Matrix, CH	0	4	0	9	4
1270	40	Matrix, CH	0	0	2	0	2
1280	120	Matrix, CH	0	4	0	0	4
1300	118	Matrix, CH	0	4	0	0	4
1310	79	Matrix, CH	0	4	0	0	4
1320	77	Matrix, CH	0	4	0	0	4
1330	66	Matrix, CH	0	4	0	0	4
1340	98	Matrix, CH	0	4	0	0	4
1350	42	Matrix, CH	0	0	1	0	1
1360	50	Matrix	0	0	1	0	1
1370	38	Matrix	0	0	1	0	1
1380	34	Matrix, CH	0	0	2	0	2
1400	109	Matrix, CH	0	2	0	0	4
1410	34	Matrix, CH	0	0	1	0	1
1420	34	Matrix	0	0	1	0	1
1430	32	Matrix	0.12	0	0	0	2
1440	98	Matrix	0.12	0	0	0	0
1450	115	Matrix, Shelterwood	2.12	0	0	2	0
1480	121	Matrix, Shelterwood	2.12	0	0	2	0
1500	30	Matrix	0	0	0	0	0
1510	40	Matrix	0	0	2	0	2
1520	98	Matrix, Shelterwood	2	0	0	2	0
1530	36	Matrix	0	0	1	0	1
1540	110	Matrix	0	4	0	0	2
1550	34	Matrix	0	0	1	0	2
1560	32	Matrix	0	0	0	0	2
1580	29	Matrix	0	0	0	0	1

Unit	Average Stand Age	Land Allocation/ Critical Habitat (CH)/other criteria	Wildlife Tree Creation per Acre Requirement	Wildlife Tree Creation per Acre Replacement	Wildlife Tree Creation per Acre Enhancement	Large Downed Wood Creation per Acre Requirement	Large Downed Wood Creation per Acre Enhancement
1590	102	Matrix	0.12	2	0	0	2
1600	114	Matrix	0	2	0	0	2
1610	93	Matrix	0.12	2	0	0	2
1650	122	Matrix, Rockpit expansion	0	0	0	0	0
1660	110	Matrix	0	2	0	0	2
1670	67	Matrix	0	0	1	0	2
1680	112	Matrix	0	4	0	0	4
1690	38	Matrix	0	0	1	0	1
1700	120	Matrix	0	2	0	0	2
1710	120	Matrix, CH, Shelterwood	2	2	0	2	0
1720	144	Matrix	0.12	2	0	0	4
1730	147	Matrix	0.12	2	0	0	4
1750	119	Matrix	0.12	4 most on ridgetop	0	0	2
1770	108	Matrix	0.12	2	0	0	0
1810	148	Matrix, Shelterwood	2.12	0	0	2	0
1820	149	Matrix, Shelterwood	2.12	2	0	2	2
1830	118	Matrix, Shelterwood	2.12	0	0	2	0
1860	31	Matrix, Rockpit expansion	0	0	0	0	0
1870	76	Matrix, CH	0	2	0	0	4
1880	124	Matrix, CH	0	4	0	0	4
1900	141	Matrix, CH	0	4	0	0	4
1910	126	Matrix, CH	0	4	0	0	4
1920	148	Matrix, CH	0	4	0	0	4
1940	125	Matrix, CH	0	2	0	0	2
1950	108	Matrix, CH	0	2	0	0	2
1960	34	Matrix, CH west side	0	0	4	0	1
1970	143	Matrix, Shelterwood	2	2	0	2	2
1980	150	Matrix, Shelterwood	2	2	0	2	2
2010	132	Matrix, Shelterwood	2	0	0	2	2
2020	98	Matrix	0	2	0	0	4

Unit	Average Stand Age	Land Allocation/ Critical Habitat (CH)/other criteria	Wildlife Tree Creation per Acre Requirement	Wildlife Tree Creation per Acre Replacement	Wildlife Tree Creation per Acre Enhancement	Large Downed Wood Creation per Acre Requirement	Large Downed Wood Creation per Acre Enhancement
2030	102	Matrix, Shelterwood	2	0	0	2	0
2040	102	Matrix, Shelterwood	2	0	0	2	0
2060	141	Matrix, Shelterwood	2	2	0	2	2
2110	132	Matrix	0	4	0	0	4
2111	132	Matrix, western edge in deficient (2019 unoccupied) owl nest core	0	2	0	0	2
2112	132	Matrix, In deficient (2019 unoccupied) owl nest core, CH on western edge	0	4	0	0	4
2120	134	Matrix, Shelterwood	2	2	0	2	0
2130	149	Matrix	2	0	0	0	2
2140	136	Matrix, CH	0	4	0	0	4
2160	144	Matrix, CH partially, Shelterwood	2	2	0	2	2
2170	144	Matrix, CH	0	4	0	0	2
2180	123	Matrix, CH	0	2	0	0	2
2190	98	Matrix	0	2	0	0	2
2200	75	Matrix	0	0	4	0	4

Monitoring would take place after harvest and burning activities are completed, and if the recommended numbers are already present, no additional snag and large downed wood creation would take place.

The first number in columns 4 and 5 is the required number, and the second number is an enhancement recommendation. Post-harvest and burn monitoring would take place and if the recommended numbers are already present, no additional wildlife tree and large down wood creation is necessary.

2.8 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, downed wood and snag retention, skid trail spacing and use of designated skid trails.

Snag and Large Downed wood Monitoring: Wildlife biologists and/or technicians would monitor snag and downed wood levels after harvest and possible post-harvest underburning prior to additional snag and large downed wood creation.

Fuel treatments: The McKenzie River District fire and fuels personnel would informally monitor fuel loading during and following the fuel treatments. Fuel treatment results would 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 would take place for three to five years after the treatment is completed. Identified priority weed populations would be treated.

Spotted Owl Monitoring: The following six sites would need continued surveys until harvest implementation to avoid take on an individual owl pair: 0826, 2838, 2421, 2408, 1738, and 2834. Suitable nesting habitat within and adjacent to the roadside hazardous fuels treatments would need spotted owl monitoring during implementation to assure that no new nest patches occur where the fuels treatments are planned. Additional monitoring requirements may be required as part of the consultation with U.S. Fish & Wildlife Service. Note that some actions in this EIS may be NLAA (Not Likely to Adversely Affect), and those actions individually do not need additional spotted owl monitoring.

Forest Plan Implementation Monitoring: The Forest Supervisor's Staff performs annual project monitoring at each Ranger District and compiles the results in the bi-annual 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 downed wood abundance, prior to mitigation and enhancement and any seeding or planting of vegetation.

Reforestation: Ensure regenerated stands are sufficiently stocked within five years. Forest Service Manual directs us to conduct first and third year stocking surveys to determine if the site can be certified.

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 DEIS considers the environmental consequences of implementing 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 on the IDT prepared technical reports to address the affected environment and expected environmental consequences of the proposed actions and alternatives of the Flat Country project. All reports are maintained in the project file, located at the McKenzie River Ranger District in McKenzie Bridge, 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 DEIS are incorporated by reference (40 CFR 1502.21).

Role of Science

Scientific information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on scientific 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 DEIS. The referenced material is considered 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 F 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 Flat Country project.

3.1 Forest and Stand Structure

3.1.1 Summary of Effects

Stands proposed for treatment are currently in a condition that would positively respond to and benefit from treatment, based on existing stocking levels, average stand diameters, and crown ratios.

All treatments would increase diversity within the stands and the project area in terms of species, composition, and structure. Shelterwood with reserves, thinning, dominant tree release (DTR), and gaps would promote the development of a multi-layered stand structure that provides conditions favorable to the establishment of shrubs, forbs, and hardwoods in the understory. In addition, these treatments would allow overstory trees to develop deep canopies and larger diameter branches in open stand conditions. Skips would further improve stand and project level diversity by providing areas within treated stands where natural processes are allowed to take place, including the creation of snags and downed woody material through suppression mortality.

Shelterwood with reserves, thinning, DTR, and gaps would shorten the duration stands spend in the "stem exclusion" successional stage. These treatments would therefore improve the health and growth of the remaining trees in the stand by reducing inter-tree competition. However, another effect of reducing inter-tree competition is a reduction in the number of snags created through suppression mortality.

Shelterwood with reserves, thinning, DTR, and gaps would reduce the risk of fire spreading through the understory by increasing the growth of moist understory vegetation. These treatments would also reduce the risk of fire spreading through the canopy by increasing the spacing between crowns.

Shelterwood with reserves, DTR, and gaps would help provide for long-term sustainable timber production by shifting some acres into the stand initiation successional stage. These stand initiation acres would be ready for harvest in 80 to 100 years.

3.1.2 Scale of Analysis

The scale used to evaluate direct, indirect and cumulative effects on forest and stand structure associated with the Flat Country project is the project area. The project area consists of 74,063 acres within the Boulder, Kink, White Branch, and Lost Creek subwatersheds (Figure 3) of the Upper McKenzie River watershed. By using the project area, it is possible to evaluate potential impacts in an area large enough to encompass other disturbances, both human and natural, and it is a logical analysis area to assess stand conditions based on plant associations.

3.1.3 Affected Environment

The Flat Country project area consists of approximately 74,063 acres within the McKenzie River Ranger District. The project area is bounded by the Kink Creek subwatershed to the north, along the district boundary that runs along Mount Washington to the east, following the McKenzie Highway 242 to the south, and McKenzie River to the west. The project area is composed mostly of a Douglas-fir and western hemlock overstory with an understory shrub component of vine maple, salal, dwarf Oregon grape, sword fern and Pacific rhododendron. There is a transition to the true fir/mountain hemlock zone above approximately 4,000 feet.

Stand Age Classification

Stand age of Forest Service managed lands in the project area was determined using data from the Forest Service's VEGIS database in addition to stand exam data collected in 2015-2016. Data shows approximately 58,017 Forest Service managed acres as forested in the project area. Stand age in the project area is distributed into four categories: Stand Initiation, Stem Exclusion, Understory Re-Initiation, and Old-Growth.

Stand Initiation - Young Managed Plantations (0-30 years old)

Stands in this category are the younger second-growth plantations originating from regeneration harvest which took place in this area in the late 1980's and 1990's. These stands are in the stand initiation development stage (Oliver and Larson, 1996). Most stands were re-established by planting conifer seedlings at stocking levels after the regeneration harvest to ensure survival of fully stocked sites. Other plants – trees, shrubs, and forbs grown from seed, sprouts, advance regeneration, and other mechanisms are also invading the sites and compete for the open growing space. Generally, these stands have rapid growth and low to moderate amounts of downed woody debris and standing snags. Stand initiation represents approximately 4,986 acres, or approximately 9 percent of the forested lands administered by the Forest Service in the project area (Figure 11).

Stem Exclusion - Second Growth Plantation (31-80 years old)

Stands in this category are the older second-growth plantations originating from early clearcut harvest treatments in the 1940's to the early 1980's and wildfires in the early part of the century (see Fire and Fuels Section 3.12). This stand type can be characterized as a dense, closed-canopied, even-aged stand. Based on the stand development classifications (Oliver and Larson, 1996), these stands are classified as stem exclusion. The stem exclusion stage occurs after canopy closure, as the stand begins to differentiate into size classes and shading and competition for nutrients and water by larger trees leads to the death of smaller trees and much or all of the understory vegetation. Some timber stands established after wildfires have a scattered overstory of remnant old–growth. Past logging utilization practices, fuel treatments, and safety regulations governed the amount of downed woody debris and standing snags retained in the plantations. Generally, these stands have low to moderate amounts of downed woody debris and are absent of standing snags. Stem exclusion represents approximately 8,729 acres, or 15 percent of the forested lands administered by the Forest Service in the project area (Figure 11).

Understory Re-initiation - Mature (81-180 year old)

Stands in this category are characterized as a fairly uniform, single-canopied, even-aged stand. These stands are in the understory re-initiation development stage (Oliver and Larson, 1996). During the understory re-initiation stage, crowns recede and scattered overstory trees begin to die, and forbs, shrubs, and tree regeneration (usually shade tolerant species such as western hemlock, western red cedar, and true firs) appear on the forest floor. Many of these stands originated from wildfires that occurred in the late 1800's and early 1900's. The lack of legacy structural components, such as snags and coarse downed woody debris left over from the previous stands, suggest a fire regime of re-burns or multiple underburn fires over the last two centuries. Understory re-initiation represents approximately 22,006 acres, or 38 percent of the forested lands administered by the Forest Service in the project area (Figure 11).

Old-Growth – Old-Growth (greater than 180 years old)

Stands in this category are characterized as old-growth (Oliver and Larson, 1996) and would generally meet the definition of old-growth, and in some cases the (PNW-447 USDA, 1986) old-growth criteria. These stands have large, live trees, often dominated by late-seral Douglas fir; large, dead, standing and downed trees; a multi-layered canopy; and a heterogeneous understory. The old-growth stage occurs when overstory trees die sporadically and understory trees begin growing into the overstory, creating multiple canopy layers and gradual shift towards a stand dominated by tolerant species. Many of these stands have been previously salvage logged to remove wind throw and mortality. Old-growth represents approximately 22,296 acres, or 38 percent of the forested lands administered by the Forest Service in the project area (Figure 11).

Figure 11 illustrates the current stand age classifications in project area. Table 10 provides the number of acres of each stand age classification that exists in the project area and the number of acres proposed for harvest in each category by alternative.

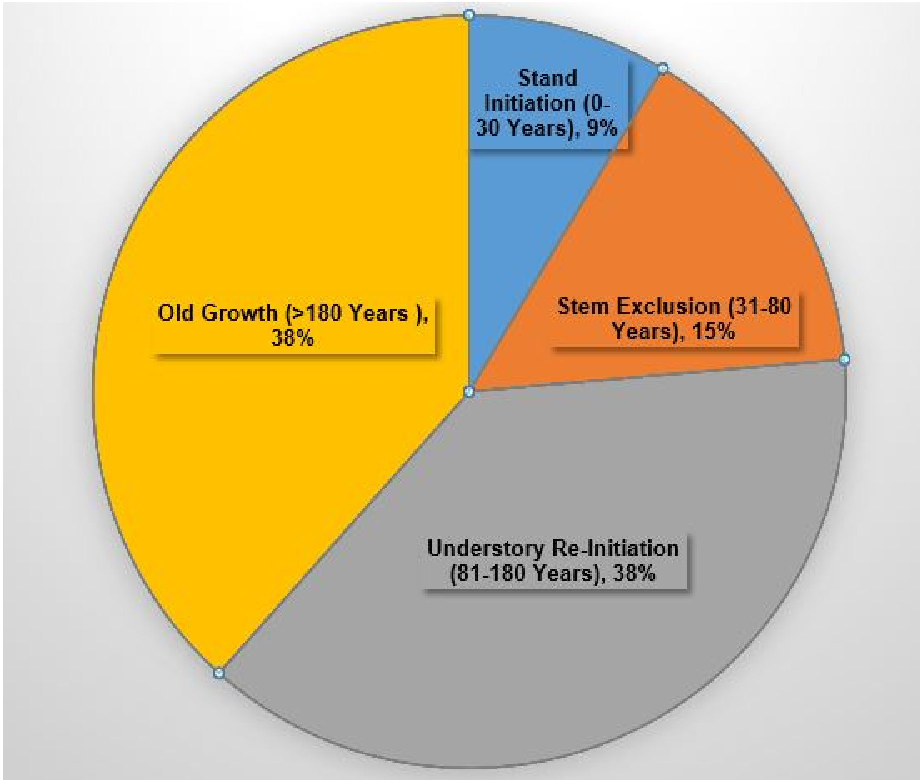

Figure 11. Current Stand Age Classification in the Flat Country Project Area

Table 10. Acres by Stand Age Classification

	Stand Initiation (0-30 years old)	Stem Exclusion (31-80 years old)	Understory Re-Initiation (81-180 years old)	Old-Growth (>180 years old)
Project Area acres[1]	4,986	8,729	22,006	22,296
Alternative 2 acres of harvest units (including skips)	81	1,221	3,136	0
Alternative 3 acres of harvest units (including skips)	81	1,221	0	0

1: Does not include non-forest areas such as waterbodies, meadows, and rock outcrops (16,018 acres). Also does not include private land (28 acres).

Stand Vigor and Growth

Stand Density Index

Harvest is proposed in both previously managed stands and fire regenerated (naturally regenerated) stands. Fifteen percent (Figure 11) of stands proposed for harvest, both managed stands and fire regenerated, in the project area are second-growth stands classified as being in the stem exclusion development stage (Oliver and Larson, 1996). Stands in this stage have dense crowns which block out the light to the forest floor and limit additional tree regeneration in the understory. Shade-tolerant understory trees that are present persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well suffer from competition and have an increased mortality rate.

Stand vigor and growth is declining in these stands. Some trees have begun to die due to overcrowding and competition between trees for nutrients and light, as evidenced by competition-induced mortality. The Stand Density Index (SDI), which is a qualitative measure of tree competition within a stand, ranges from 287 to 632 and averages 365 for all stands being considered for treatment in the Flat Country project area. In Douglas-fir stands, the maximum SDI (SDImax) is 595 (Reineke, 1933). Using SDI helps translate current conditions to future objectives, such as reduced competition to maximize individual tree or stand growth. As a stand reaches an SDI of about 149, or approximately 25 percent of SDImax, trees within the stand start to compete with each other. As SDI increases to around 357, or 60 percent SDImax, trees reach a point at which they start dying due to competition, or self-thinning (Long, 1985). Lower SDImax numbers are more suited to maximize individual tree growth, while harvesting when SDI reaches around 208-238, or 35-40 percent SDImax, the stand as a whole would have maximum growth.

Age of the stands play a role in the stand development, both in fire regenerated stands and previously managed stands, however it is not the sole factor. Because other factors such as climate/microclimate, soils, and water availability “are fundamental to site productivity – the potential for a site to produce plant biomass” (Tappeiner 2007, pg. 37) age alone does not tell much about the stands development. Stands with favorable climate, soils and water availability would grow larger diameters and heights in a shorter period compared to those stands with less favorable climate, soils and water availability.

Existing stand conditions were quantified using 2015-2016 stand exam data. The April 2016 version of Forest Vegetation Simulator (USDA Forest Service 2008, Pacific Northwest model with Western Cascade variant, revised April 2016) was used to analyze the stand data.

Previously Managed Stands

Approximately 1,302 acres of previously managed stands with trees averaging about 14 inches in diameter and ranging from around 11 to 26 inches are proposed for treatment in Alternative 2. Legacy trees identified by the wildlife biologist for wildlife benefits are excluded from cutting unless being cut for safety or operation purposes. Over about the last 61 years there has been approximately 14,457 acres of timber harvest on lands managed by the Forest Service in the project area. Approximately 2,418 acres of Forest System lands in the project area were modified with regeneration timber harvest, which is now in plantations less than 60 years old. Additionally, approximately 7,453 acres of Forest System plantations and fire regenerated stands in the project area have been pre-commercially thinned.

In previously managed stands, the average age of the stands are 41 years old with the range between 29 and 79 years old. Many of the stands are just starting to enter the stem exclusion stage or are already well in the stem exclusion stage with SDI’s averaging 363. Little understory development and species diversity appears to be in the stands. Many of the existing plantations in the analysis area are becoming ready for intermediate thinning treatments. Over the next decade, tree diameters in younger plantations would continue to become large enough for commercial thinning.

Fire Regenerated Stands

Approximately 2,210 acres of fire regenerated (naturally regenerated) stands with trees averaging almost 22 inches in diameter and ranging from around 11 inches to over 60 inches are proposed for harvest in Alternative 2. Legacy trees identified by the wildlife biologist for wildlife benefits are excluded from cutting unless cut for safety or operation purposes. The project area has been shaped by wildfires over the past several centuries, as well as timber harvest over the past 100 years. According to the Upper McKenzie Watershed Analysis (USDA 1995, pg. 79), the project area has a history of small (~20-60 acres), but frequent stand replacing fires. This area also has high elevation meadows that burned rather frequently and may have been influenced by sheep herders burning meadows in the late 1800's, and before that by aboriginal burns to enhance berry productivity. Many, but not all fire regenerated stands in the analysis area show signs of active management. Some fire regenerated stands have residual stumps representing either past salvage logging or selective harvest. The project area includes fire regenerated stands which have been both pre-commercially and/or commercially thinned in previous entries, as well as some stands that have not been previously managed.

In the fire regenerated stands proposed for treatment (stands over 80 years of age), the average age is 125 years old with a range of 93 to 150 years old. Because the majority of these stands are within the stem exclusion stage, only small amounts of understory development is apparent as the stands have started competition mortality. The fire regenerated stands proposed for harvest in the Flat Country project have an average SDI of 510 which is 85 percent of maximum SDI, indicating extreme inter-tree competition within the stands.

Table 11 illustrates average stand characteristics of previously managed, fire regenerated, and an average of all stands proposed for harvest in the project area.

Table 11. Average Stand Characteristics of Stands Considered for Harvest

	Total Trees Per Acre	Trees per acres available for harvest[1]	Quadratic Mean Diameter[1]	Average Stand Height[1]	Canopy Cover Percent[1]	Average Age[1]	Basal Area[1]	Stand Density Index
Managed Stands	558	184	14	79	69	41	196	363
Fire-Regenerated Stands	768	132	22	108	68	125	301	510
All Stands	671	671	18	94	69	86	253	442

1: Based on trees seven inches and greater DBH, because seven inches is the minimum DBH of a tree considered for harvest in the Flat Country project.

3.1.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Stands left untreated would continue growing for another 200-500 years, barring a natural disaster, but at slower rates as the trees continue to compete with each other for growing space and resources. The natural processes that affect tree vigor and cause changes in stand structure would continue as a result of high stocking density and competition. The effects of overstocked stands would include decreased growth rates, decreased live crown ratios, increased mortality rates, an increase in small diameter <15" snags and downed wood, an increased risk of insect and disease attacks, and an increased risk of stand replacing fires.

The competition-induced mortality would not be available for commercial wood products. The diameter size and product value of future trees would be reduced. Low light levels would limit understory vegetation. Shade-tolerant tree species, like western hemlock, would eventually dominate the stand in the absence of disturbances. Regeneration of shade intolerant tree species such as Douglas-fir, western white pine, and sugar pine would continue to be restricted. There would be no increased soil compaction and a potential loss of growth along temporary roads.

In addition, barring a wildfire, and as a result of ingrowth and lack of management created early-seral habitat, the current acreage of early-seral habitat for wildlife species would decline.

Alternatives 2 and 3

The following treatments are used to describe the direct and indirect impacts for treatments that would occur with both action alternatives.

Thinning

Thinning would increase the health and vigor of the remaining trees and help increase the stands' ability to adapt to environmental changes. Reduced canopy cover and increased light would help promote a second cohort of trees. Harvest would provide growing space for a second cohort of trees with vertical, horizontal, age, and species diversity in the stands. Both shade-tolerant and intolerant species may become established after thinning. Shade-tolerant species would thrive better over time as the overstory crown closes. The beneficial effects of a more open canopy would taper off over the next 15-20 years as the canopy cover increases at an estimated rate of 2 percent per year (Chan, 2006).

Conifer trees would be removed through commercial thinning across all size classes, but removal would primarily consist of smaller diameter trees within the stands (Figure 12). There would be an emphasis on retaining sugar pine and white pine; however, these species could be cut for operational purposes. The prescription would maintain or increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Young uniform stands like those proposed for treatment in the Flat Country Project can be diversified by early thinning (DeBell et al., 1997, and 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). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al, 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al., 1991, Bailey and Tappeiner, 1998, Miller and Emmingham, 2001).

Heavier thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. Many old trees grew rapidly when they were young (30-100 years), producing large stems and crowns. Evidence (Franklin et al., 1981, Tappeiner et al., 1997) suggests that the growth rates of some older forests resulted from slow regeneration and low densities over a long period with little tree-to-tree competition. Old-growth stands typically have multiple canopy layers, and thinning promotes a second canopy layer by allowing for natural regeneration to occur (Tappeiner et al., 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established shade tolerant conifers (Winter et al., 2002a 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

A short-term adverse impact to understory vegetation and below ground fungi would be the mechanical damage from logging. The removal of host trees and soil disturbance from yarding operations impacts below ground fungi (Courtney et al., 2004). The adverse impact from yarding operations would be mitigated by the use of designated skid trails with ground-based yarding systems, and log-suspension capabilities with skyline and helicopter yarding systems.

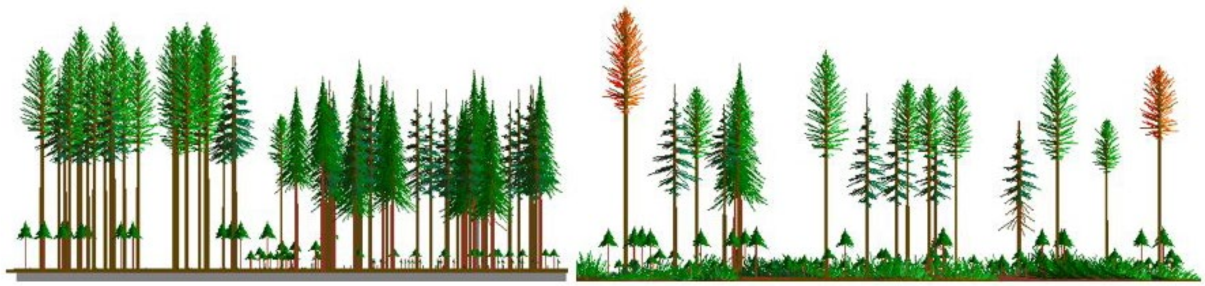

Figure 12. Visualization of a Stand Before (left side) and After (right side) Thinning

Gaps

Gaps are openings which would range in size from one to three acres outside of Riparian Reserves with small non-commercial gaps up to 1/4 acre occurring within Riparian Reserves. Gaps would be randomly placed unless it was necessary to strategically place the openings to mimic natural disturbances, minimize conflict with logging systems, minimize visual concerns, treat an identified root rot pocket, or strategically placed approximately 66 feet apart to promote uneven aged stand characteristics. Within the stand, a thinning prescription would be applied to the area outside the gaps (Figure 13).

Gaps outside of Riparian Reserves would retain up to four trees per acre to add diversity and provide for natural recruitment of snags and downed woody material in the future. Trees designated as a leave trees within the gap would not be used for snag or large downed wood enhancement projects. Retention trees meeting criteria for wildlife trees (i.e. having *Phellinus pini* conks or other elements of wood decay, crooked tops, etc.) would serve as wildlife trees and offset the need for enhancement.

By implementing gaps, the project would provide numerous benefits for many species of wildlife over the next 10-20 years before regeneration reclaims the openings. Gaps have been shown to provide habitat to shrubland birds not present in mature forest (Chandler et al. 2009) while generally providing more fruit and more resource abundance due to a lower canopy and increased fruiting (Blake and Hoppes. 1986). Generally, gaps provide more resources to forbs, shrubs, and broad-leaved plants, which provide the foundation for food webs that contribute to many different trophic levels in Pacific Northwest coniferous forest (Hargar, 2007).

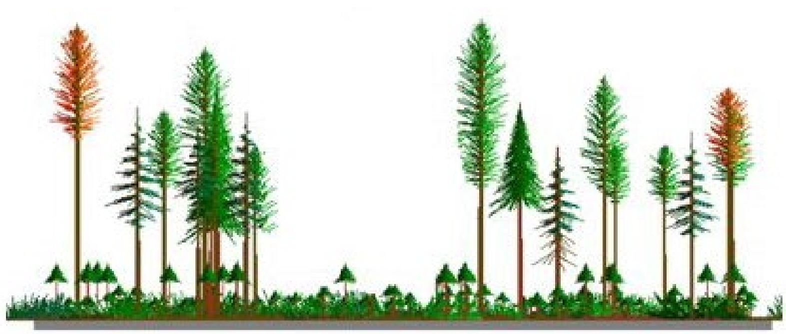

Figure 13. Visualization of Thinning with Gaps

Dominant Tree Release (DTR)

This prescription would provide for growth of a single dominant tree or a group of five to ten dominant trees to promote larger trees scattered throughout the stands. This meets the purpose of improving stand conditions in terms of species composition, diversity, density, and structure. DTR may result in open-grown trees that develop larger limbs lower to the ground, which could serve as wildlife habitat (McGuire et al, 1991), as well as greater taper, which reduces tree susceptibility to wind damage in the future. The area around the dominant tree would be cut within a 66-foot radius from the bole of an individual tree or each tree in a group. Around an individual tree, this 66-foot radius equates to an opening approximately ¼ acre in size. Around a clump of five to ten trees, this equates to an opening approximately 1/3 to ½ acre in size, depending on the number and spacing of trees retained (Figure 14). Sugar pine and western white pine over 24 inches in DBH would be treated as a dominant tree. The lack of competition would provide the tree(s) in the DTR a long term benefit of at least 50-100 years, as it would remain a dominant tree in the opening even as other trees encroach on the opening.

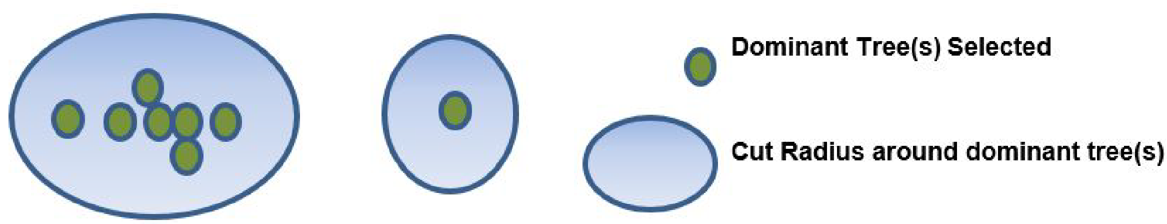

Figure 14. Visualization of Single vs. Multiple Tree Dominant Tree Release

Regeneration Harvest - Shelterwood with Reserves (Alternative 2 Only)

Approximately 961 acres with trees that are between the ages of 98-150 years old would be treated with regeneration harvest, more specifically, a shelterwood with reserves. The majority of trees would be removed with some residual live trees left on site. Although not exactly mimicking naturally occurring disturbance events, this harvest would provide forest products while creating a small-scale disturbance in the analysis area that is somewhat similar to what may have occurred naturally. The objective would be to leave approximately 20-25 trees per acre following harvest that would help establish a future stand by providing a beneficial microclimate and contributing towards creating snags and downed wood (Figure 15). Those residual trees not used for snag and downed wood creation would be retained throughout the rotation. The residual trees would on average be larger trees, including some with disease to promote natural processes. These residual trees would provide for future snag development and downed woody material, while providing a diverse stand structure in the future.

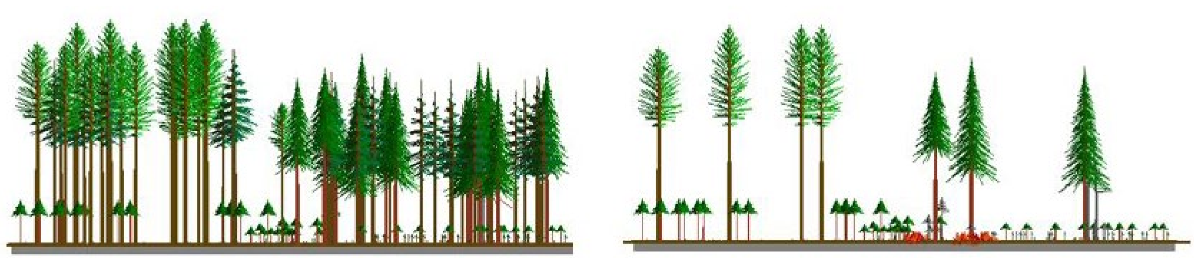

Figure 15. Visualization of a Stand Before (left side) and After (right side) Shelterwood with Reserves Treatment

Even-aged systems, such as shelterwood with reserves, provide an optimal environment for the establishment and growth of the shade intolerant species presently on site. The residual live trees are used to provide seed and/or protection from environmental extremes. The residual green trees are well-dispersed through the unit to provide a consistent level of protection. Planting would be used to help regenerate the stands (see Connected Actions below), with a pre-commercial thin (PCT) planned for 15 years later, and commercial harvest 25-40 years after the PCT.

The residual canopy would be composed of the largest trees in the stand, primarily Douglas-fir. At least 15 percent of each stand would be retained as a Green Tree Retention (GTR), in a combination of no-harvest patches and, or, residual trees scattered or clumped within the stand (NWFP 1994 C-41). Trees reserved in a shelterwood with reserves that are not utilized to meet snag requirements would count towards GTR (NWFP 1994, C-41- C-42). The retained patches would be scattered and variable in size. Stands treated as shelterwood with reserves would be treated for fuels reduction, and planted with a variety of tree species after harvest. Large wood on the forest floor would be maintained or enhanced. Numerous snags would either be maintained on site if not a hazard to logging operations, or enhanced through snag creation techniques**.**

The GTR trees in each unit would be retained in a combination of dispersed trees and clumps of trees. Generally 70 percent of this retention should be in clumps $\geq$ 0.5 acres, however in a shelterwood with reserves, most if not all the required retention would be in dispersed retention due to the desire to provide shelter throughout the stand. This retention should include at least 1 clump of 5-10 trees per acre. All Green Tree Retention areas (i.e. aggregated retention) would be mapped in the corporate database of record (FSVeg Spatial), populate the Theme attribute = "GTR". Polygons with dispersed retention would have the Habitat Feature 1 attribute = "CS" (clumped and scattered).

No Harvest – Skips

By not treating an area, the area would provide diversity within a stand. These areas would be allowed to have natural processes take place such as inter-tree competition, which would create snags and downed woody material. However, there would be an edge effect that could take place along the skips edge. Skips would be dispersed between riparian and non-riparian areas. Depending on the location and positioning of the skip, the edge effect could allow for more light to reach the trees along the edge and forest floor. This extra light could lead to greater growth of some of the individual trees, forbs, and shrubs along the edge.

Implementation of skips would be along unit boundaries and within units. Additionally, internal skips may include identifying a tree and not including for harvest any other tree within a specified distance of that identified tree. Similar to the no action alternative, trees in skips would continue growing for another 200-500 years, barring a natural disaster, but at slower rates because the trees would compete with each other for growing space and resources.

Comparison of Effects from Alternatives 2 and 3

On treated acres, both action alternatives would have the same beneficial effects. However, fewer acres would be harvested in Alternative 3 than in Alternative 2 (Table 12), which would result in fewer treatment benefits and more acres showing signs of no treatment in Alternative 3. The direct and indirect effects on the untreated acres in Alternative 3 would be the same as those explained in the Alternative 1 (No Action) section.

Thinning and DTR would be used to improve or maintain the growth and health of overstocked stands in stem exclusion on 2,055 acres in Alternative 2 and 996 acres in Alternative 3 (Table 12). Thinning and DTR would open up the tree canopy allowing more sunlight and precipitation to reach the forest floor.

This would result in changes in the microclimate (increased air and soil temperatures, relative humidity's, and air movement), under the main canopy for a short term (10-20 years) until the canopy closes back in (Chan, 2006). These changes in microclimate stimulate an increase in favorable growing conditions for most plant species.

Thinning, DTR, shelterwood with reserves, and gaps would be used to promote the development of diverse, multi-layered stands on 3,339 acres in Alternative 2 and 1,129 acres in Alternative 3 (Table 12). The treatments would primarily aid by providing conditions that favor the establishment of forbs, shrubs, hardwoods and conifer in the understory, and by releasing saplings and intermediate-crown class trees in the stand. Increased growth of the understory would provide a more contiguous bed of green, high moisture content, low flammable vegetation on the forest floor. Thinning, DTR, and gaps would also promote crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in an open stand. As the crowns differentiate, the risk of a fire spreading from crown to crown decreases. Commercial harvest may cause some stages of forest succession to be shortened due to accelerated growth and enhancement activities (Andrews et al., 2005). The stands in both alternatives would more quickly move from stand initiation to understory re-initiation and on to old-growth.

Thinning, DTR, gaps, and skips would maintain or enhance stand level, plant species diversity, composition and structure on 3,477 acres in Alternative 2 and 1,302 acres in Alternative 3 (Table 12). Species richness for herbaceous and total species richness across trees, shrubs, and herbaceous vegetation have been shown to be greater in thinned stands than in unthinned and old-growth stands (Bailey et al 1998).

Alternatives 2 and 3 would commercially thin 164 acres of Riparian Reserves in stands under 80 years old to reduce the density of overstocked stands, increase species diversity and structural complexity, and accelerate tree growth to more quickly attain ACS objectives (Table 12). Both Alternative 2 and 3 would largely protect future instream wood sources due to no-treatment buffers and skips, but may reduce short-term (1-2 decades) sources of small dead wood in the outer portions of some Riparian Reserves in order to achieve desired vegetation characteristics. Thinning trees within the Riparian Reserve areas would maintain a 40 percent canopy cover to ensure that the treatments are beneficial to the creation of late successional forest conditions.

Gaps, DTR, and regeneration harvest would shift 1,403 acres into stand initiation in Alternative 2. Gaps and DTR would shift 183 acres into stand initiation in Alternative 3 (Table 12). Those acres would provide for long term (80-100 years) sustainable timber production.

Fuel loading would increase on 3,339 acres in Alternative 2 and 1,129 acres in Alternative 3. The added fuels would mostly come from limbs and needles left on the ground after harvest, which would be small in size and would typically decompose within 2-3 years. See the Fire and Fuels section for more information on fuel loading.

Commercial harvest may cause some stages of forest succession to be shortened due to accelerated growth and enhancement activities (Andrews, et al., 2005). The stands in both alternatives would more quickly move from stand initiation to understory re-initiation and on to old-growth.

Table 12. Comparison of Treatment Acres by Alternative

Treatments, and Purpose and Need Attainment	Alternative 1	Alternative 2	Alternative 3
Acres of Thinning Outside Riparian Reserves	0	1,772	782
Acres of Thinning in Riparian Reserves	0	164	164
Acres of Shelterwood with Reserves	0	961	0
Acres of Gaps	0	323	133
Acres of Dominant Tree Release	0	119	50
Acres of Skips Outside Riparian Reserves	0	426	75
Acres of Skips Within Riparian Reserves	0	673	98
Total Acres of Timber Harvest Units (includes skips)	**0**	**4,438**	**1,302**
Acres with Improved or Maintained Growth and Health	0	2,055	996
Development of Diverse, Multi-layered Stands	0	3,339	1,129
Maintain or Enhance Stand Level, Plant Species Diversity, and Composition	0	3,477	1,302
Reduced Overstocking in Riparian Reserves	0	164	164
Acres of Stand Initiation to Promote Long Term Sustainability	0	1,403	183

Cumulative Effects

Alternative 1 – No Action

With implementation of Alternative 1, no cumulative effects to forest stand and structure would occur as the effects of Alternative 1 do not overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

Alternatives 2 and 3

Effects to forest stand and structure from Alternatives 2 and 3 overlap in time and space with effects from five past projects. The Norse CE Project was completed in 2013 and treated approximately 65 acres including approximately five acres of gaps. The Pass CE Project was completed in 2013 and treated approximately 34 acres including approximately five acres of gaps. The Muskee CE Project was completed in 2015 and treated approximately 67 acres including a one acre gap. The Dulce CE Project was completed in 2017 and treated approximately 51 acres including approximately three acres of gaps. The Ollie CE Project was completed in 2018 and treated approximately 44 acres including approximately four acres of gaps. The past five projects created 18 acres of gaps that would fill in over 5-8 years after completion and therefore would have a cumulative effect until vegetation totally fills in the gaps. Cumulatively, Flat Country Alternative 2 would contribute 3,439 acres (thinning, shelterwood with reserves, DTRs and gaps) of enhanced vegetative structural complexity and early-seral habitat to the planning area, bringing the total to 3,700 acres. Fuel treatments on these five past projects would be complete prior to the implementation of the Flat Country Project, therefore no cumulative effect to fuel loading is anticipated.

Connected Actions

The following actions and effects would occur with implementation of both Alternative 2 and 3.

Post-harvest Tree Planting

Reforestation would help to ensure sustainability of the stands into the future. Reforestation for all shelterwoods with reserves would be accomplished with planting, and reforestation for gaps would be accomplished with either planting or natural regeneration depending on gap conditions (Table 13). This planting and natural regeneration would be expected to occur within five years after harvest. All planting would use a mix of tree species that represent historic species composition, thereby resulting in an increase in the species diversity in the planted stands.

Alternative 2 would require approximately 1,112 acres of reforestation associated with regeneration harvest and gaps, while Alterative 3 would require approximately 62 acres of reforestation associated with gaps. Planting in gaps would be required when the gaps represent 10 acres or greater within a given stand and are strategically located with narrow thinned strips (66 feet wide) between them to promote an uneven-aged stand. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity by favoring species such as western white pine and western red cedar. Slash would be retained to protect young trees from damage by serving as shade and as a deterrent to browsing by deer and elk. Trees planted in identified root rot pockets would be species that are less susceptible to root rot, like western red cedar, sugar pine, western white pine or red alder. Post-harvest planting would help provide for sustainability and diversity in the project area long term.

Table 13. Acres and Mode of Regeneration by Alternative

	Shelterwood w/ Reserves	Gaps		
	Planting	Natural Regeneration	Planting	Total
Alternative 2	961	172	151	1,284
Alternative 3	N/A	71	62	133

Creating Snags and Downed wood

Up to four snags per acre would be created from the reserved trees in units with Shelterwood with reserves in Alternative 2. In addition, at least 240 linear feet of downed wood would be retained or created in decay classes 1 and 2. Enhancement opportunities would occur in thinned stands and shelterwood with reserve stands. The trees used for the snag and downed wood enhancement have been accounted for the in the prescription and would not negatively affect the forest stand structure or sustainability in the project area.

Scarification and Subsoiling

Scarification is the use of specialized equipment to break up compacted layers 3-6 inches below the surface and return the soil's structure to a more natural state. Scarification of skid trails would occur where necessary, based on site specific impacts. Soils under a retention tree canopy would not be scarified since these areas would be less compacted by operations and to avoid the risk of root damage.

Subsoiling is the use of specialized equipment to break up compacted layers 18-24 inches below the surface and return the soil's structure to a more natural state. Subsoiling would occur where a landing or temporary road has compaction levels above Forest Plan standards and guidelines. When used in appropriate site-specific conditions, subsoiling is beneficial to forest and stand structure because it reduces soil compaction that can occur as a result of by heavy equipment. Some adverse effects may occur if residual trees inadvertently have roots pruned by the subsoiling. Because of the design criteria in chapter 2, scarification and subsoiling would promote a healthier stand with better growing environment providing for improved forest stand structure and sustainability in the project area.

Temporary Road Construction and Decommissioning

Temporary road construction and decommissioning would occur where temporary roads are necessary to facilitate project activities. The initial effects of the construction would be compacted soils which could affect forest and stand structure; however those effects would be offset by decommissioning. The effects of decommissioning would be the same as subsoiling. No negative effects to Forest Stand and Structure are expected due to the design criteria identified in chapter 2.

Fuel treatments

Approximately 2,307 acres of fuel treatments in the Flat Country project area would be concentrated on both sides of roads removing noncommercial vegetation (shrubs and trees) to create a fuel break for suppression and containment opportunities for Alternative 2 & 3. The vegetation for removal includes trees 7 inches diameter and under in stands along roads that are under 80 years old. In stands along roads that are older than 80 years old; trees 10 inches diameter and under would be removed under this project. All treatments would retain trees at a spacing of approximately 20 feet drip line to dripline. The width of the fuel treatments vary due to the proximity to the Mount Washington Wilderness boundary. The roads that are closer to the Wilderness boundary would have fuel treatments on both sides of the roads with a total of 600 foot width of noncommercial vegetation removal across 11 miles. The interior roads would have a fuel treatments on both sides of road with a total of 300 foot of noncommercial vegetation removal across 26 miles. This activity would only remove the understory shrubs and trees that contribute to ladder fuels and the main canopy cover would remain intact containing intermediate, codominant, and dominate trees. Due to the small treatment footprint within individual stands, no affect would occur on the overall stand structure. For more detail on the project see the Fire and Fuels section 3.12.

Bunchgrass Meadow Restoration

Bunchgrass Meadow is part of the Mount Washington West Inventoried Roadless Area and is identified in the Willamette National Forest Plan as a 9D land management allocation. Management goals include protecting or enhancing unique wildlife habitats and botanical sites which are important components of healthy, biologically diverse ecosystems (Willamette National Forest Plan 1990). The Forest Plan 9D land allocation states that no programmed harvest shall be scheduled, however commercial harvests and vegetation treatments are permitted if necessary to meet established wildlife and botanical objectives. All restoration activities would occur without road construction, and harvest systems would be either over snow or by helicopter. Alternative 2 proposes to remove all trees under 30 inches diameter across 49 acres within the restoration area. This project would retain up to 20 trees per five acres above 30 inches diameter and at least 15 percent of the trees in the proposed area would be retained in a combination of dispersed trees or in clumps of trees. To the extent possible, dispersed and clump trees would include the largest, oldest live trees, decadent or leaning trees, and hard snags occurring in the meadow area. The clumps would be retained indefinitely. By removing the density and encroachment of trees (seedlings to mature) within the proposed project this would transition a forest back to a meadow environment and allow for grass and forb species diversity. The removal of trees would reduce the stands future growth, but does not affect the overall productivity of the planning area because these stands are not part of the timber base within the planning area.

Fall-and-Leave Treatments

Alternative 2 is proposing to create several fall-and-leave gaps (<0.25 acres each gap) in the no cut riparian buffers of stands 1310 and 2180 to enhance terrestrial habitats which are also a component of the Aquatic Conservation Strategy objectives. This project consists of creating openings by cutting trees to add additional structural complexity, vegetative and habitat diversity in the second site potential tree height in the Riparian Reserves. The project would cut and leave trees on site for downed wood to benefit wildlife. The size of the openings are small and have a minimum deductions in the overall canopy cover. The fall-and-leave treatments would not have a negative effect on the stand structure because the opening would be short lived due to the small size of the opening and the edge effect of the surrounding canopies would start encroaching the opening within the next 8 to 10 years.

Special Forest Products Removal

The stands selected for treatment would be available for collection of special forest products. These special forest products may include, but are not limited to, poles, post, landscape transplants, shakes, yew bark, seed cones, Christmas trees, boughs, mushrooms, fruits, berries, hardwoods, forest greens (e.g., ferns, salal, beargrass, Oregon grape, moss) and medicinal forest products. As these collections would occur in the areas to be treated, or that have been treated, no impact on late successional forest values should occur. Special product sales shall be designed to sustain the resource and protect other resource values such as special status plant or animal species. No negative effect on the resources would occur while providing for sustainable long term public use.

3.2 Soils

3.2.1 Summary of Effects

The short-term impacts to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (1990) include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity.

The level of impact is analyzed by measuring the total area of cumulative detrimental soil compaction, which should not exceed 20 percent of the total acreage within any unit, including roads and landings. Field investigation of pre-activity compaction indicated that 25 units approached or exceeded the Willamette National Forest FW-081 Standard of 20 percent of an activity area. The remaining units were sufficiently within the standard.

Long-term soil productivity is maintained by following soils design features and mitigation measures during and after proposed project activities. Some of the mitigations are to achieve 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.

In general, the proper project implementation and use of the design features, standard contract language and individual design features recommendations should provide sufficient erosion control measures, nutrient cycling activities and de-compaction techniques during and after project implementation, and no adverse effects to soil resources are expected.

3.2.2 Scale of Analysis

For soil resources, the scale of analysis for direct, indirect and cumulative effects is almost always the unit. A unit is the stand polygon or activity area proposed for silvicultural treatment. In this case, the soil resource was evaluated for each of the proposed timber sale units located within the context of the Flat Country Project boundary. The unit of measure for evaluating the effects is the percent of the “unit” affected. Potential impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted.

The information for this report was obtained by field reconnaissance of the proposed units and, when applicable, the terrain surrounding the units. In units where ground-based harvest methods were proposed, transects were walked and information taken to determine the numerical extent of existing compaction, as a percentage of the transect distance.

Evaluating impacts and their potential significance between or among alternatives requires a discussion of the duration and intensity of those impacts. The following definitions apply to impacts in this section.

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 10 years.
- Long-term: The effects last from about 10 years to several decades or longer.

Intensity

- Low: The impacts are essentially zero, at the lowest levels of detection, or very slight but still noticeable.
- Moderate: The impacts are readily apparent, but meet standards and guides.
- Moderate-high: The impact is moderately severe and likely approaches the upper limits of standards and guides.
- Significant: The impacts are severe, and likely exceed standards and guides or do not meet Best Management Practices.

3.2.3 Affected Environment

Geology

The project area is located within the Upper McKenzie Watershed and lies primarily within High Cascades rock formation sequences (Walker and Duncan, 1989). The High Cascade formations (from

Pleistocene and Pliocene) have been modified by stream erosion and mountain glaciation, especially during the Pleistocene to Holocene glacial activity. This represents an area of dominant volcanic and volcanoclastic origins intermixed with glacial deposits.

The volcanic and volcanoclastic formations are basalt to basaltic andesite components from flows, breccias, and pyroclastic origins. The oldest (QTba) formation is described as deposits within flows and breccia shields, lava cones, and valley fields, within areas dissected and modified by fluvial processes. The dominant landform within the area is a basaltic (volcanic) plateau, slowly and gently dissected into valley fields to the west.

The older volcanic formations were intruded with younger basaltic andesite and basaltic flow and flow breccia (Qba) formations, representative of gentle lava cones and intra-canyons flows observed within the eastern to southeaster section of the project area. Traces of pyroclastic ejecta (QTp) of basaltic and andesitic cinder cones (Holocene to Miocene) are intermixed as unconsolidated fine to coarse subaerial environment within the east section of the project area.

Some units within this project are dominated by glacial formations. During the early and most extensive glacial periods, valley glaciers surged away from the large ice mounds along the Cascade crest and traveled south and west down the McKenzie River drainage or north out of the South Fork drainage to reach their maximum extent. These glaciers acted as outlets for excess ice accumulation for the large ice platforms along the Cascade crest.

The glacial deposit components are expressed within most of the project area as unsorted bouldery gravel, sand, terminal moraines, and lateral moraines. Some glacial deposit components are locally and partly sorted where the plateau gently turns into moderate structural benches toward the western section of the project. The rocks and glacial strata of these younger Pleistocene volcanic and glacial (drift, moraine, and fluvioglacial) deposits are not well weathered at this point. Landforms are relatively uniform, and depth to bedrock generally ranges from 1 to 10 feet. These various land types are generally well-drained, with rapid permeability in the surface soils and in the subsoil. The gentle slopes and well-drained soils with slow water release result in emergent seasonal wetlands, meadows, and hillslope stability within the project area.

Soil Resources

Within the project area boundary, the majority of soil components fall into 3 categories. These categories are also linked to the origin and geomorphology of the area.

- Approximately 64 percent of the project area (eastern, middle, and south) contains Andisols. These are on smooth to uneven glaciated lava flows, gentle to steep side-slopes up to high elevations, and uneven flats and benches. Parent materials are mostly colluvium and residuum, forming moderately deep soils with sandy loam to loam textures. Some fine soil components (silt loams and clay loams) are contained within meadows and bench areas.

- Approximately 34 percent of the project area (western to southern) contains dominantly Inceptisols soils. These are found on depressions and steep slopes and are also of colluvium/residuum origin. They exhibit mostly shallow to moderately deep soils. Soils are mostly medium to coarse in texture (loamy sand to sandy loam). Fine particle sizes (silt loams – Inceptisols and Ultisols) are present in the toe slope depression zones.

- Andisols, Spodosols and Inceptisols soils are dispersed throughout approximately 2 percent of the project area. These are formed in alluvium, colluvium, glacial outwash, and glacial till. They are deep soils with medium coarse particle size that are moderately to well-drained.

Current Soil Resources Conditions

Meadows, emergent and seasonal wetlands, and saturated soil (wet zones) are present within 12 units of the project area (Table 14). The mapped wet areas within these 12 units would be avoided by excluding them from harvest activities. Refer to the map titled Soil Concerns Area for Flat Country in the soil project record.

Table 14. Wetlands and Wet Zones within the Flat Country Project Area

Unit	Condition Description	Management Recommendation
490	seasonal wetland / wet zones	avoid and buffer (potential skip)
490	wetland area / wet zones	avoid and buffer (potential skip)
1030	wetland area and displacement issues	avoid and buffer (potential skip)
1040	emergent wetland area within open system	follow soil scientist recommendations for sensitive soils in avoidance areas
1080	wetland and displacement issues	avoid and buffer (potential skip) / follow soil scientist recommendations for sensitive wetland soils, meadow enhancement, and soil restoration
1250	wetland extends through unit to northwest	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1270	wetland / wet zones gaining area from Canyon Creek	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1290	enhancement activities / meadow / emergent wetland	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1770	emergent wetlands and stream complex system	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1810	meadow / emergent wetland-wet zones areas	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1830	wetland area	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas
1980	emergent wet section area / displacement issues	follow soil scientist recommendations and other design features for sensitive wetland soils, meadow enhancement, and/or other restoration in avoidance areas

3.2.4 Environmental Consequences

Direct and Indirect Effects

The direct and indirect effects to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (1990), are assessed based on displacement, compaction, nutrient loss, and instability (Table 15). Displacement can occur with timber management during road or landing construction, yarding, or the mechanical treatment of slash, such as machine piling. The total area of detrimental soil conditions should not exceed 20 percent of the total acreage within the activity area, including roads and landings.

Table 15. Management Indicators for Assessing Effects to Soils

Management Indicator	Definition	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 of 15% or more and/or a reduction in macropore space of 50% over the undisturbed soil	FW-081
Nutrient Loss	Insufficient litter/duff retention or large dead and downed woody material to maintain a healthy forest ecosystem and ensure adequate nutrient cycling	FW-085
Instability	Increase in size, intensity or number of slope failures do not meet Forest standards for soil productivity, water quality, and protection of public safety, roads, and facilities	FW-086

Alternative 1 – No Action

Evidence of compaction from previous entries is still present in most plantation units with previous ground-based harvest. The accelerated restoration of highly compacted areas would not occur within these units, resulting in a long-term, slow natural regeneration. No new impacts would occur.

Alternative 2 – Proposed Action

Displacement

Based on field assessment as part of the FSDMP, previous management activities in units have resulted in less than 1 percent of the area in bare soils. The highest bare soil values (15 -25 percent) occur where there are highly erosive soils. Erosion impacts within monitoring areas were mostly low intensity sheet and rill erosion. Topsoil displacement action ranges from no surface displacement up to some topsoil displacement and erosion to mineral soil. Units with high displacement impact correlated with units presenting 20 percent or greater compaction. Units that had notable physical evidence of prior displacement are 360 (a dissected alluvium fill within the steep slopes), units 1030, 1080, 1980 show erosion issues within and near emergent wetland/wet zone portions of meadow areas.

Potential soil resource limitations to harvesting activities were determined by comparing soil properties (Willamette Soil Resources Inventory), levels of occurrence within the project area and type of management activities. The analysis determined that there is a low to moderate dominant potential displacement level within the project area (87 percent). A moderate to high potential displacement could occur within 12 percent of the project area. The units displaying a moderate to high and/or high displacement potential are 160, 250, 360, 1320, 1350, 1650, 1660, 1670, 1680, 1880, 1940, 1950, 1960, 2020, 2030, 2040, 2060, 2080, 2090, 2111, 2112, and 2190.

Places of concern located in some proposed ground based units would adhere to contract clauses (as stated in the soil report) which include a series of erosion control practices, classification of areas suitable for prebunching, and areas not suitable for pre-bunching within 35 to 45 percent slopes, duff retention percentage (ground cover) recommendation per units (as outlined in the Integrated Prescriptions for each unit). All the design features recommendations within the soil report objectives are to reduce erosion potential and/or improve soil productivity during and after project implementation.

Places of concern for some of these units are mostly located within the skyline (or potentially helicopter) area, and therefore would not be affected. Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1 percent of the unit area. With appropriate suspension during logging, soil disturbance is minimal and off site erosion is essentially non-existent. During harvest the retention of stream adjacent trees and the requirement of full suspension yarding over or away from stream courses would minimize or eliminate off-site erosion.

By applying all mentioned design features, disturbance from harvest activities (ground base and skyline) would be well within the Regional and Forest standards and significant adverse impacts are not anticipated. With appropriate implementation, soil displacement is minimal.

Compaction

Many units were tractor logged in the past, and several were also brush-raked with a bulldozer to remove fuels, which removed topsoil and compacted large areas, impeding tree growth. In twenty-five units in the project area, detrimental compaction ranges from 20 to 57 percent.

The twenty-five units where legacy compaction exceeds 20 percent would be prioritized for post-sale enhancement subsoiling to bring the soil compaction below 20 percent of the unit area. It is estimated that 50 to 170 acres of post-sale enhancement subsoiling are needed to promote the restoration of soil porosity and subsequent air and water circulation, nutrient cycling and microbial activity that would eventually promote healthy forest growth.

Nutrient Loss

The primary mechanism for excessive nutrient loss is uncontrolled wildfire at high fuel loadings, low fuel moistures, and adverse weather conditions. Potential nutrient loss is primarily controlled by duff retention standards. Duff retention is the amount of duff thickness remaining after management activities are completed. Duff retention objectives are specified for each unit to maintain nutrient cycling, as outlined in the Integrated Prescriptions for each unit. The integrated prescriptions are kept on file in the project record.

Ground cover percentages from duff/litter, fine woody and coarse woody material were measured as part of the forest soil disturbance monitoring protocol in some units. The duff/litter percentages range from 20 percent up to 95 percent with a depths of ½ inch up to 2 inches. Areas with less than 40 percent duff and litter occur where the forest floor was partially intact or missing. The fine woody material range from 5 up to 45 percent, with an average of 10-15 percent per area. Areas with high fine woody material occur within old slash piles. Coarse woody material range from 2 up to 30 percent, with an average of <5 to 10 percent. Areas with high coarse woody material accumulations occur on steep slopes.

For the proposed action, activity-generated slash would be reduced by post-harvest fuel treatments such as underburning, machine piling, and hand piling. Fuel treatments within areas recommended for enhancement activities (meadows) would include tree removal and broadcast burning. In addition, there are about 2597 acres proposed for road fuel treatment. Proposes fuel treatments effects to nutrient cycling sources (i.e. ground cover) were analyzed using unit aspect, soil texture, barriers and topography, type of fuel treatment and ground cover percent measured in the field using FSDMP.

The analysis determines the most effective duff retention (ground cover) percent range per unit after reduction of slash material, in order to ensure nutrient cycling. Duff retention (ground cover) includes duff/litter, fine wood and large wood material. Calculated duff (ground cover) retention percentages are provided in the project record appendix entitled Flat Country Soils Integrated Duff/ Ground Cover Retention Percent's Per Units.

Ground cover retention percentages provided depend on local topography and microclimates. On predominantly flat areas with quick recuperation potential, due to shade and humidity, ground cover retention should be between 30 and 50 percent. In general, steep side slopes should retain 40 to 70 percent ground cover. On these landforms, 50 percent ground cover is effective and attainable. In meadow enhancement areas, 20 to 30 percent ground cover retention is adequate. Design features for wetland soils and other restoration avoidance areas should be followed.

Burning the slash piles may create sufficient heat to affect the underlying soil. However, the hotter portions of pile burning involve a very small part of the acreage in any unit, usually less than 1 percent of the area (in this case, approximately 0.3 percent), and some material would be left to decompose on site and break down over time. Also, 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.

Underburning would leave pockets of live and dead fuels even in this small affected area. As with pile burning, underburning would be limited seasonally to periods with low threat of fire escaping the unit boundaries.

The calculated and provided duff (ground cover) retention percentage ranges represent the minimum to the highest values require to maintain a healthy forest ecosystem and ensure adequate nutrient cycling as stated on the Forest Plan Standard FW-085. The values would be followed during and after timber sale and fuel treatment activities.

With the retention of adequate duff and wood debris, potential adverse impacts to long-term soil productivity are not anticipated.

Instability

With proper logging system prescriptions and when the design features are followed, potential slope instability and/or mass movement with proposed management is not considered a concern in any unit. No instability concerns were noted in any of the field reconnaissance.

Connected Actions

Transportation Development

Some units may require temporary roads to access suitable landing sites for either ground based or skyline yarding systems. In all cases, these temporary roads are located on gentle to moderate, stable side slopes in common material. Some units are accessed by opening old logging roads constructed many decades ago. In most cases, use of these old roads would allow for road maintenance improvement such as drainage structure (proposed culvert upgrades) and fill stabilization. Some units are accessed by using newer Forest Service roads that now require some additional work to maintain adequate road drainage and surface integrity.

Temporary spur road construction and system road maintenance and usage would adhere to the required erosion control and soil displacement mitigation features. Per forest standards, development of the transportation system for this sale would maintain slope stability, and based on soil properties, general erosion hazard potential within the area is moderate. Reconstruction and decommissioning would provide opportunities to rehabilitate or close old road courses. Some site-specific erosion, from runoff impact could occur, requiring specific erosion control practices and stability techniques. Adhering to forest service standards for maintenance, monitoring and soil/geology mitigations (such as wet weather management, dry versus wet weather haul, erosion control practices), minimal impact is expected.

In summary, development of the transportation system for this sale would maintain slope stability, would produce little or no off site erosion, and would provide opportunity to rehabilitate old road courses.

Rock Resource Development

Primary rock sources that could be used for this project include Boulder Rock Source at the end of Rd 2653704 at T15S, R6E, Sec 36, NW of the NW and Chinook Rock Source near the end of Rd 2653760 at T16S, R6E, Sec. 1, and NE of the NE. Both sites are major sources that have had thousands of cubic yards removed. Stand 9144 is specifically intended to clear Boulder for additional expansion of 1 to 3 acres. Stand 1855 would provide lateral expansion for Chinook Rock Source. Chinook Pit has already been cleared for movement into the hillside with Cub Thin Unit 3. Development of rock sources creates localized, irreversible impacts to a resource and is deemed necessary to protect other resources from road sedimentation.

Road Management and Road Sustainable/Investment Strategy Analysis

Up to 15.0 miles of temporary roads constructed and/or improved for project implementation would be decommissioned upon completion of the project. Additionally, a total of 4.7 miles of existing roads are proposed for storage. A long-term beneficial impact is expected by closing these segments to permanent traffic (using berms or other temporary closures). Natural revegetation and stability regeneration would occur and improved soil and geology resource limitations in the intermediate to long-term duration.

Storage or decommissioning of road segments reduces road density, increases productivity (by providing ground cover), infiltration potential (drainage), natural revegetation, provides opportunities to quantify mass movement risks and design the appropriate mitigations to reduce the potential for sediment movement.

Cumulative Effects

The primary previous impact to the soil resource from management is compaction, the effects of which can remain apparent for decades. The analysis of soil and geology resource effects from harvest activities shows that erosion, compaction, rutting and displacement are predominantly low to moderate within the project area. Field reconnaissance shows that cumulative detrimental estimates were mostly below the 20 percent standard. Areas above the standard are proposed for soil restoration actions. These are the units that have mitigation subsoiling (soil restoration actions), other subsoiling actions, and slash disposal restrictions to insure that displacement / compaction / nutrient loss are reduced to more acceptable levels. Though the standard may not be reached, the objective is to reduce effects below pre-management levels, maintain long term soil productivity, and provide a level of erosion control that is consistent with State guidelines.

In summary, the No Action alternative would allow soil conditions in these areas to continue in their existing condition, and in most cases, subsequently return to near pre-harvest conditions over the very long term. The Proposed Action would have some impacts to the soil, as discussed above. However, proper implementation and monitoring before, during, and after the project activity would ensure that detrimental soil condition levels fall below the required 20 percent standard, ultimately reducing the cumulative effects.

3.3 Hydrology

3.3.1 Summary of Effects

The riparian vegetation and large woody material that provide for aquatic and terrestrial habitat complexity and productivity have been altered by past logging practices and road construction. There is a lack of vegetation species diversity and structural complexity at the landscape and project scales. In general, habitat elements that contribute to fish and wildlife habitat quality of productivity are in an impaired condition primarily due to the alteration of riparian vegetation due to past logging activities. These conditions need to improve in order to meet Aquatic Conservation Strategy (ACS) objectives and support healthy, native fish and wildlife populations in the watershed.

Alternative 1 would have no immediate effect on the current conditions. Desired riparian conditions – high species and structural diversity with large dead and downed wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Active restoration of Riparian Reserve stands that currently do not meet ACS objectives would not occur. In addition, the currently dense Riparian Reserve stands would be at greater risk of high severity fire, insect infestation, and disease – which could all be carried more efficiently through overstocked stands. Alternative 1 would result in little or no change to impaired conditions for Riparian Reserves, water quality and stream flow.

Alternatives 2 and 3 would commercially thin 164 acres of Riparian Reserves to reduce the tree density of overstocked stands, increase species diversity and structural complexity, and accelerate tree growth to more quickly attain ACS objectives. Alternative 2 would skip (i.e. not thin) 673 acres of Riparian Reserves, while Alternative 3 would skip 98 acres of Riparian Reserves. Both Alternative 2 and 3 would largely protect future instream wood sources due to no-treatment buffers and skips, but may reduce short-term (1-2 decades) sources of small dead wood in the outer portions of some Riparian Reserves in order to achieve desired vegetation characteristics. However, riparian wood quantity and quality would remain within the range of natural variability and abundant overstory would be retained for future wood input sufficient to sustain physical complexity. As part of Alternatives 2 and 3, direct management actions would create dead and downed wood within some Riparian Reserves. Sedimentation potential would increase during harvest activities but decrease after harvest due to road upgrades, decommissioning, and storage. The risk of sediment delivery through culvert failure would be reduced due to culvert replacement, culvert maintenance and cleanout as part of both action alternatives. Due to project design features, protection measures, and enhancement treatments, Alternatives 2 and 3 would result in maintenance or enhancement of Riparian Reserves, water quality and flow conditions.

3.3.2 Scale of Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects to water quality and aquatic resources for this project includes the project area units, the project area, the Kink Creek (170900040204), Boulder Creek (170900040206), White Branch (170900040207) and Lost Creek (170900040208) 6th Field subwatersheds (Figure 3), and the Upper McKenzie River 5th Field watershed (1709000402).

3.3.3 Assessment Methodology

Data on current and historic watershed condition was gathered from the Upper McKenzie Watershed Analysis (UMWA) (USDA, 1995) and through GIS analysis of spatial data and satellite imagery (NAIP 2016).

All potential treatment units were surveyed by fisheries and hydrology specialists. When waterbodies were found, they were mapped with GPS devices through the unit to their terminus or origination point. Notes on each waterbody commonly include, but are not limited to: stream class and presence of fish, stream width, dominant substrate, stream gradient, surface connection (or lack of) to another waterbody, size and abundance of functioning large woody material (LWM) in channel (i.e. forming pools, retaining sediment), and characteristics of adjacent riparian stand (e.g. diameter of trees, amount and diversity of understory vegetation, amount of hardwood species).

Based on stream and riparian characteristics, a recommendation was made for treatment (riparian thinning), no-treatment buffers and other potential treatments (e.g. downed wood creation) for each waterbody. After surveys were conducted, specialists from fisheries, hydrology, wildlife, and botany met as a team to discuss findings and develop an integrated Riparian Reserve management plan for each unit where waterbodies were present. Refer to Appendix G for unit by unit information on riparian treatments.

3.3.4 Affected Environment - Riparian Conditions

Most of the Flat Country project area is in the gently sloping terrain of the High Cascades which has a large water storage capacity, contributing to a stable, even flow regime. Mass wasting is not common in the project area, generally occurring on valley side slopes in lower portions of Scott and Boulder Creeks.

The project area is bordered by the McKenzie River to the west. Primary streams within the project area include Kink Creek, Sweetwater Creek, Anderson Creek, Olallie Creek, Norwegian Creek, Twisty Creek, Boulder Creek, Scott Creek and Lost Creek. The project area also includes most of the High Cascades glacial lakes in the Upper McKenzie watershed. Figure 16 shows the waterbodies and Riparian Reserve network within the project area.

Channels in the project area generally exhibit relatively low incision due to the young age and high porosity and storage capacity of the High Cascades geologic material in much of the project area. The exceptions are lower Scott and Boulder Creeks, which flow through older West Cascades geology, resulting in deeply incised, higher gradient channels in those areas. Perennially flowing streams are relatively rare in the project area, with much of the stream network consisting of class 4 channels. Large flow events draining from this area are rare, and perennially flowing streams in the project area are characterized by steady, uniform flow rates typical of spring-fed systems. Anderson, Olallie and Sweetwater Creeks support spawning and rearing habitat for bull trout, providing much colder year-round water temperatures (2-8º C) than nearby streams (6-14º C) such as Boulder and Scott Creeks. The spring-fed nature of streams within the project area provide for a high level of channel stability and low levels of sediment transport. Likewise, instream large woody debris (LWD) is not often moved by high flows, typically decomposing where it falls.

Most of the naturally occurring lakes and ponds in the Upper McKenzie watershed are located within the Flat Country project area. Most of the lakes are ultraoligotrophic (very low productivity) and few have inlets or outlets. None of the lakes in the project area have historically been inhabited by fish (USDA, 1995).

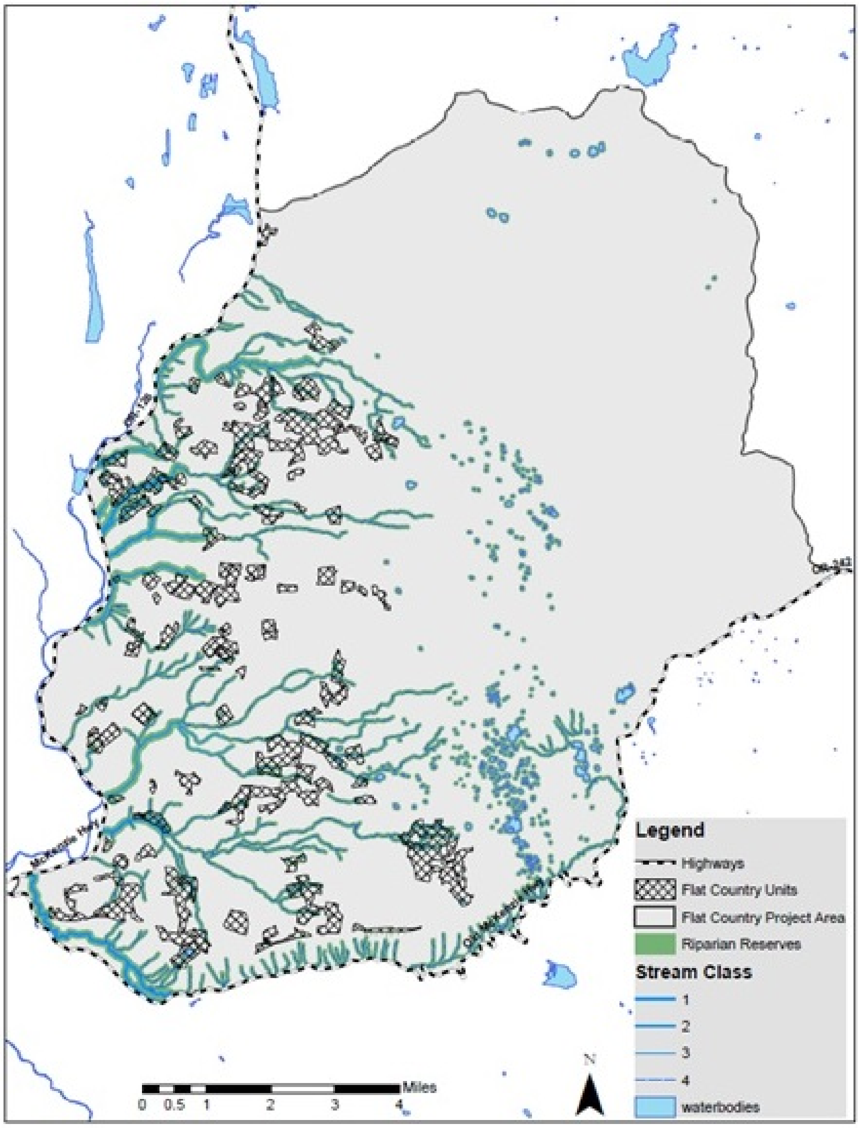

Figure 16. Map of the Riparian Reserve Network in the Flat Country Project Area

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest system lands in the 1970s and 80s. Much of this activity that occurred prior to implementation of the Northwest Forest Plan resulted in removal of riparian vegetation that provided large wood and shade to the small tributary streams in the project area. There are pockets of mature forest, but most of the land has been impacted by management and recreation. Some Riparian Reserves were clearcut and replanted with Douglas-fir. As a result, many of these stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominant stands, with tree densities above the natural range of variability expected in this area. 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 (Tappeiner et al. 1997; Poage and Tappeiner 2002). Stand densities in the project area range from 51 to 345 trees per acre, with an average of 156. Additionally, Pollock et al. (2005) found that natural "riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest." The existing lack of complexity and diversity of many of the stands in the project area may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian dependent wildlife.

To assess aquatic habitat conditions, the Forest Service conducted stream surveys, most recently in 1999, including wood counts (Table 16). A goal of 80 "large" pieces per mile has been set by fisheries agencies to characterize habitat as "properly functioning." As indicated by Table 16, some perennial streams in the project area do not reach this goal, while others exceed it. Applying the USFS Watershed Condition Framework rating criteria for large woody debris, all of the streams surveyed in the project area would be considered "Functioning at Risk" or "Functioning Properly" (FS, 2011). Little is known of wood counts in the smaller unnamed streams within project units since few are fish-bearing and are not typically surveyed using the standard FS protocol. Field surveys were conducted in all proposed units, but these surveys provided only an estimated size range of "pool forming" wood and an estimated range of abundance.

Table 16. Woody Material Counts for Streams in the Flat Country Project Area

Stream	Survey Reach	Wood/Mile Small/Medium/Large*	FS Watershed Condition Framework Rating
Boulder Creek (1992)	1	166	Good, Functioning Properly
	2	173	
	3	111	
	4	217	
	Average	**167**	
Kink Creek (1998)	1	33	Fair, Functioning at Risk
	2	26	
	3	24	
	Average	**28**	
Scott Creek (1997)	1	38	Fair, Functioning at Risk
	2	88	
	3	95	
	Average	**74**	
Olallie Creek (1999)	1	105	Good, Functioning Properly
	2	214	
	3	309	
	Average	**209**	
Sweetwater Creek (1998)	1	**110**	Good, Functioning Properly

*Small – are at least 12 inches in diameter at 25 feet from the large end. Medium – are 24 inches to 36 inches in diameter at 50 feet from the large end. Large – are greater than 36 inches in diameter at 50 feet from the large end.

Note: A survey for Anderson Creek could not be located but LWM frequencies are similar to Olallie Creek. See Figure 17.

Figure 17. Anderson Creek Woody Material Loading

Fire has been suppressed in the watershed for over 100 years, and historic logging practices have greatly altered vegetation patterns. As a result, there is a lack of early-seral vegetation within the entire Upper McKenzie watershed. Within the project area, less than 1 percent of Riparian Reserve vegetation is currently early-seral (<20 years old). The natural range of variability is between 5 and 20 percent (Swanson 2012); and a large component of this early-seral vegetation is deciduous and herbaceous, particularly within riparian areas (Gregory et al. 1991). The determination that early-seral vegetation is underrepresented in the project area is supported by a study (Acker et. al, in preparation) which found that streams in the Flat Country project area had a lower proportion of sapling/pole sized riparian vegetation and a higher proportion of small/medium sized riparian vegetation, as compared to reference conditions in the High Cascades ecoregion.

Mature and late-seral vegetation (>80 years old) currently make up about 76 percent of the project area (FSVeg). Stands over 180 years old make up approximately 38 percent of the project area. In late-seral stands, shrubs and herbs are reinitiated as conifers die and create gaps in the canopy. A study of riparian plant communities in northwest Oregon (McCain 2004) provides data on "relatively unmanaged" conditions. In this study, a total of 441 sites in the Cascades were surveyed, with many of the Willamette sites on the McKenzie River Ranger District. The study describes riparian and upland plant communities based on geomorphic features (e.g. in-channel, cobble bars, terraces, floodplain, etc.). For the "high terraces/major floodplain" features (similar to streams in the project area), deciduous trees had typical percent cover values of 15-40 percent. This study suggests that in "relatively unmanaged" riparian plant communities, there is typically a hardwood, shrub, and herb component.

A hardwood analysis was conducted in ArcGIS for the Flat Country project area using GNN structure maps (LEMMA, 2012) (Table 17). Currently, there is less than 2 percent deciduous or mixed type vegetation within the Riparian Reserves of the project area. Based on the fact that there is a lack of early-seral vegetation classes that have a large deciduous and herbaceous component, it follows that these species are underrepresented on the current landscape. These deciduous and herbaceous species provide many benefits to riparian and aquatic ecosystems, including better food resources and higher productivity for aquatic invertebrates compared to conifer-dominant systems (Sedell and Dahm 1984; Webster and Benfield 1986; Romero et al. 2005; Allen 1995; Wipfli 1997; Wipfli and Gregovich 2002; Cummins 2002; Allan et al. 2003; Musselwhite and Wipfli 2004; Wilzbach et al. 2005; Kiffney and Roni 2007);

increased nitrogen fixation, organic matter cycling, and soil fertility (Compton et al. 2003); and wildlife benefits. Figure 18 illustrates the desired conditions for late-seral Riparian Reserves with a mix of species and complex stand characteristics. Figure 19 illustrates typical overstocked stands in the project area.

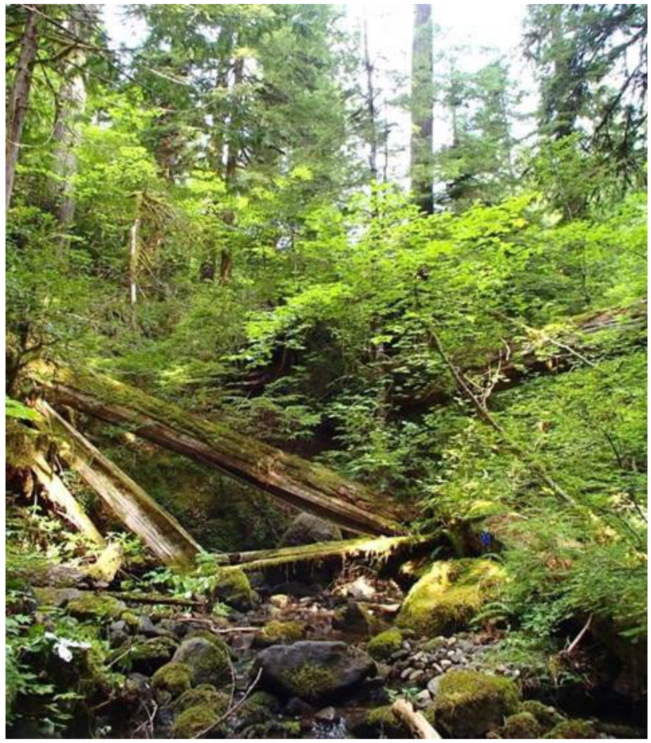

Figure 18. Desired Conditions for Late-Seral Riparian Reserves

Some portions of Riparian Reserves within 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 20 illustrates properly functioning conditions within Riparian Reserves in the project area.

Table 17. Current Abundance of Vegetation Types within Riparian Reserves in the Flat Country Project Area

Vegetation Type	Acres	Percent of the Riparian Reserve Network
Conifer	8,870	84.5
Mix	168	1.5
Hardwood	5	< 1
N/A (Open/Sparse/Water)	1,344	14

Figure 19. Typical Overstocked Conifer-Dominant Stand in a Riparian Reserve in the Flat Country Project Area

Figure 20. Properly Functioning Riparian Reserve in the Flat Country Project Area

The overall lack of deciduous and herbaceous vegetation may be impacting stream ecosystems. Nutritional energy becomes available to the stream community from two main sources: photosynthesis by aquatic plants in the stream itself (autochthonous sources) and decomposition of organic matter imported from outside the stream (allochthonous sources). The mix of energy sources has a major influence on the structure and function of stream ecosystems. Streamside vegetation provides large quantities of organic matter in the form of leaves, needles, and woody material. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams (Murphy and Meehan 1991). Leaves and needles need to be conditioned by microbes for about 30 days before invertebrates would consume them.

Conditioning increases concentrations of nutrients in leaf detritus because microbes use nitrate and phosphate from stream water and carbon compounds from the leaf to build their own proteins thereby decreasing the carbon to nitrogen (C:N) ratio of the detritus. Most animals require food with a C:N ratio less than 17:1. Almost all forms of allochthonous organic matter have a C:N ratio higher than 17:1 so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely as measured by the C:N ratio or the percentage of lignin. At the low-quality end of the spectrum are woody debris and conifer needles and at the high-quality end are periphyton, macrophytes, and fast-decaying deciduous leaves (Murphy and Meehan 1991).

In summary, the riparian vegetation and large woody material that provide for aquatic and terrestrial habitat complexity have been altered throughout much of the watershed and project area due to: clearcutting and replanting to single species monocultures; removal of hardwoods from riparian areas; removal of instream wood; replanting to create overstocked conditions; and removal of the fire disturbance mechanism. 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. See Appendix G (Riparian Reserve treatment tables) for more details. Though the trend is slow, the overall aquatic habitat is improving in the project area as the riparian vegetation recovers towards more natural conditions.

3.3.5 Environmental Consequences – Riparian Conditions

Direct and Indirect Effects

Alternative 1 – No Action

Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, fire, wind and snow downed trees), would be maintained. Alternative 1 would provide a slightly higher rate of instream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent. In some streams, recruitment trees are of sufficient size to meet ACS Objectives; but in other streams, with small average diameter riparian trees, the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Instream wood abundance is variable for streams in the project area. For streams that are lacking instream wood, it is largely due to the lack of current large wood inputs.

The No-Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions – high species and structural diversity with large dead and downed wood – would slowly develop over several decades and depend solely on natural thinning events (stem exclusion mortality and disturbance). Fire has historically been a dominant disturbance type in the project area, increasing the amount of dead standing trees available as a future wood source. However, fire has been, and would continue to be, suppressed, further reducing large wood recruitment in project area streams. Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity in Riparian Reserves would remain at relatively low levels.

Accelerated restoration of riparian stands that currently do not meet ACS Objectives would not be accomplished. ACS Objective 8 (NWFP Standards and Guidelines, p. B-11) states that a proposed management action should "maintain and restore the species composition 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 distributions of coarse woody debris sufficient to sustain physical complexity and stability." Alternative 1 would not meet or restore this objective, this alternative would perpetuate the impacts of homogenous, densely stocked stand conditions potentially by several decades. In addition, currently dense riparian stands would be at greater risk of high severity fire, insect infestation, and disease – which can all be carried more efficiently through overstocked stands. Although these are natural disturbance processes that contribute to forest habitat and diversity, a large disturbance event, or one of high severity, has potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves. Research conducted in the Pacific Northwest has shown that while fire severity may be lower along perennial streams due to relatively cool and moist conditions, fire severity along intermittent streams can be similar to adjacent upland areas (Tollefson 2004). In fact, under some circumstances, riparian areas can become corridors of increased fire spread (Pettit 2007).

Alternatives 2 and 3

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 Guidelines, TM-1(c)). Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the approximately 10,385 acres of Riparian Reserves in the project area 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. In some cases, maintaining and/or restoring each one of the ACS Objectives can be a balancing act with trade-offs. For example, to meet the riparian vegetation objectives ("species composition and structural diversity of plant communities" and "habitat to support well distributed populations of native plant, invertebrate and vertebrate riparian dependent species") in young, dense conifer stands, a common silvicultural tool is to remove overstory density to encourage understory growth and structural development. Removal of overstory density, however, could potentially lead to increased thermal loading or reduction of wood volume available for recruitment. Because of these trade-offs, conflicting objectives were carefully balanced based on characteristics of each waterbody and adjacent riparian area.

Alternatives 2 and 3 propose both active and passive management of Riparian Reserves: thinning, gap creation, downed wood augmentation, and no treatment. Below are descriptions of the types of treatments proposed and the considerations for analysis with each.

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. Instream wood recruitment, upland downed woody material levels, stand structure, and species composition are described below. Stream temperature, sediment, riparian microclimate, and other factors are described in the sections below. Alternatives 2 and 3 would both thin approximately 164 acres within Riparian Reserves. Appendix G details where treatments are proposed within Riparian Reserves and the vegetation objectives for each unit.

Instream Wood

Instream wood is important to the health of aquatic habitats, and many researchers have studied the areas along streams where wood recruitment typically occurs. Wood recruitment zones, as they are called, vary from as little as 8m (26 feet) up to about 45m (148 feet) depending on various factors (Benda and Bigelow 2014, Spies et al. 2013). According to Benda and Bigelow (2014), wood source areas are highly variable, but are strongly correlated to tree height and the dominant wood recruitment process for each stream reach. In their study, they found that in managed forests of the Cascades Range, where tree mortality and disturbance are the dominant wood recruitment processes, 90 percent of instream wood originated from within about 8 meters (26 feet) of stream channels and the remaining 10 percent is supplied from a distance equivalent to one tree height. Figure 21 shows the source distance curves for instream wood in Benda and Bigelow (2014). In less managed and unmanaged forests, 90 percent of instream wood originated from about 13 meters (43 feet) of stream channels.

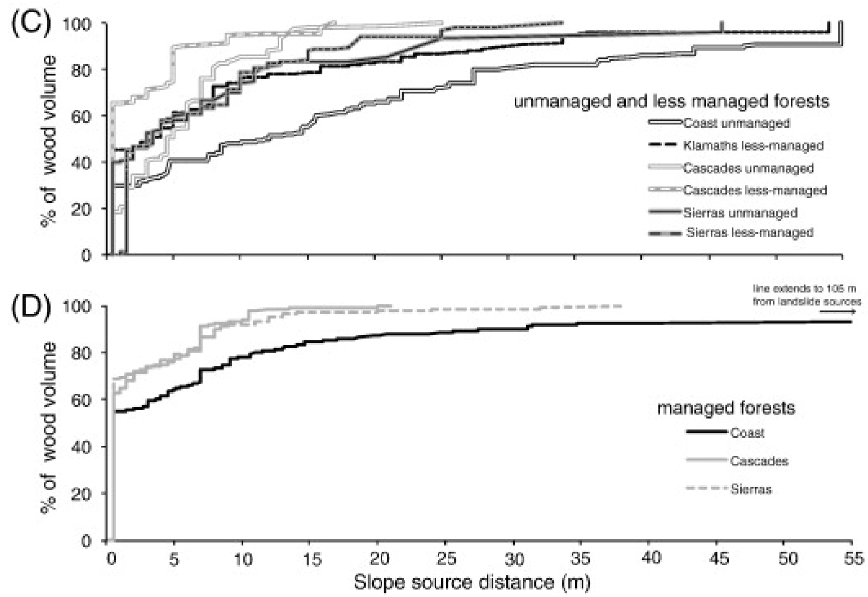

Figure 21. Source Distance Curves for Instream Wood in the Cascade Range (Benda and Bigelow 2014)

In Meleason et al. (2003), the simulation model OSU STREAMWOOD was used to evaluate the potential effects of different riparian thinning scenarios on wood recruitment to streams over time. In one scenario, they modeled the contribution of wood from forest plantations (up to 120 years old in a Douglas-fir – western hemlock forest), beyond no-harvest buffers of varying widths. The results suggest that no-harvest buffers greater than 10 meters (33 feet) from the stream channel contributed minimal amounts of wood volume to streams. In McDade et al. (1990), the mean wood source distance for first, second, and third order Cascade and Coast Range streams in mature and old-growth stands was approximately 10 meters. Conifer tree heights in these stands ranged from 40 to 80 meters (131 to 262 feet). Johnston et al. (2011) demonstrates that in streams adjacent to undisturbed mature or old-growth forests in central and southern British Columbia, 90 percent of the wood at 90 percent of the study sites originated within 18 m (59 feet) of the channel. Robison and Beschta (1990) determined that the probability of a tree falling into a stream channel is primarily a function of tree height and distance from the stream. The upper crown of a tree, however, particularly in managed stands, is not of sufficient size to be considered of functioning size in the channel (i.e. large enough to influence stream morphology). Therefore, the “effective tree height” – the height to the minimum diameter and length necessary for the wood to qualify as “of functioning size”– is a more appropriate standard to use for assessing source area distance.

In all the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect wood recruitment zones as well as other resources such as temperature. The overall goal for developing wood recruitment zones was to protect at least 90 percent of trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be sufficient to sustain physical complexity and stability required by the ACS Objectives. This no-harvest buffer ranges in width depending on specific conditions in each unit (i.e. width and gradient of stream, vegetation characteristics, etc.) and by stream type (i.e. seasonally flowing streams, perennial non-fish bearing streams, and fish bearing streams). Based on the research findings, a minimum 30-foot no-harvest buffer was prescribed for intermittent (class 4) streams in the project area, to protect the primary wood recruitment zone of young, dense stands within the project area, where tree mortality is the dominant wood recruitment process. Other class 4 streams, where Riparian Reserves are on their way to attaining ACS objectives, no Riparian Reserve treatments are proposed. Perennial non-fish bearing streams in the project area have no cut buffers ranging from 60-180 feet, and along the perennial fish bearing streams, no-treatment buffers range from 75-360 feet depending on conditions. See Appendix G for unit by unit Riparian Reserve treatment recommendations. These no harvest zones allow for the preservation of near-stream wood recruitment zones while treating the outer portions of 164 acres of Riparian Reserves in the project area in order to accelerate the attainment of ACS objectives of structural and species diversity of riparian plant communities.

Terrestrial Downed Wood

In addition to instream wood, numerous studies have been conducted that address both the specific roles of downed wood in ecosystem as well as its ecological function for wildlife and aquatic species. However, it is more difficult to quantify the exact levels of downed wood expected to have occurred in the upland portions of Riparian Reserves assuming there was no human impact to the forest since these are subject to many variants. Only two management rotations in Douglas-fir stands have been estimated to reduce the abundance of dead wood by 90 percent compared to levels in natural old-growth systems (Rose et. al. 2001). It should be noted that stands go through a “U” shaped pattern of downed wood development naturally; and depending on stand age, a fluctuation of LWM is expected.

An estimate of the range of natural variability was used to develop downed wood objectives. These objectives were based on input from wildlife specialists, modeling exercises using Forest Vegetation Simulator (FVS), and scientific literature review. Across the project area, current levels of downed wood are within estimated historical ranges (see Section 3.5.6 for more information). Field surveys of the Flat Country proposed units during 2017 and 2018 showed approximately 36 percent of all proposed units to have higher levels of large down logs (over 14 inches diameter) over 6/acre, 45 percent had moderate levels of about 3-6/acre, and about 19 percent had low levels of large down logs under 3/acre (Table 18). Many of the plantations showed relatively high levels of large downed wood that was left from the original harvest, with quite large diameters over 40 inches, such that it would last many more decades.

Table 18. Downed Wood Field Surveys in the Flat Country Project Area 2017-2018

	High (>6 trees/acre)	Moderate (3-6 trees/acre	Low (<3 trees/acre)	None
Flat Country units (108)*	36%	45%	17%	2%

* visual estimates of downed wood over 14 inches diameter

The number of total trees per acre (i.e. this number includes trees less than 7 inches in diameter) within most of the treatment areas range from 56 to 3,091. 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 (Tappeiner et al 1997; Poage and Tappeiner 2002). Given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century) there would still be adequate woody material to maintain volumes within the natural range of variability, and abundant overstory would be retained for future wood input sufficient to sustain the objectives listed in the Aquatic Conservation Strategy (Appendix E).

Within specific treatment units where current estimates are below the desired ranges, dead and downed wood objectives would be met through leaving more of the residual stand or through supplemental downed wood creation treatments. These treatments are proposed as a potential enhancement effort so that habitat needs could be met at site specific and landscape scales.

Stand Structure and Species Composition

Based on a review of existing literature and stand development theory, 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 plantations less than 80 years and especially less than 50 years old." The benefits of thinning in stands over 80 years old are more variable. Stand conditions were reviewed for each waterbody and recommendations were based on multiple variables, not just age. These factors included tree height and diameter, stand density, species composition, and understory development.

In Alternatives 2 and 3, all stands where thinning would occur within Riparian Reserves are under 80 years old. Based on field reviews by resource specialists, none of the stands over 80 years old that are proposed for treatment were found to have Riparian Reserves in conditions requiring treatment in order to attain ACS objectives, so no treatments are proposed within the Riparian Reserves of those stands. No stands over 80 are proposed for treatment in Alternative 3, so Riparian Reserve thinning acres are the same for both Alternatives (164 acres).

Where thinning is proposed within Riparian Reserves, increases in abundance of understory vegetation, species diversity, stand structural diversity, and tree growth at a faster rate than background levels are expected. It should be noted that some modeling has shown that young conifer stands, if left untreated, would follow a trajectory towards forest structure found in certain 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, and a well-developed understory of shade-tolerant trees. However, according to Harrington et al. (2005) thinning tends to increase shrub cover and greatly increase within-stand variability where shrub cover is absent before treatment. Riparian thinning can also promote the development of late successional forest attributes of value to many riparian and upland-associated species (Pabst et al. 2008, Harrington et al. 2005). Based on recent research (Ruzicka et al. 2014), increased tree growth within no-treatment buffers adjacent to thinned stands is also anticipated. In the Ruzicka et al. study, trees responded to an apparent edge effect up to 15 m (49 feet) downslope of thinned areas. Similar beneficial effects are expected within a large portion of the no-treatment buffers in the Flat Country project area.

To add additional structural complexity, vegetative diversity, and habitat diversity, two of the stands containing Riparian Reserves not proposed for thinning are proposed to have a small fall-and-leave gap created (<0.25 acres each gap) in the second site potential tree height to enhance terrestrial habitats which are also a component of the ACS objectives (see Wildlife Section and Appendix E). Table 19 shows a list of these proposed units.

Table 19. Proposed Units with Wildlife Gaps in the Second Site Potential Tree Height

Stream Class	Unit	Treatment Description
Class 2	1310	Fall-and-leave conifers to create gaps <0.25 acres each in the second site potential tree height for a total of approximately 0.5 acres.
Class 2	2180	

A minimum of 50 percent canopy closure (approximately 40 percent canopy cover) would be maintained throughout Riparian Reserves proposed for treatment (which results in an average of 70-90 trees per acre remaining on site which is higher than average old-growth stand densities. These proposed prescriptions are a compromise between thinning and retention to try and meet the greatest diversity and important resource protection needs such as microclimate and future large wood input.

No-harvest Treatments in Riparian Reserves

Alternatives 2 and 3 propose a variety of management actions for Riparian Reserves. One action is to leave the current stand relatively intact. The no-harvest portions of the Riparian Reserves were selected where added protection of existing habitats was needed. These no-harvest areas are either partial buffers within the Reserves or full Riparian Reserves. Many of the units proposed for treatment contain Riparian Reserves with existing stand and vegetation diversity, sensitive habitat, soil stability issues, temperature sensitivity, or existing quality aquatic habitat, so no treatment was recommended. Information on proposed silvicultural treatments in Riparian Reserves, or non-treatment, can be found in Appendix H.

Fall-and-leave Instream Treatments in Riparian Reserves

Several streams were identified during field surveys to have a shortage of large woody material within the channel or floodplain. Selected streams were chosen for their vegetation characteristics at the catchment scale and at the site-specific scale, as well as existing LWD levels outside of the natural range of variability. Units 1590, 1720, 1730, 1810, 2010, and 2160 have instream fall-and-leave prescriptions along approximately 5 miles of streams (Table 20). This would be done either through fall-and-leave of individual or small groups of trees or through whole tree winching to leave the root wads attached. The additional coarse woody debris added to these streams would improve habitat conditions for aquatic and terrestrial species, while increasing physical complexity of the stream channel.

Table 20. Proposed Units with Instream Fall-and-Leave Treatments

Stream Class	Units	Treatment Description
Class 3	1590	Fall conifers into channel every 50-100 feet alternating sides and avoid bank trees
Class 4	1720, 1730, 1810, 2010, 2160	

Other Treatments

Within some treatment units, the introduction of low severity fire into patches of Riparian Reserves is anticipated during fuel treatments. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fireline around the Reserves which would potentially result in erosion. With local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. 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 as compared to untreated plantations.

Roadside hazardous fuels reduction treatments are proposed on approximately 2,307 acres in the project area as part of both Alternative 2 and 3. These treatments would cut the understory up to 7 inches DBH on previously managed stands, and up to 10 inches DBH on older stands. The cut material would be chipped, or piled and burned. On about 11 miles of roads, treatments would occur within 300 feet of road systems surrounding the Mount Washington Wilderness Area. Elsewhere in the project area, on about 26 miles of roads, treatments would occur within 150 feet of road systems. See section 3.12.2 for more details on proposed treatments. Of the 2,307 acres proposed for treatment, approximately 429 acres fall within Riparian Reserves. Waterbodies overlapping with fuels reduction treatments would include no-treatment buffers to protect near stream vegetative diversity and microclimate (Table 21) and cut fuels would be piled for burning no closer than 15 feet from no-treatment buffers. The total number of Riparian Reserve acres that would be treated for roadside fuels reduction would be 345 acres, meaning approximately 84 acres would be excluded from treatment.

Table 21. Treatment Prescription for Roadside Hazardous Fuels Reduction in Riparian Reserves

Acres of Riparian Reserves Proposed for Roadside Hazardous Fuels ReductionTreatment	Waterbody Type	No-Treatment Buffer
345 acres	Class 1	120 feet
	Class 2	75 feet
	Class 3	60 feet
	Class 4	30 feet
	Lakes	75 feet

Table 22 summarizes the acres of Riparian Reserves affected by the various vegetation treatments. It also includes the number of acres that would not be treated based on recommendations from site specific field visits.

Table 22. Riparian Reserve Management on Federally Managed Lands in the Flat Country Project Area

Total Riparian Reserves within the Project Area	Activity	Proposed for Treatment		
		Alternative 1	Alternative 2	Alternative 3
10,385 acres	Thinning	0 acres	164 acres	164 acres
	No Treatment	10,385 acres	10,221 acres	10,221 acres
	¼ acre Gaps (second site potential tree height)	0 acres	0.5 acres	0 acres
	Fall-and-Leave	0 miles	5 miles	0 miles
	Hazardous Fuels Reduction	0 acres	345 acres	345 acres

Wherever possible, temporary roads would be located on ridge tops, gentle slopes, or would utilize locations previously disturbed by historic logging that had not been decommissioned. Those segments located within the Riparian Reserves would be located well outside of the primary shade zone or cross perpendicular to the stream. Alternative 2 would have approximately one mile of temporary roads within the Riparian Reserves. This is equivalent to approximately 1.5 acres of disturbance. Alternative 3 would have one short length of temporary road (approximately 0.1 miles) in Riparian Reserves, which is equivalent to less than an acre of disturbance. Temporary roads located within Riparian Reserves would have similar effects to a minor disturbance event resulting in a gap, such as a blowdown event. The localized effects would not have an appreciable effect on riparian conditions at the watershed scale. There are five proposed temporary stream crossings as part of Alternative 2 and three as part of Alternative 3, which are needed to access portions of units (Table 23). Impacts to large wood are expected to be similar to those of thinning treatments. Re-vegetation would typically occur within two decades from natural regeneration if the disturbed area is not replanted. All temporary road crossings would be removed, and all temporary roads in Riparian Reserves would be decommissioned after treatment activities are completed.

Table 23. Units Proposed to Include Temporary Stream Crossings by Alternative

Unit	Stream Class at Crossing	Alternative
80	Class 4	2, 3
1040	Class 4	2, 3
1140	Class 4	2
1230	Class 3	2, 3
1810	Class 3	2

In summary, Alternative 2 would thin approximately 164 acres within Riparian Reserves. Additionally, 0.5 acres of gaps would be created within the second site potential tree height. Approximately 5 miles of stream would have large wood enhancement treatments. Alternative 3 would also thin approximately 164 acres within Riparian Reserves. Additional treatments proposed in Alternative 2 would not occur. The adverse impacts of thinning on instream large wood and future recruitment would be very minor at the watershed, project, and reach scales because only 164 acres (less than 2 percent) of Riparian Reserves in the project area would be thinned in Alternatives 2 and 3, and within those units at least 90 percent of the wood recruitment zones would be preserved. The minor reduction in wood recruitment would occur at a very slow rate due to the naturally slow rate of the dominant wood recruitment process (tree mortality) of streams in the project area. The beneficial impacts of thinning to accelerate tree growth would also be very minor at all scales due to the relatively small area treated and slow rates of tree growth. The beneficial impacts of thinning on riparian forest structure and diversity would be minor at the watershed scale due to the limited area of treatment, but would have measurable beneficial impacts at the project and unit scales. Benefits of thinning are well documented, would start occurring within 3-5 years, and would persist for decades. Analysis and field reconnaissance of Riparian Reserves by fisheries, hydrology and wildlife personnel on a unit by unit basis assured that Riparian Reserve treatment prescriptions would provide for small wood inputs from no-harvest buffers and fall-and-leave in the short term (1-2 decades) while treating outer portions of Riparian Reserves for long-term (2-5 decades or more) shade, wood source and terrestrial habitat complexity. Table 22 summarizes the acres of Riparian Reserves affected by the various treatments. The proposed management of Riparian Reserves in Alternatives 2 and 3 would not deter attainment of and would largely benefit ACS Objectives. The Aquatic Conservation Strategy compliance document (Appendix E) explains how each Objective is maintained or improved. Refer to Appendix H for a summary of the proposed Riparian Reserve treatments within the project area.

Cumulative Effects

Alternatives 2 and 3

Federal timber sales and pre-commercial thinning are ongoing in the project area, and the cumulative effects are a reduction in Riparian stand densities and a short term (1-2 decades) reduction in small woody material. All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and would 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 F) were analyzed for effects to riparian condition and were found to have no effect, negligible effect, or beneficial effects. The negligible or beneficial effects combined with the minor impacts expected from the Flat Country project would not measurably contribute to impaired riparian conditions.

3.3.6 Affected Environment – Stream Shade and Temperature

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

Stream temperature data were collected at 9 locations in and around the project area during the summer months (June through September 2017 and 2018). The data for this analysis were collected for a minimum of two seasons with a maximum of six seasons. A summary of the stream temperature data for Flat Country project area is provided below in Table 24. Control streams were selected because they are relatively un-impacted and were thought to be hydrologically/geologically similar to the project area streams.

The existing conditions for temperature in the Flat Country project area are variable due to differences in underlying geology. Anderson, Olallie and Sweetwater Creeks all flow almost entirely from the groundwater dominated High Cascades geology and exhibit the characteristically colder temperatures. Boulder, Kink and Scott Creeks flow from a combination of the West and High Cascades and exhibit intermediate temperatures.

The Elk Creek, Roaring River and Upper South Fork River control streams are similarly spring-fed, exhibiting colder year-round temperatures. Walker, Rebel and French Pete control streams all originate in the Three Sisters Wilderness, and flow through runoff dominated West Cascades geology, exhibiting characteristically higher average maximum temperatures.

Changes in the range of maximum temperatures from one water year to the next are attributable to annual differences in precipitation and stream flows. The annual timing of the maximum temperature occurred between July and August in all instances.

Table 24. Stream Temperatures for the Flat Country Project Area

	Lowest Max. Daily Temp. °C*	Highest Max. Daily Temp. °C*	Range of Values °C	Composite Average Value °C
Control Streams				
Elk Creek	8.7	9.8	1.1	9.0
Walker Creek	14.5	15.5	1.0	14.8
Rebel Creek	13.3	14.9	1.6	13.8
French Pete Creek	15.7	16.5	0.8	16.0
Roaring River	7.2	7.6	0.4	7.3
Upper South Fork River	8.4	9.2	0.8	8.8
Flat Country Project Area Streams				
Anderson Creek	6.9	8.4	1.5	7.5
Boulder Creek	13.6	14.4	0.8	13.9
Kink Creek	11.4	12.6	1.2	12.1
Kink Creek Headwaters	6.9	8.8	1.9	7.9
McKenzie River above Trailbridge Reservoir	7.0	8.4	1.4	7.4
McKenzie River below Trailbridge Reservoir	9.6	11.8	2.2	10.1
Olallie Creek	5.6	5.7	0.1	5.6
Scott Creek	11.8	12.2	0.4	12.0
Sweetwater Creek	6.8	6.8	0.0	6.8

* Maximum 7-day average

Under section 303(d) of the 1972 Clean Water Act, states are required to develop lists of impaired waters. The McKenzie River (river mile 0-54.6) was listed as 303(d) for temperature (16° C) prior to the 2010 revision. From the data collected internally by the Forest Service, the McKenzie River bordering the project area is well below the 16° C criteria for core cold water habitat (Oregon DEQ. 2010. 303(d) List of Impaired Waters). No other streams in the project area are listed for temperature.

3.3.7 Environmental Consequences – Stream Shade and Temperature

Direct and Indirect Effects

Alternative 1 – No Action

Activities that affect shade vegetation would not occur. Water temperatures in streams in the project area would continue to recover toward more natural levels as riparian vegetation that was disturbed or removed by management activities prior to implementation of the Northwest Forest Plan re-grows and re-establishes streamside shade. However, there would be an increased risk of high severity wildfire, which can be carried more efficiently through dense stands, which may affect water quality in the future. The corresponding loss of vegetation and duff may affect temperatures and microclimates around the edges of the streams and wetlands. Intermittent (class 4) streams and seasonal wet meadows go dry during the summer when temperatures are typically an issue. Increased stream temperatures are not expected in most of the class 4 streams in the project area under current vegetation conditions or after a high-severity fire. However, temperatures and microclimates of perennial streams would be affected by a high-severity fire. See the Fire and Fuels Section in Chapter 3 for more specifics on the probability and effects of wildfires in the project area.

Alternatives 2 and 3

The system of Riparian Reserves under the ACS provides zones around streams, wetlands, and water bodies that contribute to protecting or restoring the physical, chemical, and biological integrity of these waters, which is the major goal of the Clean Water Act. For the action alternatives, treatments within riparian areas have been designed to comply with the "Northwest Forest Plan Temperature TMDL Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (TMDL 2012). All streams in the project area, other than Olallie and Sweetwater Creeks, exhibit intra-annual variability greater than 0.3° C despite the fact that there has been no additional vegetation management along these streams during the time they were monitored.

To comply with the stream temperature standards, no-harvest buffers were developed to mitigate management effects. These buffers were developed based in part by calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading, known as the primary shade zone; and the width of the riparian area that provides shade in the morning and afternoon, considered the secondary shade zone. 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 and Rothacher 1967, Brown and Krygier 1970, Swift and Messer 1971, Macdonald et al. 2003). In several cases, buffer distances less than one site potential tree height have been shown to protect water temperature. Typically, the primary shade zone is half of the site potential tree height. Gomi et al. (2006) reported maximum daily temperatures in headwater streams did not increase significantly when 30- or 90-foot buffers were applied.

In overly dense riparian stands, sufficient 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 most of the solar radiation. All units with proposed thinning in the Riparian Reserves are managed stands with high conifer densities. Where Riparian Reserves are actively managed, a minimum of 50 percent canopy closure (approximately 40 percent canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help protect microclimate. Some of the streams in the project area are less than 3 feet wide and others have very coarse substrate. The effective shade is typically less for these streams. In addition, several papers have been published recently indicating that hyporheic flow (water flowing through gravel), not just shade, has a significant influence on stream temperature. Janisch et al. (2012) found that that the canopy cover of "buffers" was not a strong variable for temperature in small (<7feet wide) headwater streams. Instead, the streams with coarse-textured streambeds tended to be thermally unresponsive as compared with fine-textured streambeds or those with small, near-stream wetland areas. This re-emphasizes the important role gravel and large wood play in stream temperatures and was considered in determining no-harvest buffer recommendations.

The development of no-harvest buffer widths also considered stream classification. Intermittent (Class 4) streams are dry during the portion of the year when elevated temperatures occur and therefore temperature is not a significant issue for those streams. However, intermittent streams all have a minimum 30-foot no-harvest buffer, which was prescribed for other resource concerns, and would provide sufficient shade when water is present in those streams. Much of the stream-influenced microclimate would also be preserved, since the gradients are strongest within the first 20-30 feet from the stream (Anderson 2007) and a portion of the canopy cover throughout the rest of the Riparian Reserve would be maintained. No-treatment buffers on perennial streams have varying widths, developed, in part, to accelerate species and structural diversity while protecting effective shade.

Class 3 (non-fish bearing perennial) streams within the proposed harvest units have a minimum 60-foot no-harvest buffer to retain effective stream shade and terrestrial microclimates (Anderson 2007) while still providing the opportunity to treat the rest of the Riparian Reserve for other desired characteristics. Where thermal loading, soil stability, desired stand characteristics, etc. are present; no-treatment buffers are wider. Perennial class 1 and 2 (fish bearing) streams are prescribed minimum 120-foot and 75-foot no-treatment buffers, respectively, to retain effective stream shade. Some units have additional riparian treatments within the traditional no-harvest buffer for instream large wood creation or to increase primary productivity (Table 20). Approximately 5 miles of streams would have wood added through fall-and-leave treatments as part of Alternative 2. Trees selected for large wood creation would be spaced so that they minimize the impacts of canopy removal to stream temperature.

There are four proposed temporary class 4 (intermittent) stream crossings and one proposed temporary class 3 (perennial non-fish bearing) stream crossing as part of Alternative 2 treatment activities (Table 23). Of those, three of the temporary class 4 crossings are also proposed as part of Alternative 3. Class 4 streams are dry during the summer when water temperature is typically a concern. When there is water in the streams however, the width of the clearing needed to establish the crossings would not create a detrimental change in temperature or shade because the primary and secondary shade zones of the surrounding riparian area would retain sufficient canopy closure to provide shade to these narrow streams. A few short segments of other temporary roads would enter the outer portion of the Riparian Reserves but not cross any streams. This would allow for historically compacted areas to be re-used then properly sub-soiled and re-vegetated. The reduction in canopy closure of the secondary shade zone is considered in the overall calculations of canopy closure on Riparian Reserve thinning treatments. Based on implementation of the design features outlined in Chapter 2, which mitigate the effects of disturbance due to temporary roads and skid trails, as well as field observations during project reconnaissance; a minimal direct effect is anticipated at a localized level within a few feet downstream of the temporary road crossings.

Additional road decommissioning and storage analyzed under this DEIS are expected to be accomplished within the subwatersheds during the time period of this project. These activities help restore streamside vegetation which would provide additional shading of streams previously impacted by human activities.

No long-term (> 5-10 years) increases of stream temperature are anticipated within the project area as a result of these alternatives. Consequently, as in the No Action Alternative, water temperatures of streams within the project area would continue to recover toward more natural levels as riparian vegetation re-grows and re-establishes streamside shade. Where Riparian Reserves are actively managed, a minimum of 50 percent canopy closure (approximately 40 percent canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help protect microclimate. Many of the treatment units are over-stocked plantations with small diameter riparian trees. Thinning within the secondary shade zone would increase growth of the remaining trees. Additionally, thinning of dense stands and managing fuel loading helps reduce the risk of high severity wildfire. This, in turn, reduces the risk of impacts to stream shade and microclimate.

Cumulative Effects

All recent and planned timber harvest and fuels reduction projects were and would be designed with similar protection measures, design features, and Best Management Practices that minimize effects to stream temperature. Each of the past projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to stream temperature and were found to have no effect or a slight beneficial effect from road decommissioning. This means that there are no detrimental cumulative effects from this and other projects combined.

3.3.8 Affected Environment – Stream Flows/Disturbance History

Projects involving timber harvest on the Willamette National Forest are 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 or ARP, as specified by the Forest Plan. The ARP model compares the acres of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each planning subdrainage and are intended to represent a minimum safe level of vegetative recovery in the planning subdrainages to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average more than 8 inches DBH and crown closures exceed 70 percent. The analysis is based on data extracted from the Forest's FSVEG and FACTS databases, which include information about all past harvest activities in the planning subdrainage. Current ARP levels in the Upper McKenzie watershed are above the Forest Plan Midpoints.

3.3.9 Environmental Consequences – Stream Flows/Disturbance History

Direct and Indirect Effects

Alternative 1 – No Action

Current ARP values are well above Midpoint ARP values specified in the Forest Plan. Alternative 1, No Action, would result in no changes to existing peak flows based on vegetation removal. However, several miles of roads are in poor condition, currently transporting runoff to stream crossings or into alternative drainages. These alterations to stream flows would not be improved with the implementation of this Alternative due to the lack of road maintenance, storage, or decommissioning. However, the effect would be localized to a few yards down-stream in most cases.

Alternatives 2 and 3

Table 25 summarizes levels of recovery immediately after implementation of the project for each of the action alternatives. Completion of implementation is estimated to occur by 2024. The Midpoint Aggregate Recovery Percentage (ARP) value varies by planning subdrainage and ranges from 60-75.

Table 25. Aggregate Recovery Percentages for the Flat Country Project

Planning Subdrainage	Current Condition, 2019 (%)	Alternative 2 post-treatment, 2019 (%)	Alternative 2 post-treatment, 2024 (%)	Alternative 3 post-treatment, 2019 (%)	Alternative 3 post-treatment, 2024 (%)
Anderson	92	89	94	91	94
Boulder	88	85	88	87	89
Craters	100	100	100	100	100
Kink	90	89	90	89	90
Olallie	95	94	96	94	96

Planning Subdrainage	Current Condition, 2019 (%)	Alternative 2 post-treatment, 2019 (%)	Alternative 2 post-treatment, 2024 (%)	Alternative 3 post-treatment, 2019 (%)	Alternative 3 post-treatment, 2024 (%)
Scott	85	81	84	84	85
Scott-Anderson	90	88	91	90	91
Twisty	92	91	90	92	90
Washington	94	94	95	94	95
White Branch	98	96	98	97	98

ARP levels are maintained above recommended Midpoint values for both action alternatives in the affected planning subdrainages, 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.

Additionally, several miles of roads are currently in poor condition and transport runoff to stream crossings or into alternate drainages. These alterations to stream flows would be improved with the implementation of the preferred Alternative. However, the effects would be localized to a few yards downstream. Overall, there would be no adverse impact to stream flow timing or duration through the implementation of these alternatives.

Cumulative Effects

ARP levels would remain well above the midpoint so effects to peak flows throughout the watershed are not expected by vegetation removal. Each of the past and future projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix F) were analyzed for effects to peak flow and were found to have no effect or a slight beneficial effect from road decommissioning.

3.3.10 Affected Environment – Sedimentation

Direct and Indirect Effects

Most of the geologic terrain and soils within the Flat Country project area are not inherently prone to erosion unless disturbed, as discussed in the Soils section of this document. Though much of the project area has stable geology, there are areas of earth flow terrain and other unstable geologic features. Roads on earth flows or the more deeply dissected slopes above the river terrace employed construction methods such as cut and fill that resulted in relatively unstable road beds.

Since implementation of the Willamette National Forest Plan in 1990, road maintenance activities have eliminated many of these unstable fill situations. Even so, roads continue to be the largest source of human-caused sedimentation in the project area, and a few old roads still carry runoff during winter storm events, essentially extending the stream system and occasionally diverting flow from natural stream channels. Additional impacts to streams within the project areas include degrading old log culverts, sedimentation from old skid roads, failing culverts, and displacement from steep road cut-banks along the lower tributaries of the McKenzie River. Other stream reaches have been completely covered by historic logging debris.

The subwatersheds in the project area have road densities ranging from 0.33 to 3.22 mi/mi^2. These road densities were calculated using total road miles (open and closed roads) per square mile of each subwatershed. Road densities under 1 mile of road per square mile are considered to be "Functioning Properly", densities between 1 and 2.4 miles of road per square mile are considered to be "Functioning at Risk" and densities over 2.4 miles of road per square mile are considered to have "Impaired Function" using the FS Watershed Condition Framework rating criteria (FS 2011). The road density in Boulder Creek subwatershed is high, falling in the "Impaired Function" category with 3.22 miles of road per square mile (Table 26). Other subwatersheds in the project area are either "Functioning at Risk" or "Functioning Properly".

Table 26. Total Road Densities for Subwatersheds in the Flat Country Project Area

Subwatershed (HUC12)	Road Miles	Subwatershed Area (mi^2)	Road Density (mi / mi^2)	FS Watershed Condition Framework Rating
Boulder Creek (170900040206)	180.22	56.04	3.22	Poor, Impaired Function
Kink Creek (170900040204)	55.74	54.27	1.03	Fair, Functioning at Risk
Lost Creek (170900040208)	27.25	18.24	1.49	Fair, Functioning at Risk
White Branch (170900040207)	20.00	61.13	0.33	Good, Functioning Properly

In addition, past timber harvest methods resulted in varying levels of compaction for most of the units previously harvested with ground-based logging systems. Twenty five of the project area units proposed for treatment approached or exceeded the 20 percent maximum compaction allowed by the Forest Standards and Guidelines (Soils Specialist Report). With increasing levels of compaction, there is an increased risk of surface erosion.

Based on observations of existing road conditions during field reconnaissance for the project, 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 269 cubic yards per year for the project 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, etc. Research comparing WEPP estimated sediment rates to actual rates has shown the model to over-estimate values. Therefore, sediment delivery estimations using the WEPP model should only be used for relative comparisons between alternatives rather than actual values expected to be produced.

3.3.11 Environmental Consequences – Sedimentation

Direct and Indirect Effects

Alternative 1 – No Action

Rates of road related sediment yield were estimated to remain relatively constant under Alternative 1 (No Action), reflecting no specific changes due to the lack of road upgrades. 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 high priority 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 storage or decommissioning would occur. Table 27 provides a comparison of sediment outputs between all Alternatives.

Alternatives 2 and 3

Past human activities have resulted in altered sediment regimes along many of the streams in the project area. Hydrologically disconnecting roads by installing or improving road drainage features is a fundamental practice for eliminating chronic water quality impacts from roads and other disturbances. At a minimum, these activities would include the establishment of proper drainage through maintaining existing structures, installing water bars, or restoring natural drainage features. Installation of new ditch-relief culverts and replacement of existing ditch-relief culverts that are currently in poor condition would also occur. These actions would reduce the likelihood of sediment leaving the road through runoff by reducing the average distance between drainage structures and consequently, the amount of water that each structure needs to handle. Less water on the road means less sediment-carrying capacity.

Road work associated with the Flat Country Project would also include replacement of several culverts that are currently in poor repair or inadequately sized to pass 100-year flood flows (Q100). These culverts currently pose an elevated risk of fill failure. Discussion with engineering personnel indicated that the average fill volume is approximately 300 cubic yards per culvert. This material is at risk of entering the streams and potentially generating debris torrents if the existing culverts fail.

Replacement would require instream work in these locations. Work would be done during non-flow periods for intermittent streams, and engineering practices such as requiring sediment barriers and flow bypass systems would minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 1.0 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 of volumes are not feasible. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 1.5 cubic yards per installation based on professional experience. This sediment would settle out within a few hundred feet and are not volumes that would harm aquatic insects or amphibians.

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. The same analysis was conducted for each alternative incorporating all project related road maintenance, temporary road construction activities, and haul route activity. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project (Table 27).

For both action alternatives, annual sediment yield increases during harvest activities. This represents an estimated 16-24 percent increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. Alternative 2 shows the highest increase during operations when there is increased traffic on haul routes and freshly established temporary roads. By implementing either Alternative, overall human caused sediment input would eventually decrease to an estimated 3-14 percent from current levels following the completion of project related activities.

Table 27. Estimates of Sediment Production Rates for Flat Country Project Area Roads

	Alternative 1 (No Action)	Alternative 2 During Harvest	Alternative 2 After Harvest	Alternative 3 During Harvest	Alternative 3 After Harvest
Gross Sediment Yield (yrd^3)	269	333	233	311	262
Net increase/decrease (yrd^3)	-	64	-37	42	-8
Percent increase/decrease	-	24	-14	16	-3

Approximately 15.5 miles of temporary road construction would occur with Alternative 2 and 6.7 miles would occur in Alternative 3. However, only one mile in Alternative 2 and 0.1 miles in Alternative 3 would be located within Riparian Reserves. This represents approximately 1.5 and 0.01 acres of ground disturbance, respectively. All temporary roads would be stabilized with erosion control measures to minimize accumulation of runoff and transport of sediment during the wet season and would be fully decommissioned after the project is complete. In addition, 15.0 miles of road decommissioning and 4.7 miles of storage are proposed in both action Alternatives, which would reduce current sediment inputs. Decommissioning would include activities such as the removal of culverts, ripping or recontouring of the road surface, and revegetation. Based on professional experience, each fill removed would produce on average <1 cubic yard of fine sediment that would leave the fill removal site and settle out in the first 100 feet below the fill removal during the first winter.

Table 28 below provides a summary of the culvert replacements and the potential amount of stabilized fill material that would have a reduced risk of entering streams. It also estimates the amount of sediment produced from the culvert replacements. The maximum estimated sediment yield from culvert replacements would be approximately 99 cubic yards for Alternative 2. In comparison, the estimated volume of fill stabilized is 19,800 cubic yards for Alternative 2. For Alternative 3, the estimated maximum sediment yield and fill stabilized would be approximately 55.5 cubic yards and 11,100 cubic yards, respectively. Either Alternative 2 or 3 would reduce the potential for runoff effects and culvert failures that may affect Riparian Reserves or water quality.

Table 28. Culvert Replacements in Streams by Alternative for the Flat Country Project

Alternative	Stream Type	Number of Culverts Installed/Replaced/Removed	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
Alternative 1 (No Action)	None	0	0	0
Alternative 2	Intermittent	56	16,800	28 - 84
	Perennial	10	3,000	5 - 15
	Total	66	19,800	33 - 99
Alternative 3	Intermittent	37	11,100	18.5 – 55.5
	Perennial	3	900	1.5 – 4.5
	Total	40	12,000	20 - 60

Most harvest-related sediment input to streams comes from skid trails, historic roads that were poorly located, historic log culvert crossings, or historic skyline corridor crossings. Research has shown that by keeping these at least 33 feet from streams and following BMP guidelines, essentially all of the harvest related sediment is eliminated (Roshin 2006, Lakel 2010). In addition, as discussed in the Soils section of this document, soils in the project area have naturally high rates of infiltration and low potential for overland flow. The Design Features for Alternatives 2 and 3 designate a minimum 50-foot equipment exclusion zone around all waterbodies, which would essentially eliminate any routing of water from the logging operations to streams (Table 8, Chapter 2).

The McKenzie River Sub-Basin, which includes the Flat Country project area, provides municipal water to the City of Eugene by way of the Eugene Water and Electric Board's intake at Hayden Bridge, approximately 60 miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Flat Country Project that could adversely affect municipal water quality; but with the design features that restrict the location of skid roads and temporary roads as well as best management practices, adverse effects are not anticipated.

Natural 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. However, the risk of road and fill failures during major storm events would be reduced. With the additional activities that would be part of the Flat Country project, overall anthropogenic sediment input would decrease slightly across the 6th field subwatersheds in the project area.

Cumulative Effects

Alternatives 2 and 3

All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and would 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 F) were analyzed for effects to sediment 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 Flat Country project during timber haul, road maintenance and culvert replacement would not measurably or cumulatively contribute to impaired aquatic conditions.

3.4 Aquatic Resources (Fisheries and Aquatic Insects)

3.4.1 Summary of Effects

Endangered Species Act and Management Indicator Species

The Flat Country Project would have both negative and beneficial effects on fish in the project area (Table 29). All fish species in the project area would be subject to negative effects of thinning in the Riparian Reserves by removing about 10 percent of the woody material supply that could be delivered to fish-bearing streams. This effect is specific to Scott Creek and Lost Creek. However, in the long-term (decades) the thinned area of the Riparian Reserve would see increased tree growth (height and diameter) due to reduced competition with other conifer trees. For example, unit 360 is adjacent to Scott Creek and surveys show that the first reach of the stream is low in "large wood" abundance (i.e. trees at least 50 feet long and 36 inches in diameter) so there is not enough large wood to provide complex habitat that fish require. Thinning would accelerate the time and improve the quality of future woody material delivered to the stream.

The Flat Country project would also cause increases in sediment production during harvest activities but would decrease overall sediment production after all project related activities are complete. The increase in sediment would have negative effects on fish because it can increase turbidity and impact egg and embryo survival. The reduction in overall sediment production, combined with the road decommissioning work completed with the Robinson Scott EIS (1997-2016), would have beneficial effects on fish populations in the project area over the long term.

For ESA listed fish species in the project area, analysis of the effects of the proposed action determined that the project *may affect, and is likely to adversely affect* (LAA) Upper Willamette River Spring Chinook, the coterminous population of Bull Trout, and their respective Critical Habitat (Table 29). However, the project would not jeopardize the continued existence of either of these species or adversely modify their Critical Habitat. For Management Indicator Species (MIS), the project may impact individuals but would not contribute to a negative trend in viability for the populations.

Table 29. Summary of Findings for ESA and MIS Fish

Species	Finding
Upper Willamette River spring Chinook salmon (*Oncorhynchus tshawytscha*)	May Affect, Likely to Adversely Affect
Upper Willamette River spring Chinook salmon – Critical Habitat	May Affect, Likely to Adversely Affect
Essential Fish Habitat – spring Chinook salmon	Adversely Affect
Bull trout (*Salvenlinus confluentus*)	May Affect, Likely to Adversely Affect
Bull trout – Critical Habitat	May Affect, Likely to Adversely Affect
Management Indicator Species	Would not contribute to a negative trend in viability on the Willamette National Forest for management indicator fish species

Forest Service Sensitive Species

The project would not impact Pacific lamprey and Fluminicola virens (a freshwater snail) because they have not been documented in the planning area. However there are two other special status species (caddisflies) that would be impacted by the project (Table 30). There would be direct effects in the headwater springs area of Anderson Creek where a road crosses the springs, and in unit 1590 where fall-and-leave activities are proposed. Wet-weather haul and road maintenance has the potential to deliver sediment to Anderson Creek which would have negative impacts on caddisflies, but project design features developed for the project and found in the programmatic biological opinion for fish listed on the Endangered Species Act (ESA-listed) would reduce those effects. Fall-and-leave actions in unit 1590 would have long-term (decades) beneficial effects on habitat by increasing overall complexity. It could also have short-term (immediate) negative effects if felled trees landed on caddisflies. Fall-and-leave prescriptions would maintain overall shade and protect stream banks.

Table 30. Summary of Findings for Forest Service Aquatic Sensitive Species

Species	Finding
Rhyacophila chandleri and Rhyacophila leechi (Caddisflies)	May adversely impact individuals, but not likely to result in a loss of viability in the Flat Country Planning Area, nor cause a trend toward federal listing.
Fluminicola virens (a freshwater snail)	No Impact because they are not known to occur in the project area.
Pacific lamprey (Entosphenus tridentatus)	No Impact because they are not known to occur in the project area.

3.4.2 Scale of Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects to fish and aquatic invertebrates for this project includes the project area units, roads in the project area, the Kink Creek (170900040204), Boulder Creek (170900040206), White Branch (170900040207) and Lost Creek (170900040208) 6th Field sub-watersheds, and the Upper McKenzie River 5th Field watershed (1709000402).

3.4.3 Assessment Methodology

Methods used for analysis included:

- Habitat enhancement and timber harvest units were surveyed during the summer of 2018.
- Stream surveys conducted by the Forest Service for creeks in the project area were reviewed.
- The Upper McKenzie Watershed Analysis was reviewed for pertinent information.
- The Robinson-Scott EIS was reviewed for pertinent information since that project took place in the same area.
- Macroinvertebrate data collected on the McKenzie River Ranger District.
- The reports of other interdisciplinary team (IDT) members were reviewed.
- The IDT collectively reviewed every road and unit in the project area and developed project area and site-specific design features to reduce environmental effects.

3.4.4 Affected Environment

The upper McKenzie watershed is in an area of volcanic terrain on the west side of the Cascade Range. Two physiographic provinces meet here: The Western Cascades and High Cascades. The Flat Country project is primarily located in the High Cascades geologic province.

Stark contrasts in topography and drainage development reflect the underlying geology, geomorphology, and hydrology of the upper McKenzie watershed. Western Cascades volcanic landscapes comprised of older, deeply weathered, and uplifted basalt flows and volcanoclastic rocks have evolved through debris sliding, debris flows, and deep-seated mass wasting. Steep slopes with shallow, rapid subsurface flow are dissected by a dense network of steep, incised channels that efficiently convey surface runoff and sediment. Stream channels in the Western Cascades exhibit dynamic morphology in response to peaked storm runoff, high sediment yield, and periodic debris flows (Stillwater Sciences 2006b).

High Cascades landscapes, in contrast, are composed of broad areas of hydrologically disconnected surface runoff due to low gradient topography, disorganized drainage patterns, and subsurface flow through relatively unweathered and rapidly permeable Quaternary volcanic flows. Stream discharge remains relatively constant throughout the year regardless of rainfall, snowmelt or rain-on-snow events. This characteristic surface and subsurface hydrology, in combination with predominantly low gradient hillslopes with low drainage density, results in very low sediment yield in the High Cascades. Channel morphology is relatively static, as evidenced by mature upland and riparian vegetation growing near a stable base flow water surface elevation, and moss-covered bed particles and large wood in active channels (Stillwater Sciences 2006b).

The filtering characteristics of the younger High Cascades lava and glacial deposits produce a subsurface aquifer very low in fine sediments. Unlike streams that flow overland within stream channels, the water that flows subsurface within the upper McKenzie does not have the potential to pick up channel sediment and is not exposed to air temperatures and direct sunlight that could heat the water. This results in springs with extremely clean, cold water and these springs are the source for the perennial segments of Sweetwater, Anderson, and Olallie Creeks. Because these creeks were filled by younger High Cascade lava flows, they flow within channels that have broad valley bottoms that are not incised or entrenched (USDA 1995). The lower sections of these three creeks are Critical Habitat for bull trout. The upper portions of these creeks are non-fish-bearing intermittent creeks.

In contrast, the lower reaches of streams such as Kink, Twisty, Boulder, and Scott that flow over the lava of the older Western Cascades and glacial deposits have more incised channels than those flowing over the High Cascades. The channels in the lower reaches are more incised because they have down-cut through the glacial deposits, returning to their original channels within the older Western Cascades that have been subjected to fluvial process for a longer time. The lower reaches of Kink, Boulder and Scott are perennial and these are the sections inhabited by fish. The upstream portions of these channels are intermittent where they flow over the top of the glacial deposits and have not cut down into the underlying lava (USDA 1995).

The Upper McKenzie Watershed Analysis (USDA 1995) describes that much of the Lost Creek sub-watershed drains gently, sloping terrain of the High Cascades province and have new and old lava flows that have large water storage capacity. These conditions create stream habitat very similar to that found in Sweetwater, Anderson, and Olallie Creeks. Lost Creek lies within a glacial trough where the creek's springs are located.

There are two ESA-listed fish and designated Critical Habitat in the project area. Bull trout and upper Willamette River spring Chinook salmon are both listed as "threatened" under the Endangered Species Act. Figure 22 below shows Flat Country management units, and the distribution of bull trout and spring Chinook salmon and their designated Critical Habitat in the Flat Country project area.

Salmon are anadromous fish which means they spend part of their life history in freshwater and part of it in salt water. Much has been learned about the spring Chinook salmon population in the McKenzie River by the Forest Service and the Oregon Department of Fish and Wildlife (ODFW), (also see Stillwater Sciences 2006a, and USDA 1995). Based on that knowledge, the following is a general description of their life history. Spring Chinook salmon in the McKenzie River spawn from mid-September to mid-October and die after spawning. Their eggs incubate during the fall and winter. They emerge from the redd as fry in the spring and rear in fresh water during the early part of their life. The majority of these juvenile fish will migrate to the Pacific Ocean in their first year of life and rear in the marine environment until they are mature at which time they will return to the McKenzie to spawn and start the whole cycle over.

Much has been learned about the bull trout population in the McKenzie River by the Forest Service and ODFW (also see Stillwater Sciences 2006a, and USDA 1995). Based on that knowledge, the following is a general description of their life history. Bull trout spawn from mid-September to mid-October and their eggs incubate during the fall and winter. By March of the following year bull trout fry have started to emerge from the redd. Most bull trout live in their natal streams until they become juvenile fish (around age 3-4). Then as juveniles they migrate to the McKenzie River and rear in that system as sub-adults and finally grow to adulthood. They return to spawn in their natal streams when they are adults. Bull trout do not necessarily die after spawning so the adults return to the McKenzie River after spawning.

In the planning area bull trout spawn in the spring-fed streams (Sweetwater, Anderson, and Olallie Creeks). Bull trout require very cold water relative to the other salmonids in the McKenzie River. In the Flat Country project area bull trout have only been observed spawning in streams with temperatures whose composite average value was 7.5o C or lower (see Table 24 hydrology section 3.3.6). Boulder and Scott Creeks do not have the stream temperatures required for successful bull trout reproduction (see Table 24 hydrology section 3.3.6). Although Lost Creek is a cold, spring-fed stream bull trout have not been observed spawning in that creek (USDA 1995).

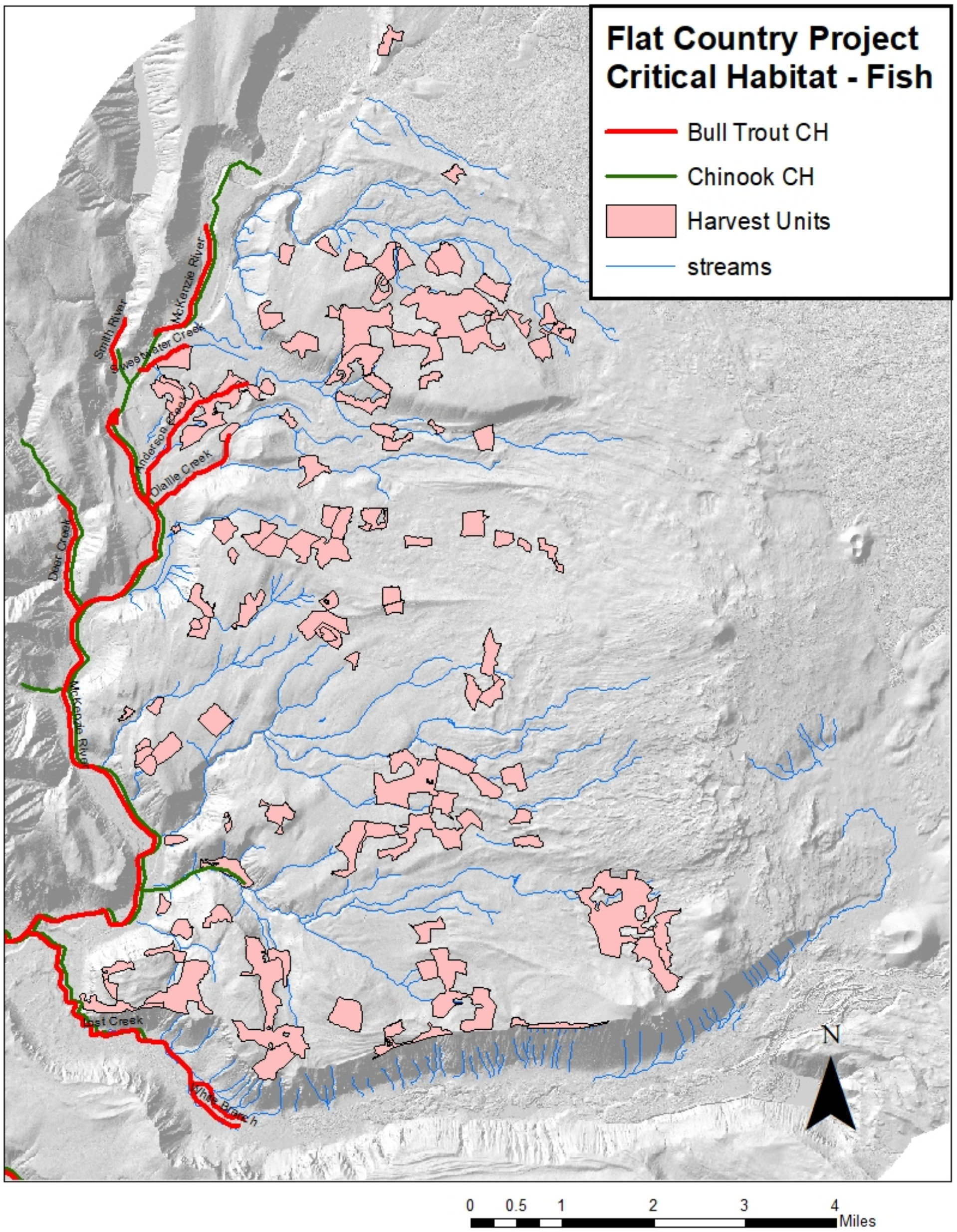

Figure 22. Map of Flat Country Critical Habitat for Bull Trout and Spring Chinook Salmon

The Upper McKenzie Watershed Analysis (USDA 1995) provides information on fish found in the watershed. The Forest Service has conducted stream surveys in most of the streams in the project area and incorporated that information into the watershed analysis (USDA 1995). Lastly, a consultant for the

Eugene Water & Electric Board (Stillwater Sciences) has also conducted fish inventories in the upper McKenzie watershed. Table 31 below displays only those fish species with confirmed presence in the watershed (USDA 1995, Stillwater Sciences 2006a).

Table 31. Fish Species with Confirmed Presence in the Upper McKenzie Watershed

Common Name	Scientific Name
Mottled sculpin	*Cottus bairdii*
Shorthead sculpin	*Cottus confusus*
Torrent sculpin	*Cottus rhotheus*
Mountain whitefish	*Prosopium williamsoni*
Spring Chinook salmon	*Oncorhynchus tshawytscha*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*
Rainbow trout	*Oncorhynchus mykiss*
Bull trout (char)	*Salvelinus confluentus*
Brook trout* (char)	***Salvelinus fontinalis***
Brown trout*	***Salmo trutta***
Atlantic salmon*	***Salmo salar***
Kokanee salmon*	***Oncorhynchus nerka***

Bold* – Non-native, introduced species

Coastal cutthroat trout have the widest distribution of all the salmonid fish in the project area (Figure 23). Although they have the widest distribution, relative to other watersheds their distribution is limited due to the geology of the High Cascades. Cutthroat can spend their entire life in small headwater streams, or as they mature and grow they can become river migratory. Moving into the McKenzie River as adults to rear and then returning to smaller streams to spawn.

Rainbow trout can have a similar life history as cutthroat. They tend to become river migratory and move to the McKenzie as adults and some spend their entire life in the river. This is because they can spawn in the McKenzie or they can migrate to smaller tributaries and spawn in those systems. Because cutthroat and rainbow trout are spring-spawners they spawn when streamflows are relatively high compared to fall-spawning fish. This means they have good access to streams like Scott Creek and Boulder Creek where they can build dozens of redds.

Mountain whitefish are a river migratory fish. During snorkel surveys Forest Service fish biologists tend to see whitefish in larger systems (i.e. the McKenzie River and Lost Creek). They have not been documented in the smaller systems like Sweetwater, Anderson, Olallie, Boulder, and Scott Creeks. Unlike other salmonid fish in the McKenzie sub-basin, whitefish do not build a redd. Instead, they “broadcast spawn” which means that they release their sticky eggs directly into the water column and their eggs stick to the river substrate.

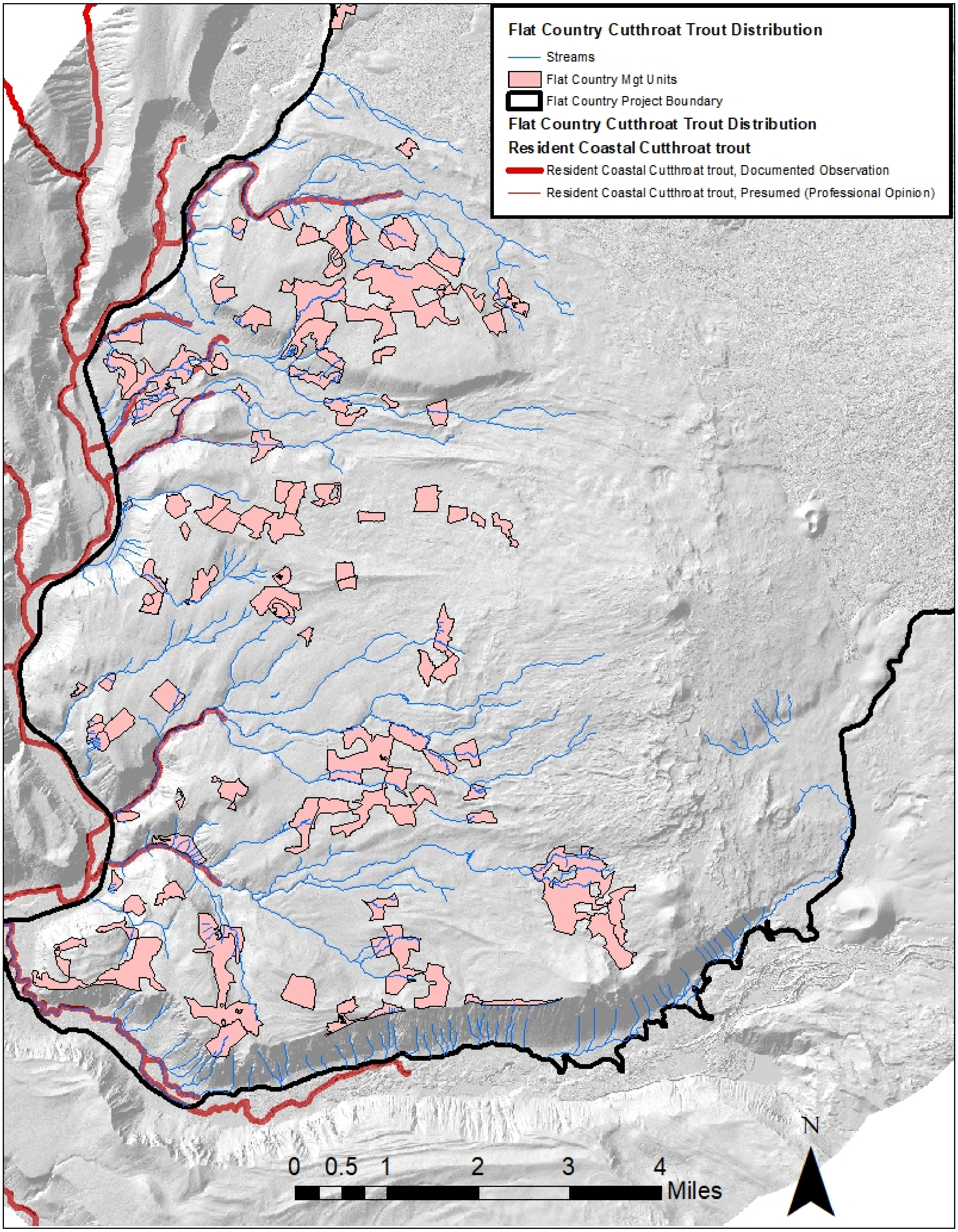

Figure 23. Map of Coastal Cutthroat Trout Distribution

Forest Service Special Status Species

There are four aquatic sensitive species (a Forest Service designation) designated on the Willamette National Forest. Only two species will be analyzed in this section, both caddisflies, and rationale why the other two species are not carried forward can be found below.

Sensitive Species – Aquatic Insects

Two aquatic insects found on the Regional Forester's sensitive species list have been documented on the Willamette National Forest in the HJ Andrews Experimental Forest which is located on the McKenzie River Ranger District. These aquatic insects are caddisflies and little is known about them. In fact, the common name for these caddisflies is "A Caddisfly." These caddisflies have not been documented in the Flat Country project area but the spring-fed streams in the area would be excellent habitat. Surveys for these specific caddisflies are taking place in the project area during the summer of 2019. A short summary of the distribution and known habitat associations are provided below.

Rhyacophila chandleri: In Oregon, this species is documented on Willamette, Deschutes, and Umpqua National Forests. It is documented on the Willamette National Forest as a rare insect on the H.J. Andrews Experimental Forest.

The entire *Rhyacophila* genus, whose name is derived from the Greek roots rhyaco (stream or torrent) and philia (fondness), is confined to running water. In the Cascade Mountains of Oregon, this species is associated with very cold, larger spring-fed streams (USDA Forest Service and USDI Bureau of Land Management 2012a). Elevations of known populations range from around 1219 to 1700 m (4000 to 5600 ft.) in Oregon.

In the Flat Country project area there are springs and a spring-fed stream (North Fork Boulder Creek) in unit 1590 that could provide habitat for this species.

Rhyacophila leechi*:* In Oregon, Rhyacophila leechi is documented to occur on the Willamette National Forest and on BLM land in the Medford District.

Rhyacophila leechi adults have been collected from springs and cold, spring-fed streams. This species appears to require colder water temperatures than the common and more widely distributed Rhyacophila verrula, and is likely confined to smaller, headwater streams and springs (USDA Forest Service and USDI Bureau of Land Management 2011). Oregon sites range in elevation from 440 to 980 m (1444 to 3210 ft.) (USDA Forest Service and USDI Bureau of Land Management 2011).

In the Flat Country Project the lower reaches of Sweetwater, Anderson, Olallie, and Lost Creeks could provide habitat for this species.

Sensitive Species – Freshwater Snail

Fluminicola virens: is a freshwater snail. It has not been documented on the McKenzie River Ranger District but has been documented on other ranger districts on the Willamette National Forest (USDA and USDI 2013). Since it has not been documented on the McKenzie River Ranger District no further analysis for this species will take place.

Sensitive Species - Fish

Pacific lamprey (*Entosphenus tridentatus*): The Pacific lamprey is an ancient fish and surveys for lamprey have been conducted on the Willamette National Forest from 2015 through 2017. The Middle

Fork Ranger District fisheries crew surveyed the entire forest and the McKenzie River Ranger District was surveyed in 2016. Those surveys documented Pacific lamprey in the lower McKenzie River and in the South Fork McKenzie River below Cougar Dam which is about 14 miles downstream of the Flat Country project area. It has not been documented in the upper McKenzie River or the Flat Country project area. Since this species has not been documented in the project area, no further analysis will take place for Pacific lamprey.

3.4.5 Environmental Consequences Fisheries and Aquatic Invertebrates

Direct and Indirect Effects

The introduced species in Table 31 can be found in the upper McKenzie River watershed but are not located in the Flat Country project area where activities are proposed. Except for brook trout, they are exclusively found in high mountain lakes in the wilderness (e.g. Benson Lake and Tenas Lakes) or in landlocked lakes with no outlet (e.g. Linton Lake). Brook trout can be found in the upper McKenzie River but have not been documented in the tributary streams found in the Flat Country project area. Therefore these species will not be analyzed. All the native species listed in Table 31 (sculpins, whitefish, salmon, trout, and chars) can be found in the project area and potential affects to these fish will be analyzed. Coastal cutthroat trout have the widest distribution of the fish in the project area so they can be used to discuss effects at a larger scale than the other fish who have more limited distributions.

Salmon, trout, chars, and whitefish belong to the family of fish called Salmonidae. These fish, and caddisflies on the Forest Service sensitive species list, can all be affected by changes in the supply and delivery of large woody material to the stream channel, changes in stream shade that can increase stream temperatures, and changes to the sediment regime. Therefore, these habitat attributes are analyzed to determine the effects of proposed activities on salmonid fish and Forest Service special status species (i.e. Sensitive Species). In general, salmonids require cold, clean water, abundant large woody material in the stream to create complex habitats, and spawning gravels relatively free of fine sediments (Bjornn and Reiser 1991).

Sculpins belong to the family of fish called Cottidae. In general, they require similar habitat conditions as the salmonid fish (e.g. clean/cold water, substrates relatively free of fine sediments, and complex habitats to find cover). The sculpins that can be found in the Flat Country project area are not ESA-listed or found on the MIS list. For these reasons this analysis will use the salmonid fishes as surrogates for potential effects to sculpins.

The section above (3.3 Hydrology) provided analysis, findings of effect, and rationale for those habitat elements that affect fish and aquatic invertebrates (large woody material, stream shade, and sediment) so that information would not be re-stated here. Instead, this section would specifically assess those habitat elements and proposed activities that could affect fish and aquatic invertebrates.

Alternative 1 – No Action

Fish – Anadromous and Resident

The hydrology analysis found that there would be no effect on shade under this alternative. Therefore, there would be no effect on fish or caddisflies in regards to stream temperature. Hydrology analysis also found that current rates of large wood recruitment, provided mostly by tree mortality (from competition, disease, wind and snow downed trees), would be maintained. Alternative 1 would provide a slightly higher rate of instream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent.

The direct and indirect effects of sediment under Alternative 1 on fish would be difficult to measure at the landscape level. First, fish distribution in the project area is limited (Figures 22 and 23) to the lower sections of some of the named creeks (Kink, Sweetwater, Anderson, Olallie, Boulder, Scott, and Lost Creeks) and much of the proposed action is located in the middle and upper portions of the sub-watersheds. Second, because of the geology in the High Cascades erosion is minimal, sediment delivery to streams is low, mobilization and transport of sediment and large woody material to the lower reaches of these streams is negligible due to the streamflow regime. Also, almost every stream channel in its middle and upper reaches in the project area is a seasonal flowing stream (class 4) and those that are perennial (class 3) in the upper watershed go subsurface (class 4) before reaching fish-bearing sections (class 1 and 2).

At the site level direct and indirect effects of sediment could occur but would also be minimal and difficult to measure. Forest roads can be the biggest source of sediment delivery to streams. All the roads but one that are proposed for decommissioning (Figures 32-34 in Section 3.8) would not have beneficial or adverse direct or indirect effects on fish habitat because they are not close enough to fish-bearing streams to realize those effects and almost all lie in the High Cascades geology where erosion from roads is low when compared to road systems in the Western Cascades. The one road (2600728) that could have indirect effects on fish habitat and is not in the High Cascades geology can be found in the glacial valley of the McKenzie River and it crosses Norwegian Creek (Figure 24). Norwegian Creek is a nonfish-bearing stream and it goes subsurface in the glacial valley due to the soil porosity and permeability (Figures 24 and 25). Not removing the stream crossings on this road could potentially have negative indirect effects on fish in the McKenzie River by maintaining the potential for sediment delivery. Figure 24 shows that there is not very much fill material over the culvert, so if the crossing failed it would likely be less than a cubic yard of sediment that would be delivered to the McKenzie River downstream. This sediment could indirectly affect spawning habitat for fish in the river but in the overall sediment regime of the McKenzie River (Stillwater Sciences 2006b) the effects would be minimal.

Figure 24. Norwegian Creek Culvert Forest Road 2600728

Note that there is very little fill material over the stream crossing, the area is flat, and the stream is dry.

Figure 25. Norwegian Creek Upstream of Culvert on Forest Road 2600728

Activities to fall and leave conifers in stream channels would have no direct or indirect effect on fish-bearing streams or fish. This is because the units where fall-and-leave is proposed are too far away from fish-bearing streams to realize a benefit. For example, unit 1590 is about 4 miles upstream from fish-bearing reaches of Boulder Creek and the creek goes subsurface in the summer and fall between unit 1590 and the fish-bearing segment.

Sensitive Species – Aquatic Insects

Alternative 1 (No Action) would have no direct or indirect effect on these aquatic insects since there would be no timber haul. It would also have no direct or indirect effect because all shade trees would be maintained and there would no change in the amount or frequency of woody material delivered to streams where these species could potentially occur.

If the fall-and-leave activities in the upper reaches of watershed did not take place, there would be no effect on caddisflies that could exist in the lower reaches of the spring-fed creeks. This is due to the distance between fall-and-leave activities and perennial stream reaches. However, there are small springs and a small spring-fed creek (North Fork Boulder Creek) in unit 1590 that could be habitat for *Rhyacophila chandleri* due to their spring-fed nature and the elevation of the unit. Alternative 1 would maintain all habitat elements (sediment, shade, woody material delivery) for this stream. It would also forego the fall-and-leave actions that are proposed which would be beneficial to these caddisflies by increasing hydraulic and habitat complexity. The effect would not be of the magnitude that it would create a viability concern for caddisflies in the stream.

Alternatives 2 and 3

Alternatives 2 and 3 would have similar effects to aquatic organisms since the Riparian Reserve strategy would be the same, so they will be analyzed together for effects. Fall-and-leave treatments (see Table 20 and Appendix H) are miles away from fish-bearing streams. Unit 1590 is about 4 miles upstream from fish-bearing reaches of Boulder Creek and the creek goes subsurface in the summer and autumn between unit 1590 and the fish-bearing segment of the creek. This is just one example but is typical of all fall-and-leave scenarios. Due to the distance of fall-and-leave treatments from fish bearing streams, the underlying geology, and the flow regime, these activities would have no direct or indirect effects to fish or their habitat. Therefore, fall-and-leave treatments will not be analyzed for fish in this section but will be analyzed for aquatic insects (caddisflies).

In general, Alternatives 2 and 3 would have direct and indirect effects on fish, their habitat, and caddisflies on the sensitive species list. At the landscape level these effects would be difficult to measure in the fish-bearing, and perennial streams because of the limited distribution of fish and sensitive caddisflies in the project area, and the underlying geology. At the site level these effects could be realized and some would be negative and some beneficial. The analysis below will focus on specific locations, fish species, and caddisflies where these effects could be realized.

Alternatives 2 and 3

Alternatives 2 and 3 would have similar effects to aquatic organisms since the Riparian Reserve strategy would the same so they will be analyzed together for effects

Fish

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. Table 32 and 33 show Riparian Reserve widths used in the Flat Country project. Note that one site-potential tree height in the upper McKenzie watershed is 180 feet so that height is used (see appendix H). The no-harvest widths in Table 32 are the same as PDF B1 in the fisheries programmatic biological opinion (fish BO) (NMFS 2018, USFWS 2019). The widths in Table 33 were used in Riparian Reserves where it was determined that current conditions are not meeting desired vegetation characteristics and thinning is prescribed.

Table 32. Riparian Reserve Widths from the Northwest Forest Plan

Stream Type	Riparian Reserve Width
Fish-bearing	Two site-potential tree heights or 300 feet, whichever is greater
Permanently flowing non-fish-bearing streams	One site-potential tree height or 150 feet, whichever is greater
Intermittent streams	One site-potential tree height or 150 feet, whichever is greater
Constructed ponds or reservoirs	One site-potential tree height or 150 feet, whichever is greater
Lakes and natural ponds	Two site-potential tree heights or 300 feet, whichever is greater

1One site potential tree height in the Flat Country planning area is 180 feet, as determined by the Upper McKenzie Watershed analysis (1995).

Table 33. No-Harvest Buffer Widths for Riparian Reserves with Thinning

Stream Class	No-harvest Buffer Width
Class 1 - Streams with anadromous fish and/or bull trout	120 feet
Class 2 - Streams with resident fish like rainbow and cutthroat trout	100 feet within 1,000 feet of a Class 1 stream, 75 feet outside of 1,000 feet from a Class 1 stream
Class 3 - Permanently flowing non-fish-bearing streams	60 feet
Class 4 - Intermittent streams	30 feet

Spring Chinook Salmon (Anadromous Fish)

The Flat Country project could have direct and indirect effects on spring Chinook salmon and their designated Critical Habitat. Spring Chinook salmon distribution is very limited in the project area (see Figure 22). The only two streams where Chinook salmon occur in the project are Scott Creek and Lost Creek both of which are designated Critical Habitat (Figures 27 and 28). Both of these creeks provide spawning and rearing habitat. Scott Creek flows through the Western Cascades geology so during the spawning season (mid-September to mid-October) the stream is at its baseflow (i.e. lowest flows of the year). This makes it difficult for a fish as large as an adult salmon to negotiate the channel but it can be done. It is unknown how much spawning is taking place in Scott Creek, but based on spawning seen in other Western Cascades geology streams (e.g. Deer Creek) it is likely that less than a dozen redds (i.e. fish nests) would be constructed. Lost Creek is spring-fed and has substantial flows all year so during the spawning season there is enough water for salmon to easily access the stream. In calendar year 2018, ODFW counted 30 spring Chinook redds in Lost Creek.

Alternatives 2 and 3 both propose to thin previously managed stands near spring Chinook Critical Habitat and would implement no-harvest buffer widths found in Table 33. The units are 360 near Scott Creek (Figure 26) and 1960 near Lost Creek (Figure 27). These widths would maintain 100 percent of the stream shade that exists in the Riparian Reserves so there would be no effect on stream temperatures. Thinning within one site-potential tree height means that the supply of large woody material would be affected. The hydrology analysis found that the Riparian Reserve strategy would maintain 90 percent of the supply but that means there could be a 10 percent loss of trees that could reach the channel. This would be a direct negative effect on the large woody material supply. However, by thinning the outside of the 120-foot no-harvest buffer tree growth would be accelerated due to a reduction in competition between conifer trees. These larger trees would be beneficial to the first reach of Scott Creek (fish-bearing) as it currently does not meet properly functioning conditions (see hydrology section 3.3.4 and Table 16). Eighty pieces of “large” wood per mile is considered properly functioning and Table 16 shows there are only 38 pieces per mile of all size classes in reach 1 where salmon habitat is located. The 1997 stream survey found only 1 piece per mile in the “large” size class in reach 1, and 4 pieces per mile in reach 2. In Lost Creek, surveys in 2003 found between 4 and 13 pieces per mile in three stream reaches in the “large” size class.

Any negative or beneficial direct or indirect effect of thinning on fish habitat in Lost Creek would be difficult to measure because there would be a 120-foot no harvest buffer and there is an existing road (2600350), mature forest, and a scree slope between portions of the unit and the creek. Despite the difficulty in measuring the effects, they would not be insignificant. Thinning within one site potential tree height means that the supply of large woody material would be affected. The hydrology analysis found that the Riparian Reserve strategy would maintain 90 percent of the supply but that means there could be a 10 percent loss of trees that could reach the channel. This would be a direct negative effect on the large woody material supply and habitat complexity in Scott Creek and Lost Creek.

Alternatives 2 and 3 would cause changes to the sediment regime in the planning area and this would have both negative and beneficial effects on salmon and their habitat.

Sediment increases would have a negative effect on spring Chinook salmon and designated Critical Habitat caused by timber haul, especially during wet weather. 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. The same analysis was conducted for each alternative incorporating all project related road maintenance, temporary road construction activities, and haul route activity. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. Table 27 (hydrology section 3.3.10) shows the estimates of sediment production rates based on WEPP.

For both action alternatives, annual sediment yield increases during harvest activities. This represents an estimated 16-24 percent increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. Alternative 2 shows the highest increase during operations when there is increased traffic on haul routes and freshly established temporary roads. By implementing either Alternative, overall human caused sediment input would decrease and estimated 3-14 percent from current levels following the completion of project related activities.

The negative direct and indirect effects on spring Chinook salmon would be greatest for haul routes near their habitat. Due to the limited distribution of salmon in the project area, this is limited to unit 360 which is adjacent to designated Critical Habitat for spring Chinook habitat in Scott Creek (Figure 26). In Figure 26, note that the green Critical Habitat line is not mapped correctly, the blue LIDAR stream line is mapped correctly and that is where the Critical Habitat lies. Timber haul would take place on the 2649 road and there are 0.35 miles of road that are within 500 feet of Scott Creek. This increases the chances of sediment reaching salmon habitat indirectly via the road system. Especially during wet-weather haul. Fine sediment can have adverse effects on the survival of salmon eggs in the redd.

Unit 1960 is near designated Critical Habitat in Lost Creek (Figure 27). The 2600350 road is close to Lost Creek but would not be used for timber haul. Instead, trees would be yarded uphill to a landing and timber haul would be via the 2647505 road to the 2647 road to Highway 126. The 2647 roads are not near salmon habitat and Highway 126 is paved. Because of this, it is unlikely that sediment would reach Lost Creek due to timber haul.

The programmatic fish BO (USDC NMFS 2018, USDI FWS 2018) for timber operations has PDFs for wet-weather haul that would reduce the potential for effects (specifically PDF H-6). In addition, the interdisciplinary team has developed PDFs for wet-weather haul that would reduce the potential adverse effects to spring Chinook streams. Adherence to the PDFs found in the fish BO (USDC NMFS 2018, USDI FWS 2018) would ensure that the activities in the Flat Country Project would not jeopardize the continued existence of Upper Willamette spring Chinook salmon.

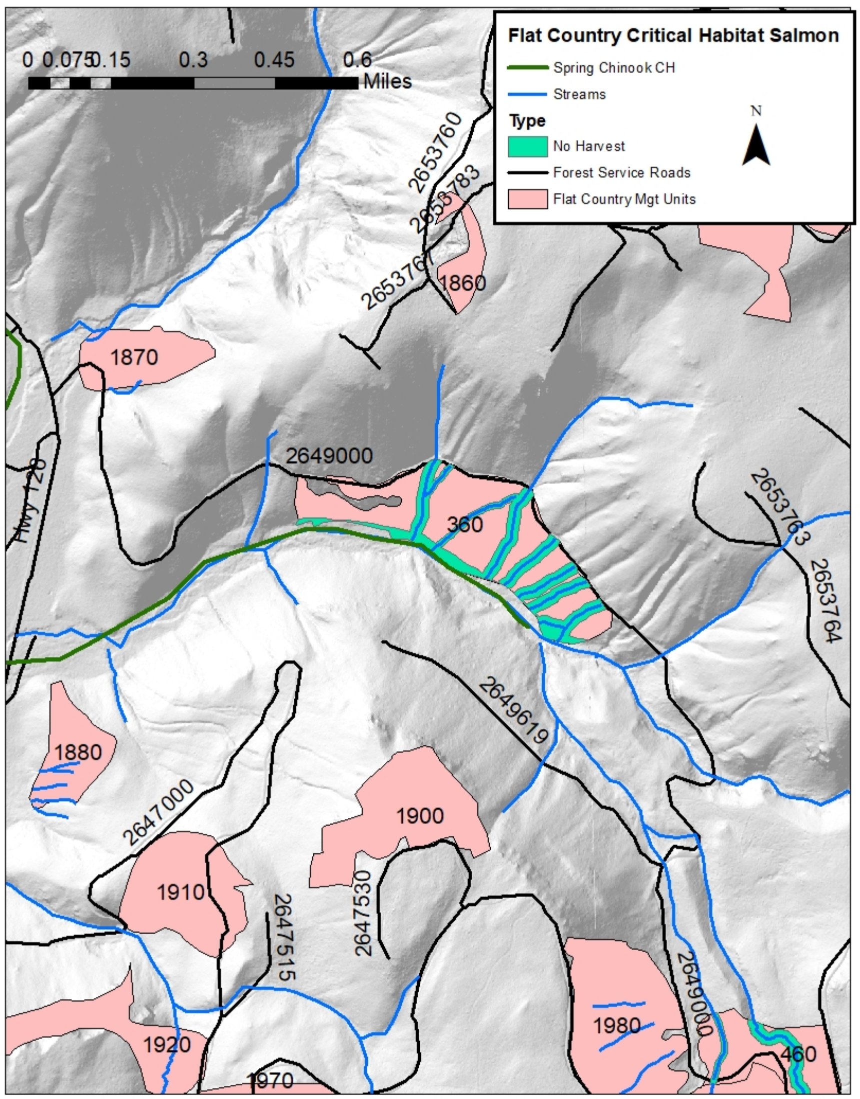

Figure 26. Map of Spring Chinook Critical Habitat in Scott Creek

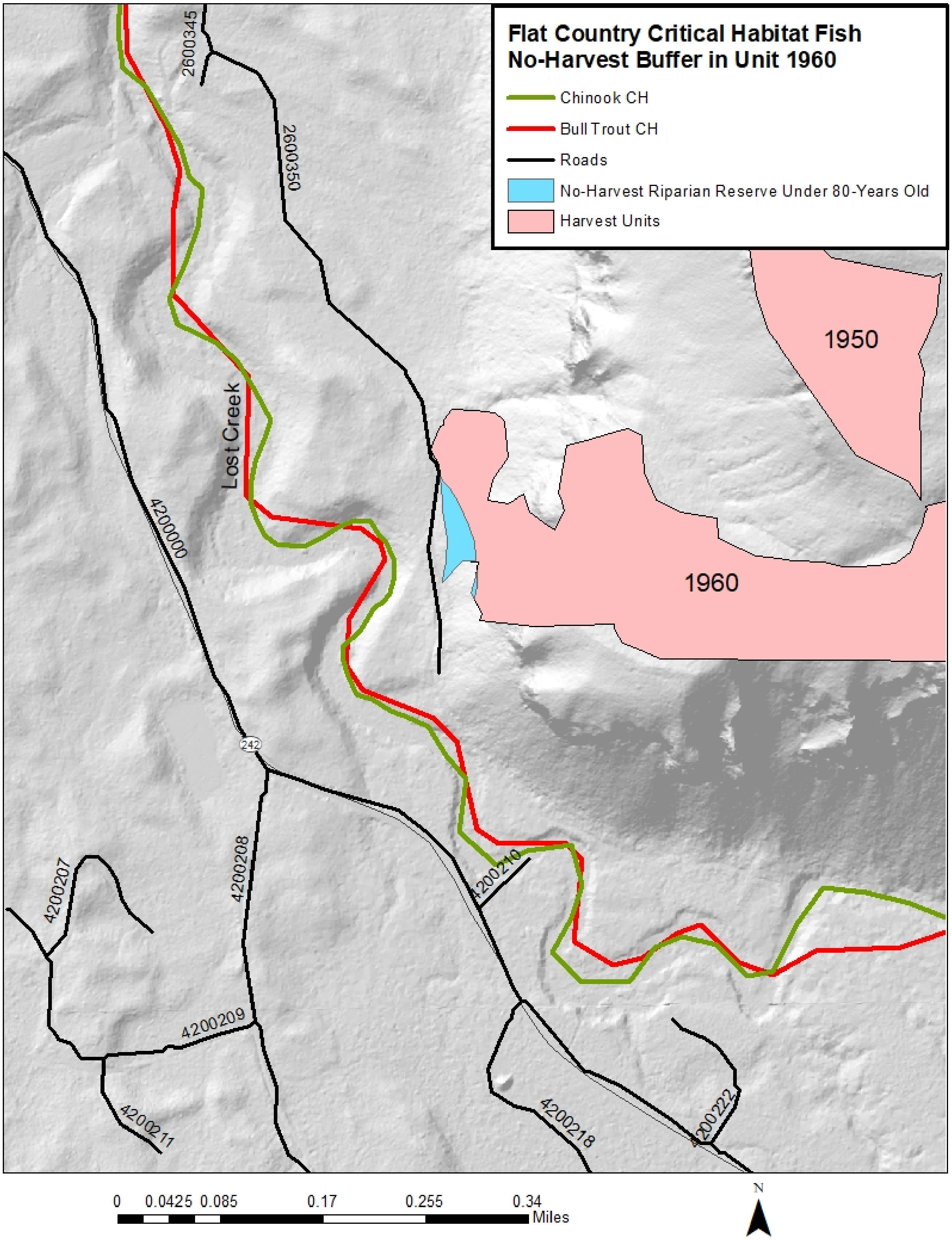

Figure 27. Map of Unit 1960 and Critical Habitat in Lost Creek for both Bull Trout and Chinook Salmon

Note that Critical Habitat for both species overlaps up to a point near the 42000222 road. Also see Figure 28 for Critical Habitat in Lost Creek.

Bull Trout

In general, the Flat Country Project could have direct and indirect effects on bull trout and their designated Critical Habitat. Bull trout distribution and Critical Habitat is shown in figures 22, 27, and 28 and within the project area is limited to Sweetwater, Anderson, Olallie, and Lost Creeks. Sweetwater, Anderson, and Olallie Creek provide spawning, early rearing, and juvenile rearing habitat. Bull trout have not been documented spawning in Lost Creek but sub-adults and adults have been documented foraging in the stream (USDA 1995).

Much is known about bull trout spawning in the project area. Table 34 shows the number of bull trout redds for streams in the project area, based on annual spawning surveys from 1991 to 2018.

Table 34. Number of Bull Trout Redds in the Flat Country Project Area Based on Spawning Surveys

Survey Year	Anderson Creek	Olallie Creek	Sweetwater Creek	Annual Total
1991	8	0	0	8
1992	13	0	0	13
1993	15	0	0	15
1994	30	3	0	33
1995	73	10	0	83
1996	82	7	0	89
1997	85	9	0	94
1998	79	7	0	86
1999	77	6	0	83
2000	83	9	2	94
2001	72	6	2	80
2002	60	10	1	71
2003	56	17	4	77
2004	49	12	9	70
2005	47	12	9	68
2006	59	8	21	78
2007	58	15	22	95
2008	53	12	20	85
2009	65	13	21	99
2010	23	18	4	45
2011	33	15	7	55
2012	29	18	11	64
2013	34	18	17	69
2014	37	17	20	74
2015	30	16	15	61
2016	29	18	19	66
2017	22	24	11	57
2018	38	27	21	86

The direct and indirect effects to bull trout from Flat Country Project activities would essentially be the same as those described in the spring Chinook section above. However, due to the differences in the distribution of spring Chinook and bull trout in the project area (see Figure 22) there are some specific differences.

Large wood delivery and shade would have no-harvest Riparian Reserve buffers (Table 32) along units 1260, 1300, 1310, and 1320. These units are adjacent to Critical Habitat in Sweetwater, Anderson, and Olallie Creeks (Figure 28). Thinning is proposed in unit 1960 which is close to Lost Creek Critical Habitat (Figure 27) which would have Riparian Reserve prescriptions found in Table 32. As with spring Chinook salmon, any negative or beneficial direct or indirect effect of thinning on fish habitat in Lost Creek would be difficult to measure because there would be a 120-foot no harvest buffer, there is an existing road (2600350), mature forest, and a scree slope between portions of the unit and the creek. Despite the difficulty in measuring the effects, they would not be insignificant. Thinning within one site potential tree height means that the supply of large woody material would be affected. The hydrology analysis found that the Riparian Reserve strategy would maintain 90 percent of the supply but that means there could be a 10 percent loss of trees that could reach the channel. This would be a direct negative effect on the large woody material supply which affects habitat complexity in Lost Creek.

The effects of sediment on bull trout would also be similar to those described for spring Chinook salmon but due to differences in distribution the specific areas would be different. There is a total of 0.95 miles of timber haul within 500 feet of bull trout habitat that could take place during wet-weather conditions. This would be on the 2600722 road (0.62 miles), 2600727 road (0.08 miles) and the 2657 (0.25 miles) (Figure 28). The 2657830 road does not have timber haul within 500 feet of bull trout habitat but it does cross Anderson Creek in a section where the creek is intermittent-flowing but also where some substantial springs cross the road. This is the beginning of Anderson Creek's perennial section of stream and sediment delivery could occur during wet-weather haul and road maintenance. The 2657830 road crosses Anderson Creek about 4,500 feet upstream of bull trout Critical Habitat (Figure 29).

Sediment delivery from timber haul would indirectly affect bull trout habitat in an adverse way by sediment entering ditchlines and eventually reaching streams. This is especially true for Anderson Creek where the 2657830 crosses the stream and the springs. Since the road crossing is about 4,500 feet upstream of bull trout habitat, and due to the flow regime and the abundant amount of woody material in the stream, it could take years for sediment to reach bull trout habitat. But that sediment would have adverse effects on spawning habitat by increasing the amount of fine sediment in the stream channel. The programmatic fish BO (USDC NMFS 2018, USDI FWS 2018) for timber operations has PDFs for wet-weather haul that would reduce the potential for effects (specifically PDF H-6). In addition, the interdisciplinary team has developed PDFs for wet-weather haul that would all reduce the potential adverse effects to bull trout streams. Adherence to the PDFs found in the BO would ensure that the activities in the Flat Country Project would not jeopardize the continued existence of bull trout.

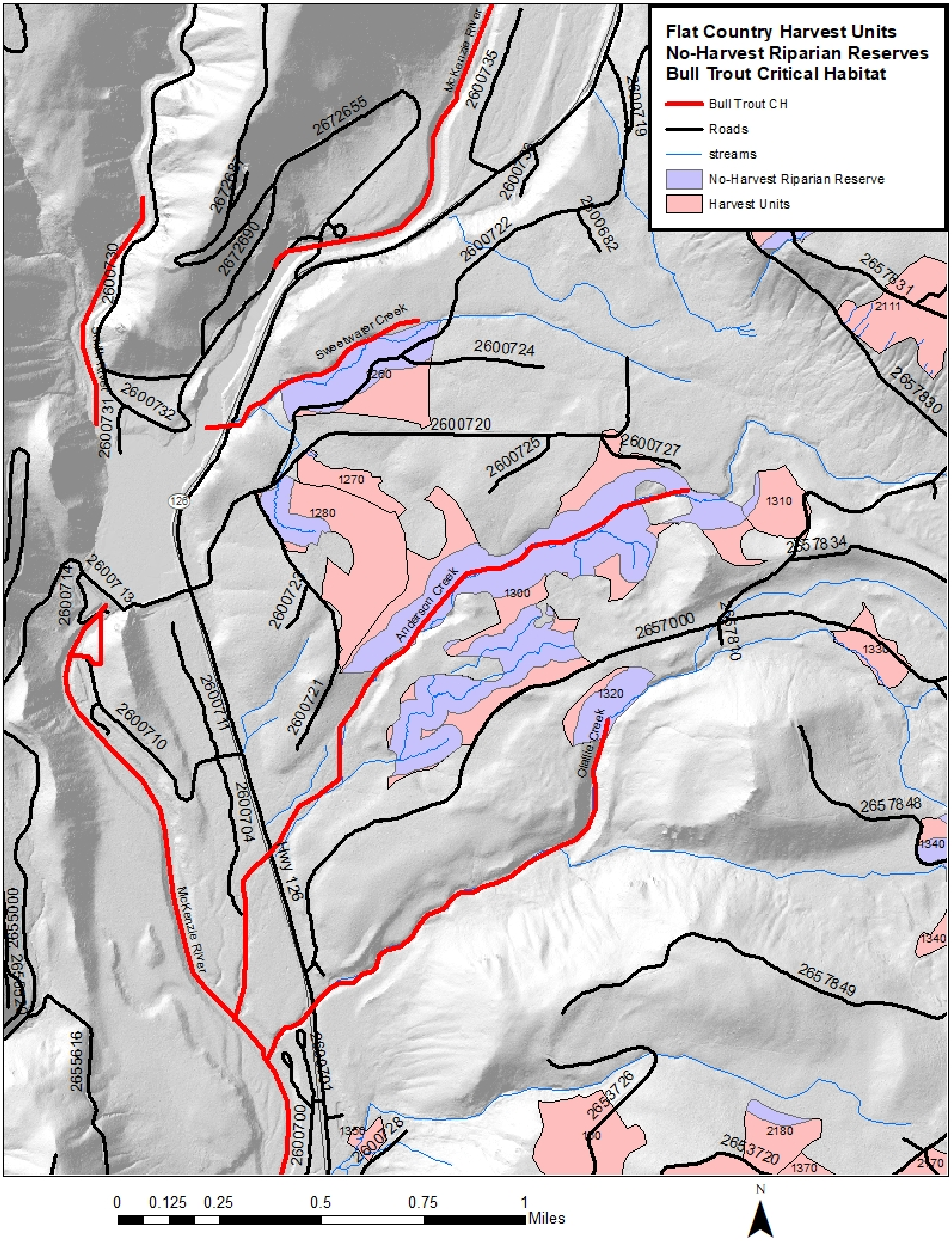

Figure 28. Map of Bull Trout Critical Habitat, Harvest Units, and Riparian Reserves

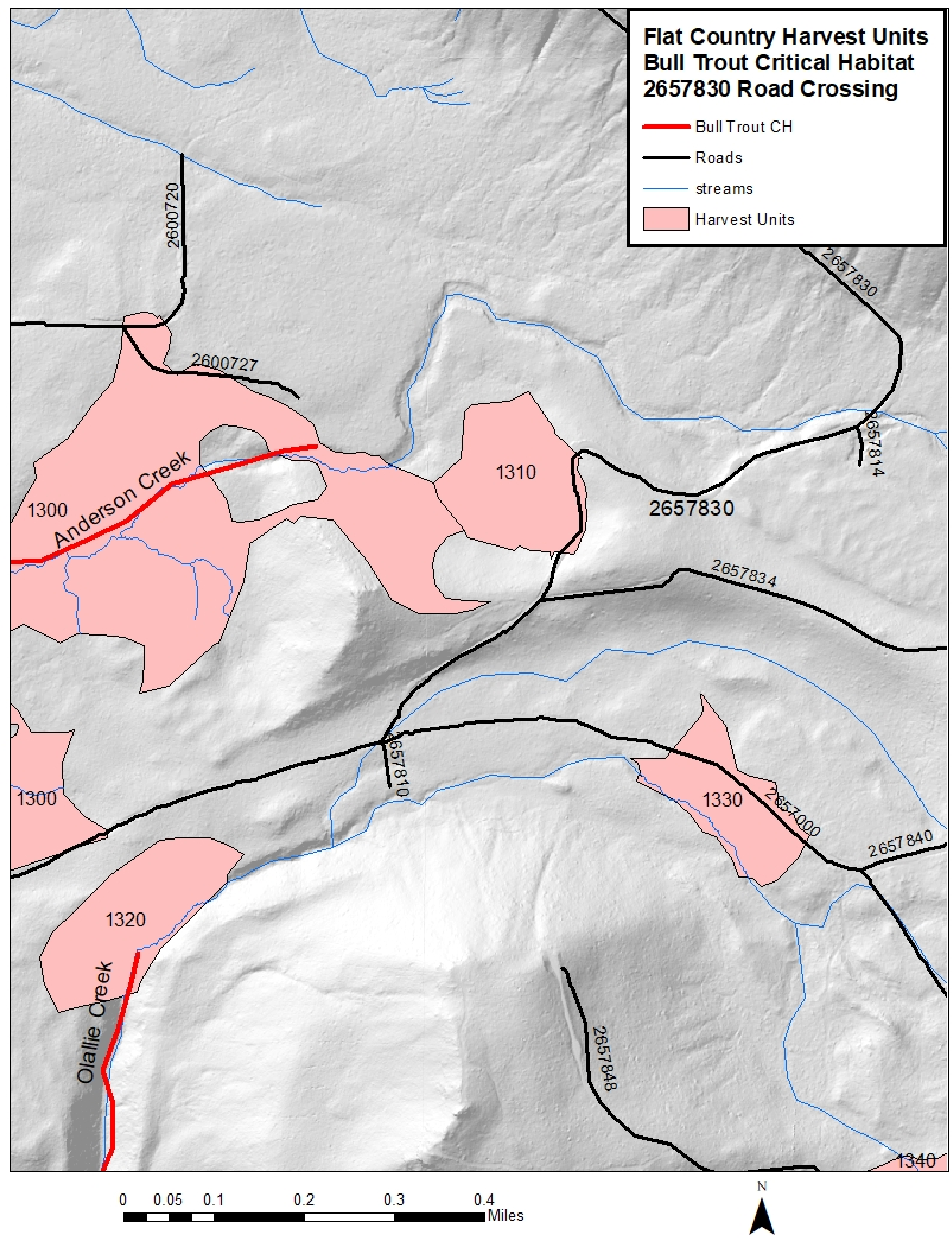

Figure 29. Map of the 2657830 Road and Anderson Creek

Resident Fish – Coastal Cutthroat Trout, Rainbow Trout, and Mountain Whitefish

Not much is known about specific redd numbers for these fish or population densities. See the Upper McKenzie River Watershed Analysis (USDA 1995) and Stillwater Sciences (2006b) for information on what is known.

In general, the Flat Country project would have direct and indirect effects on these fish species through changes in woody material supply and changes in the sediment regime. These effects would be both negative and beneficial depending on their spatial and temporal aspects. The project has been designed to protect shade trees (see hydrology section 3.3.7) so no effect is expected on shade or stream temperatures.

The project would have direct and indirect effects on the supply of woody material due to thinning for vegetative diversity. As described in the hydrology section, in all the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect these wood recruitment zones as well as other resources such as temperature. The overall goal for developing wood recruitment zones was to protect at least 90 percent of trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be sufficient to sustain physical complexity and stability required by the ACS Objectives. In those reserves where thinning is prescribed, perennial class 1 and 2 (fish-bearing) streams are prescribed a minimum 120-foot and 75-foot no-treatment buffers, respectively, to retain effective stream shade and woody material delivery. This buffer would maintain shade and at least 90 percent of the woody material that could be delivered to the channel while providing for some long-term benefits (decades) in the future as the thinned area have accelerated growth. See appendix H for specific information on Riparian Reserve treatments.

The project would change the sediment regime which would have negative effects on resident fish in the short-term (years) but beneficial effects in the long-term (decades). Spawning habitat for all resident fish would be negatively affected by fine sediment which can have negative impacts on egg and embryo survival. The action alternatives would have similar effects to resident fish as those to bull trout and spring Chinook salmon because their overlapping distribution. The hydrology analysis found that annual sediment yield increases during harvest activities for both action alternatives (see Table 27). This would have short-term negative effects on resident fish during harvest by directly delivering sediment to resident trout streams. Based on the distribution of resident fish and the underlying geology of the project area that naturally limits sediment production and delivery, these effects would not be substantial enough to cause any viability concerns for these species.

The hydrology analysis also found that there would be beneficial effects from the project by reducing sediment delivery in the long-term (see Table 27). By implementing either action alternative, overall human-caused sediment input would decrease by an estimated 3-14 percent from current levels following completion of project related activities. This would have long-term beneficial effects on spawning habitat by reducing the amount of fine sediment delivered to streams.

Sensitive Species – Aquatic Insects

These species *Rhyacophila chandleri*, and *Rhyacophila leechi* have not been documented in the Flat Country project area but have been documented on the McKenzie River Ranger District. Only limited sampling has taken place in the past, but during calendar year 2019 extensive surveys for caddisflies are taking place in the spring-fed streams in the Flat Country project area.

Since these species require the same type of habitat that bull trout need (i.e. cold, spring-fed streams with woody material) the direct and indirect effects on aquatic insects would be similar to those of bull trout. In Sweetwater, Anderson, and Olallie Creeks 100 percent of the shade and large woody material available to the stream would be maintained. Sediment would be delivered during maintenance and haul to streams with suitable habitat for these caddisflies and have negative impacts on them. This is especially true at the 2657830 road crossing where the Anderson Creek springs are located.

Alternative 2 would fall and leave trees along a spring-fed creek in unit 1590. This stream is suitable habitat for *Rhyacophila chandleri* due to elevation. Table 20 in the hydrology section displays fall-and-leave treatments for the Flat County Project. This activity would have short-term impacts on individuals (i.e. by a tree falling on them) but would have long-term (decades) beneficial impacts by increasing stream complexity and by protecting overall shade conditions and bank stability. Alternatives 1 and 3 would not fall and leave trees in this unit so these alternatives would not have the same effects as alternative 2. That is, the channel would not benefit from the addition of large wood but no individuals would be impacted from falling trees.

Based on this analysis, the Flat Country project may adversely impact individuals, but not likely to result in a loss of viability in the Flat Country Planning Area, nor cause a trend toward federal listing. This effects determination is due to the potential for sediment delivery from timber haul and maintenance activities on the 2657830 road and fall-and-leave actions in unit 1590.

Fuel treatment Activities on all Fish Species and Caddisflies

Alternative 1 (No Action)

Alternative 1 would not have any direct or indirect effects on fish or caddisflies because no ground disturbing or burning would take place in the watersheds or near perennial streams.

Alternatives 2 and 3

Fuel treatment activities would not have direct effects on fish or caddisflies because project design features (PDFs) found in Table 8 and in the Biological Opinion (BO) for spring Chinook salmon and bull trout would prevent direct effects when implemented. There could indirect effects on sediment delivery and shade if the fire burned too far into the Riparian Reserve. However, fire personnel would be there to “knock down” the fire which would minimize impacts to vegetation so the indirect effects on shade and sediment would be minimal.

Fuel treatment activities could include pile burning, broadcast burning, and roadside hazardous fuels treatments. Pile burning is not expected to cause any additional tree mortality so all existing woody material and shade would be protected. During broadcast burning, fire would be allowed to back into the Reserves and burn in a mosaic pattern (BO PDF-I1) rather than requiring a fireline around the Reserves which would potentially result in erosion (BO PDF-I6). With local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow, vine maple, and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. 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 non-thinned plantations.

3.4.6 Cumulative Effects

Not all the activities in appendix F, in combination with effects from the Flat Country Project, would have effects on fish and caddisflies. All the projects in the appendix listed as "CE" (i.e. categorically excluded under NEPA) were designed to have "no effect" on listed fish and thereby "no effect" on all fish species. The only activity listed in appendix F, that in combination with effects from the Flat Country Project, would have effects on fish and caddisflies would be the Robinson Scott EIS.

Alternative 1 – No Action

Cumulative effects on fish and caddisflies under Alternative 1 would be realized if this alternative was selected. This is because road decommissioning would not take place so an overall reduction in human caused sediment would not take place. Road decommissioning in combination with the 4.1 miles completed under the Robinson Scott EIS that were closer to bull trout habitat would have been beneficial effects to aquatic systems.

Alternative 1 would forego the fall-and-leave actions that are proposed which would be beneficial to caddisflies by increasing hydraulic and habitat complexity in in a spring-fed stream in unit 1590. The effect of Alternative 1, in combination with actions taken during Robinson Scott activities would not be of the magnitude that it would create a viability concern for caddisflies in the stream. Like Alternative 1, Alternative 3 would have similar effects because fall-and-leave activities are not proposed under Alternative 3.

Stands that are currently not meeting ACS objectives would continue naturally on their current trajectory. The lack of thinning means that it would take longer for trees to become large enough to significantly affect habitat. This would have the most pronounced effects in Scott Creek where large woody material numbers are currently low.

Alternatives 2 and 3

Cumulative effects on fish and caddisflies under Alternatives 2 and 3 would be realized if either of these alternatives was selected. This is because road decommissioning would take place so an overall reduction in human caused sediment would also take place. Both Alternative 2 and 3 would decommission 15.1 miles of road. In combination with the 4.1 miles decommissioned under the Robinson Scott EIS, this would be a cumulative beneficial effect to aquatic systems.

In Robinson Scott, thinning took place in the Riparian Reserves of young stands. In "bull trout" areas for that project (Sweetwater, Anderson, and Olallie Creek sub-drainages), and for Flat Country, full Riparian Reserve widths were implemented in bull trout areas. In non-bull trout areas (Twisty, Norwegian, Scott, and Boulder Creek sub-drainages) some class 3 and 4 Riparian Reserve stands were thinned under Robinson Scott. The thinning that took place under that project, in combination with the thinning proposed in unit 360 would cumulatively improve large woody material quality in the long-term (decades) for these specific stream systems. There would be short-term (less than 10 years) negative cumulative effect on the quantity of large woody material (about a 10 percent loss) in these specific systems.

3.4.7 Magnuson-Stevens Fishery Conservation and Management Act

Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (i.e. Blue River Dam), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for "Essential Fish Habitat" (EFH) that requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. 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 McKenzie River is Chinook salmon.

The Flat Country project would adversely affect EFH in the project area for the same reasons there would be an adverse effect to listed Upper Willamette River spring Chinook salmon. That is, EFH in the project area would be subject to negative effects of thinning in the Riparian Reserves by removing about 10 percent of the woody material supply that could be delivered to fish-bearing streams. However, in the long-term (decades) the thinned area of the Riparian Reserve would see increased tree growth (height and diameter) due to reduced competition with other conifer trees. For example, unit 360 is adjacent to Scott Creek and surveys show that the first reach of the stream is low in "large wood" abundance (i.e. trees at least 50 feet long and 36 inches in diameter) so there is not enough wood to provide complex habitat that fish require. Thinning would accelerate the time and improve the quality of future woody material delivered to the stream.

The Flat Country project would also cause increases in sediment production during harvest activities but would decrease overall sediment production after all project related activities are complete. The increase in sediment would have negative effects on salmon because it can increase turbidity and impact egg and embryo survival. The reduction in overall sediment production, combined with the road decommissioning work completed with the Robinson Scott EIS (1997-2016), would have beneficial effects on EFH in the project area.

3.4.8 Management Indicator Species

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 common salmonid sport fish that have habitat on the McKenzie River Ranger District are spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout.

Management Indicator Fish Viability Statement: The Flat Country Project would maintain habitat conditions for aquatic management indicator species in the project area. Riparian Reserve design would maintain at least 90 percent of large wood available for delivery to fish bearing streams, protect all shade trees, and reduce the potential impact of sediment to management indicator fish species and their habitat. Based on conditions inventoried during stream surveys, the road network in the project area has not had effects that have created conditions that have substantially affected spawning habitat, embryo incubation, and emergence of trout or salmon fry. However, road decommissioning associated with the project would have indirect beneficial effects on fish habitat in the McKenzie River. **Therefore, the Flat Country Project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.**

3.5 Wildlife

3.5.1 Summary of Effects

All Alternatives

All three Alternatives would maintain viable populations at the Forest level of all special-status wildlife species that have habitat in the Flat Country project area; this includes Federally Threatened species, Northwest Forest Plan Survey and Manage species, Forest Service Region 6 Sensitive Species, Willamette National Forest Management Indicator Species, and U.S. Fish and Wildlife Service Birds of Conservation Concern.

Beyond maintaining viable populations at the Forest level, all three alternatives would have no impacts on marten, bald eagle, peregrine falcon, bufflehead, northern waterthrush, fisher, or Crater Lake tightcoil.

Alternative 1

Alternative 1 would have no direct effect on northern spotted owl (also called “spotted owl”) known sites, suitable habitat, dispersal habitat, or Critical Habitat. However, as an indirect effect, roadside hazardous fuels reduction treatments would not occur and therefore there would be a reduced ability to contain high severity fire from destroying spotted owl habitat. Younger, dense stands would remain unthinned and would be at greater risk of high severity fire, which is carried more efficiently through overstocked stands.

Alternative 1 would not increase habitat for early-seral species, including three Birds of Conservation Concern, nor improve the quality of deer and elk forage levels in the Flat Country project area. Early-seral habitat from other recent and ongoing projects currently totals under 1 percent (550acres) of the Flat Country project area. In the absence of additional harvest or wildfire in the next ten years, early-seral habitat availability would decrease. Deer and elk forage levels, which are already poor or marginal, would decline.

Alternative 1 would continue to gradually increase large diameter trees, large snags, and large downed wood over time, which species such as cavity excavators, marten, and northern goshawk prefer. Alternative 1 would not conduct fall-and-leave treatments in Riparian Reserve stands that currently do not meet Aquatic Conservation Strategy (ACS) objectives for downed wood, and it would take several decades longer for these stands to meet ACS objectives (see Section 3.3.1 Hydrology Summary) In addition, Alternative 1 would not enhance Bunchgrass Meadow and this meadow’s size and species diversity would decrease over time.

Alternative 1 would have no effects on the existing road density.

Alternative 2

Alternative 2 would conduct thinning in stands that are 29-149 years old (see Appendix C). Thinning these proposed stands would improve growth of the remaining trees, allow overstory trees to develop deep canopies and larger diameter branches, increase understory plant diversity, and promote development of a multi-layered stand structure. Gaps would provide early-seral habitat. Skips would protect unique trees and sensitive areas. Overall, this combination of actions would increase stand-level habitat diversity, which would benefit many wildlife species.

Thinning would result in fewer snags and subsequent downed wood being created through suppression mortality, which may impact habitat for species such as bats, woodpeckers, fisher, and Sierra Nevada red fox. However, this would not result in a loss of viability in the project area for any species, nor cause a trend towards federal listing. Alternative 2 would retain all existing snags that do not pose a hazard to harvest operators and all large downed wood. Additional snags and downed wood would be manually created in stands with identified deficiencies.

Alternative 2 would conduct regeneration harvest in some stands over 80 years old using a method called shelterwood with reserves. These shelterwoods with reserves would create openings that increase forage quantity and quality for many species that benefit from openings, such as deer, elk, great gray owl, olive-sided flycatcher, purple finch, rufous hummingbird, and western bumble bee. The openings would generally last 15-20 years, with a greatly shortened timeframe if they are replanted with conifers.

The reduction in Douglas-fir canopy cover in stands over 80 years old would reduce higher-quality red tree vole habitat outside of documented red tree vole nest areas. The remaining trees would continue to grow into larger trees that could provide future red tree vole nesting platforms and cavities after several decades.

The reduction in canopy cover in stands over 80 years old would also reduce the quantity and quality of spotted owl habitat; this effect would last for several decades. These stands would recover to provide spotted owl dispersal habitat after about 40 years, and spotted owl foraging habitat after about 80 years. The spotted owl foraging habitat created through shelterwood with reserves would be higher quality than spotted owl foraging habitat created through other regeneration harvest methods, because it would have large trees, snags, and downed wood retained throughout multiple future harvest cycles.

Alternative 2 would affect about 5 percent (99 acres of removal plus 333 acres of thinning) of the spotted owl dispersal habitat in the project area and about 16 percent (2,556 acres of removal plus 487 acres of downgrade) of the suitable habitat in the project area. Removal and downgrading of suitable habitat and Critical Habitat *may affect, and is likely to adversely affect* spotted owls because it would decrease the amount of nesting, roosting, and foraging habitat available to support spotted owls. Removal of suitable habitat would occur within the home range of 15 known spotted owl activity centers (eight of which have their site centers in Critical Habitat); none of these activity centers were occupied in 2018 and 2019.

No occupied territories would be impaired and no disruption to territorial spotted owls would occur. Protocol surveys have been completed for the entire project area, and much of this area is annually surveyed as part of a demography study. Consultation with the U.S. Fish & Wildlife Service is complete. Their Biological Opinion concluded that the Flat Country Project is not likely to jeopardize the continued existence of the spotted owl and that incidental take is not reasonably certain to occur (USFWS 2019; Reference Number 01EOFW00-2020-F-0133). Alternative 2 would not preclude meeting recovery goals for spotted owls, and the landscape would still provide suitable and dispersal spotted owl habitat post-treatment. In addition, RA32 habitat (see Glossary) has been identified and excluded from treatment.

Alternative 2 would harvest encroaching conifers in Bunchgrass Meadow, which would prevent a large natural meadow from decreasing in size and gradually converting from meadow species to forest species. Meadow habitat is an important component of landscape-scale habitat diversity, and it is uncommon across the Flat Country project area. Meadow enhancement would benefit wildlife species that require meadow habitat, such as the great gray owl. There may also be beneficial impacts to other species that use food sources in early-seral and edge habitat, such as deer, elk, fisher, marten, olive-sided flycatcher, purple finch, rufous hummingbird, Sierra Nevada red fox, and western bumble bee.

Alternative 2 would fall-and-leave trees in Riparian Reserves, which would improve habitat conditions along streams that are currently lacking downed wood (Table 20). One tree would be felled every 50-100 feet on alternating sides of the stream. This treatment would provide benefits to fish, aquatic salamanders, and upland species, by increasing hiding and denning habitat.

Alternatives 2 and 3

Alternatives 2 and 3 would conduct the same roadside hazardous fuels treatments. These roadside hazardous fuels treatments would temporarily remove the understory within 150-300 feet on both sides of specific roads that were identified as strategic locations to use for future fire containment. The overstory would remain intact, however there would be impacts to the understory through vegetation removal which may expose red tree voles to a higher incidence of predation due to reduced hiding cover. Other wildlife species that benefit from understory hiding cover or understory forage, including the northern spotted owl, would have decreased habitat quality for about ten years until the understory recovers. Impacts would become long-term if these treatments are repeated in the future.

Alternatives 2 and 3 would decommission and store the same roads. Decommissioning and storing roads would reduce the amount of disturbance and mortality caused to wildlife by motor vehicles. This would benefit many wildlife species, such as elk, and could help increase population levels.

Alternatives 2 and 3 would temporarily displace individuals of mobile wildlife species, such as deer and nesting birds, during implementation. Due to the retention of habitat components, including leave trees, snags, downed wood, and understory shrubs, some individuals of mobile species are expected to return to the treatment units soon after activities end. Individuals of less mobile wildlife species, such as salamanders and mollusks, would persist in the treatment units during implementation, but in lower abundance than if no treatment had occurred.

Alternative 3

Alternative 3 would not thin stands over 80 years old or above 4,000 feet elevation. Alternative 3 would harvest 0.3 percent (75 acres) of suitable habitat, 3 percent (274 acres) of dispersal habitat, and 2 percent (927 acres) of non-habitat for the spotted owl in the Flat Country project area (Table 6).

Alternative 3 would create 189 fewer acres of gap forest openings for deer and elk forage compared to Alternative 2. Combined with the already existing early-seral habitat, the total amount of early-seral habitat would be less than 1 percent of the entire Flat Country project area. A small amount of early-seral habitat has been created by wildfires in the project area in the past 15-20 years, and this has occurred in the wilderness and along the eastern edge of the project area.

Related to the lower harvest, Alternative 3 would have 7 fewer miles of temporary road construction compared to Alternative 2, which would reduce the amount of disturbance to wildlife compared to Alternative 2

3.5.2 Scale of Analysis

Northern Spotted Owl

Multiple geographic scales of analysis were used for spotted owls. These were (1) the disturbance zone around occupied sites (60 meters from the edge of 300-meter nest patches for power equipment and 0.25 miles from the edge of nest patches for burning; these distances may be adjusted up or down based on local topography and other site-specific factors), (2) the known spotted owl activity centers (containing the 70-acre “nest patch”, the 500-acre “core area”, and the 2,955-acre “home range”; see Glossary), (3) the Flat Country project area (74,063 acres of federal land), and (4) Critical Habitat (see Glossary) Unit WCS3 (4,858 acres overlap the Flat Country project area).

Forest Service Sensitive Wildlife Species

The geographic scale of analysis for FS sensitive wildlife species (Table 46) was the project activity units and the project area.

Survey and Manage Wildlife Species

The geographic scale of analysis for Survey and Manage wildlife species was the project activity units and the project area.

Management Indicator Species

The geographic scale of analysis for terrestrial Management Indicator Species was the project activity units and the project area. Related to cavity excavator MIS, the geographic scale of analysis for snags and downed wood was the project activity units and the McKenzie River 5th Field Watershed (137,567 acres).

Birds of Conservation Concern

The geographic scale of analysis for Birds of Conservation Concern was the project activity units and the project area.

Cumulative Effects

The geographic scale of analysis for determining the cumulative effects was the project area and the temporal scale of analysis was a combination of the past, present and reasonably foreseeable actions for this project area (Appendix F).

3.5.3 Affected Environment

Northern Spotted Owl

The northern spotted owl is a federally threatened species under the Endangered Species Act (ESA) that uses forested habitat in the Flat Country project area. Information on the northern spotted owl in the project area is provided by the H. J. Andrews Spotted Owl Demographic Study (Forsman et al. 2011) with additional surveys to cover the affected entire project area in 2018 and 2019, and field assessments of habitat suitability conducted by the wildlife biologist in 2017 and 2018. No additional “potential owl sites” (see Glossary) were determined to exist in the project area based on the wildlife biologist’s knowledge of spotted owl habitat requirements for reproduction, current habitat availability, and the current density of known and historic sites.

Range-wide Habitat Trends

Davis et al. (2016) conducted monitoring of northern spotted owl habitat trends across its’ entire range to determine if the Northwest Forest Plan is providing for conservation and management of the owl’s habitat over the first 20 years of the plan’s implementation (1994-2013). Results showed a 2.2 percent net increase in dispersal habitat occurred on federal lands. Results also showed a 1.5 percent net decrease in nesting/roosting habitat occurred on federal lands, despite a 7.2 percent gross decrease caused by wildfire (5.2 percent), timber harvest (1.3 percent), and insects or other causes (0.7 percent). This indicates that, at the range-wide scale, the process of forest succession has compensated for much of the losses resulting from disturbance. Results also showed that large wildfires are the leading cause for loss of northern spotted owl habitat on federal lands.

Competition with Barred Owls

Another important threat to northern spotted owls is competition with barred owls (Dugger 2015). The barred owl occurs throughout the Willamette National Forest. In western Oregon, both species prefer forests older than 120 years of age, and the larger and more aggressive barred owls can displace spotted owls from their territories (Wiens 2012). Wiens (2012) has recommended retaining conifer forests older than 120 years of age as a method to reduce competition between these two territorial owl species. Where barred owls occur, he has found that spotted owl survival significantly declines as the percent of forests greater than 120 years of age in the general home range drops below 35 percent.

Suitable Habitat, Dispersal Habitat, and Non-Habitat

The Flat Country project area has been classified as “suitable habitat”, “dispersal habitat”, or “non-habitat” (see Glossary) based on aerial photography and field reviews conducted in 2017 and 2018. A GIS calculation based on owl habitat mapping shows that there are currently 19,123 acres of suitable habitat (26 percent), 8,683 acres of dispersal habitat (12 percent), and 46,229 acres of non-habitat (62 percent) in the Flat Country project area (Table 35).

Table 35. Current Amount of Spotted Owl Habitat in the Flat Country Project Area

	Suitable Habitat	Dispersal Habitat	Non-Habitat	Total
Acres (% of project area)	19,123 (26%)	8,683 (12%)	46,229 (62%)	74,063 (100%)

Field reviews by the wildlife biologist of all proposed treatment stands in 2017 and 2018 resulted in the delineation of 65 acres of RA32 habitat (see Glossary), which resulted in those high-quality habitat areas being dropped from harvest treatments.

Critical Habitat

Critical Habitat is made up of specific areas designated by the USFWS for a species listed as threatened or endangered under the Endangered Species Act. In 2012, the USFWS designated 1,355,198 acres as northern spotted owl Critical Habitat within the “West Cascades South Unit, WCS 3 Subunit”. The USFWS determined that all of the unoccupied and likely occupied areas within this WCS3 subunit are essential for the conservation of the northern spotted owl and that they merit continued maintenance and recruitment to provide for viable populations over the long term. Management actions, including harvest, are allowed within Critical Habitat if they are for the purpose of restoring underrepresented early-seral diversity on the landscape and conserving biological diversity (USFWS 2012).

Survey and Manage Species

Survey and Manage species are species that were believed to be rare at the time of the Northwest Forest Plan’s enactment in 1994. The Northwest Forest Plan developed standards and guidelines for conducting surveys, protecting nest sites, and protecting habitat to provide a reasonable assurance of persistence for these species. For vertebrate species, this persistence objective is consistent with the goal of providing for viable and well-distributed populations under the National Forest Management Act Regulations (FS and BLM 1994; FS and BLM 2001). Surveys are required for Survey and Manage species prior to a project decision. Surveys are not required for red tree vole above 3,500 feet elevation (Forest Service and BLM, 2012) or for Survey and Manage wildlife species in stands under 80 years old that would be thinned (Northwest Ecosystem Alliance v. Rey, No. 04-844-MJP, Oct. 10, 2006).

Survey and Manage direction would be followed for all Survey and Manage species that have habitat in the Flat Country project area. They are Crater Lake tightcoil, great gray owl, Oregon Megomphix, and red tree vole.

Crater Lake Tightcoil (snail)

The Crater Lake Tightcoil is on both the Survey and Manage species list and the FS Sensitive species list. In this document, discussion of this species will be limited to the Survey and Manage species section.

The Crater Lake Tightcoil is a terrestrial snail that is associated with areas within 10 meters of perennial wetlands and riparian areas (Duncan et al. 2003). Surveys are not required for the Flat Country project because all suitable habitat for Crater Lake Tightcoil would be protected by a minimum of a 30-foot no-harvest buffer. There would be no prescribed fire ignitions or pile burning within this 30-foot buffer. Many of the perennial streams and wetlands would have a no-harvest buffer in excess of 30 feet and up to 180 feet (see project design criteria in chapter 2).

Great Gray Owl

Great gray owls typically nest in the same home range year after year (Bull et al. 1988). They demonstrate strong fidelity to breeding and wintering areas (Bull et al. 1988), but less to specific nest sites. They will, however, often reuse nests, and a pair will sometimes return to the same nest site year after year (Franklin 1988; Bull et al. 1988; Duncan 1992). Downed wood appears to be an important component of foraging habitat. In northeastern Oregon, downed wood was found within one meter of where prey was caught or attempted to be caught 80 percent of the time (Bull and Henjum 1990). Snags are another important habitat component that are used for nesting, foraging perches, and climbing juveniles (Schaeffer 1993). They perch in live trees and snags adjacent to open areas while hunting.

In the area of the Northwest Forest Plan, pre-implementation surveys are required only in suitable nesting habitat, which is defined as older forest within 660 feet of meadows at least 10 acres (USDA Forest Service et al. 2016). In the Flat Country project area, the only proposed units that meet these nesting habitat requirements are the units adjacent to, and those within the Bunchgrass Meadow area (Units 1110, 1160, 1170, and 1180). If a nest is found, a 30-acre management area is delineated, which includes the best potential habitat (USDA Forest Service Region 6 and USDI Bureau of Land Management, Oregon and Washington. 2012). Other guidelines include establishment of a ¼-mile protection zone around nest sites (USDA Forest Service, USDI Bureau of Land Management 2001).

No great gray owl sightings have occurred in the project area since 2002; however, extensive survey work has not been done since 2002. In total, 12 out of 74 past great gray owl sightings in the Flat Country project area have occurred near Bunchgrass Meadow, including two pair sightings (NRIS, accessed June 20, 2019). In the early 2000s, Bunchgrass Meadow had some large encroaching conifers removed from it to maintain an open condition and allow pocket gophers, the great gray owl's main prey species, to flourish.

Decades of successful fire suppression, coupled with past timber harvest followed by dense planting, and climate change, has resulted in a limited quantity of openings to support great gray owls across the Flat Country project area. On the west slope of the Cascades, harvest-created openings initiate an early successional stage that can support small mammal populations likely to be used by great gray owls for up to ten years post-harvest (Quintana-Coyer et al. 2004). In the Willamette National Forest, shelterwood harvesting has been found to be beneficial to great gray owls because it improves foraging habitat (FS and BLM 2001).

Oregon Megomphix (snail)

Under the Northwest Forest Plan, Oregon Megomphix (*Megomphix hemphilli*) is in Survey and Manage Category "A" in Linn County, which includes the northern portion of the Flat Country project area. This means the FS is required to survey stands over 80 years old prior to ground-disturbing activities in suitable habitat, and to manage known Oregon Megomphix sites.

Oregon Megomphix is a terrestrial snail that occurs at elevations below the zone of seasonally persistent snowpack (FS and BLM 1999). In western Oregon, most of its locations are between 500-1,500 feet (FS and BLM 1999). However, this species was found at approximately 3,000 feet elevation on the McKenzie River Ranger District (NRIS, accessed June 20, 2019) and therefore, we are using this elevation as the upper elevation limit for its habitat. Oregon Megomphix is most often found within the mat of decaying vegetation under sword ferns or 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). Although these habitat characteristics are present within the Flat Country project area, it is possible that Oregon Megomphix does not occur in the project area.

Oregon Megomphix were surveyed to protocol between 2017 and 2019 in units 10, 1260, 1280, 1300, 1340, 2111, and 2112 and no individuals were found. In addition, the agency's wildlife sighting web database (NRIS, accessed on June 22, 2019) contains no records of Oregon Megomphix in the Flat Country project area. The nearest record is from a location approximately 5 miles to the west in the Blue River Watershed. Beyond that, there are 90 records approximately 13 miles to the west of the Flat Country project area, where they appear to be abundant.

Red Tree Vole

The red tree vole is endemic to moist coniferous forests of western Oregon and extreme northwest California. It's known and suspected range extends from the Columbia River south through western Oregon and from the Siskiyou Mountains south to the Salmon and Klamath Rivers in northern California. Active nests have been found in remnant older trees in younger stands, indicating the importance of legacy structural characteristics for red tree vole persistence in younger stands (USDA/USDI 2012b). While there are cases of red tree vole nests in younger, managed stands (NRIS, accessed November 1, 2019), these stands do not provide high quality nesting habitat.

Red tree vole surveys were conducted in 2017 in all proposed harvest units over 80 years old that meet the survey requirements for stand structure as described in the most recent version (version 3.0) of the red tree vole survey protocol (FS and BLM 2012). This included 13 units, which total an area of 1,887 acres. Nineteen red tree vole nests were discovered during these surveys, ten of which were active. Approximately 45 acres were dropped across units 1970 and 1980 to protect these ten known active nest sites with a minimum no-harvest buffer of 180 feet (FS and BLM 2000).

Forest Service Sensitive Species

A total of ten FS sensitive species have habitat in the Flat Country project area. Four of these ten sensitive species would not be negatively impacted and will not be further discussed in this document; they are the American peregrine falcon, bufflehead, Johnson's hairstreak, and Northern waterthrush. Four of these sensitive species may have beneficial impacts; they are western bumble bee, Mardon skipper, fisher, and Sierra Nevada red fox. Four of these ten FS sensitive species would be impacted in some way; they are the fisher, fringed myotis, Townsend's big-eared bat, and Sierra Nevada red fox (for more information, see the Wildlife Biological Evaluation in the project record).

Fisher

Fishers use a wide variety of densely forested habitats at low to mid-elevations. For nesting sites, they use ground burrows, tree cavities, witch's-broom or other clumped growth, or occasionally bird or small mammal nests (Raley et al. 2012 p.191). Tree cavities are used by most maternal females with young and ground burrows are used mostly in winter. Data suggests fishers do better in areas that have minimal fragmentation of old-growth, second-growth, and riparian habitat, as well as abundant downed wood and snags (Aubry and Lewis 2003).

It is unlikely that fishers occur in the project area. While there have been three reported fisher sightings on the McKenzie River Ranger District (NRIS, accessed June 20, 2019), none of these sightings have been verified with a photo or DNA. The last verified records of fishers on the Willamette National Forest were in the 1940s, with the exception of a 2014 detection at the very south end of the Forest. This 2014 detection may have been of a dispersing male from the recent fisher reintroduction at Crater Lake.

Outside of proposed treatment areas, there are approximately 2,000 acres of high-quality fisher habitat (dense forest below 4,000 feet elevation) in the Mount Washington Wilderness in the eastern portion of the Flat Country project area and there are approximately 2,600 acres of high-quality fisher habitat that would not have any habitat altered due to a land allocation of administratively withdrawn (no proposed action), in the southern portion of the Flat Country project area.

Fringed Myotis (bat)

Fringed myotis bats fly over large areas and forage in a variety of habitats, including open and forested areas. They have strong fidelity to natal roost sites and pups are weaned by the end of July to the end of August depending on the lateness of spring (Ormsbee personal communication July 19, 2013). They are known to roost in tree and snag cavities and under loose bark (Lacki et al. 2007). On the west side of the Cascades, snags are thought to be their main roosting habitat (Ormsbee personal communication July 19, 2013). The highest quality and densest concentration of roosting snags are found in older unmanaged stands. Based on surveys by the wildlife biologist, the proposed harvest units under 80 years old in the project area currently contain little to no snag habitat.

No tree or snag roost sites have been documented by the FS in the project area or on the Forest, but such sites are very difficult to detect.

Townsend's Big-Eared Bat

Townsend's big-eared bats fly over large areas and forage in a variety of habitats, including open and forested areas. Townsend's big-eared bats are known to roost in tree and snag cavities and under loose bark (Lacki et al. 2007). However, on the west side of the Cascades, snags are thought to be a minor roosting component for Townsend's big-eared bats (Ormsbee personal communication July 19, 2013).

No tree or snag roost sites have been documented by the FS in the project area or on the Forest, but such sites are very difficult to detect. All of the known roost sites for Townsend's big-eared bats on the Forest are located under bridges. There are a total of eight recorded locations on the McKenzie River Ranger District, including one in the Flat Country project area from 1992 (NRIS, accessed June 7, 2019). Only one winter hibernation site is known on the McKenzie River Ranger District. From 2009 to 2015, this winter hibernation site had 6-12 Townsend's big-eared bats.

Sierra Nevada Red Fox

Sierra Nevada red fox is a subspecies that is believed to occur at a very low density across its range (Perrine et al. 2010). It is generally found above 4,000 feet elevation, but may use lower elevations in winter (Perrine et al. 2010). It is associated with dense mature forests, talus, and meadows. Forest openings are important habitat components because they provide habitat for a majority of the fox's prey base (Perrine et al. 2010).

Western Bumble Bee

Western bumble bees have three basic habitat requirements: suitable nesting sites for the colonies, suitable overwintering sites for the queens, and nectar and pollen available throughout the duration of spring, summer, and fall (Jepsen 2014). Nesting occurs underground primarily in rodent burrows. There are 17 documented locations of western bumble bee in the Flat Country project area (NRIS database, accessed May 24, 2019).

Mardon Skipper (butterfly)

Mardon skippers are grassland dependent butterflies that appear to have narrow habitat requirements in some portions of their range. In Oregon, most feeding was seen on varileaf cinquefoil (*Potentilla diversifolia*). There are no documented observations of Mardon skipper in the Flat Country project area. Bunchgrass Meadow may provide suitable habitat and was surveyed twice in 2006 with no detections.

Management Indicator Species

A total of seven Management Indicator Species, plus one group of Management Indicator Species (cavity excavators) have habitat in the Flat Country project area. Three of these Management Indicator Species would not be impacted in any way; they are marten, bald eagle, and peregrine falcon. Three of these Management Indicator Species and/or groups may be impacted beneficially; they are elk, deer, and cavity excavators. Pileated woodpeckers would be slightly impacted, cavity excavators would be impacted, and the northern spotted owl would be adversely affected.

Cavity Excavators

Cavity excavators are used as ecological indicators for the abundance of dead and decaying trees.

There are seven cavity excavator MIS that are known to occur or have potential habitat in the proposed Flat Country units; they are black-backed woodpecker, downy woodpecker, hairy woodpecker, northern flicker, pileated woodpecker, red-breasted nuthatch, and red-breasted sapsucker. None of these species are federally Endangered or Threatened Species, Forest Service Sensitive species, or Birds of Conservation Concern (USFWS 2008). All of these cavity excavator species are highly mobile and have no known barriers to their movements within the Willamette National Forest and surrounding areas.

Black-backed woodpeckers in the Willamette National Forest have additional Standards and Guidelines on matrix lands (USDA Forest Service, USDI Bureau of Land Management, 2001). They primarily use recently burned areas in high elevation mixed conifer and lodgepole pine stands above approximately 4,000 feet elevation. Approximately 5,000 acres burned in the Mount Washington Wilderness portion of the Flat Country project area in 2010 and 2017 with the Scott Mountain and Separation Fires. These areas now have an abundance of snags across the full range of sizes, which are expected to remain in a condition that would continue to provide high-quality dead wood habitat for black-backed woodpeckers for the next 20 years.

Pileated woodpeckers in the Willamette National Forest are monitored as part of Forest Plan Monitoring. They are detected widely across the Willamette National Forest and monitoring suggests that much of their suitable habitat on the Forest is occupied. Pileated woodpecker populations have shown a significant increase since 1966 (Sauer et al. 2017).

As part of the Willamette National Forest Plan, habitat capability for primary cavity excavators must be maintained to provide for at least 40 percent or greater potential populations, and habitat must be provided and monitored at the subdrainage level (Standard and Guideline FW-121). The method that the Forest Plan used in 1990 to determine the current distribution of large snags and the capability of the landscape to support primary cavity excavators is no longer considered by Region 6 program managers to be the best available science. Instead, 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 5th field McKenzie River watershed (137,567 acres) was used to evaluate deadwood at the landscape level for the Flat Country project.

DecAID evaluates deadwood levels by wildlife habitat type. The McKenzie River watershed contains five different wildlife habitat types. Treatment units within the Flat Country project are made up entirely of Westside Lowland Conifer-Hardwood Forest (WLCH_C) at the lower elevations, and the Montane Mixed Conifer (MMC) habitat type at the higher elevations over 3,500 to 4,000. The other three habitat types, WODF, EMC_ECB, and PARK, do not have any activities proposed in them, and are thus not further discussed.

Visual field surveys for snags and large downed wood in the Flat Country proposed units were conducted during 2017-2018 to determine the current condition (Table 36 and Table 37), which was then compared to the forest-level and future projected levels for snags and large downed wood.

Table 36. Current Snag Levels in the Proposed Flat Country Units Based on Visual Surveys

	High (>6 snags/acre)	Moderate (3-6 snags/acre)	Low (1-3 snags/acre)	None (0 snags/acre)
Proportion of acres in Flat Country units that have snags greater than 14 inches DBH	4%	46%	30%	19%

Table 37. Current Large Downed Wood Levels in the Proposed Flat Country Units Based on Visual Surveys

	High (>6 trees/acre)	Moderate (3-6 trees/acre)	Low (1-3 trees/acre)	None (0 trees/acre)
Proportion of acres in Flat Country units that have downed wood greater than 14 inches diameter	36%	45%	17%	2%

A DecAID analysis was conducted at the Forest level for all 5th field watersheds in February 2016 to estimate the current proportions of the landscape that contain various levels of habitat with large snags greater than 20 inches DBH. The results of the DecAID analysis indicate that in the Headwaters McKenzie River Watershed, both the Westside Lowland Conifer-Hardwood and Montane Mixed Conifer wildlife habitat types are currently below the estimated historic reference condition for the proportion of the landscape that contains greater than 50 percent large snags (Table 38 and Table 39).

In addition, 49 percent of the proposed harvest units in the Flat Country project area show levels of 0-3 snags per acre (Table 36). The median historic condition for snags at least 20 inches DBH is approximately 12 snags per acre on 20 percent of the watershed. The median historic condition for smaller and medium snags less than 20 inches DBH is approximately 11 snags per acre on six percent of the watershed. Levels of dead wood have fluctuated considerably over time, and plus or minus 50 percent of the estimated median value was used to approximate the historic range of variability (Table 38 and Table 39).

The median historic condition for the McKenzie River watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages along with an estimate of the normal distribution of seral stages derived from the assumed fire return interval. 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). Since many, though not all, snags are fire-created, levels of dead wood have fluctuated considerably over time.

The complete methodology and results of this DecAID analysis are available in the project record.

Table 38. Current and Historic Proportion of the Landscape in Large Snags (>20 inches DBH) in the Headwaters McKenzie River Watershed for the Westside Lowland Conifer-Hardwood Wildlife Habitat Type

Condition	Watershed	Wildlife Habitat Type	Tolerance Level 0 – 30%	Tolerance Level 30 – 50%	Tolerance Level 50 – 80%	Tolerance Level 80% +	Total Acres
Current	Headwaters McKenzie River	Westside Lowland Conifer-Hardwood	31%	18%	10%	41%	115,530
Historic	Headwaters McKenzie River	Westside Lowland Conifer-Hardwood	14%	11%	18%	57%	115,530
Historic Median	Entire Willamette National Forest	All Habitat Types	30% (variability: 15-45%)	20% (variability: 10-30%)	30% (variability: 15-45%)	20% (variability: 10-30%)	1,675,407

Table 39. Current and Historic Proportion of the Landscape in Large Snags (>20 inches DBH) in the Headwaters McKenzie River Watershed for the Montane Mixed Conifer Wildlife Habitat Type

Condition	Watershed	Wildlife Habitat Type	Tolerance Level 0 – 30%	Tolerance Level 31 – 50%	Tolerance Level 51 – 80%	Tolerance Level 81% +	Total Acres
Current	Headwaters McKenzie River	Montane Mixed Conifer	34%	18%	10%	38%	68,118
Historic	Headwaters McKenzie River	Montane Mixed Conifer	15%	10%	17%	58%	68,118
Historic Median	Entire Willamette National Forest	All Habitat Types	30% (variability: 15-45%)	20% (variability: 10-30%)	30% (variability: 15-45%)	20% (variability: 10-30%)	1,675,407

The current low density of snags and the greater percentage of areas lacking higher levels of snags compared to historic conditions is due to past harvest and fire suppression practices. Past clearcut logging removed existing snags and trees that could provide future snags. Fire suppression has allowed for very little change in burned area and the frequency distribution of snag densities. For example, in the Headwaters McKenzie River Watershed, the fires of 2017 burned less than 1 percent of the area within the Westside Lowland Conifer-Hardwood wildlife habitat type, 6 percent of the area within the Montane Mixed Conifer wildlife habitat type (Acker 2018), and caused very little change in the frequency distribution of snag densities.

Due to the lack of areas with high levels of snags, hundreds of snags have been created since the late 1980s in various harvest units in the Headwaters McKenzie River watershed. Snag creation methods used in the past have been blasting, girdling, girdling with inoculation, inoculation, sawtopping, and sawtopping with inoculation.

Deer and Elk

In addition to being recreationally and economically important, deer and elk are used as ecological indicators for the quality and abundance of diverse early-seral habitat and winter range.

The Flat Country project area is in the state-designated McKenzie Wildlife Management Unit (WMU). Within the McKenzie WMU, deer numbers and hunter success have declined by more than 50 percent and elk numbers have declined substantially since the beginning of the Willamette Forest Plan in 1990 (FS 2011). The professional consensus of the Oregon Department of Fish and Wildlife (ODFW) managers is that elk numbers within the McKenzie WMU are substantially below State Population Management Objectives (Brian Wolfer, pers. com. 2014). This professional consensus is based on minimum known elk numbers, estimates of animals missed during surveys, and the amount of areas lacking counts.

Management objectives for deer and elk habitat apply to specific mapped "emphasis areas" within the Willamette National Forest. Each emphasis area consists of one to several subwatersheds, ranges from 1,000 to 15,000 acres in size, and has been assigned a priority rating of high, moderate, or low (USDA Forest Service 1990). Standards and Guidelines for management of these emphasis areas were developed in cooperation with ODFW. The Flat Country project area includes eight designated emphasis areas, 5 of which are rated as high priority. The emphasis areas are managed for elk habitat under guidance from the Willamette National Forest Plan Standards and Guidelines (FW-137), with the assumption that providing high quality elk habitat will also adequately address the needs of black-tailed deer.

Maintaining a balance of cover and forage areas is a key component of elk habitat management (Wisdom 1986). However, Cook et al. (1998) found that thermal cover did not enhance elk survival and production. They also found that thermal cover was not required by elk where food was not limiting, and that thermal cover could not compensate for inadequate forage conditions. Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, population growth, and population stability (Cook et al. 2004). The greater importance of available forage abundance and quality, compared to thermal cover, has also been supported by nutritional and physiological studies of black-tailed deer (Parker et al. 1999).

Marten

Marten are used as ecological indicators for the abundance of old-growth and mature conifers.

Recent information suggests that marten primarily use montane conifer forests above approximately 4,000 feet elevation on the Willamette National Forest (Hiller and McFadden-Hiller 2013). While there have been marten detections at camera stations at lower elevations on the McKenzie River Ranger District (NRIS, accessed June 20, 2019), they are more abundant at higher elevations. Marten are likely to inhabit the eastern portions of the Flat Country project area, where elevations are above 4,000 feet.

Birds of Conservation Concern

Federally ESA-listed birds, FS sensitive birds, and birds that are Management Indicator Species have been addressed above. In addition to these categories, Birds of Conservation Concern (BCC) is a category of bird species that represent USFWS's highest region-specific conservation priorities for migratory and non-migratory birds (US Fish and Wildlife Service 2008). Four BCC species that have been identified for the Northern Pacific Forest (USFWS 2008) have habitat in the Flat Country Project Area; these four species are northern goshawk, olive-sided flycatcher, purple finch, and rufous hummingbird.

All four of these species are considered migratory birds under the Migratory Bird Treaty Act (USFWS 2013).Three of these species (Olive-sided flycatcher, purple finch, and rufous hummingbird) use early-seral habitat. An emerging concern for migratory birds in the Pacific Northwest is declining early-seral forest habitat (Swanson et al. 2010) and the understanding that early-seral conifer habitat is important habitat for many migratory bird species (Altman and Hagar 2007). In particular, there is a lack of complex early-seral habitat (Altman and Hagar 2007), which is early-seral forest with abundant and diverse shrub understory composition, high abundance of large diameter snags and downed logs, and substantial green tree retention.

Northern Goshawk

Northern goshawk uses mature forests with relatively closed canopies for breeding, large trees for nest sites, and open understories for foraging. There is no record in the agency's wildlife sightings database of any northern goshawks within the proposed Flat Country units (NRIS accessed June 20, 2019). Northern goshawk surveys were not conducted for the Flat Country project because they are not legally required.

Olive-sided Flycatcher

Olive-sided flycatcher uses natural or man-made openings with tall trees or snags.

Purple Finch

Purple finch uses a variety of forest habitat types, including open and semi-open coniferous forests, mixed coniferous-deciduous forests, edges of meadows, and riparian corridors.

Rufous Hummingbird

Rufous hummingbird uses early-seral habitat, forest edges, and openings with a diversity of flowering plants and shrubs.

3.5.4 Environmental Consequences - Direct and Indirect Effects

Northern Spotted Owl

The effects of the various proposed actions of the Flat Country project are addressed in a Biological Assessment written by the Willamette Planning Province Level I Terrestrial Team (2019) and evaluated by the USFWS in a Biological Opinion (2019) in fulfillment of the Section 7 requirement of the Endangered Species Act.

The USFWS concluded in their Biological Opinion that incidental take is not reasonably certain to occur in any of the Alternatives in the Flat Country project because no disturbance to occupied spotted owl sites would occur, and no individual occupied territories would be impaired.

Alternative 1 – No Action

Because Alternative 1 does not implement any actions, there would be no effects on any known owl sites. No project activities would occur and thus, there would be no disturbance to spotted owls.

Disturbance of Occupied Sites

Alternative 1 would have no effect on occupied spotted owl sites.

Habitat Modification

Alternative 1 would have no direct effect on spotted owls or their habitat.

Non-habitat plantations would slowly develop into dispersal habitat within 10-15 years as the stands thin themselves. Stands that are currently dispersal habitat would develop into low-quality foraging habitat within 40-50 years. Stands that are currently dispersal habitat and have larger remnant trees could become low-quality nesting habitat within 40-50 years. Stands that are currently foraging habitat with some nesting opportunity would develop towards old-growth conditions and start to become high-quality suitable owl habitat fitting RA32 stand characteristics in approximately 50-100 years.

Alternative 2

The effects of Alternative 2 on the northern spotted owl are summarized in Table 40.

Table 40. Alternative 2: Summary of the Effects on the Northern Spotted Owl

Types of Effects	Determination
Incidental Take	Not reasonably certain to occur, because occupied territories would not be impaired and no disruption to territorial spotted owls would occur.
Noise and Smoke Disturbance	*May affect, Not likely to adversely affect (NLAA)* with seasonal restrictions March 1-July 15 for occupied nest patches
Spotted Owl Habitat Modification	*May affect, Likely to adversely affect (LAA)*
Effects to Critical Habitat	*May affect, Likely to adversely affect (LAA)*
Adverse Effects to RA32 Habitat	No
Habitat Modification within 300-meter nest patches	No
Habitat Modification within 0.5-mile nest cores	Yes
Habitat Modification within 1.2-mile home ranges	Yes

Disturbance of Occupied Sites

The Biological Assessment determined that noise and smoke in Alternative 2 may affect but are “not likely to adversely affect” (NLAA) spotted owls (Table 40).

Protocol surveys in 2018 and 2019 resulted in no spotted owl detections in the Flat Country project area, so none of the territories are currently occupied. However, 3 of the known spotted owl sites in the Flat Country project area were occupied at some point during the years 2013-2017 (0822, 0825, and 2827; Table 43). Surveys would be conducted in the years leading up to implementation to determine any changes in occupancy.

All project activities with potential to disturb an occupied site would be conducted outside the disturbance period (March 1 - July 15) or implemented during years when the survey protocol determines that the nest sites are unoccupied. All helicopter logging and associated helicopter landings would be located well beyond the disruption distance from known owl sites and would therefore not require a seasonal restriction. If roadside hazard trees need to be cut during the nesting season within the 60 meters disruption distance to spotted owl nest sites, a seasonal restriction would be implemented (Willamette Planning Province Terrestrial Level I Team, 2019).

Habitat Modification

The Biological Assessment determined that Alternative 2 may affect, and is “likely to adversely affect” (LAA) spotted owl habitat (Table 40).

The LAA determination in the Biological Assessment would require spotted owl monitoring to take place as harvesting in the Flat Country Project is implemented. However, some components of the Flat Country project are NLAA and those may still take place in the absence of additional spotted owl monitoring; this includes the roadside hazardous fuels reduction and hazard tree felling operations with any needed seasonal restrictions.

Harvest would remove a total of 2,556 acres of suitable habitat and downgrade a total of 487 acres of suitable habitat to dispersal habitat (Table 41). Habitat removal and/or downgrade would occur within 0.5-mile nest cores (8 total sites; Table 42) and 1.2-mile home ranges (15 total sites; Table 43). No habitat removal or downgrade would occur within 300-meter nest patches and no adverse effects would occur within RA32 habitat. Thinning would upgrade 262 acres of non-habitat to dispersal habitat. Roadside hazardous fuels treatments would reduce the quality of 841 acres of suitable habitat but still maintain these acres as suitable habitat. The effects of Alternative 2 on spotted owl habitat are summarized in Table 41.

Table 41. Alternative 2: Summary of the Effects on Spotted Owl Habitat

Proposed Activity	Current Habitat Type	Post-treatment Habitat Type	"LAA" Acres	"NLAA" Acres	"No Effect" Acres	Beneficial Acres
Harvest – Habitat Removal	Suitable	Non-habitat	2,556	0	0	0
Harvest – Habitat Downgrade	Suitable	Dispersal	487	0	0	0
Harvest – Habitat Removal	Dispersal	Non-habitat	0	186	0	0
Harvest – Habitat Maintained	Dispersal	Dispersal	0	123	0	0
Thinning	Non-habitat	Non-habitat	0	0	0	1,115
Thinning	Non-habitat	Dispersal	0	0	0	262
Roadside Hazardous Fuels Treatments[1]	Suitable	Suitable	841	0	0	0
Roadside Hazardous Fuels Treatments[1]	Dispersal	Dispersal	0	255	0	0
Roadside Hazardous Fuels Treatments[1]	Non-habitat	Non-habitat	0	0	1,211	0
Meadow Enhancement	Non-habitat	Non-habitat	0	0	149	0

1 Note that some of the roadside hazardous fuels treatments overlap harvest units, and these treatments are expected to occur post-harvest.

Suitable Habitat

Alternative 2 would affect 16 percent of spotted owl suitable habitat in the Flat Country project area by removing 2,556 acres of suitable habitat and downgrading 487 acres of suitable habitat (Table 41). Some of these stands just over 80 years old are currently marginally suitable habitat, and those over 110 years old are better quality suitable habitat. After harvest, stands that were previously suitable habitat would develop into dispersal habitat in approximately 40 years. These regenerating stands would become suitable habitat and may achieve stand characteristics that fit the RA32 description in 80 to 140 years after harvest, due to the retention of legacy trees. Retention of about 25 large trees per acre under the shelterwood with reserves treatments would allow these stands to more rapidly develop into suitable habitat compared to what would occur in a regeneration harvest without leave tree retention. This would especially be true for stands with existing large snags and downed wood.

Alternative 2 would underburn up to 2,021 acres to reduce harvest-generated fuels. During the underburns, approximately 20 percent of the 3-9 inch slash would be consumed (see Fire and Fuels section 3.12). Post-harvest underburning may also result in a small amount of overstory tree mortality. Generally, an overstory mortality level of up to 10 percent 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.

Table 42. Alternative 2: Modification of Suitable Habitat within the Core Area of Known Spotted Owl Sites

Site #	Land Use	Change	Acres Changed	Acres Before	Acres After	% Before	% After	Year last occupied	Harm?
2456	Congr. Reserved	Removal	3	274	271	55%	54%	1991	No
2834	Wilder-ness	Removal	29	248	219	50%	44%	2013	No
0826	LSR-100	Removal	1	156	155	31%	31%	2005	No
1738	LSR-100	Removal	52	299	247	60%	49%	2005	No
2408*	LSR-100	Downgrade to Dispersal	27	226	199	45%	40%	2005	No
2829*	LSR-100	Downgrade to Dispersal	60	391	331	78%	66%	1991	No
2421	Matrix	Removal	92	201	109	40%	22%	2000	No
2838*	Matrix	Removal/ Downgrade to Dispersal	29/1	242	212	48%	42%	2006	No

*Owl site is in Critical Habitat.

Suitable habitat levels below the threshold of 50% (Willamette Planning Province Terrestrial Level I Team, 2019) after harvest are shaded orange.

Table 43. Alternative 2: Modification of Suitable Habitat within the Home Range of Known Spotted Owl Sites

Site #	Change	Acres Changed	Acres Before	Acres After	% Before	% After	Year last occupied	Harm?
2456	Removal	12	1194	1182	40%	40%	1991	No
2834	Removal	198	1050	852	36%	29%	2013	No
0826	Downgrade	8	844	836	29%	28%	2005	No
1738	Removal/ Downgrade to Dispersal	202/13	1235	1020	42%	35%	2005	No
2408*	Removal/ Downgrade to Dispersal	71/98	1122	953	38%	32%	2005	No
2829*	Removal/ Downgrade to Dispersal	139/88	1930	1703	65%	58%	1991	No
2421	Removal	479	1081	602	37%	20%	2000	No
2838*	Removal/ Downgrade to Dispersal	105/133	1637	1399	55%	47%	2006	No
2409*	Removal/ Downgrade to Dispersal	72/10	1703	1621	58%	55%	2014	No
2415	Removal	10	1328	1318	45%	45%	2005	No
0829*	Removal	20	1771	1751	60%	59%	2012	No
0823*	Removal	27	1619	1592	55%	54%	2013	No
0822*	Downgrade	20	2125	2105	72%	71%	2016	No
0825*	Removal	22	1830	1820	62%	62%	2013	No
2827	Removal/ Downgrade to Dispersal	116/49	1811	1645	61%	56%	2017	No

* Owl site is in Critical Habitat. Suitable habitat levels below the threshold of 40% (Willamette Planning Province Terrestrial Level I Team, 2019) after harvest are shaded orange.

Dispersal Habitat

Alternative 2 would affect 5 percent of spotted owl dispersal habitat in the Flat Country project area by thinning or harvesting with a shelterwood with reserves treatment 431 acres of dispersal habitat (Table 41). Thinning that results in a post-treatment canopy cover of less than 40 percent would remove dispersal habitat. Units proposed for moderate thinning that maintain an average of 40 percent canopy cover are expected to close their canopies back to pre-harvest conditions within approximately 20 years. Units proposed for heavier thinning treatments that maintain an average of 30 percent canopy cover are expected to close their canopies back to pre-harvest conditions within approximately 25 years.

Thinning of dispersal habitat would benefit overall forest structural development and improve long-term spotted owl habitat conditions beginning after 25 years. However, thinning of young Douglas-fir forests may also decrease the density of northern flying squirrels, the main prey of spotted owls in the central Oregon Cascades, for at least 12 years after treatment (Manning et al. 2012). Post-harvest snag and large downed wood habitat enhancement in selected thinning units would improve stand structure conditions for spotted owls and their prey in the short-term for up to 20 years.

About 32 acres would be harvested under a shelterwood with reserves treatment, with would leave approximately 25 trees per acre. Those stands would have their spotted owl habitat type set back by about 40 years, at which time the remaining 25 trees per acre would have accelerated their growth rates and crown sizes. After many more decades, those older trees may achieve large, dense crown structures and branch structures to benefit late-successional species such as spotted owls.

Based on the distribution of suitable habitat and dispersal habitat, the proposed treatments would decrease landscape connectivity for spotted owls in the short-term, but the landscape connectivity would still remain functional based on the amount of suitable and dispersal habitat that would remain on the landscape as shown by the number of owl sites that meet suitable habitat thresholds (Table 42 and Table 43).

Non-Habitat

Alternative 2 would affect 2 percent of non-habitat for spotted owls in the Flat Country project area by thinning 1,120 acres of forested stands that are currently non-habitat for spotted owls (Table 41). Many of these forested stands that are characterized as non-habitat contain the lower size limit typically used to describe dispersal habitat (stand averages of trees with the DBH of 11 inches); however, tree densities in these stands were judged by the wildlife biologist to be too dense for owls to fly through, therefore this habitat was determined to be non-habitat. Thinning the current non-habitat stands to leave an average of 40 percent or denser canopy cover, would meet dispersal habitat conditions immediately after thinning, which is faster than if they were left to develop naturally. This thinning would improve this habitat in the near future and the longer term. Possible structural enhancements, such as snag and downed wood placement, would further benefit spotted owl habitat quality and improve this habitat almost immediately post-treatment and longer term for 20-30 years post-treatment. The 126 acres that would be harvested under a shelterwood with reserves treatment would have about 25 trees per acre remaining. These stands would grow into dispersal habitat in about 40 years, at which time the overstory trees would be about 80 years of age and contribute to a more diverse habitat structure.

Critical Habitat

The Biological Assessment determined that Alternative 2 may affect, and is “likely to adversely affect” (LAA) spotted owl Critical Habitat (Table 40). The following summary of effects and discussion (Alternative 2) is specific to treatments which would occur in Northern Spotted Owl Critical Habitat Unit Cascades South, subunit WCS3. Alternative 2 of the Flat Country Project would affect about 0.5 percent of the total suitable habitat acres in Critical Habitat Unit WCS3 on the Willamette National Forest.

Known Sites Within Critical Habitat:

Alternative 2 would downgrade or remove a total of 925 acres of suitable habitat across nine known sites within Critical Habitat. Downgrade of suitable habitat tends to fragment larger blocks of “continuous blocks of late-successional forest” (USFWS 2012). Three of these owl sites would have suitable habitat removed and/or downgraded within their core areas, and eight of these owl sites would have suitable habitat removed and/or downgraded within their home ranges (Table 42 and 43). All of these owl sites have suitable habitat within their home ranges that extends outside Critical Habitat. For unit by unit information on pre- and post-treatment canopy cover for harvest units in each of the nine known sites in Critical Habitat, see the Biological Evaluation in the project record.

Suitable Habitat Within Critical Habitat:

Alternative 2 would downgrade 496 acres and remove 399 acres of suitable habitat within Critical Habitat, which in total is 0.5 percent of the total suitable habitat acres in Critical Habitat Unit WCS3. The stands downgraded from suitable habitat to dispersal habitat would recover to low quality suitable habitat conditions in approximately 25 years, with higher habitat quality if snags and large downed wood are present. The stands removed from suitable habitat (with canopy cover reduced to 36 percent) are expected to recover to dispersal habitat conditions in less than 5 years and develop low quality suitable habitat conditions in approximately 30 years.

Dispersal Habitat Within Critical Habitat:

Alternative 2 would thin a total of 309 acres of dispersal habitat within Critical Habitat, which may affect, but is "not likely to adversely affect" (NLAA) spotted owl Critical Habitat. Alternative 2 would thin 123 acres of dispersal habitat within Critical Habitat to a final canopy cover of 40 percent, which would maintain its function as dispersal habitat, while accelerating its development into suitable habitat. Alternative 2 would thin 186 acres of dispersal habitat within Critical Habitat to a final canopy cover of 33 percent, which would recover to dispersal habitat within 5 years, while increasing tree growth and stand structural diversity. Some of these units would have post-harvest snag and large downed wood enhancement, and being located within Critical Habitat makes those treatments a higher priority due to benefits to the spotted owl prey base (see Appendix H).

Non-habitat Within Critical Habitat:

Alternative 2 would thin a total of 218 acres of non-habitat within Critical Habitat, which may affect, but is "not likely to adversely affect" (NLAA) spotted owl Critical Habitat. The average DBH of these stands exceeds the minimum 11 inches, however, the district wildlife biologist determined they were too dense for owl movement to provide for dispersal habitat function. Thinning prescriptions were designed to improve tree and canopy growth, and enhance diversity. Thinning of these non-habitat stands would improve habitat structure for spotted owls after approximately 10 years.

Alternative 3

The effects of Alternative 3 on the northern spotted owl are summarized and compared with the effects of Alternative 2 in Table 44.

Table 44. Comparison of Alternatives 2 and 3: Treated Acres by Spotted Owl Habitat Category

	Suitable Habitat		Dispersal Habitat		Non-habitat	
Alternative	Alternative 2	Alternative 3	Alternative 2	Alternative 3	Alternative 2	Alternative 3
Shelterwood with Reserves Acres	2,556	75	32	38	126	114
Thinning Acres	487	0	337	236	994	813
Total Treated Acres	3,043	75	369	274	1,120	927

Disturbance of Occupied Sites

The Biological Assessment determined that noise and smoke in Alternative 3 may affect but would be "not likely to adversely affect" (NLAA) spotted owls.

Identical to Alternative 2, all project activities with potential to disturb known nest sites would be conducted outside the disruption period (March 1 - July 15) or implemented during years when the survey protocol determines that the nest sites are unoccupied.

Habitat Modification

The Biological Assessment determined that habitat modification in Alternative 3 may affect, and would be "likely to adversely affect" habitat and Critical Habitat.

Treatments in Suitable Habitat: Alternative 3 does not propose to harvest any stands over 80 years old, however one stand of 75 acres that is also 75 years old was identified as poor quality foraging or suitable habitat. The effects of Alternative 3 on spotted owls would be much reduced compared to Alternative 2. Treating this one stand would affect less than 0.5 percent of the suitable spotted owl habitat in the Flat Country project area.

Treatments in Dispersal and Non-Habitat: Alternative 3 would thin about 236 acres of dispersal habitat and 813 acres of non-habitat (Table 44). Additional shelterwood harvest with reserves treatments would occur on about 38 acres of dispersal and 114 acres of non-habitat. Treatments in dispersal and non-habitat would benefit stand structure in the long-term over several decades. The non-habitat stands would grow into dispersal habitat in about 40 years after treatment. Compared to now, the more open stands would allow owls to fly through the canopy. Snag and large downed wood enhancement would also benefit the prey base.

Alternative 3 would conduct underburning on up to 318 acres to reduce harvest-generated fuels. Fewer acres would be underburned compared to Alternative 2, meaning there would likely be less new snag habitat created by fire.

Critical Habitat

Alternative 3 would not conduct any harvest in suitable habitat within Critical Habitat. The same amount of dispersal and non-habitat would be harvested as with Alternative 2.

Alternatives 2 and 3

Roadside Hazardous Fuels Reduction

The Biological Assessment determined that the proposed 2,307 acres of roadside hazardous fuels reduction in both Alternatives 2 and Alternative 3 may affect, and is "not likely to adversely affect" (NLAA) spotted owl habitat and Critical Habitat (Table 41). The number of acres affected within each habitat category are summarized in Table 45.

Table 45. Alternatives 2 and 3: Roadside Hazardous Fuels Reduction by Spotted Owl Habitat Category

	Suitable Habitat	Dispersal Habitat	Non-habitat	Total
Treated Acres	841	255	1,211	2,307
Treated Acres in Critical Habitat	15	0	159	174

The proposed fuels treatment fuel treatment would maintain existing habitat at the stand level while degrading the understory quality and foraging conditions. The effects of this treatment could last for 20-30 years until the understory vegetation, including conifers up to 10 inches DBH, reestablishes. Although this treatment is NLAA, the proposed roadside fire breaks would simultaneously provide a benefit to spotted owl habitat by improving the ability to reduce wildfire spread and fire risks to spotted owl nest patches, nest cores, Critical Habitat, and LSRs.

Of the eight known spotted owl core areas that overlap the fuel treatment area, between 2-16 percent (8-80 acres) of any core area would have fuel treatment. RA32 habitat, four known nest patches that are located near the roads to be treated (2838, 2408, 2834, and 2829), and suitable habitat in two deficient nest cores within Critical Habitat (2408 and 2838) would be excluded from fuel treatment. In total, 97 acres would be excluded from fuel treatment. In addition, spotted owl surveys would be required during implementation to assure that no newly-occupied nest patch is treated.

Forest Service Sensitive Species

A total of ten FS sensitive species (see Glossary) occur or have potential habitat in the project area and were analyzed in detail in the wildlife Biological Evaluation (BE; available in the project record). This EIS tiers to the analysis in the BE and provides a summary of the effects (Table 46). Species with no impacts shown in Table 46 are not further discussed.

Table 46. Impacts of Alternatives 2 and 3 on the Forest Service Wildlife Sensitive Species that Occur or Have Potential Habitat in the Flat Country Project Area

FS Sensitive Species	Impact Determination For Alternatives 2 and 3	Rationale For Determination
American Peregrine Falcon	No Impact	Proposed harvest treatments, roadside hazardous fuels treatments, meadow enhancement and road decommissioning and storage would be neutral to falcon foraging habitat. Seasonal restriction on unit 490 in secondary range would prevent disturbance to a nearby nest site.
Bufflehead	No Impact	No potential nesting snags over 18 inches DBH would be cut.
Crater Lake Tightcoil (snail)	No Impact	Survey data has only detected this species at a single location on the Willamette National Forest. There would be no treatment within 10 meters of perennially wet areas. In addition, prescribed fire treatments would not be lit in these 10-meter buffer areas, although fire would be allowed to back into these areas. (See project design criteria).
Fisher	No negative impact Long-term beneficial impact	Fishers are unlikely to occur in the project area and the scale of the Alternatives would not preclude them from reestablishing in the watershed. Alternative 2 would impact 5 to 24 percent of four hypothetical female fisher home range and 9 to 13 percent of two hypothetical male fisher home ranges. In the long-term, fisher habitat quality would immediately benefit from year-round road closures and large downed wood mitigation and enhancement, as well as fall-and-leave trees in Riparian Reserves and large downed wood mitigation and enhancement.
Fringed Myotis and Townsend's Big-eared Bat	Not likely to contribute to a trend towards Federal listing nor a loss of viability to the population or species.	Effects to foraging habitat and potential tree roosting and natal habitat is minor at the project, watershed, and Forest scale. Probablility that an occupied roost or natal site would be destroyed during logging, hazard tree felling operations, or roadside hazardous fuels treatments is low. Snag habitat mitigation and enhancement would help provide habitat in the longer term (>10 years).
Mardon Skipper (butterfly)	Long-term beneficial impact	Bunchgrass Meadow enhancement would maintain and improve potential habitat in the long-term (50 years).
Northern Waterthrush	No Impact	No riparian habitat would be modified.
Sierra Nevada Red Fox	Not likely to contribute to a trend towards Federal listing nor a loss of viability to the population or species. Long-term beneficial impact	Roadside hazardous fuels treatments would decrease habitat qualilty while also reducing the risk of stand-replacing fires. Habitat benefits would occur in the long-term (50years) due to increased edge habitat for hunting and meadow enhancement which benefits prey.
Western Bumble Bee	Long-term beneficial impact	Bunchgrass Meadow enhancement would maintain and improve potential habitat in the long-term (50 years).

Fringed Myotis and Townsend's Big-eared Bats

Alternative 2 has the potential for direct mortality to these bat species. The wildlife biologist's professional judgement is that the potential for direct mortality to these bat species is extremely low, because they are relatively uncommon and natal colonies occur at low densities on the landscape. Nevertheless, if trees or snags with active natal sites are felled or consumed during prescribed underburning, it is likely that adults would escape but that the young would be killed. Logging may occur before the young are weaned in late summer, especially in years with a late spring. In addition, snags would be felled if they posed a safety hazard to operators in units or along haul routes.

Snag creation in Alternative 2 would benefit bat roosting habitat in the long-term. Snag creation is required on 64 units at an average rate of 2 snags per acre and is recommended as an enhancement on an additional 30 units (Table 9).

Alternative 3 would harvest 1,301 acres of younger, lower-quality bat habitat. The likelihood of cutting snags used by roosting bats is lower compared to Alternative 2.

In Alternatives 2 and 3, tree mortality caused by post-harvest prescribed underburning would lead to the creation of suitable bat roosting habitat once the bark begins to peel off from the snag, leaving suitable bat roosting crevices. In Alternatives 2 and 3, roadside hazardous fuels treatments would remove trees and snags up to 10 inches DBH, which are unlikely large enough to be used by roosting bats.

Mardon Skipper (butterfly) and Western Bumble Bee

Alternatives 1 and 3 would lead to the gradual loss of Bunchgrass Meadow, the largest natural meadow opening in the project area. Aside from Bunchgrass Meadow, aerial photography shows one 14-acre meadow to the east in the wilderness, and small meadow patches under 10 acres elsewhere in the Flat Country project area (refer to the Special Habitat analysis in the Botany Chapter).

Sierra Nevada Red Fox

Alternatives 1 and 3 would lead to the gradual loss of Bunchgrass Meadow, the largest natural meadow opening in the project area. This would reduce the quality of Sierra Nevada red fox habitat because there would be a loss of hunting habitat. Other smaller-scale meadow enhancement treatments in the project area may continue to be implemented as part of other projects.

Alternative 2 would harvest approximately 1,700 acres in potential Sierra Nevada red fox habitat (above 4,000 feet elevation). In addition, Alternative 2 would enhance 205 acres of meadow in potential Sierra Nevada red fox habitat (above 4,000 feet elevation). Alternative 2 would provide a diverse stand structure which would provide hiding cover for foxes and habitat niches for their prey. The logging activities would maintain older forest structural elements such as snags, large downed wood, and small no-harvest skips along streams and within stands.

Alternatives 2 and 3 would include approximately 770 acres of roadside hazardous fuels treatments in potential Sierra Nevada red fox habitat (above 4,000 feet elevation). Roadside hazardous fuels treatments would result in a rather open understory within 150 and 300 feet of treated roads. While there would still be some amount of large downed wood on the ground to provide hiding cover, the more open stand would provide lower-quality habitat for the prey base. Foxes may also be less likely to use that area until understory shrubs and conifers return. However, these hazardous fuels reduction activities may also help prevent larger stand-replacing fires, and thus indirectly benefit foxes because prey base populations would not be harmed.

Alternatives 2 and 3 would also decommission approximately 6 miles of road in potential Sierra Nevada red fox habitat (above 4,000 feet elevation), which would benefit this species by reducing road disturbance.

Survey and Manage Species

Great Gray Owl

Alternative 1 would lead to the gradual decline in the amount of available foraging habitat because there would be no meadow enhancement and no additional landscape openings created by shelterwood and gap harvesting.

Alternative 2 would create 1,283 acres of open habitat (322 acres of gaps and 961 acres of shelterwood regeneration harvest) which would enhance foraging opportunities for great gray owl.

Alternative 2 would also enhance 150 acres of foraging habitat in Bunchgrass Meadow, which includes providing at least 10 snags and 10 large down trees per acre post-harvest. Downed wood appears to be an important component of great gray owl foraging habitat.

Alternative 2 would cumulatively open up 1,418 acres, which may improve foraging habitat quality for great gray owls. It is unknown if harvest-created gaps would promote nest establishment in the surrounding stand. Potential nest trees for great gray owls would continue to be present across the Flat Country project since most of the largest overstory trees would be retained.

Alternative 3 would create 133 acres of gaps, which may provide foraging habitat. Alternative 3 would not conduct meadow enhancement and would therefore lead to a loss of up to 150 acres of foraging habitat over the next several decades, unless Bunchgrass Meadow experienced a wildfire.

Oregon Megomphix (snail)

This project may impact individual Oregon Megomphix snails but would not result in any effects to the population viability of this species.

Alternative 1 would have no effect on the Oregon Megomphix snail because there would be no changes to current habitat near bigleaf maple trees.

Alternative 2 harvest treatments may impact Oregon Megomphix habitat on approximately 1,000 acres (11 percent) of the Oregon Megomphix suitable habitat in the project area. Alternative 3 harvest treatments may impact Oregon Megomphix on approximately 350 acres (4 percent) of the Oregon Megomphix suitable habitat in the project area. In addition, fuel treatments in Alternatives 2 and 3 would degrade approximately 200 acres of Oregon Megomphix habitat. Fuel treatments would remove much of the understory, which may result in drier habitat conditions and less hiding cover. The overstory would remain, which would continue to provide shade, and existing downed wood would be left in place, which would continue to provide hiding spaces.

Red Tree Vole

Alternative 1 would have no direct effect on the red tree vole. Thinning of 1,558 acres of younger stands would not occur, and those stands would take longer to achieve higher quality red tree vole habitat characteristics, including larger tree canopies and diverse structure.

Alternative 2 would remove or thin 3,051 acres (footprint acres with skips included) of red tree vole habitat in stands over 80 years old, but would not affect any documented red tree vole nest areas.

Alternative 2 would remove or thin 16 percent of the 19,123 acres of higher-quality red tree vole habitat (equivalent to spotted owl suitable habitat) in the project area. Based on the number of overstory trees that are being left, the stands would return to conditions matching the description of suitable red tree vole habitat (Forest Service and BLM 2012) in approximately 50-60 years. Alternative 2 would also impact 431 (footprint acres with skips included) acres of lower-quality red tree vole habitat in stands (equivalent to spotted owl dispersal habitat quality). While nests in younger or more open-canopied stands are less likely to be present, they may still occur.

Alternative 2 would cumulatively impact 3,602 acres of higher-quality stands over 80 years of age, and 431 acres of lower-quality red tree vole habitat in stands under 80 years of age. This represents 19 percent of the higher-quality stands in the Flat Country project area.

Alternatives 2 and 3 would not conduct roadside hazardous fuels reduction treatments or prescribed burning in the four designated Red Tree Vole Habitat Areas in units 1970 and 1980. Outside of these Red Tree Vole Habitat Areas, there would be minor impacts to red tree vole habitat quality from roadside hazardous fuels treatments because red tree voles mainly use tree canopy habitat. Any movements through the treated understory may expose them to a higher incidence of predation due to reduced hiding cover.

Alternative 3 would have impacts from timber harvest limited to 431 acres of trees under 80 years old, which is low-quality red tree vole habitat.

Management Indicator Species

Table 47. Impacts of Alternatives 2 and 3 on the Wildlife Management Indicator Species that Occur or Have Potential Habitat in the Flat Country Project Area

Indicator Species	Impacts Determination for Flat Country Alternative 2	Indicator Habitat	Reason Selected in 1990
Bald Eagle	No impact	old-growth conifers near large bodies of water	federally threatened species, subsequently delisted, now a FS sensitive species
Cavity Excavators (Six species: red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, black-backed woodpecker)	Loss of snags may negatively impact, but snag mitigation and enhancement would have beneficial impact	dead and decaying trees	ecological indicator, limited habitat
Deer	Beneficial impact	winter range	commonly hunted
Elk	Beneficial impact	winter range	commonly hunted
Marten	Degrades approximately 516 acres of marten habitat in the preferred	old-growth and mature conifers	ecological indicator, limited habitat

Indicator Species	Impacts Determination for Flat Country Alternative 2	Indicator Habitat	Reason Selected in 1990
	montane forest habitat type		
Peregrine Falcon	No impact	cliff nesting habitat near abundant prey	federally endangered species, subsequently delisted, now a FS sensitive species
Pileated Woodpecker	Minor impact	old-growth and mature conifers	ecological indicator, limited habitat

Deer and Elk

To evaluate elk habitat and estimate habitat effectiveness, we used the model by Wisdom (1986). This model incorporates the following four key attributes: size and spacing of forage, quality of forage, cover areas, and open road density through elk habitat. This model considers past and ongoing activities and results in an evaluation of the cumulative impacts on elk habitat from the past, present, and foreseeable future actions in the elk emphasis areas.

In addition, we also used the Westside Elk Model (Rowland et al. 2013) to predict how silviculture treatments would affect elk forage quality and habitat use. The first part of this model predicts dietary digestible energy across the landscape based on the potential natural vegetation zone, the modeling region, the percent canopy cover of live trees, and the proportion of total live trees greater than 2.5 cm DBH that are hardwoods. The second part of this model predicts elk habitat use based on the dietary digestible energy information, distance to publicly open roads, percent slope, and distance to cover-forage edge.

Alternative 1 would maintain the currently poor and marginal quality big game forage levels in the Flat Country project area. Current trends of elk habitat development would occur naturally over time with Alternative 1. Existing elk foraging habitat in open plantations would continue growing denser into hiding cover and then into thermal cover over the next few decades. While the overall amount of low quality forage may continue to decrease herd health.

In ten years, forage availability is expected to decrease even more in this area as current harvest openings grow into hiding cover. In the absence of additional harvest or wildfire, no new foraging areas would be created. Current amounts and quality of optimal and thermal cover would not significantly change in the next few decades. Within 75 years, all of the existing thermal cover would shift into optimal cover. Road density and big game security would not change. Overall habitat quality would decrease from the loss of forage. The open road density would remain at about 1.7 miles of open road/square mile for the project area.

Shelterwood harvest and commercial thinning on 4,437 acres in Alternative 2 would change the function of elk habitat from thermal cover to lower quality thermal cover that contains small inclusions of forage areas. Units with a post-harvest canopy cover below 40 percent would not provide thermal cover for 7-15 years. However, it is additional forage not additional thermal cover that enhances elk survival and reproduction (Cook et al. 1998). These more open units would show improved shrub and forb development compared to those with canopy cover above 40 percent. This improved forage habitat in the thinned areas would last approximately 15-20 years.

In addition, gap creation in Alternative 2 would create early-seral foraging habitat in 1-3 acre gaps on a total of 322 acres within thinning units. Forage in gaps would be higher-quality and more long-lasting than in the thinned areas surrounding the gaps. In this project, 172 acres (35 percent) of these gaps would be left to regenerate naturally, which would allow them to remain in a higher forage condition for a few additional years.

Post-harvest underburning on 2,021 acres in Alternative 2 would be light-intensity and patchy, which would stimulate understory vegetation growth and provide higher quality forage to elk and other species dependent on early-seral habitat.

Roadside hazardous fuels treatments on 2,307 acres would limit the quantity of forage for approximately five years until understory vegetation re-sprouts. Grass and forb growth may increase after five years, depending on sun exposure and plant association.

The decommissioning of 14 miles or road and storage of 5 miles of road in Alternative 2 would result in an open road density of 1.5 miles of open road per square mile. The creation of 16 miles of temporary roads in Alternative 2 would result in an increase in disturbance to deer and elk throughout the implementation timeframe of this project (2-10 years). All temporary roads would be decommissioned once activities are completed.

Cavity Excavators

Population viability for cavity excavator species that depend on this habitat type would be maintained at the project, McKenzie River watershed, and Forest level under all Alternatives. The snag replacement and enhancement that is proposed (Table 9) would improve post-harvest habitat conditions.

We used stand exam data and the Forest Vegetation Simulator (FVS; FS 2016) to predict changes in snag habitat levels over the next 100 years for the three Alternatives. The FVS model factors in background mortality over time due to competitive suppression between trees; however, it does not account for dead wood created or lost through harvest, prescribed fire, mechanical damage, or random environmental events such as wildfire or windthrow. The results of this model are shown below. Alternative 1 is the no action and depicted by the lines labeled “No Action Natural Stands” and “No Action Plantations”. Alternative 2, the preferred alternative, is depicted by the lines labeled “Thinning” and “Shelterwood.” The line labeled “Thinning” is applied to both plantations and a subset of natural stands; it assumes 20 percent of the unit on average is unthinned while the Shelterwood is applied to a subset of the natural stands and assumes 15 percent of the stand is untreated (Figures 30 and 31).

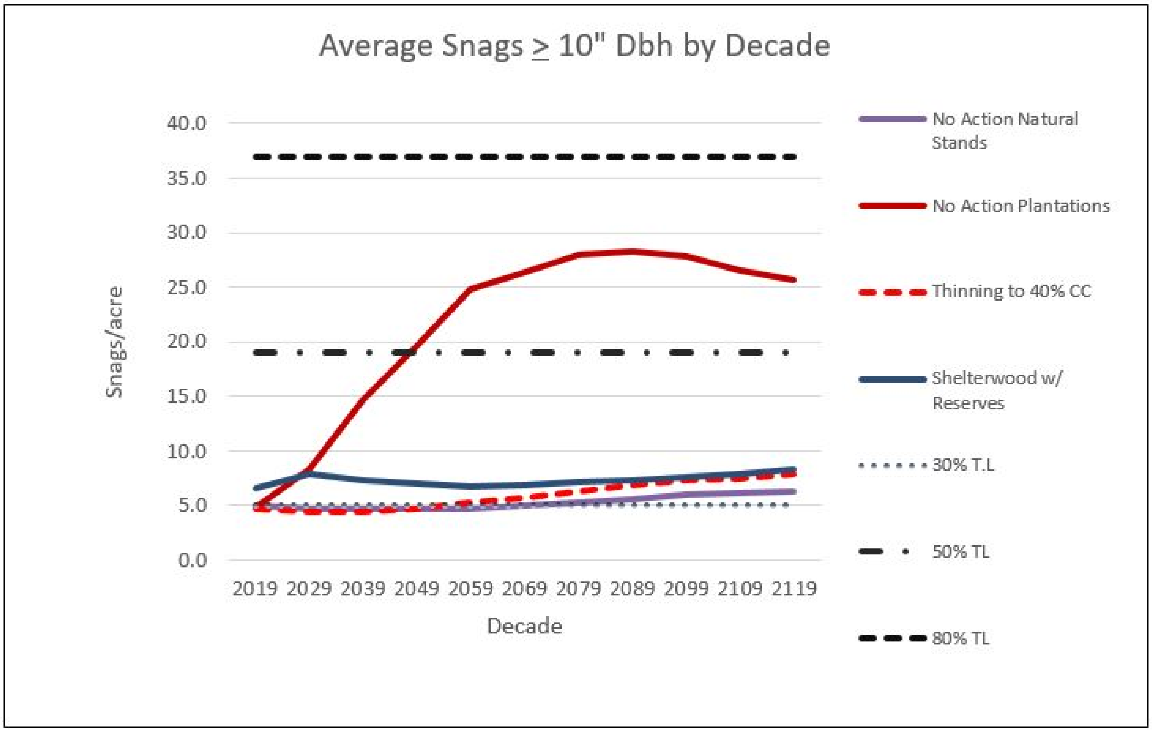

Figure 30. Predicted Changes Over Time in Total Snags ≥10 Inches for Alternatives 1, 2, and 3

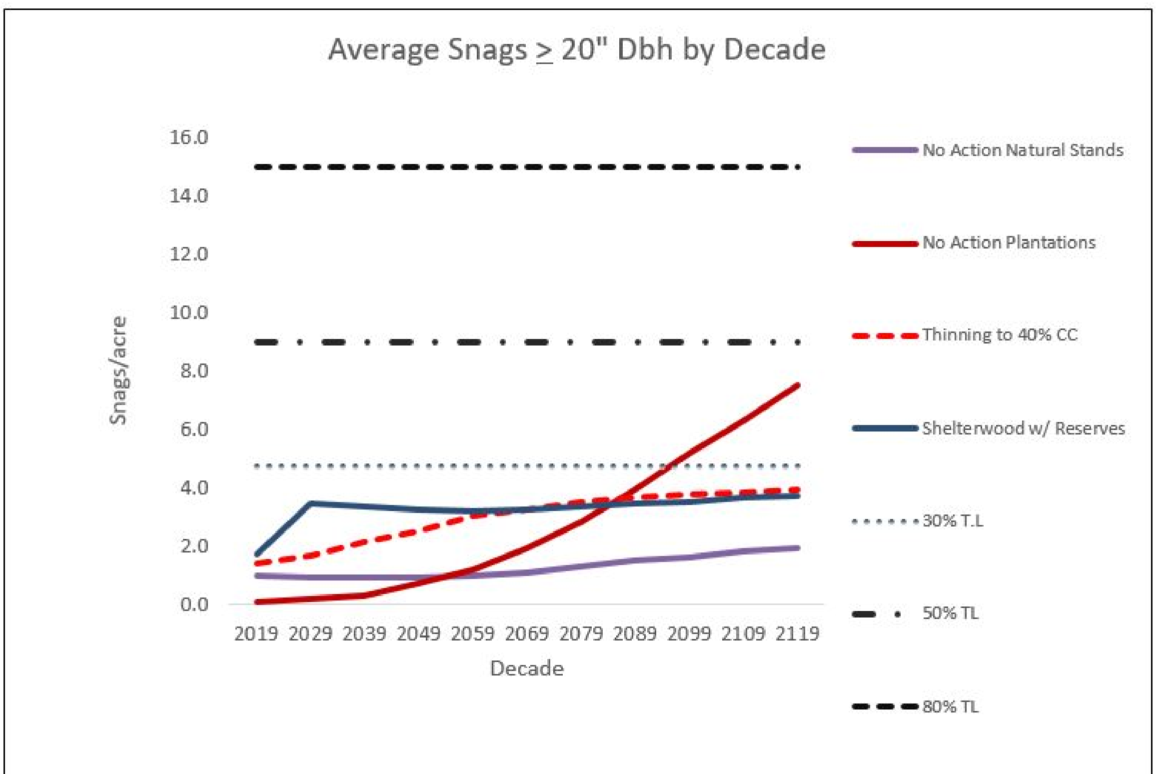

Figure 31. Predicted Changes Over Time in Total Snags >20 Inches for Alternatives 1, 2, and 3

Alternative 1 would have no impact on any cavity excavator MIS including 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 downed wood creation.

Alternative 2 would degrade 12 percent of the cavity excavator habitat in the project area, based on the amount of forest with trees capable of producing snags at least 11 inches DBH. Suitable and dispersal spotted owl habitat can be used as a proxy for general cavity excavator habitat.

The prescriptions for the Flat Country project must meet the snag and downed wood mitigation requirements in the Forest Plan Standards and Guidelines (USDA Forest Service 1990). In addition, the wildlife biologist has also made recommendations for snag and large downed wood enhancement above these minimum standards, some of which is required. If funding is available and these enhancement recommendations (Table 9) are implemented, Alternative 2 would temporarily degrade, but not remove, habitat for most cavity excavators.

Snag densities of at least 1snag per acre over 20 inches are present on 3,051 acres of the older stands proposed for or adjacent to harvest (in skips or untreated Riparian Reserves)(Figure 31). This makes up 16 percent of this kind of habitat in the project area. These stands would have some existing snags removed if they pose a safety hazard to the logging operations. Few large snags would be lost in younger stands because snag abundance is generally less than 1 snag per acre or non-existent in the plantations across the Flat Country project area (Figure 31).

Prescribed underburning would create some degree of overstory tree mortality, which would improve snag habitat conditions. Overstory tree mortality would be desirable at a level of up to 10 percent (see project design features in Table 8).

Northern flicker would benefit from treatments in older stands over 80 years old since they prefer large snags, forest edges, and open forest habitat, all of which would be maintained or created by the proposed silviculture treatments. Red-breasted nuthatch would benefit from thinning treatments in stands under 80 years old since they benefit from high structural diversity. 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).

Alternatives 2 and 3 may impact individuals, but neither Alternative is expected to lead to a loss of population viability for cavity excavators at the project or Forest scale.

Alternatives 2 and 3 would reduce snag habitat levels in thinned stands under 80 years old over the next 100 years compared to natural succession (no treatment). However, this negative effect is balanced against the beneficial effect of accelerating larger diameter trees and multiple canopy layers (see Forest and Stand Structure Section). Snag creation is expected to result in a short-term increase in cavity excavators.

Project design criteria (Table 8) would protect all existing snags and downed wood to the extent feasible during project activities, but some snags would be lost through the felling of hazard trees. Any snags that are felled would be left on site to contribute to downed wood levels. Additional snag creation (approximately 3 percent of trees) may occur though damage associated with logging activities. Additional snag creation (up to 10 percent of trees) would also occur through mortality from underburning. Downed wood levels would be monitored after harvest and possible post-harvest underburning. Depending on unit specifics, 0-4 trees per acre would be felled to meet downed wood requirements and recommendations (Table 8) if these levels are not present.

Alternatives 2 and 3 would remove current and future cavity excavator foraging opportunities in 2,307 acres of roadside hazardous fuels treatments because no current understory trees would be suppressed and develop into future snags and subsequent downed wood. The negative effects of the roadside hazardous fuels treatments on cavity excavators could last for 20-30 years until the understory vegetation reestablishes. The roadside fire break may benefit cavity excavator habitat in the long term by improving the ability to reduce wildfire spread to adjacent older stands of higher-quality cavity excavator habitat.

Alternative 3 would not harvest stands over 80 years old and would remove very few large snags in adjacent stands for roadside hazard tree purposes. Most of the younger stands have very few, if any, large snags that can be used by cavity excavators.

Marten

Alternative 1 would maintain the current forest habitat and the stands would continue to develop large diameter trees, large snags, and large downed logs as the stands progress into old-growth forests. Structural features that marten prefer would continue to increase over time. There are no harvest units proposed above 4,000 feet elevation in Alternative 3. No additional fall-and-leave treatments would take place in Riparian Reserves above 4,000 feet where current large downed wood conditions are very low.

Alternative 2 would harvest 516 acres of older forested marten habitat above 4,000 feet elevation which is the highest quality habitat. Canopy cover would be reduced, providing less hiding cover, and large snags that provide denning opportunities may be felled if they pose a safety hazard or may burn during underburning treatment. All of these harvest units (1480, 1590, 1610, 1720, 1750, 1770, 1810, 1820, and 1830) have snag and large downed wood mitigation or enhancement recommendations, which would help maintain quality marten habitat.

About four miles of fall-and-leave treatments in Riparian Reserves (Table 20) would improve existing low levels of large downed wood in older stands, which would further improve marten habitat conditions above 4,000 feet. One additional mile of fall-and-leave treatments would occur below 4,000’ which is less likely to benefit marten.

Birds of Conservation Concern

Northern Goshawk

Alternative 1 would allow units to continue to develop towards old-growth forest conditions over many decades, resulting in improved nesting and foraging habitat for northern goshawks.

Alternatives 2 would maintain viable populations at the landscape level of northern goshawks and other birds that use older conifer forests because over 20 percent of the project area would remain in older forested habitat over 180 years old. Using spotted owl suitable habitat as a proxy for northern goshawk habitat, Alternative 2 would impact 16 percent of the suitable northern goshawk habitat in the project area. The shelterwood treatment units would return to northern goshawk habitat in approximately 80 years after timber harvest. The thinned units would return to northern goshawk habitat after approximately 50 years, with more heavily thinned stands taking longer to recover.

Alternative 3 would not harvest stands over 80 years old, and current northern goshawk habitat conditions would be maintained.

Alternatives 2 and 3 would conduct roadside hazardous fuels treatments, which may help prevent large wildfires that would temporarily degrade northern goshawk habitat. Alternatives 2 and 3 would also protect northern goshawk and other raptor nests if they are found during layout or implementation (see project design features).

Olive-sided Flycatcher, Purple Finch, and Rufous Hummingbird

Alternative 1 would have no direct effect on the amount of habitat available for olive-sided flycatcher, purple finch, or rufous hummingbird. The 150-acre Bunchgrass Meadow would continue to have small conifer encroachment. This would lead to the eventual loss of meadow forb species and the amount of meadow and edge habitat. Barring a major wildfire, Bunchgrass Meadow would shrink in size and value to these bird species.

Alternative 2 would create a small amount of early-seral forest through harvest, while maintaining a variety of closed-canopy forest habitats across the landscape. In total, 172 acres of unplanted gaps would develop shrubs and forbs, which would benefit olive-sided flycatcher, purple finch, and rufous hummingbird. These shrubs include vine maple, deerbrush, red alder, Oregon grape, and red huckleberry. These unplanted gaps are expected to remain open habitat for approximately 15 years.

Alternative 3 would create 71 acres of unplanted gaps, which is 101 fewer acres of unplanted gaps than Alternative 2. These unplanted gaps would function the same and last the same amount of time as in Alternative 2.

Alternatives 2 and 3 would conduct roadside hazardous fuels treatments on approximately 2,307 acres. This would remove understory shrubs with flowers, fruits, seeds, and insects that birds forage on. On the other hand, roadside hazardous fuels treatments may help prevent large wildfires that could temporarily degrade large areas of habitat for these bird species.

Alternatives 2 and 3 would conduct road decommissioning and storage of about 19 miles of roads. This may eventually provide benefits to olive-sided flycatcher, purple finch, rufous hummingbird, and other bird species when useable vegetation that provides nesting habitat and seeds grows back onto the road surface.

3.5.5 Cumulative Effects

The 74,063-acre Flat Country project area spatially overlaps with one past EIS (Robinson Scott), five past timber CEs for stands under 80 years old (Dulce, Norse, Pass, Muskee, and Ollie), one ongoing EA (South Fork), and no additional foreseeable projects. The Robinson Scott EIS, completed in the early 2000s, downgraded 2,358 acres of foraging habitat to dispersal habitat and maintained 80 acres of dispersal habitat (thinning leaving over 40 percent canopy cover). The Ollie CE maintained dispersal habitat and the other four CEs removed a total of 232 acres of dispersal habitat. The ongoing South Fork EA would harvest 51 acres of spotted owl foraging habitat. The Flat Country Project would downgrade 2,640 acres, which is 3.6 percent of the project area.

The cumulative effect on snags in the Flat Country project area is not significant due to the small percent of the project area affected, the creation of snags, and the development of new snags naturally over time. Table 48 provides a summary of the cumulative effects to wildlife for each alternative in terms of spotted owl suitable habitat, mid-seral forest, early-seral habitat, meadow habitat, Megomphix habitat, and roads closed.

Table 48. Summary of the Cumulative Effects to Wildlife for Each Alternative in the Flat Country Project Area

	Spotted Owl Suitable Habitat Affected	Mid-Seral Forest Structurally Diversified	Early-Seral Habitat Structurally Diversified	Meadow Enhanced and Maintained	Megomphix Habitat Impacted	Roads Closed
Alternative 1	0	0	0	0	0	0
Alternative 2	16%	5%	10%	150 acres	11%	19%
Alternative 3	less than 1%	3%	5%	0	4%	19%

Alternative 1 – No Action

Since Alternative 1 would have not cause any wildlife impacts, there are no cumulative effects to be considered.

Alternative 2 – Preferred Alternative

Alternative 2 combined with all past, ongoing, and foreseeable projects within the Flat Country project area would cumulatively affect 16 percent (3,043 acres) of the currently available suitable spotted owl habitat in the Flat Country project area (Table 48). Alternative 2 would not preclude meeting recovery goals for spotted owls.

Alternative 2 would cumulatively affect 5 percent (431 acres) of the mid-seral forest age class, generally between 40-80 years old in the Flat Country project area.

Alternative 2 would cumulatively improve 10 percent (7,130 acres) of early-seral habitat in the Flat Country project area.

Alternative 2 would cumulatively enhance and maintain 150 acres of meadow within the Flat Country project area, which benefits species such as Roosevelt elk and western bumble bee.

Alternative 2 would cumulatively impact 11 percent (1,051 acers) of the suitable Oregon Megomphix habitat in the Flat Country project area.

Alternative 2 would cumulatively close 19 percent (20 miles) of roads in the Flat Country project area, which would continue to provide a degree of seclusion to elk, deer, and other wildlife species.

Alternative 3

Alternative 3 combined a with all past, ongoing, and foreseeable projects within the Flat Country project area would cumulatively affect less than one percent (75 acres) of suitable spotted owl habitat in the Flat Country project area. Alternative 3 would not preclude meeting recovery goals for spotted owls.

Alternative 3 would cumulatively affect 3 percent (274 acres) of the mid-seral forest age class, generally between 40-80 years old in the Flat Country project area.

Alternative 3 would cumulatively improve 5 percent (3,994 acres) of early-seral habitat in the Flat Country project area.

Alternative 3 would cumulatively enhance and maintain no acres of meadow within the Flat Country project area, which benefits species such as Roosevelt elk and western bumble bee.

Alternative 3 would cumulatively impact 4 percent (350 acres) of the suitable Oregon Megomphix habitat in the Flat Country project area.

Alternative 3 would cumulatively close 19 percent (20 miles) of roads in the Flat Country project area, which would continue to provide a degree of seclusion to elk, deer and other wildlife species.

3.6 Botany and Invasive Plants

3.6.1 Summary of Effects

The Botany Biological Evaluation determination for sensitive vascular plants, lichens and bryophytes is no impact. The project would 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 would 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 Flat Country Project has a high risk of introducing or spreading known populations of non-native invasive plants under Alternative 2 and a moderate risk for Alternative 3. Invasive plant control measures are identified under the Project Design features in Chapter 2.

Buffering special habitats from direct activity and to protect microclimate of the wetter sites would be consistent with the Forest Plan which states that these sites shall be maintained or enhanced. Active management of special habitats in Units 1160, 1170, 1180, 1190 would be a benefit to these habitats.

3.6.2 Scale of Analysis

The spatial extent of analysis is the entire project area, which encompasses 74,063 acres east of Highway 126 extending from Scott Mountain to the upper McKenzie River and including the following 6th field watersheds: Boulder Creek, Kink creek, and Lost creek and extends to the eastern district boundary through the Mt Washington Wilderness.

3.6.3 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 managed according to 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 was 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.

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 with the species. There are 92 species on the Regional Forester's 2015 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 field surveys to determine whether special status botanical species occur in the project area. Prior to the Flat Country botanical surveys, several Region 6 sensitive species had been documented in the project area. These species include a fungi, *Mythicomyces corneipes* and a vascular plant, *Gentiana newberryi.* In addition, 21 survey and manage species had been documented. There is also a candidate species for listing under the endangered species act, white bark pine, *Pinus albicaulis* in the planning area.

Intuitive controlled surveys conducted in the field seasons of 2017-2018 documented the presence of a Region 6 Sensitive species, a lichen *Stereocaulon spathuliferum,* and a List 3 species of concern *Plagiothecium piliferum,* a moss. Field surveys also revealed a new species of fungus that has not been previously documented in the state of Oregon, *Gymnomyces ellipsosporus* and 39 additional sites of survey and manage species.

The analysis area contains habitat for 55 species of the 97 on the Regional Forester's Sensitive Species List (dated Dec 2015). 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 Flat Country 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 49 outlines the Northwest Forest Plan Survey and Manage categories from the 2001 Record of Decision (ROD). A Biological Evaluation for the Flat Country EIS is in the project file. All sensitive and Survey and Manage botanical species in the project area are outlined in Table 50.

Table 49. Northwest Forest Plan Survey and Manage Categories from the 2001 Record of Decision

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 Strategic Surveys	Category E: Manage All Known Sites Strategic Surveys
Uncommon	Category C: Manage High-Priority Sites Pre-Disturbance Surveys Strategic Surveys	Category D: Manage High-Priority Sites Strategic Surveys	Category F: Strategic Surveys

Table 50. Sensitive and Survey and Manage Botanical Species in the Flat Country Planning Area

Species	Life Form	Category	Number of Sites	Location
Bauxbaumia viridis	moss	Survey and Manage D	1	Unit 90
Chaenotheca chrysocephala	Lichen	Survey and Manage B	18	Units 1110, 1240, 1260 1300, 1710, 1810, 1880 1970, 1980, 2020, 2120 2130, 2160, 2170, 2180
Chaenotheca furfuracea	Lichen	Survey and Manage F	7	1300, 1680, 1870, 1920
Chaenotheca subroscida	Lichen	Survey and manage E	1	1810
Chroogomphus loculatus	Fungus	Survey and Manage B	1	Mt Washington Wilderness
Clavariadelphus ligula	Fungus	Survey and Manage B	1	Along the 2647 north of unit 1940
Clavariadelphus truncatus	Fungus	Survey and Manage B	1	Along 2647 SW of unit 1880
Collema nigrescens	Lichen	Survey and Manage F	1	South of 2649 and unit 2080
Galerina cerina	Fungus	Survey and Manage B	1	North of Unit 90
Gastroboletus subalpinus	Fungus	Survey and Manage B	1	Hwy 242 East of Craig Lake
Gastroboletus turbinatus	Fungus	Survey and Manage B	1	North of 242 West of Craig Lake
Gentiana newberryi	Vascular plant	Sensitive	1	By Hand Lake
Gomphus clavatis	Fungus	Survey and Manage F	1	2647 by Belnap springs
Gymnomyces albietis	Fungus	Survey and Manage B	2	Along 242 by Craig lake
Gymnomyces ellipsosporus	Fungus	New species to Oregon	2	1280, 2160
Gymnopilus punctifolius	Fungus	Survey and Manage B	2	Unit 190
Helvella crassitunicata	Fungus	Survey and Manage B	1	Mt Washington wilderness by Elf lake
Hypogymnia oceanica	lichen	Survey and Manage F	53	Unit 90,190,1810, 2160
Mythicomyces corneipes	fungus	Sensitive	1	2647 by Belnap springs
Nephroma bellum	Lichen	Survey and Manage F	4	Unit 90, 1710, 2010
Nephroma occultum	Lichen	Survey and Manage B	15	Unit 90, 1020, 1130, 1260, 1310, 1730, 1810 and fuels

Species	Life Form	Category	Number of Sites	Location
				unit between Unit 190 & 260
Peltigera pacifica	Lichen	Survey and Manage E	5	Bunchgrass meadow
Pinus albicaulis	Vascular plant	Candidate for listing as threatened under the ESA	27	Mt Washington Wilderness Belnap Crater, Scott Mtn
Plagiothecium piliferum	moss	Species of Concern	1	Unit 1980
Pseudocyphellaria rainierensis	Lichen	Survey and Manage A	3	Unit 1110 1300, 2111
Ramaria celerivirescens	Fungus	Survey and Manage B	1	By Tenas lakes
Ramaria rubrievanescens	Fungus	Survey and Manage B	9	Unit 1440 and in fuels unit south of 1440
Sarcodon fuscoindicus	Fungus	Survey and Manage B	1	South of Unit 1960
Stereocaulon spathuliferum	Lichen	Sensitive	1	Unit 1820 fuels

Shaded cells Indicates the species requires a buffer.

Multiple surveys were conducted within the Flat Country project area for botanical species on the Regional Forester‘s Special Status Species List (Revised December 2015), and the Survey and Manage List (USDA and USDI, 2001). Field surveys were conducted using the intuitive controlled method in the summers of 2017-2018. 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.

Bauxbaumia viridis is a moss that grows in our area on decaying logs in shaded sites from California to Washington. Leaves are strongly reduced with a persistent protonema. Populations are usually small, discontinuous with a documented location in Unit 90 which is under 80 years old so no buffer is required. *Bauxbaumia viridis* is on the survey and manage list and even more rare in California.

Chaenotheca chrysocephala, C. furfuracea, C. subroscida are pin lichens that look very similar and microscopic characteristics must be used for species confirmation. *C. chrysocephala* and *C. subroscida* grow on the bark and wood of old conifers and snags and are about 1mm tall. Both species were found during 2017 field surveys in unit 1810, and *C. chrysocephala* was also found in units 1300, 1710, 1880, 1970, 1980, 2020, 2120, 2130, 2160, 2170, 2180. *C. furfuracea* is slightly larger up to 2.6 mm tall growing in the hollow spaces beneath roots of old-growth trees and in cracks in rocks in Unit 1300, 1680, 1870 and 1920. All three Chaenotheca species are on the Survey and Manage list.

Gymnomyces ellipsosporus is a fungus that has never before been documented in the state of Oregon. It was found during project area field surveys of 2017 in Units 1280 and 2160. *Gymnomyces ellipsosporus* is sequestrate so even the fruiting body is underneath the soil with no distinct cap or stem. Little else is known about this species and would be treated similarly to other Gymnomyces which are Survey and Manage Category B.

Gymnopilus punctifolius is a fungus fruiting in groups on decaying conifer logs or soil rich in humus. It is a Survey and Manage species found in unit 190.

Hypogymnia oceanica is a foliose lichen species that is common in Coastal Alaska and becomes increasingly rare as you go south. It’s found mostly on bark and wood of conifers in moist coastal forests and in units 90, 190, 1810, 2160.

3.6.4 Environmental Consequences – Special Status Botanical Species

Direct and Indirect Effects

Alternative 1

No 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 and regeneration harvest have been shown to have negative, short-term (5-7 years) impacts to fungi (Pilz et al., 2003) and fungal species diversity has been shown to increase with stand age. There would be no removal of mycorrhizal host trees by shelterwood removal, dominant tree release 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. Some anecdotal evidence suggests certain foliose lichens may benefit from the increased light after thinning. Bryophytes thrive under low light conditions and high levels of downed wood that can be expected under the No Action Alternative.

Overstocked plantations 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 (1,772 acres), thinning in Riparian Reserves (164 acres), shelterwood with reserves (961 acres), dominant tree release (119 acres), gap creation (323 acres) fuel break creation (2,305 acres), and meadow enhancement (150 acres). Additionally, there would be skips, gaps and early-seral habitat creation. Associated road work and fuel treatment are also proposed. Temporary road construction is proposed for 15.5 miles and road decommissioning is proposed for 15.0 miles.

Direct effects of the proposed action on special status vascular plants, lichens and bryophytes is minimal because sites within or adjacent to units would be buffered by a no harvest, no burn buffer of 150 feet. These special status species may also be protected by placing a skip (no harvest, no treatment) in the site rather than a 150 foot buffer.

Buffers are for:

- *Chaenotheca chrysocephala*- in units 1110, 1260, 1300, 1710, 1810, 1880, 1970, 1980, 2020, 2120, 2130, 2160, 2170, and 2180 would be buffered by 150 feet or in a skip.
- *Chaenotheca furfuracea* – in units 1300, 1680, 1870, 1920 would be buffered by 150 feet or a skip.
- *Chaenotheca subroscida* -in unit 1810 would be buffered by 150 feet or a skip.
- *Gymnomyces ellipsosporus*-in units 1280, and 2160 would be buffered by 150 feet or a skip.
- *Gymnopilus punctifolius*-in unit 190 would be buffered by 150 feet or a skip.
- *Hypogymnia oceanica*-in units 190, 1810, and 2160 would be buffered by 150 feet or a skip

- *Nephroma bellum*-in units 1710, and 2010 would be buffered by 150 feet or a skip
- *Nephroma occultum*- in units 1130, 1260, 1310, 1730, 1810, and in the roadside fuels unit between unit 190 and 160 would be buffered by 150 feet no cut, no burn buffer or a skip.
- *Peltigera pacifica*-in enhancement unit bunchgrass meadow would be buffered by 150 feet.
- *Plagiothecium piliferum*-in unit 1980 would be buffered by 150 feet or a skip.
- *Pseudocyphellaria rainierensis*-in units 1110, 1300, and 2111 would be buffered by 150 feet or a skip.
- *Ramaria rubrievanescens*-in units 1440, and in a roadside hazardous fuels treatment unit south of 1440 would be buffered by 150 foot no cut no burn buffer or a skip.
- *Stereocaulon spathuliferum*-in unit 1880 and a fuels unit would be buffered by 150 foot no cut, no burn buffer.

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 hypogenous (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 hypogenous. 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 in shelterwood prescriptions with reserves 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). Alternative 2 would have a significantly greater loss of host trees than Alternative 3 but can be partially mitigated by keeping reserve trees within the shelter harvest units.

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 would 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 plantations 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).

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 Flat Country; with only two species documented during the course of surveys, both with only one known site. *Bauxbaumia viridis* does not require a buffer because it is a survey and manage species growing in a stand under eighty years old. Plagiothecium piliferum population would be buffered by a full 150 feet or a skip protecting the substrate and microclimate, therefore no effects to this species is 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 removing their substrate through thinning, aggregate retention harvest, and gap creation. The creation of roadside fuel breaks or dominant tree retention would not benefit rare lichen habitat.

If the roadside fuel breaks and fuel treatments reduce the risk of a stand replacing fire, then indirectly, habitat for all special status botanical species would benefit. The effectiveness of roadside 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 shelterwood harvest and harvesting in older stands. All of the stands older than 80 years are dropped along with the proposed shelterwood treatments. Temporary road construction would be reduced from 15.5 miles to 6.7 miles, and road decommissioning would stay the same at 15.0 miles. Approximately 782 acres would be thinned to 40 percent canopy cover, and an additional 164 acres would be thinned in Riparian Reserves under Alternative 3 as well as 133 acres of gaps, and 50 acres of dominant tree release. Roadside hazardous fuels treatment acres would remain the same as that proposed in Alternative 2 at 2,305 acres. There would be no meadow habitat enhancement in Alternative 3. As in Alternative 2, no direct effects to special status species are expected due to buffers of existing sites.

Thinning of densely stocked Douglas-fir plantations could eventually lead to more compositionally and structurally diverse late-successional habitat that would benefit special status species. 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 stands above 80 years old included in this alternative. There are 133 acres of gaps in this alternative, which have would negatively affect mycorrhizal connections at least in the short term but less than in Alternative 2 which proposes 323 acres of gaps and the additional 961 acres of shelterwood acres not included in Alternative 3.

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 and 3

The area analyzed for cumulative effects was the Flat Country Planning Area in the Upper McKenzie watershed encompassing 74,063 acres located on the western slope of the Cascades extending from Scott Mountain to the headwaters of the McKenzie River, bound by Hwy 126 to the west, Hwy 242 to the south, and the district boundary in the Mt Washington Wilderness to the East. Much of the old-growth forest was clearcut in the Upper Mckenzie watershed in the last 50 years. Old-growth forests were harvested for timber and 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 patches of mature and old-growth forests still remaining in the Upper McKenzie Watershed including an inventoried roadless area and the Mt Washington 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 3,136 acres of forest stands over 80 years of age would be treated in Alternative 2 to the extent that they would negatively impact ectomycchorizal fungal species (gaps, shelterwood, thinning to less than 40 trees/acre). Alternative 3 that treats plantations only, minimally adding to the cumulative effects in the watershed.

More recent past actions (within the past 10 years) that occurred within the Flat Country planning area include timber harvested under the Roscoe EIS which included 461 acres of shelterwood treatment and 1,875 acres of commercial thinning with 102 acres of gaps and 700 acres of precommercial thinning. Most of these stands were treated with fire to reduce slash generated by harvest activities. Fungal diversity declines with gaps, shelterwood treatments and fire (Byrd et al., 2000; Bruns et al., 2002) therefore it is very likely these past actions have had a negative effect on special status fungi.

3.6.5 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 wildlife, many of which are not found in forested areas. Special habitats cover only about 5 percent of the area in the Cascades Range, but 85 percent of native flowering plants are found in these unique non-forested 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 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

There is a total of 445 acres of special habitats in the Flat Country planning area including rock outcrops, talus slopes, Sitka alder patches, wet meadows, sedge meadows, and dry meadows. Several of the harvest units in Flat Country contain special habitats (Table 51). These areas 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 an "area to protect" (Table 51). Special habitats within managed stands tend to have more weed species and altered hydrology due to past disturbance.

Fingerboard prairie is a special habitat in the planning area that was historically a wet meadow. Road construction and channelization has altered the hydrology of the wet meadow essentially dewatering areas that are now being colonized by trees and dry meadow species.

The largest special habitat in the planning area, Bunchgrass Meadow, is an enhancement unit divided into unit numbers 1160, 1170, 1180, and 1190 and has proposed enhancement activities to improve habitat for plant and wildlife species. Bunchgrass meadow is categorized as a dry meadow currently mapped at 125 acres but was historically much larger before becoming encroached with conifers. The goal of the Bunchgrass Meadow enhancement project is to maintain a relatively open, rare meadow habitat type that would sustain a broad array of plant and wildlife species. This meadow complex is diverse in terms of vegetative structure. The presence of shrubs, forbs, sedges and grasses with patchy distributions across the meadow complex make this a unique feature on the landscape and would require active treatment to prevent it from converting to forest habitat. Research on the transition between meadow and forest and resulting changes in the understory has been conducted at Bunchgrass Meadow since 2005 (Halpern et al. 2019 in review). This research included experimental tree removal followed by prescribed burn treatments. Historic research plots, would be buffered by a minimum of 20 m to maintain site integrity and allow future research to continue.

The results of research suggest that Bunchgrass Meadow was largely open with only a few scattered trees at the turn of the 20th century. Subsequent conifer invasion occurred over many decades with two distinct pulses in establishment. Several factors likely contributed to the invasion of this meadow by lodgepole pine and then grand fir. Once established, conifers changed the microsite conditions of the meadow, both above ground through shading and below ground by changing soil chemistry and mycorrhizal fungi. This facilitated the establishment of conifers while inhibiting the growth and establishment of meadow species. Even when the canopy was removed, meadow species did not readily recolonize formerly forested areas. This was likely a result of changed soil conditions and a lack of viable meadow species seed in the seed bank. As forest encroachment progressed, the re-introduction of meadow species became more difficult. These research results at the Bunchgrass site show that active meadow management is a high priority if we want to maintain these open and diverse habitats.

We propose removing all trees under 30 inches DBH, and retain up to 10 trees per 5 acres above 30 inches DBH in selected treatment areas for a total of 150 acres (Table 7). Priority areas are those that are currently open, which contain the most meadow forb species, as well as around the edges of those areas. We propose an emphasis on creating a corridor no less than 100 feet wide connecting meadows for seed dispersal and pollinator access (15 acres).

We considered the use of prescribed fire treatments only, but the abundance of large tree encroachment coupled with the results of long-term research at this site do not support this proposed management. Plots where prescribed fire was introduced did not show an increase in expected meadow species diversity, and in some areas plant diversity even decreased. Several factors including a lack of meadow species in the seed bank, dispersal limitations, and soil conditions that inhibit the germination or establishment of meadow species, could influence the loss of meadow species. Thus, we propose to include post-implementation seeding as part of the project, using seed collected from meadow species established in remnant patches within Bunchgrass Meadow (avoiding seed collection in research plots) and nearby meadows.

In order to minimize ground disturbance, the proposed harvest of encroaching conifers would occur with logging equipment on snow or with helicopters.

Pre- and post-treatment surveys would include sampling botanical species along transects that include each treatment area, as well as installing treatment and control plots for seeding trials to evaluate establishment limitations with regards to seed bank and seed dispersal. Weed surveys would also occur across the entire area. Weed treatments to maintain native vegetation would be conducted annually as funding allows.

Table 51. Conditions and Buffers for Special Habitats in the Flat Country Units

Unit	Special Habitat	Conditions and/or Buffer
360	Talus slope	Area to Protect: Avoid direct impact to habitat, directional felling away from talus, no skidding heavy equipment or roads through habitat, no buffer recommendation
1140, 1710, 1780	Dry meadow	Area To Protect: Avoid direct impact to habitat, directional felling away from meadow, no skidding heavy equipment or roads through habitat, no buffer recommendation
1160, 1170, 1180, 1190	Dry meadow (Bunchgrass meadow)	Enhancement unit with proposed enhancement activities (see Table 7)
1080, 1770	Mesic meadow	Area to Protect: 100 foot no-cut, no-impact buffer
490, 1030,1040, 1250,1270,1280, 1290, 1300, 1810, 1830	Sedge meadow, wet meadow, wetland	Area to Protect: 150 foot no-cut, no-impact buffer
490, 1980	Pond	Area to Protect: 180 foot no-cut, no-impact buffer

3.6.6 Environmental Consequences – Special Habitats

Direct and Indirect Effects

Alternative 1 – No Action

There would be minimal direct or indirect effects to special habitats under the No Action alternative. Trees in, or surrounding the special habitats would 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 would likely continue to spread, altering the plant composition of those sites. Meadow habitats that have been encroached by conifers would continue to shrink and meadow plant communities would continue to be replaced with forest species. 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. Fingerboard prairie is another special habitat in the planning area that was historically a wet meadow. Road construction and channelization has altered the hydrology of the wet meadow essentially dewatering areas that are now being colonized by trees and dry meadow species.

Alternative 2 – Proposed Action

Special habitats are generally protected from physical disturbance in all action alternatives. Many special habitats were removed from harvest unit acres but some special habitats were surveyed in harvest units. Rock outcrops, talus slopes, and dry meadows would be considered as areas to protect (ATP) to protect these special habitats from physical disturbance avoiding direct impact to habitat, directional felling away from habitat, no skidding heavy equipment or creating roads through habitat, but do not require a no harvest buffer because they are already open habitats. No-cut no-treatment buffers, when prescribed, should be sufficient to protect the microclimate and prevent invasive weed introduction. Unit 360 has talus slope and rocky outcrop habitat (1.5 acres), with trees approximately 42 years old and would be designated as an ATP. Unit 1140 is stand of approximately 138 years old and has two dry meadows within its boundary and would be buffered from direct impacts from harvest activities by felling trees outside the meadow habitat and avoiding any ground disturbing activity within the meadows.

Unit 1770 has over 22 acres of mapped mesic meadow within the 108 year old harvest unit which would be buffered by 100 feet from any ground disturbing activity including tree felling, skidding, landings, temp road construction or prescribed fire. On rare occasion and under special circumstances where yarding activities necessary to treat the stand must go through a small section of the buffer such activities would be considered on a case by case basis. Unit 1280 has a sedge meadow in the center of a 120 year old stand which is already buffered out of the harvest unit boundary. There would be a 100 foot no cut, no ground disturbing activities for this special habitat.

Several of the special habitats in plantations have invasive species in them, including Bunchgrass Meadow and some control measures would be taken with the action alternatives to minimize the introduction and spread of non-native invasive plants into these special habitats. 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 would have no effect on special habitats.

Alternative 3

There would be no direct effects under this alternative because special habitats are buffered or designated as “Areas to Protect”. Less active management would occur in special habitats under Alternative 3 because enhancement units in Bunchgrass meadow would not be treated. 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 would be no cumulative effects under the No Action alternative.

Alternatives 2 and 3

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.

3.6.7 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 Flat Country planning area contains ample infestations of invasive weed species. By far the most problematic are false brome (*Brachypodium sylvaticum*), spotted knapweed (*Centaurea maculosa*), Scotch broom (*Cytisus scoparius*), non-native blackberries (*Rubus armenicus* and *R. discolor*), and tansy ragwort (*Senecio jacobaea*) all of which are found in multiple Flat Country units, proposed landings and along roads accessing those units as well as in roads slated to be closed or decommissioned and in proposed roadside hazardous fuels treatments (Table 52). Other non-native weeds that occur to a lesser extent are Herb Robert (*Geranium robertianum*), Deptford pink (*Dianthus ameria*), common mullein (*Verbascum thapsis*), curly dock (*Rumex crispus*) and bind weed (*Convulvus arvensis*).

Established weeds common in the Flat Country planning area are oxeye daisy, St. John's-wort, Canada thistle, and bull thistle. Direct control efforts are not practical due to their widespread occurrence along the road system.

Harvest units and associated landings, enhancement units, decommissioned roads, temp road construction and roadside hazardous fuel treatments that have existing weed infestations are listed in Table 52 below. High priority weed infestations would be pre-treated before ground disturbing activities begin.

Table 52. High Priority Non-Native Invasive Plant Infestations in Proposed Harvest Units and Roadside Hazardous Fuels Treatments

Invasive Plant Species	Harvest Unit #	Roads to be Decommissioned	Proposed Temp Roads (unit# or FID)	Roadside Hazardous Fuels Treatments
Blackberry (Armenian and cutleaf)	460, 2160	none	none	by units 460, 2112,
False brome	10, 160, 250, 260, 300, 350, 360, 1260, 1340, 1360, 1810, **1910, 1920**, 1970, 1980, 2130	4200, 4200-(220, 222, 249, 253, 723), 2647-515, 2653-709, 2657-(805,900),	Unit 350, FID 87, 132	by units 260, 1810,1910,1920, 1970, 1980, and along Rd 242,
Knapweeds (spotted and diffuse)	10, 360, 1170, 1280,1330, 1980, 2130	2600-(550, 702, 719, 728, 736, 748,752) 2657-814, 900) 4200	none	By Unit 2130
Scotch broom	70, 300, 350, 1070, 1170, **1320**	2647-517, 2649-625, 2653-(709, 806)	Units 1070, 1120, 1320	By units 1310, 1340, 1710, 1970, 1030, 1340, 1970 and between units 1220 and 1110
Tansy ragwort	70, 80, 90, 460,1090, 1110, 1330, 1340, 1360, 1550, 1670, 1960, 1970, 1980, **2111**, **2112**, 2120, **2180**	2657-(815, 821)	Unit 1060 FID 125, 137	By units 90, 460,1330, 1980, 1970, 1110, 1340, 1550

***Bolded** units have associated landings on existing high priority weed infestations

3.6.8 Environmental Consequences – Invasive Plants

Direct and Indirect Effects

Alternative 1 – No Action

The No Action alternative has the least risk of spreading invasive plants. 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 unless there is a wildfire in which case the rate of introduction and spread would increase. Traffic from logging on private timberland, recreationalists and Forest Service personnel would continue to spread weeds along roads and in dispersed recreation sites.

Alternatives 2, and 3

Invasive weeds are expected to spread under the action alternatives due to the increased light and the ground disturbance created by regeneration harvest, thinning, gap creation, fuels reduction, quarry expansion, temporary road construction, road decommissioning 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 53 outlines the proposed activities by alternative and rates their risk level with regard to weed introduction and establishment based on the estimated amount of bare ground created by the proposed activity, proximity to current infestations, species of invasive plant, and mode of dispersal.

Table 53. Risk of Invasive Weed Introduction and Establishment by Alternative

Silvicultural Activities	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Thin leaving 40% canopy cover (variable density) including Riparian Reserves	Acres	0	1,936	946
Shelterwood with Reserves	Acres	0	961	0
Dominant tree release	Acres	0	119	50
Gaps	Acres	0	323	133
Skips	Acres	0	1,099	173
Total acres of silvicultural activities	Acres	0	4,438	2,604
Risk from all silvicultural activities	Rating	Low	High	Medium-High
Other Project Activities	**Unit of Measure**	**Alternative 1**	**Alternative 2**	**Alternative 3**
Ground-based yarding	Acres	0	1,769	635
Skyline yarding with one-end suspension	Acres	0	1,553	487
Helicopter	Acres	0	17	7
Total number of landings created and re-habilitated	Number of landings	0	224	132
Length of haul routes maintained	Miles	0	108	56.2
New temporary road construction	Miles	0	15.5	6.7
Road storage	Miles	0	4.7	4.7
Road decommissioning	Miles	0	15.0	15.0
Pile burn (grapple and hand)	Acres	0	1,318	811
Post-harvest Underburn	Acres	0	2,021	318
Roadside hazardous fuels treatments	Acres	0	2,305	2,597
Rock obtained from existing quarries	Cubic Yards	0	20,000	20,000
Stream Culvert replacement	Each	0	66	35
Non-commercial treatments (bunchgrass)	Acres	0	149	0
Risk from all non-silvicultural project activities	Rating	Low	High	Medium-High
Combined risk from all project activities	**Rating**	**Low**	**High**	**Medium-High**

Alternatives 2 and 3 rate very similarly with Alternative 2, having a higher risk because of the higher number of acres of ground disturbing activities such as more acres of harvest units, more gap and shelterwood acres, more post-harvest fire, and more non-commercial acres treated. Many 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. There are two quarries designated at material sources for Flat Country, both of which have had infestations of Scotch broom, spotted knapweed and other noxious weed species. There is likely a considerable seed bank of these species in and around the quarry, particularly Chinook quarry that would contaminate the rock source. All existing infestations have been and would continue to be treated before expansion activities occur, and specific design features are in place to avoid disturbing existing seed banks and removing gravel from weed free areas of the quarries. Alternative 2 has 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 medium-high 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.

Cumulative Effects

Alternative 1 – No Action

There are no cumulative effects for Alternative 1 – No Action.

Alternatives 2 and 3-Action Alternatives

The area analyzed for cumulative effects is the Flat Country project area and the road system accessing the project 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, wildfires and recreation use have resulted in numerous weed sites. This project would construct up to 15.5 miles of new temporary roads, and thin or otherwise treat up to 4,438 acres. Pre-treatment and post- harvest monitoring and control measures in project design features would reduce these cumulative effects. The identification of project Design features is also consistent with the Region 6 Invasive Plant EIS/ROD (2005) and the Willamette National Forest Integrated Weed Management EA (2007).

3.7 Heritage

3.7.1 Summary of Effects

No effects are expected for activities associated with Alternate 1, 2 and 3. Areas previously identified as culturally sensitive, and areas identified during surveys as culturally sensitive have been avoided by either dropping the proposed unit or redesigning the unit boundary. Additionally, any sites uncovered during project implementation are covered by Project Design features listed in Chapter 2 Table 8.

3.7.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Heritage Resources within the Flat Country project includes the timber units proposed for treatment, new temporary road construction and reconstruction, harvest landings, post-harvest fuel treatments and meadow enhancement. All of these ground disturbing activities have the potential to affect the integrity of cultural resources. An archaeological survey of Flat Country project was conducted over three field seasons to comply with Section 106 of the National Historic Preservation Act (NHPA) and other relevant laws and regulations. A systematic surface pedestrian search is the principal manner for implementing the mandated goals.

3.7.3 Assessment Methodology

The field survey of Flat Country project area was performed by eight crew members, utilized on different days, during spring and summer 2016, 2017 and 2018. Pedestrian transects spaced at intervals of 20 meters or less followed a specific orientation based on factors that included the shapes of units and landforms and the possible presence of historic, Indian or Euro-American travel routes. Archeological survey followed the approved Willamette NF Cultural Resources Inventory Plan (CRIP).A total of 3654 acres were surveyed.

3.7.4 Affected Environment

There are 48 recorded cultural sites within the Flat Country project that are considered eligible or potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine their eligibility to the NRHP.

Cultural History

Ethnographic research indicates that highly mobile prehistoric and early historic Indian groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purposes of seasonal hunting, fishing, and plant gathering. Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be composed of montane-based bands who were living in the western Oregon Cascades during the historic period.

Most of what is known of the Molala comes from two of the three subgroups into which they are generally split: the Northern Molala located in the vicinity of Mount Hood’s drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of the third group, referred to as the Upper Santiam/Santiam band of Molala, who are thought to have inhabited Linn and Lane counties in the areas between the northern and southern groups. The Molala are also often culturally grouped with the Kalapuya who were based in the Willamette Valley, but probably made seasonal forays to the Cascades for large game and berries.

The first recorded contact between the Indians and European trappers and settlers came in 1812 when members of the Pacific Fur Company under the leadership of Donald McKenzie (for whom the river and valley are named) entered the area (Williams 1988). Unfortunately, Indian contact with trappers, missionaries, military expeditions and settlers also brought them into contact with European diseases such as smallpox and influenza, which decimated their populations.

By the mid -1800s many of the remaining Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molala Treaties of 1855. Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath Reservation to the south and to the Warm Springs Reservation in eastern Oregon where they were absorbed into the Confederated Tribes of Warm Springs.

Pre-contact Indian use in the area is reflected in the cultural material they left behind including chipped obsidian lithic scatters and obsidian lithic isolates, representing tool use, modification, or manufacture related to hunting and gathering.

The McKenzie Highway constructed in 1917 provides visitors outstanding scenic views and roadside geologic attractions. This highway is listed in the National Register of Historic Places for its historic association with early transportation in Oregon as the primary motor route over the middle Cascade Mountains. The McKenzie Highway has long been considered one of the most scenic routes for recreationists in the Pacific Northwest. Oregon 242 provides visitors with natural scenic vistas and impressive views of volcanic activity (Chapman 2009).

Historic trails and roads within the project area functioned as a part of the administrative and communication network in the early days of the Forest Service. During the Civilian Conservation Corps (CCC) era from 1933-1942, a workforce composed of young men maintained miles of trails that linked to lookouts and guard stations throughout the district.

The Clear Lake Road was constructed up the McKenzie River canyon from Belknap to Clear Lake in the 1930s by the CCC and then later connected to Santiam Pass and became the route of the modern McKenzie River Highway (Highway 126). It was one of the first major projects of the CCC at Camp Belknap (now the FS McKenzie River Ranger Station) and was the first road route north of the McKenzie Pass Road, connecting north via the McKenzie River canyon to Clear Lake, Fish Lake, and on to the Santiam Wagon Road route that crossed Santiam Pass. Portions of the through road route were realigned when Highway 126 was built (approx. 1953-1962) and segments bypassed by the new highway continued in use as Forest Service (FS) roads or were abandoned.

3.7.5 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Implementation of the no action alternative would have no direct or indirect effect on cultural resources since there would be no change to the integrity of cultural resource sites.

Alternative 2

Implementation of Alternative 2 would result in ground disturbance on 108 miles of road maintenance on haul routes, 15.5 miles of new temporary road construction, 4.7 miles of road storage, and 15.0 miles of road decommissioning. Ground disturbance can affect the surface and subsurface integrity of an archaeological site and thus its significance to the National Register of Historic Places. A total of 3339 acres are proposed for timber harvest, including 1936 acres of thinning, 323 acres for gaps, 119 acres of dominate tree release (DTR) gaps, and 961 acres of Shelterwood Cuts with reserves. A total of 1769 acres would be ground based yarding, 1553 acres would be skyline yarding, and 17 acres would be helicopter yarding. Throughout the project area, a total of 271 ground and skyline landings are proposed, and 22 helicopter landings are proposed. Post-harvest activities include 2021 acres of underburning slash and 1318 acres of pile and burn slash with harvest units and 2305 acres roadside hazardous fuels treatments.

Appropriate and approved surveys and cultural site protection measures are listed in the Project Design features Table 8 in Chapter 2. Therefore, the potential direct and indirect effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of cultural resources which were not discovered during survey. Any inadvertent discoveries of cultural resources during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the district archaeologist notified to evaluate the discovery and recommend subsequent courses of action. This action is included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during ground disturbing operations.

Alternative 3

Implementation of alternative 3 would have no direct or indirect effect on cultural resources since there would be no change to the integrity of cultural resource sites. However, alternative 3 would have a reduced footprint on the landscape and help protect any undiscovered cultural sites that were not found during the survey for Flat Country.

Appropriate and approved surveys and cultural site protection measures are listed in the Project Design features Table 8 in Chapter 2. Therefore, the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the district archaeologist notified to evaluate the discovery and recommend subsequent courses of action. This action is included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during ground disturbing operations.

Cumulative Effects

Alternatives 2 and 3

Based on a review of the past, present, and foreseeable projects listed in Appendix F, none overlap in time and space that would cause cumulative effects to the known cultural sites from any of the proposed actions under the Flat Country Project. Appropriate and approved surveys and cultural site protection measures are already in place for this project in the Project Design features Table 8, Chapter 2.

3.8 Roads and Access

3.8.1 Summary of Effects

The Flat Country project area includes 223 miles of roads of which, 192.3 are Forest Service system roads. Alternative 2 would have approximately 15.5 miles or Alternative 3 would have approximately 6.7 miles of temporary roads built within the project area to support timber haul. Implementation of either alternatives 2 or 3 would result in a temporary increase of potential sediment delivery due to additional miles of temporary road use, road maintenance activities and increased traffic accessing the treatment stands. Temporary roads would be decommissioned once activities are completed and would not change road miles or access in the long term.

The Interdisciplinary Team (IDT) used recommendations from the Willamette Roads Investment Strategy (2015) as a starting point for establishment of the Minimum Sustainable Road System (MRS) needed for safe and efficient travel and for administration, utilization and protection of National Forest System lands. Alternatives 2 and 3 would implement approximately 19.7 miles of system road closures or decommissioning within the project area to implement the MRS. The proposed road closures 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..

3.8.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the overall Flat Country project area.

3.8.3 Affected Environment

The Forest Road system consists of approximately 41.8 miles of collector roads and 150.5 miles of local roads. Additionally, there are 30.2 miles of State Highway and 0.4 miles of County road. There are no privately-owned roads within the project area boundary.

Past management activities in and near the Flat Country project area have provided the current network of Forest Roads, mainly from timber sales. The current system of roads provides access to the area for administration, fire protection, public recreation, and forest product utilization. Approximately 162.8 miles are surfaced with crushed aggregate, 2.0 miles are surfaced with improved native material, and 27.5 miles are native surfaced. Approximately 70.3 miles of road within the project area are currently open to mixed motorized use. (MVUM 2017).

Oregon State Highway 126 is the primary transportation corridor serving the project area. Roads 2647 (Cupola), 2649 (Scott CR.), 2653 (Boulder CR.), 2657 (Olallie CR.) and 2664 (Robinson Lake) are classified as collector roads and provide the primary access to Oregon State Highway 126. These roads serve as major routes for fire and public access, silvicultural operations and haul routes for any commodity extraction activities along with important recreational access, for hunting, scenic driving, and dispersed recreation.

There are currently 122.4 miles of forest system roads in the project area that are closed. These roads are closed by means of gates, berms, or other physical barriers implemented through road management, or naturally by vegetative growth or blown down timber, or by administrative order. There are approximately 1.8 miles of roads in the project area that have been decommissioned.

The current road system allows the Forest Service administrative access to conduct a wide variety of forest management and fire protection activities in the area. Specifically, the forest roads provide access to developed Forest Service campgrounds, developed rock quarries, seed orchards, numerous trailheads, lakes, and various dispersed camping sites. These roads also allow access for firewood and special forest products gathering.

The road system receives maintenance in accordance with established road management objectives. Over the last decade or more, 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 primary and secondary roads in the project area. Under Alternatives 2 and 3, there are drainage improvements, including replacing poorly functioning culverts, which would be implemented prior to commercial haul, to protect water quality. Additional deferred maintenance is expected in the future unless maintenance budget funding is improved.

3.8.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1

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. Brush and tree re-growth and associated reduced visibility, debris on road, and surface irregularities from OHV and other traffic could eventually result in 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 fallen trees or brush encroachment. Culverts that are not maintained because of impassible roads may plug and cause washouts with sediment reaching into major drainages.

Alternative 2 and Alternative 3

Road maintenance would occur on 108.2 miles of road with Alternative 2 or 56.2 miles with Alternative 3. Road maintenance would protect the existing road infrastructure, improve safety of the road, and decrease sedimentation on roads used for project implementation. Road maintenance may include roadside brushing, road surface repair and blading, ditch and culvert drainage maintenance, culvert replacement, surface rocking, and the installation of drainage dips and water bars which would result in the proper drainage and safe use of the roads (see Design features Table 8 in chapter 2). Roadside brushing would increase sight distance and increase visibility for safer driving. There are miscellaneous segments of low standard road identified as potential haul routes throughout the project area that would require minor road width adjustments and road surface rehabilitation to support commercial haul.

Maintenance proposed with Alternatives 2 and 3 may cause a temporary increase in sedimentation while the road maintenance work is being done (prior to treatments and associated road use) but would decrease the volume and velocity of water that carries sediments off roads afterwards. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts may increase sediment production until road surfaces and slopes stabilize, typically within approximately one to two seasons. Attention would be paid during road maintenance activities to minimize potential delivery to adjacent streams and Best Management Practices (BMPs) would be applied to prevent sedimentation to the greatest extent. Designated water sources for filling water tankers for surface blading, compaction and dust abatement operations would follow project design features and other relevant BMP's.

Alternative 2 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 108.2 miles of road or approximately 56 percent of the Forest Service road system within the project area. Alternative 3 would provide necessary road maintenance on haul routes and roads used for other treatment activities. The maintenance performed would reverse the trend of declining road conditions across an estimated 56.2 miles of road or approximately 29 percent of the project area's road system. Alternative 3 would maintain less miles of road than Alternative 2 because it would have less haul routes associated with these activities. The use of fewer roads in the project area would continue the backlog of needed road maintenance activities. The miles of road open to public access in both alternatives would be reduced. Maintenance activities would cause some short-term delays or detours for road users while roadwork is being performed. All OHV use on roads currently open to mixed use would be restricted while treatment activities are taking place.

Alternative 2 would have approximately 15.5 miles and Alternative 3 would have approximately 6.7 miles of temporary roads built within the project area. Implementation of either action Alternative 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 blocked, decommissioned and hydrologically stabilized once activities are completed and would not change road miles or access in the long term.

Portions of the original road system were constructed to accommodate large yarding towers that were used to log large tracts of land. Current thinning activity usually utilizes small, mobile, road-based yarders. Temporary spur road construction needed to reach harvest units by smaller yarders has been kept to a minimum in both action Alternatives, utilizing the existing transportation system, skid trails and previously disturbed areas wherever possible. New temporary roads would typically be located to use gentle slopes and minimize soil disturbance wherever possible.

All currently closed system roads that would be re-opened and utilized for timber haul (approximately 13.2 miles in Alternative 2 and 2.9 miles in Alternative 3) would have maintenance performed prior to any haul. Upon the completion of project activities, these roads would then be physically blocked to traffic. All roads treated would be left in a hydrologically stable condition to drain properly and protect water quality. Future road maintenance costs would be reduced because roads would be re-closed to traffic and left with self-maintaining water drainage features.

Results of the forest level Travel Analysis Process (TAP), also known as the Willamette National Forest Road Investment Strategy (RIS; FS 2015) were analyzed at the project scale using field assessment and district roads analysis. The district inter-disciplinary team (IDT) went road by road looking at roads labeled “likely not needed for future use” and “analyze for closure” to determine whether the forest level recommendations were appropriate at the project scale. The road by road analysis table (available in the project file) lists all the system roads that were reviewed within the project area, comments from the various IDT resources, and recommendations. The conclusions of the road by road analysis are as follows:

- As recommended by the RIS, 41.8 miles of road were analyzed for decommissioning; 14.09 of those miles were approved for decommissioning by the District Ranger and IDT.
- As recommended by the RIS, 7.17 miles of road were analyzed for closure; 4.7 of those miles were approved for closure by the District Ranger and IDT.

Once signed, this decision designates the Minimum Road System (MRS) needed for public and administrative use within the Flat Country project area.

Both action Alternatives 2 and 3 would implement approximately 19.7 miles of system road closures or decommissioning within the project area as part of this decision that would implement the MRS (Figures 32-34 and Appendix D). These roads would be closed through placement of various types of barriers. Roads identified for storage treatments 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 and reduction of fill depth for culverts in deep fill locations. Stored roads would include minimal disturbance to the roadbed because they may need to 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 previous treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope re-contouring, and sub-soiling. System roads are decommissioned when it is has been determined they are no longer needed to provide access for management activities, these roads are removed from the road system. Roads currently closed by gates would continue to maintain administrative access.

The proposed road closures 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 closed 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 roads for fires suppression would take additional time and equipment. Table 54 shows the proposed road activities associated with harvest and the miles for each alternative.

Table 54. Proposed Road Activities Associated with Harvest

Activities	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
New Road Construction	Miles	0	0	0
Temporary Road Construction	Miles	0	15.5	6.7
Roads Maintained	Miles	0	108.2	56.2
Road Decommissioning	Miles	0	14.8	14.
Road Storage	Miles	0	4.7	4.7
Rock obtained from expanding existing quarries	Cubic Yards	0	20,000	20,000

Cumulative Effects

Alternative 1

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. Combined past, present and reasonably foreseeable effects to the road system would cause a trend of decreased access as roads self-close and effects to aquatic resources would continue.

Alternatives 2 and 3

Past management actions have created 192.3 miles of Forest Service road system within the project area that require continuing road maintenance to provide adequate safe use and resource protection. Past budgets have resulted in maintenance rates that have led to a decline in road conditions across the project area. Alternatives 2 and 3 would provide necessary road maintenance on the haul routes and roads used for other treatment activities. Road maintenance and road closure treatments proposed under these alternatives, would continue to improve the road system by reducing sedimentation increasing safety and reducing future maintenance costs. Road storage and decommissioning would provide fewer roads for public and administrative vehicle access for recreation, reforestation and fire access. Project activities, when analyzed with past, present and reasonably foreseeable activities, would contribute to a trend of improved conditions for aquatic resources while reducing public access in some locations.

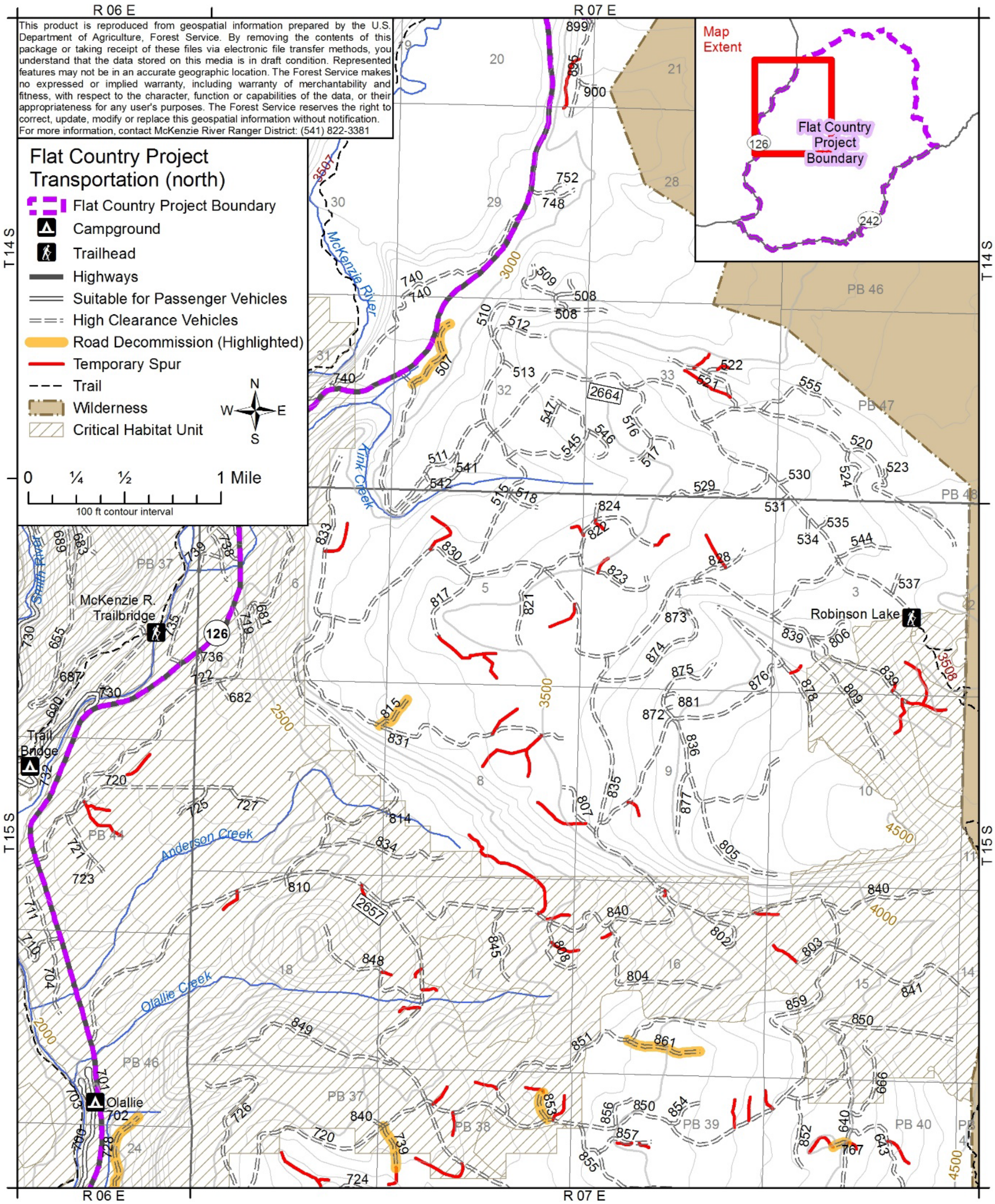

Figure 32. Map of Proposed Road Activities Associated with Harvest (North)

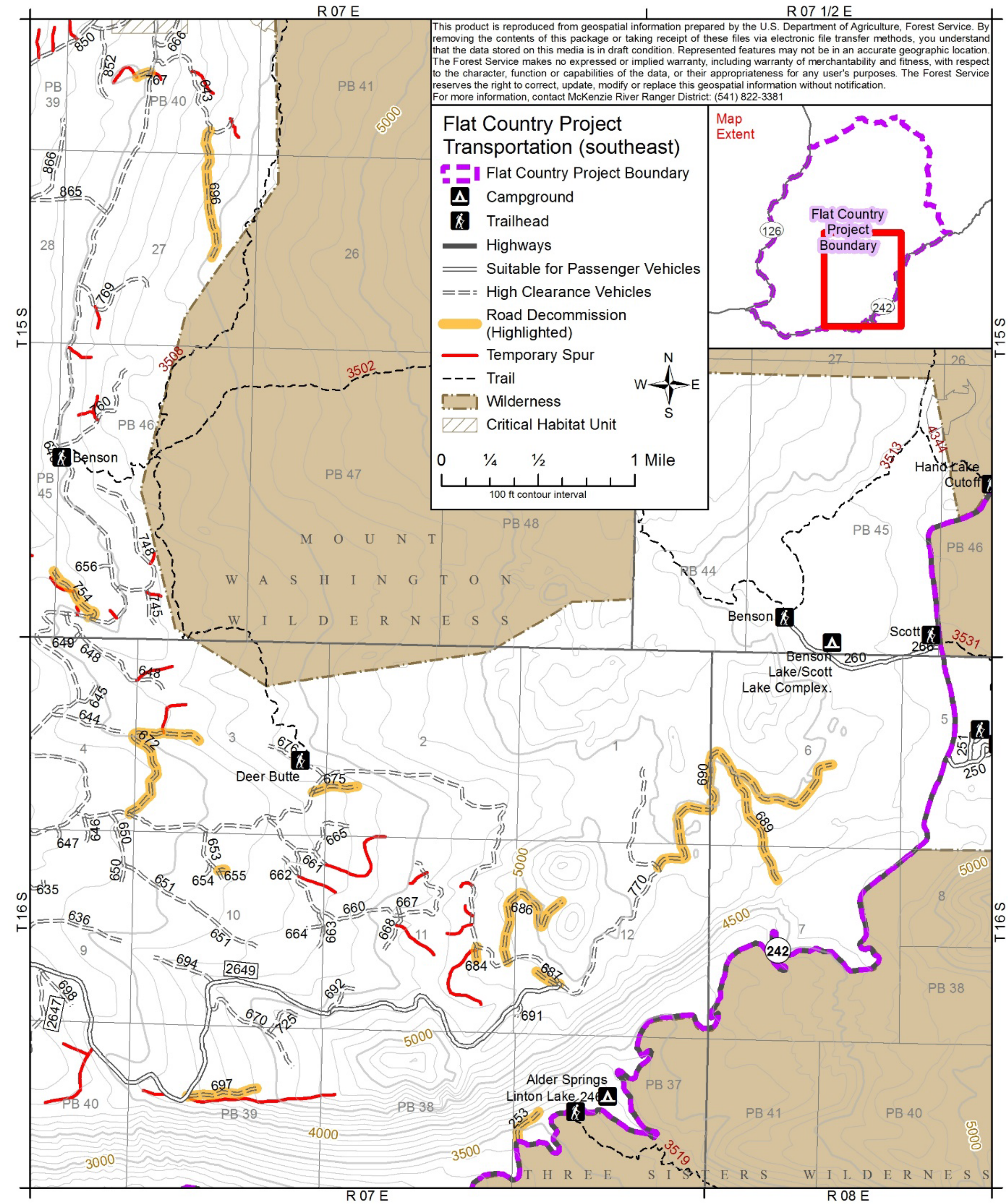

Figure 33. Map of Proposed Road Activities Associated with Harvest (Southeast)

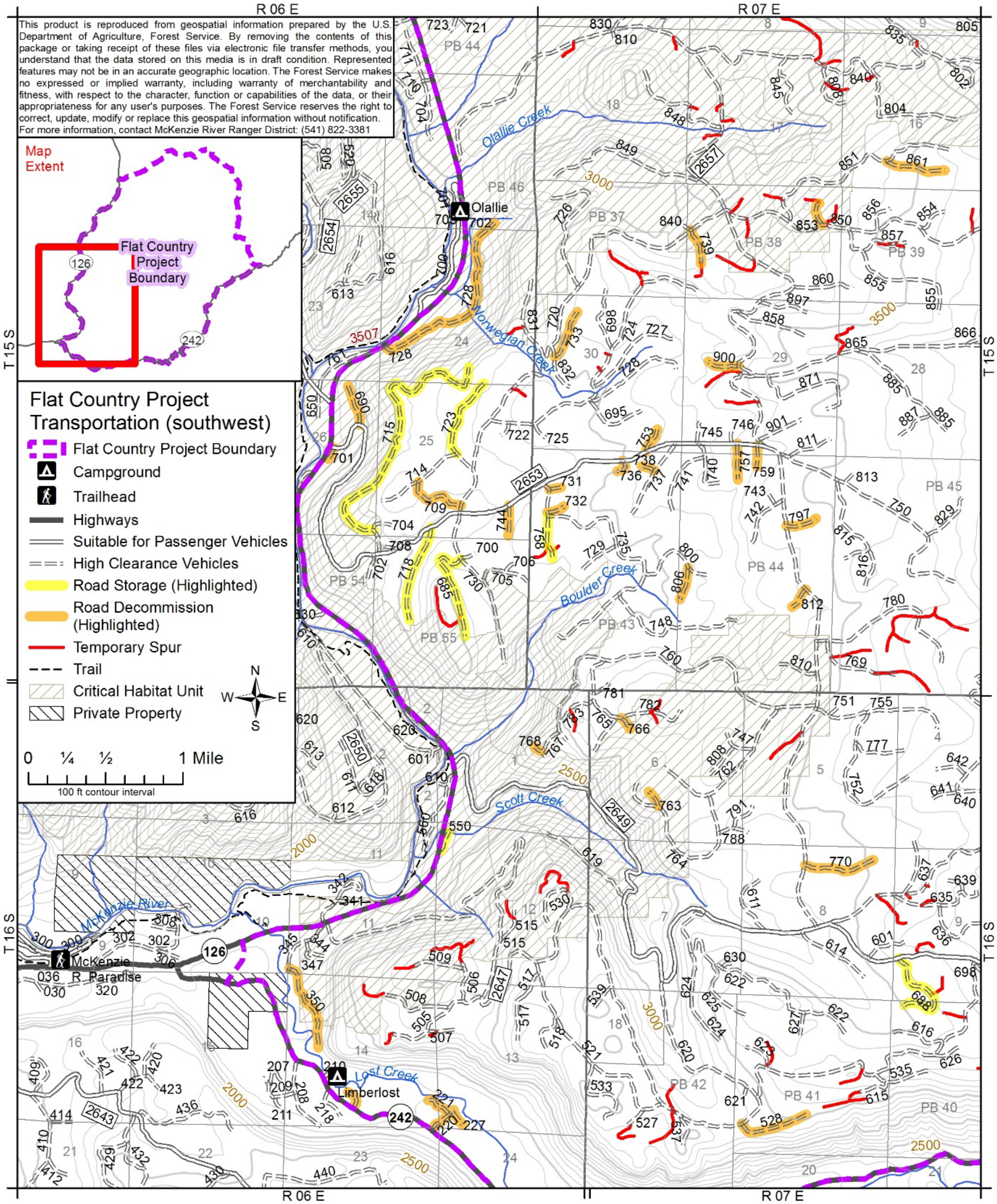

Figure 34. Map of Proposed Road Activities Associated with Harvest (Southwest)

3.9 Recreation

3.9.1 Summary of Effects

Alternative 2 would have limited short term effects on recreational travel and associated access to recreation resources within the project area. Timber harvesting, log hauling, fuel treatment, and road decommissioning may cause short-term disruption at Camp Melakwa, Robinson Lake trailhead, Tenas Lakes trailhead, Fingerboard prairie trailhead, and dispersed recreation sites. Expected effects are disruptions to recreational visitors traveling along the Forest Service road system in or near the project area and some effects to general dispersed recreation. Beneficial effects to recreational driving and dispersed recreational use are likely to occur in the medium to long term due to maintenance of secondary roads and improved driving conditions. Alternative 1 would have no direct, indirect or cumulative adverse effects on Recreation resources.

3.9.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to recreation resources is the Flat Country project area.

3.9.3 Affected Environment

The Flat Country project area within the McKenzie River Ranger District has four trailheads, three trail segments, one campground, and a Boy Scouts of America camp under special use permit:

- Robinson Lake Trailhead
- Tenas Lakes Trailhead
- Fingerboard Prairie Trailhead
- Benson Trailhead
- Benson/Tenas Trailhead
- Scott Lake Campground
- Deer Butte Trail (#3508)
- Benson Lake Trail (#3502)
- Hand Lake Trail (#3502)
- Boy Scouts of America, Camp Melakwa

During the summer months, recreation use of FSRD 2664 and 2649 significantly increases due to the summer operation of Camp Melakwa and access to the trailheads listed above. Outside of these facilities, there is limited to low use of the dispersed recreation use during the spring, summer, and fall. Dispersed camping, scenic driving, and hunting are the primary activities with concentrations of sites around Fingerboard Prairie Springs, Irish Lake, Deer Butte, and many other locations.

Several Forest Service Roads within the Flat Country project area provide connectivity between Highway 126 and the recreation resources available in the project area, and are used for recreation access, dispersed camping, dispersed day use recreation, and hunting. These roads include: 2664, 2653, 2649, 2657, 640, 830, 835, and 840.

3.9.4 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. The full suite of ROS classifications is included within the project area. Management activities within the project area have been tiered to the management, enhancement, and fuel treatments to closely align with the standards and objectives described in the forest plan. Project design features have been crafted to ensure compatibility with the corresponding ROS class and the desired conditions in terms of setting and recreational activities (Table 55).

Table 55. Acres of Treatment and Desired Conditions by Recreational Opportunity Spectrum Class

<table>
<tr><th>ROS Class</th><th>Treatment Type</th><th>Treatment Acres</th><th>Desired Condition for Setting</th><th>Desired Condition for Recreational Activities</th></tr>
<tr><td>Roaded Modified (14a)</td><td>Management</td><td>4,300</td><td rowspan="3">Opportunity to get away from others, but with easy access

Environment would appear substantially modified

Access and travel is conventional motorized vehicle

Shape and blend vegetation alterations, foreground should be natural appearing</td><td rowspan="3">Access for people with disabilities is a moderate challenge

Rustic facilities provide some comfort and site protection

Moderate site modification can occur</td></tr>
<tr><td>Roaded Modified (14a)</td><td>Enhancement</td><td>123</td></tr>
<tr><td>Roaded Modified (14a)</td><td>Fuels</td><td>1,984</td></tr>
<tr><td>Roaded Natural (11c)</td><td>Management</td><td>114</td><td rowspan="2">Opportunity to affiliate with others but with some chance for privacy

Some obvious control of users

Mostly natural appearing setting
Vegetation modification done to maintain desired visual characteristics</td><td rowspan="2">Access for people with disabilities is difficult

No on-site facilities except occasional signing site modification by users</td></tr>
<tr><td>Roaded Natural (11f)</td><td>Management</td><td>20</td></tr>
<tr><td>Semi-Primitive Motorized (10b)</td><td>Management</td><td>9.2</td><td rowspan="2">Visitors can experience a moderate degree of isolation from the sights and sounds of human activity

Area may show evidence of subtle modifications of the natural landscape and would not draw the attention of most visitors.</td><td rowspan="2">Both motorized and nonmotorized recreation may occur

Access to and within the area would be provided by trails and roads

Facilities would be limited and used to protect fragile</td></tr>
<tr><td>Semi-Primitive Motorized (10c)</td><td>Fuels</td><td>85</td></tr>
</table>

ROS Class	Treatment Type	Treatment Acres	Desired Condition for Setting	Desired Condition for Recreational Activities
			The area would be managed to minimize the presence of on-site controls and use restrictions	resources. Facilities would be simple in design and constructed to blend with the natural surroundings
Semi-Primitive Nonmotorized (10e)	Fuels	70	Visitors can experience a high degree of isolation from sights and sounds of human activity Area may show evidence of subtle modifications of the natural landscape and would not draw the attention of most visitors. The area would be managed to minimize the presence of on-site controls and use restrictions	Activities associated with this area are exclusively non-motorized in nature Access within and through the area would be limited to trails and exiting roads Facilities would be limited to trail shelters, meet sanitary needs, safety needs, or protect fragile resources.

3.9.5 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 adverse effects on recreation within the project area. Beneficial effects to scenic driving and dispersed use that are likely to occur in Alternative 2 due to maintenance of secondary roads and improved driving conditions would not be realized in Alternative 1.

Alternatives 2 and 3

Short term effects of proposed timber harvesting, log truck hauling, fuel treatments, and road decommissioning would include localized road delays and possible closures limiting access and causing some disruption to recreational visitors to the forest. Logging activity, hauling, and fuel treatments would likely cause temporary noise and dust or smoke disturbances in some instances.

Harvest activities may create limited disruptions to hunters in areas where harvest units are located during hunting season. Truck traffic associated with harvest activity may affect hunters accessing areas on the National Forest within the project area.

All activities proposed in the Flat Country project are consistent with the requirements for existing ROS classes within the project area. The desired condition for the setting and activities in all the ROS classifications within the project area would be 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.

Alternative 2 (Preferred Action) &3

The Flat Country Project would not add cumulatively to effects to recreation in the Flat Country project area because there would be no long term adverse effects to recreation as a result of project implementation.

3.10 Scenic Quality

3.10.1 Summary of Effects

Alternative 2 (preferred action) would have no adverse effect on scenic resources because all harvest related activities would be consistent with forest plan standards and guidelines for scenery management. Short term effects to visual quality would be limited to exposed stumps from harvested trees, less dense forested stands (increased depth of view), slash or underburned areas, and possible dust from transporting forest products on unpaved forest roads.

3.10.2 Affected Environment

The geographic scale used to assess direct, indirect and cumulative effects for scenic quality was the Flat Country project area. There are numerous forest system roads within the project area that are not considered important, visually sensitive travel corridors. There are no developed recreation facilities or other important viewpoints within the project area. Past and present natural and human caused disturbances or modifications (including fire, disease, timber harvest, fire suppression and roads) are visible throughout the project area.

3.10.3 Methodology

The analysis method used to evaluate the effects of the proposed action on scenery were based on a review of the Forest Plan for consistency with standards and guidelines applicable to the management areas and related visual quality objectives (VQO) where timber harvest is proposed by the Flat Country Project.

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 travel-ways 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 (clearcuts). This inherent assumption in the methodology adds complexity to using the system when interpreting and evaluating modern commercial thinning treatments.

VQOs for the Flat Country project area include retention, partial retention, and maximum modification (USDA Forest Service, 1990).

Scenery Management System (SMS)

The Scenery Management System (SMS) is a methodology 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.

3.10.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No stand treatments would occur with the implementation of alternative 1 so there would be no direct, indirect or cumulative effects on scenic quality in the project area.

Alternative 2 – Proposed Action

The proposed action would treat 4437 acres with a combination of thinning, gaps, and skips. There would be no adverse effect on scenic resources because all harvest related activities would be consistent with forest plan standards and guidelines for scenery management. A total of 70 acres of fuel treatment are proposed within management allocation preservation (MA 10E). These fuel treatments are located:

- Along the north edge of FSRD 2649000 near Twin Buttes and on the east side of 2649770 near Melakwa Lake
- Three units at Melakwa Lake
- Three units northwest side of Scott Lake
- One unit on the east side of trail #3513 immediately north of Scott Lake.
- The proposed treatments at these sites would include:
- Thin conifer trees less than 10 inches
- Thin Pacific Yew less than 3 inches DBH
- Leave trees at 20x20 foot spacing measured from drip line of all green trees greater than 10 inches DBH
- No living sugar pine or madrone would be cut

- Thin all shrubs and brush less than 7 inches DBH
- Cut all Scotch broom with proposed fuel treatment areas
- Cut all vine maple less than 7 inches DBH
- Cut all other deciduous trees less than 3 inches DBH
- Cut all dead or diseased conifer or deciduous trees less than 10 inches DBH
- Created slash from fuels reduction would be hand piled, burned, and or chipped

All proposed fuel treatments in MA-10e are within an expanded footprint of recreation facilities and roads providing access to recreational facilities. These fuel treatments would have minimal effects on Semiprimitive Nonmotorized recreation values and would continue to support the use, resource values, and administration of recreation infrastructure. The fuel treatments would result in a short-term visual change where stumps, stubs, and less dense forested stands would be visible from forest roads, trails, and recreation facilities. After 3-6 years, vegetation recovery would naturalize the effects of this treatment activity.

For those visitors traveling the forest road system in the project area, short term noticeable effects due to timber harvest would be limited to exposed stumps from harvested trees, less dense forested stands (increased depth of view), slash or underburned area, and possible dust from transporting forest products from the forest on unpaved forest roads. Long term effects would include fewer exposed stumps due to vegetation recovery (3-6 years after treatment), and larger diameters and crowns of residual trees in thinning units due to increased growing space. Thinning treatments are expected to accelerate stand development toward a more natural range of conditions and scenic diversity in the project area.

Alternative 3

The proposed action would treat 1302 acres with a combination of thinning, gaps, and skips. Alternative 3 also removes all of the proposed management actions that would remove trees 80 years and older. There would be no adverse effect on scenic resources because all harvest related activities would be consistent with forest plan standards and guidelines for scenery management. All other effects are identical to those described in Alternative 2.

Cumulative Effects

The no-action and proposed action would not add cumulatively to past, present and reasonably foreseeable future projects because the no-action and proposed action alternative would not adversely affect scenic resources.

3.11 Wilderness and Inventoried Roadless Areas (IRA)

3.11.1 Summary of Effects

Alternatives 2 and 3 would have no adverse effect on Wilderness resources and Inventoried Roadless Areas (IRA's) since most harvest related activities are located outside of Wilderness and IRA's, and would be consistent with forest plan standards and guidelines. The proposed activities within the Mount Washington West IRA are centered on enhancement of bunchgrass meadow and a roadside fuel break, and would meet and maintain the nine roadless area characteristics.

3.11.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Wilderness and Inventoried Roadless Areas is the Flat Country project area.

3.11.3 Affected Environment - Wilderness

The Wilderness Act and Forest Service policy direct the Forest Service to manage Wilderness areas for the "preservation of their wilderness character." The 54,278 acre Mount Washington Wilderness was established as part of the Wilderness Act of 1964. Approximately 36,214 acres of the Mount Washington Wilderness are within the Flat Country project area. 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 Mount Washington Wilderness in the Flat Country project area. However, for the purposes of determining 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 it 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 Mount Washington Wilderness and is not considered in this analysis. (Landres et al., 2015, p. 33-61)

Area Description

This geological wonderland of rugged terrain topped by jagged peaks includes, near its center, the 6,872-foot cinder and ash cone of Belknap Crater, whose eruptions created one of the largest sheets of lava in the United States. The summit of the 7,794-foot dissected volcano named after our first president, scraped bare by ancient glaciation (the peak, not the president), overlooks some 75 miles of black lava-strewn plains. A dense forest of lodgepole pine and mountain hemlock covers much of the Wilderness. There are

28 lakes and wildlife enough to attract hunters. Only State Highway 242 separates Mount Washington Wilderness from Three Sisters Wilderness to the south. The primary trail through this area is 16.6 miles of the Pacific Crest National Scenic Trail. Tenas Lakes and Benson Lake in the southwest corner receive substantial human use, as does Patjens Lake in the north.

3.11.4 Environmental Consequences - Wilderness

Direct and Indirect Effects

Alternative 1

No treatments would occur with the implementation of Alternative 1 therefore no direct or indirect effects to the Mount Washington Wilderness would occur.

Alternatives 2 and 3

Direct and indirect effects to wilderness are shown below as related to the four qualities of wilderness character applicable to the Mount Washington Wilderness. No harvest or other connected actions would occur in the Mount Washington Wilderness. Units 10, 1130, 1140, 1450, 1480, 1720 and 1750 are in close proximity to the Wilderness.

Untrammeled

There are no proposed activities within the Mount Washington Wilderness in this project. Therefore, there are no actions that would result in trammeling and no effects to the untrammeled quality of wilderness character.

Natural

There are no proposed activities within the Mount Washington Wilderness. Any effects to the natural quality of wilderness character would be limited and indirect, as identified in the effects analyses of other resources. The indicators and measures used to determine the effects to the natural quality of wilderness character are displayed in Table 56. Effects are described below according to each indicator and measure.

Table 56. Indicators and Measures for the Natural Quality of Wilderness

Indicator	Measures
Botanical Resources	Invasive species
Wildlife	Terrestrial wildlife
Aquatic ecosystems	Aquatic organism passage
Ecological processes	Biological diversity

Indicator: Botanical Resources

Measure: Invasive Species

The presence of non-native, invasive plants detracts from the natural quality of wilderness character. The Flat Country planning area contains infestations of invasive weed species, including false brome (*Brachypodium sylvaticum*), spotted knapweed (*Centaurea maculosa*), Scotch broom (*Cytisus scoparius*), non-native blackberries (*Rubus armenicus* and *R. discolor*), and tansy ragwort (*Senecio jacobaea*). St. John's Wort (*Hypericum peforatum)* is another invasive species present along most roadways. All of these species are found in multiple Flat Country units, proposed landings and along roads accessing those units as well as in roads slated to be closed or decommissioned and in proposed roadside hazardous fuels treatments. Currently, there are populations directly adjacent to the Mount Washington Wilderness.

Activities associated with the Flat Country project include logging with ground-based equip, grapple piling fuels, and temporary road construction, all of which would result in soil disturbance adjacent to the wilderness. Of particular concern are the seeds of false brome which have a long awn and are easily tracked not only by footwear, vehicles, equipment and wildlife. Given the amount of soil disturbance associated with the Flat Country project it is possible that false brome and other invasive species may migrate by foot, vehicle, and or animal to the interior of Mount Washington Wilderness. The effect of invasive species spread to the interior of Mount Washington Wilderness would impair the natural quality of wilderness character for the long-term. Mitigations outlined in the project design features table along with invasive species monitoring would help minimize the risk of invasive species spread.

Both alternatives present some risk of weed spread due ground disturbance and the current existence of weed populations in the area. To help mitigate this risk, design features are included for this project in Chapter 2.

Indicator: Terrestrial Wildlife

Measure: Terrestrial Wildlife

The project may have some beneficial effects to 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 Flat Country project.

Indicator: Aquatic Ecosystems

Measure: Aquatic Organism Passage

The condition of aquatic ecosystems inside the Mount Washington Wilderness can be generally represented by the presence or absence of aquatic passage barriers at road crossing outside of the Wilderness. Boulder creek originates inside the Mount Washington Wilderness, but is ephemeral in nature, does not have surface flow until the confluence of Boulder Creek and the North Fork of Boulder Creek, which is located outside of wilderness. There would be no benefit or impairment to the natural quality of wilderness character in the wilderness based upon aquatic organism passage.

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. Fire is a fundamental ecological process for this wilderness landscape and occurs regularly.

Taking no action (Alternative 1) would result in no vegetative changes in a landscape that is prone to wild fire. Taking no action would likely limit the management response to future wild fire in and outside of wilderness.

Alternative 2 would result in more biological diversity improvements in areas near the wilderness than Alternative 3. While no treatment would occur within wilderness, Alternative 2 would treat units directly adjacent to wilderness. These units currently provide similar ecological functions as most forested conditions in the Mount Washington Wilderness. The combination of commercial thinning, aggregate retention, and fuel treatments would mimic fire and help compliment some of the ecological functions that fire already plays in this landscape. Actions associated with alternative 2 would result in greater diversity in stand structure, shape, and age. Doing this would provide managers more decision space in the event of a future wild fire. Insects and wildlife within 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 that may spill over into wilderness.

Alternative 3 would have similar effects as Alternative 2, but to a lesser extent because fewer acres of commercial thinning and aggregate retention harvest would occur. Commercial thinning, prescribed underburning, and under planting would occur and provide some level of increased diversity in forest structure and species diversity.

Undeveloped

There are no proposed activities within the Mount Washington 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 Flat Country project and are displayed in Table 57. Effects are described below according to each indicator and measure.

Table 57. Indicators and Measures for the Outstanding Opportunities Quality of Wilderness

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	Recreation access

Indicator: Remoteness from Sights and Sounds of Human Activity Outside the Wilderness

Measure: Visible Human Activity

Wilderness does not exist in a vacuum and the objective of this analysis is to identify where there is possibility for proposed treatments outside wilderness to affect the outstanding opportunity quality of wilderness character. Units 1140 and 1720 adjoin the Mount Washington Wilderness boundary and wilderness trail #3508. The proposed activities in these units would likely effect wilderness visitors as they travel along trail #3508, temporarily affecting the opportunity for solitude and unconfined recreation quality. The visible evidence of human activity would fade and the effects would be reduced and eventually eliminated. The effects of proposed treatments in other units would be limited due to distance, the rolling topography, and dense forest that characterizes the area.

Measure: Sounds of Human Activity

The soundscape of the Flat Country project area is highly variable and is greatly influenced by topography and vegetation, weather, and seasonality. In both Alternative 2 and 3, anticipated sources of human generated sounds that may be heard within the wilderness include ground-based logging systems, skyline systems, limited helicopter logging, quarry operations, and the construction and decommissioning of temporary roads and landings. Alternative 3 would create less operational noise because fewer acres would be treated. Under both alternatives, noise impacts would be limited to operational periods only, and would be short-term.

Summary of Effects to Wilderness Character

Overall, the wilderness character of the Mount Washington wilderness would be maintained. The untrammeled and undeveloped qualities are unaffected by the proposed activities. The natural quality may improve in some areas while being negatively affected in others. The effects to the opportunities for solitude and a primitive and unconfined type of recreation are limited and intermittent.

Cumulative Effects

Alternative 1, 2 and 3

Effects to wilderness from the Flat Country project overlap with the implementation of the Wilderness Visitor Use Management Strategies (summer 2020). There are no other projects that overlap in time or space with any past, present, or reasonably foreseeable future actions (Appendix F). Because wilderness character is largely unaffected by this project, no cumulative effects on Wilderness would occur.

3.11.5 Affected Environment – Inventoried Roadless Areas

Inventoried Roadless Areas (IRAs) were 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. Most IRA boundaries are substantially identical to those identified as “Roadless Areas” referred to in the 1982 planning rule (36 CFR 219.17) and identified by the Forest Plan, FEIS, Appendix C; however some localized, minor differences in boundaries may exist.

Two IRAs are located in the Flat Country project area: Mount Washington West (6,641 acres); Mount Washington South (4,375 acres). These IRAs in relation to Alternative 2 units are illustrated in Figures 35, 36 and 37.

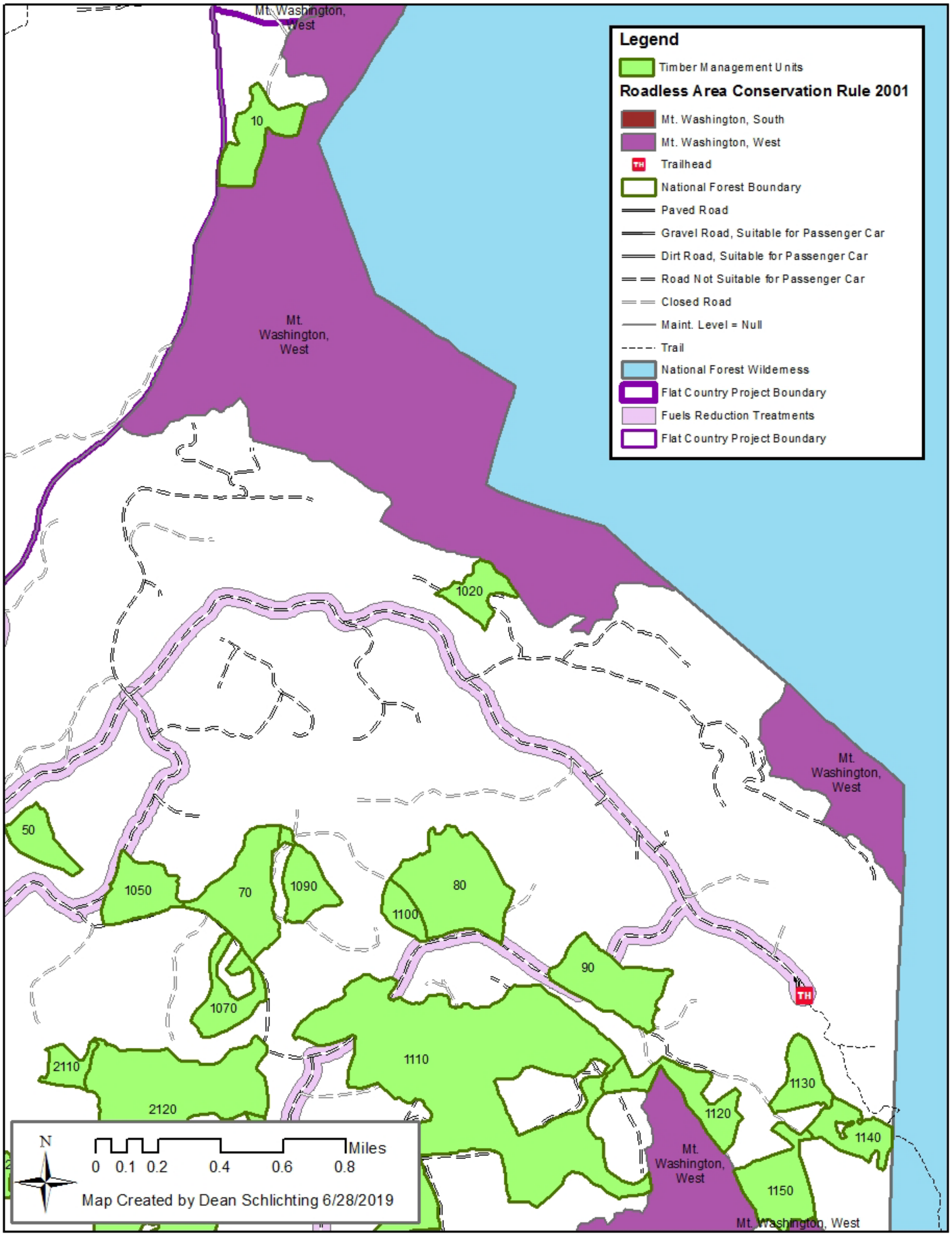

Figure 35. Map of Inventoried Roadless Areas in the Flat Country Project Area (North)

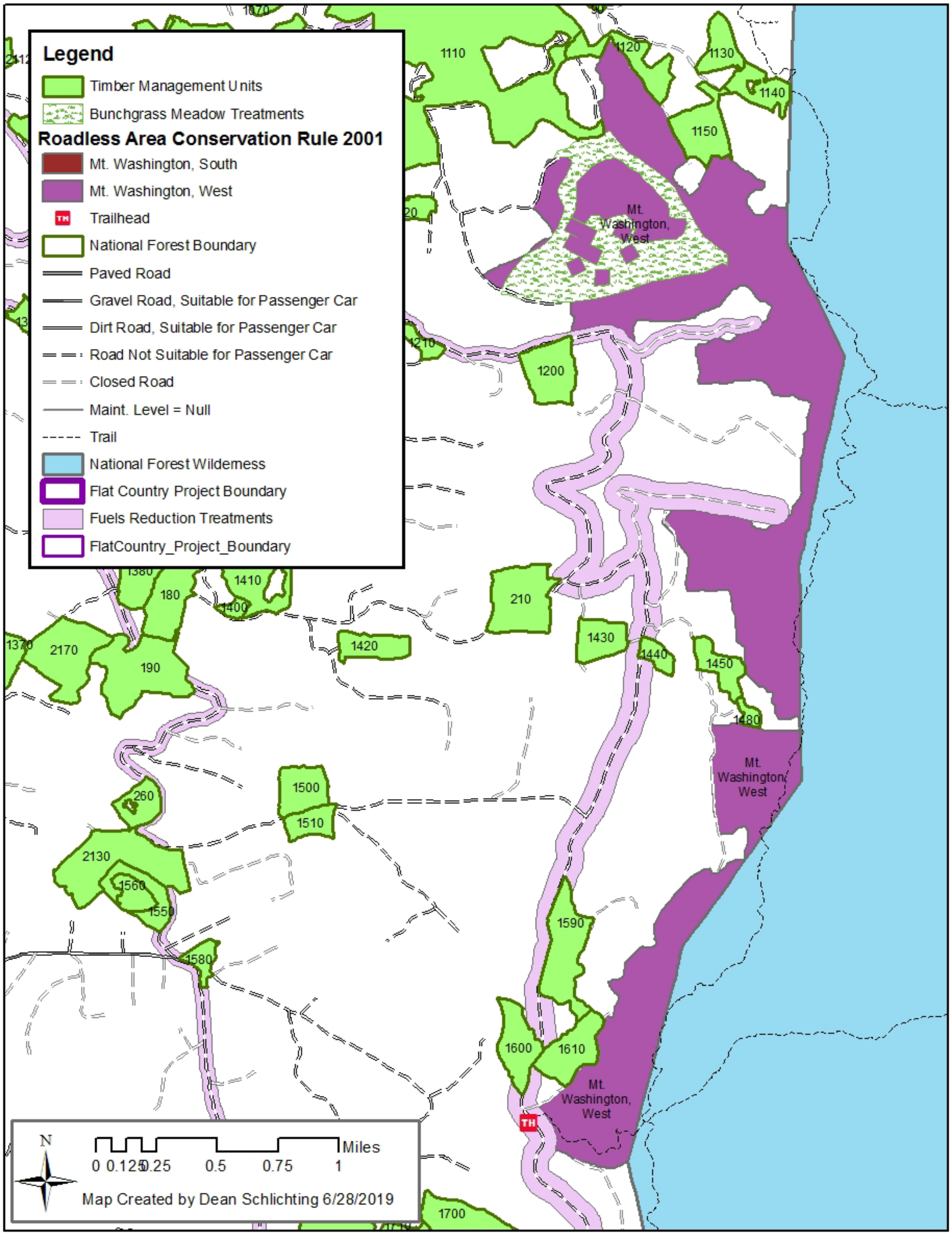

Figure 36. Map of Inventoried Roadless Areas in the Flat Country Project Area (Middle)

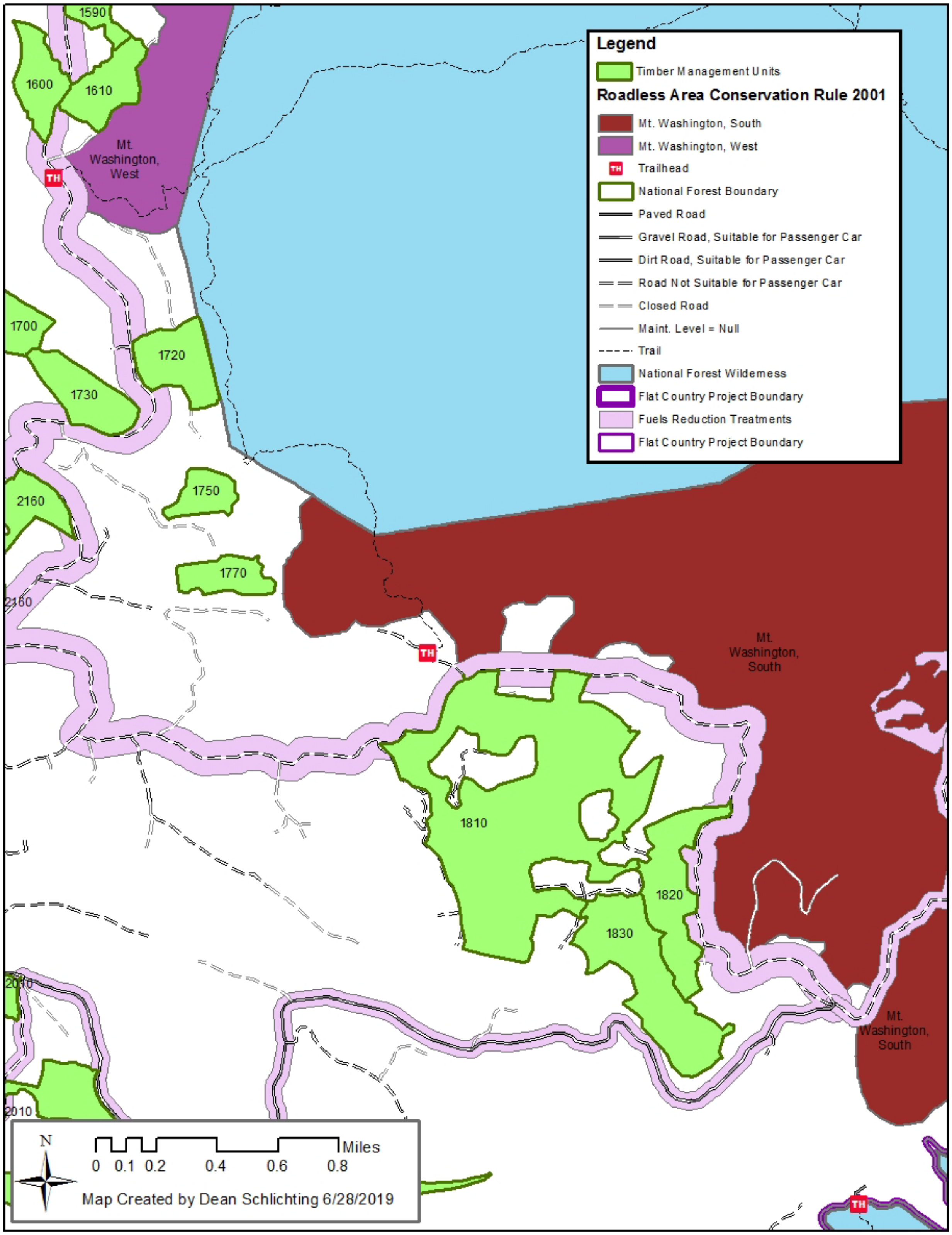

Figure 37. Map of Inventoried Roadless Areas in the Flat Country Project Area (South)

3.11.6 Environmental Consequences – Inventoried Roadless Areas

Direct and Indirect Effects

Alternative 1

No treatments would occur with the implementation of Alternative 1 therefore no direct or indirect effects to IRA's would occur.

Alternative 2

The timber harvest units (excluding enhancement units discussed below) and their associated activities would not occur within IRA's.

A total of 10 units in the Flat Country project area are adjacent to an IRA (10, 1020, 1110, 1120, 1150, 1450, 1480, 1610, 1810, and 1820). These units would have boundary markers established during implementation to ensure all project activities are restricted to areas outside the IRA boundaries.

Alternative 2 would have limited or beneficial effects on IRA's due to the proposed enhancement treatments in the Bunchgrass Meadow 9D special treatment areas (units 1160, 1170, 1180 and 1190). Limited commercial harvest of timber would occur as part of the treatment. No new or temporary roads would constructed, all harvest would be done over snow or through Helicopter yarding. See Wildlife and Botany sections for more information.

In alternative 2, there would be a total of 150 acres of meadow enhancement, with 49 of those acres being currently forested. Harvest would remove approximately 1 MBF from the IRA (less than 1 percent of total project volume). Following harvest the slash would be treated by pile burning.

Alternatives 2 and 3

In both action alternatives 23.4 acres of roadside fuel breaks within the Mount Washington West IRA, and 174.8 acres in the Mount Washington South IRA. Treatments would occur on up to 300' of both sides of the existing roads with a treatment width of 600' total. Treatments would thin conifer trees less than 7 inches DBH in managed timber stands and less than 10 inches DBH in unmanaged timber stands. See Fire and Fuels section for further discussion of the roadside hazardous fuels treatments.

Alternative 3

The timber harvest units and their associated activities would not occur within IRA's.

One unit in the Flat Country project area is adjacent to an IRA (1020). This unit would have boundary markers established during implementation to ensure all project activities are restricted to areas outside the IRA boundary.

The bunchgrass meadow treatments would not occur under Alternative 3.

All treatments in the IRA would maintain and meet the 9 roadless area characteristics in CFR 294.11.

1. High quality or undisturbed soils, water and air: No temporary roads would be constructed or used. All operations in IRA would be harvested over snow or by helicopter. Roadside hazardous fuels treatments would be by hand with no soil disturbance.

2. Sources of public drinking water: There are no streams or swales within the bunchgrass meadow area. Streams within roadside hazardous fuels treatments would be buffered from treatment (see project design features table in Chapter 2).

3. Diversity of plant and animal communities: The Bunchgrass meadow treatments are designed to increase plant and animal diversity on the site as well as on the landscape. Roadside hazardous fuels treatments would be limited to trees under 10 inches DBH, and would not be ground disturbing.

4. Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species that depend on large, undisturbed areas of land: The Bunchgrass meadow treatments would enhance habitat for great gray owls. The roadside hazardous fuels treatments would be limited to trees under 10 inches DBH, and no more than 300 feet from the road. See Wildlife and Botany sections for more discussion.

5. Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: Dispersed recreation could be temporarily displaced during operations, as well as affected by noise from logging, meadow enhancement and fuel break operations, however these effects would be short term.

6. Reference landscapes: The reference landscape would not be altered.

7. Natural appearing landscapes with high scenic quality: Bunchgrass Meadow enhancement and expansion would have an appearance similar to the past meadow treatments in the area. The majority of the activity fuels would be piled and burned. The landscape would eventually appear natural as stumps and residual downed wood decompose. Skidding of logs would be over snow and by helicopter, resulting in minimal soil disturbance. Roadside fuel breaks would be limited to 300’ on either side of the existing road. The remainder of the IRA would not be affected.

8. Traditional cultural properties and sacred sites: None present in the proposed treatment area. Cultural resources would be buffered from roadside hazardous fuels treatments. The remainder of the IRA would not be treated, and any existing cultural property and cultural sites would be not be disturbed by this project.

9. Other locally identified unique characteristics: Bunchgrass meadow itself is a locally identified unique location, the treatments are designed to maintain and enhance its characteristics. The roadside hazardous fuels treatments would not affect any locally identified unique characteristics. The remainder of the IRA would not be treated, and any unique characteristics in the IRA would be not be diminished by this project.

Best Management Practices and Design Elements would be in place to protect: soil, water, and air; plant and animal communities and habitat for TES species; classes of recreation and landscapes; cultural properties and unique areas.

Approximately 0.4 percent of the Mount Washington West Inventoried Roadless Area would be treated by Meadow enhancement and roadside hazardous fuels treatments, the remainder of the IRA would not be affected.

Cumulative Effects

Alternative 1, 2 and 3

Some effects to IRA's would occur with the Flat Country project due to the proposed meadow enhancements and roadside fuel breaks; however there are no past activities in time or space that overlap with the proposed bunchgrass or fuel treatments. Therefore no cumulative effects on IRAs would occur, only the direct and indirect effects.

3.12 Fire and Fuels

3.12.1 Summary of Effects

Proposed treatments would include underburning and hand/machine piling and burning. Treatments would meet Forest Standards and Guides to reduce fuel loading created from harvest. Reduced fuels would create greater safety for firefighters and public when future wildfires occur. The treatments would reduce the potential for high intensity wildfire behavior within the Wildland-Urban Interface of private land and community boundaries, improve wildfire management operations and support landscape ecological function.

3.12.1 Scale of Analysis

Project and stand specific data, as well as landscape level data, were used since fire is a landscape level natural disturbance. Stand level information was used to identify and predict specific fuels characteristics and effects.

3.12.2 Affected Environment

Fire on the Landscape

Fire has been a dominant disturbance in the project area. The proposed project is needed to create strategic suppression and containment opportunities along the Mount Washington Wilderness boundary and main access routes. If a wildfire became established beyond initial attack, the strategic suppression and containment areas would expand fire management responses while exposing firefighters and the public to less risk. Records indicate 3 large fires (Scott Mountain Fire – 2010, Shadow Lake Fire – 2011 and Separation Fire - 2017) started in the Mount Washington Wilderness and burned into the Flat Country project area. Records also indicate 194 fires occurred in the Flat Country project area from 1970-2018.

Roadside Hazardous Fuels Reduction Treatments

Approximately 2,307 acres of fuels reduction non-commercial thinning treatments are proposed for both Alternative 2 and 3. On both sides of about 11 miles of road, non-commercial thinning treatments would occur, with a 600-foot total treatment width. This treatment is meant to contain fires that could spread westward from the Mount Washington Wilderness Area. On both sides of about 26 miles of road, non-commercial thinning treatments would occur, with a 300-foot total treatment width. This treatment is in a primarily north and south orientation to provide a strategic shaded fuel break.

Fuel Models

Dead needles, sticks and branches are the fuels that most often carry the fire and are measured by size as it relates to the amount of time for the fuel to dry: 1 hour fuels – 0-.25 inch diameter; 10 hour fuels - .25-1 inches; 100 hour fuels – 1-3 inches (NWCG Glossary). Larger fuels, greater than 3 inches, contribute to residence time and play a role in fire behavior but they are not often used to model fire behavior. One, 10 and 100 hour fuels are those estimated and used in fire behavior modeling and predictions. Most often the dead fuels available during a wildfire or prescribed fire are 1, 10, and 100 hour fuels (0-3 inch diameter) and lichen. One hour fuels moisture content fluctuate quickly during the course of a day and when 10 and 100 hour fuels lose moisture fire can move more quickly. Surface fuel loading (the amount of fuels on the ground) and depth correlate to the fire behavior (Brown and Snell 1980). Fuel loading (measured in tons/acre) is used to model fire behavior within the units and varies with different aged stands. Horizontal or surface fuels refer to fuels on the ground, while vertical fuels refer to the ladder fuels such as limbs on the bole of larger trees, brush and younger trees within the stand.

Fuel models are used to quantitatively describe surface fuel loading to calculate predicted fire behavior (Anderson 1982; Maxwell et.al. 1980). Fuel models are a quantitative way to describe surface fuel loading, arrangement, structure, and predict fire behavior (Maxwell and Franklin 1980). Fuels created post-harvest can be heavy or light given the number of trees cut, the method of harvest, the branch density of the crowns of trees and the amount of branch and top breakage. The fuel models (FM) identified for the project area are:

- FM8 – Young stands (20-80 years old) with light fuel loading of approximately 5 tons/acre of 0-3 inch fuels and varying amounts of brush in the understory; low intensity fires with low severity (low mortality of dominant overstory vegetation).
- FM10 – Intermediate to older stands (>80 years old) with moderate to heavy fuels on the ground, ladder fuels and lichen in the trees; high fire intensity and severity including crown fire with mortality.
- FM11 – Light slash load resulting from light to moderate partial cuts or harvests which yard tops of trees attached to the last log. Fuel loading in the 0-3 inches diameter size class for live and dead fuel is <12 tons/acre. The continuity of the slash can increase fire behavior.

Fire Behavior

Wildfires continue to occur naturally in this area. Fire is a dynamic process influenced by fuel loading, wind, topography, temperature, and humidity. Modeling fire behavior helps to predict a fires movement and impacts within the vegetation. Fuel models are used as inputs to the fire behavior models, as well as for firefighter’s reference when engaged in a wild or prescribed fire.

Fire behavior was modeled using BehavePlus5 (NWCG Glossary) with fuels and topography inputs that correspond to the Flat Country project area. The results of this wildfire behavior model are shown in Table 58. Fire weather data used in the model represents actual summer conditions of hot and dry similar to 2010 and 2011. Weather conditions can directly influence fire behavior. When weather drives higher intensity wildfires, firefighters, the public, and landscapes may be exposed to more risk firefighter safety is at risk when flame lengths (FL) exceeds the length of hand tools used by firefighters (>4 foot FL) and the rates of spread (ROS) exceeds the ability of firefighters to build containment lines. Fire suppression operations would require mechanized suppression resources to safely suppress the fire when the FL or ROS exceed the firefighter’s ability to remain safe. Larger fuels, > 9 inches in diameter, are not often thought of as the carrier of fire. Large 1,000 hour fuel create longer lasting intensity, higher flame lengths and enable crown and high severity fires to progress. Crown fire creates spotting as the heat from the fire or the wind lofts embers into the air and ahead of the main fire. This increases ROS and severity/intensity as the main fire burns in to the new spots ahead (NWCG).

Table 58. Modeled Wildfire Behavior for the Flat Country Project Area

	Rate of Spread	Flame Length	Percent Mortality
Existing conditions inside and outside of units (FM10)	9 chains/hour	8 feet	45%
After harvest with no fuel treatment (FM11)[b]	15 chains/hour	8 feet	50-90%
After fuel treatment (FM8)	3 chains/hour	1 feet	1%

a – Prescription parameters used were hot, dry conditions similar to those at the peak of fire season. (80°, 10 mph 20 ft. wind, 1, 10,100 hour fuels 4, 6, 8% fuel moisture).

b – Fuel loading post-harvest can range depending on the method of harvest and would be surveyed or measured prior to fuel treatment.

Another element or fuel that affects wildfire behavior within the project area is lichen. Lichen grows on the boles of trees, and drapes throughout the branches. This fuel dries faster than 1 hour fuels, burns quickly, and carries fire into or through the crowns. When a small fire burns around a tree, lichen can easily carry fire up the bole of the tree into the canopy. Within the canopies fire can move easily from canopy to canopy even during fair weather, i.e. early in the summer season or cooler temperatures as seen on the McKenzie River Ranger District. Because lichen dries quickly and carries fire easily, lichen can foster tree crowns to burn even at the beginning of fire season when the live fuels are high (moisture level of green needles on conifers or brush). Live fuel moistures of herbs, shrubs, and trees decrease through the summer making them more burnable, but with lichen, the live fuel moisture do not play as big of a role. There are no fuel models representing lichen as a fuel and crown fire can be underestimated and local knowledge offers experience and adjustments to predictions.

Probability of ignition also plays a role when trees are torching or crown fire occurs due to the embers lofted into the air and igniting locations outside of the main fire perimeter. Probability of ignition helps to identify when spotting could become a problem and increase the ROS or add additional hazards during fire management especially if embers land in areas with more available fuel and closed canopy.

With suppression and forest management, wildfires have not played their natural disturbance role on the landscape. The departure from historic conditions influence the current wildfire behavior, fuels and the way forests move through seral stages, stand structure, spatial arrangements, species composition and successional roles. Using prescribed fire for slash reduction can offer changes to aim towards diversity and adding the ecological benefits (Means et.al. 1996).

The data and fuels modeling outputs used for this section can be found in the Flat Country project record.

3.12.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

No post-harvest fuel treatments would occur with Alternative 1. Fire suppression would continue and vegetation would persist through successional pathways with no natural disturbance. Without changes to the structure of vegetation, through thinning and prescribed fire, the project area would continue to lose attributes associated with mixed severity fire regimes, such as structural stage, canopy closure and particular species like sugar pine. Without fire disturbance or changes to stand structure, wildfires would potentially burn more acres due to increases in fuel loading, homogenous stand conditions and ladder fuels if suppression is unsuccessful.

Alternative 2

Harvests would create slash on 4,438 acres and would increase the fuel loading, especially in the 1, 10 and 100 hour fuels. Following timber harvest the heavy fuel loading can persist about five years with red needles persisting over the first one to two years. Slash is lofty which allows air to funnel through creating a productive burning environment, especially with red needles. The increase in fuels increases the potential for greater or more intense wildfire behavior. During a wildfire the rate of spread (ROS measured in chains per hour which is 66 feet) in slash can be greater than untreated existing conditions.

The proposed fuel treatments in Alternative 2 would reduce harvest created slash through prescribed fire underburns, or hand or machine piling and burning. Harvest created slash would be treated 1-2 years post-harvest. The proposed fuel treatments within each unit would help to improve firefighter and public safety during future wildfires, prepare units for planting, to create snags, help to increase vegetation diversity and return the natural disturbance process of fire. Underburns would return the disturbance that creates changes to the soil, nutrients, vegetation species and regeneration (Swanson 2008) as well as simulate non-stand replacing wildfires (mixed severity) (Tepley 2013, Barrett et al. 2010).

Post-harvest fuel loading was calculated for all units based on the stand exam data. The values are for 1, 10, and 100 hour fuels (0-3 inch diameter fuels) measured in tons/acre and categorized by stand age classes. The average post-harvest fuel loading (without fuel treatments) is 16 tons/acre. Post-fuel treatment fuel loading would meet Project Design Features (<11 tons/acre, as seen in Table 8). Modeling data was specific to each unit and can be referenced in the Fire/Fuels analysis file. Fuel loading within the project area would be approximately 6.6 to 40 tons per acre. Prior to burning post-harvest fuels are surveyed to identify the specific amount of fuel.

Fire behavior was modeled for:

- Existing Conditions
- After harvest with fuel treatments
- After harvest without fuel treatments

Weather parameters used for modeling were hot, dry conditions similar to those during the fire season with temperature of 80°F, 10 mph 20 ft. wind and 1, 10, 100 hour fuels at 4, 6, 8 percent fuel moisture, respectively.

In the event of a wildfire, fire behavior would be minimized with harvest (reducing canopy continuity) and fuel treatments (reducing fuel bed) by keeping fire on the ground and reducing the likelihood of fire entering the canopy. A more open canopy can allow the sun to quickly heat the vegetation and fuels on the ground, and with fewer trees the potential for wind within the stand can increase. Even though these modifications could result in faster rates of spread during a wildfire they would be lower intensity (heat), duration and lower flame lengths compared to harvested stands with no fuel treatments. The harvest and fuel treatments also reduce ladder fuels (vertical and horizontal fuels), reduce the potential for tree torching or crown fire (Safford 2009; Lindh 2003; Agee 2002) and reduce the potential for fire spotting.

Wildfire and prescribed fire are dynamic processes influenced by multiple environmental factors such as wind, topography, temperature, and humidity. Due to these influential factors, which create and alter fire behavior, a chance exists to exceed underburn objective parameters. To reduce these factors, underburns would be conducted during optimal weather and fuels conditions, most likely in the spring or fall. The weather and fuels conditions would be specific to the unit's location and fuel loading. Tempered speeds of ignition would also be identified to reduce mortality of residual canopy. In the event the fire behavior exceeds treatment objectives, adjustments to burning operations are implemented immediately to alter fire behavior. Containing fire in the units is important given firefighter and public safety, private property, project objectives and surrounding natural resources.

Post-harvest underburns may require firelines constructed around the perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Firelines are created around the unit by scraping fuel back to mineral soil (18 inch line) and scattering fuels that lie within 10 feet of the fireline. If needed, units on steep slopes can have water bars within the fireline to reduce erosion. Also, firelines are rehabilitated to existing conditions if needed.

Firelines are usually not built along skips or Riparian Reserves (shaded areas). During the post-harvest underburn these areas burn with less intensity due to lower temperatures and higher relative humidity from the thicker canopy cover. Fire often backs into the shade and behavior decreases to a smolder or extinguishes itself.

Hand, grapple, and landing piles are covered with regulatory plastic following construction (Oregon Department of Forestry 1995). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall, winter or early spring when there is very low risk of fire spreading from the piles.

After treatments the fuel profile would aid in protecting private infrastructure near the west and southwest portion of the project area. Fuel treatments adjacent to private property would aid in changing fire behavior moving from the project area to private and vice versa. Reduced fire behavior reduces wildfire risk, improves suppression efforts, and therefore reduces risk to people, private property, and public lands. The proposed actions (harvests with fuel treatments) would support natural ecosystem diversity by returning fire to the forest.

Roadside hazardous fuels treatments would aid in suppression efforts of a large fire giving firefighters opportunities for pre-planned and completed fuels reduction along the roadsides increasing the opportunities for containment of future fires while minimizing suppression work and associated risk.

Alternative 2 proposes to decommission approximately 14.8 miles and store 4.7 miles of system roads. The majority of these roads are currently not usable for fire suppression actions at this time due to their current conditions, which include deteriorating road surfaces that have become heavily brushed in by encroaching vegetation. Additionally many of these roads are small segments of less than a quarter of a mile that would not significantly impact fire suppression resources response times. In the event of a fire stored roads may be reopened on a temporary basis if they are determined to be needed for fire suppression operations.

Informal monitoring for McKenzie River fire and fuels would take place prior to, during and following the fuel treatments. Fuel treatments and data offer information to use in future projects.

Alternative 3

Alternative 3 would have the same effects as Alternative 2 but on fewer acres because 3,136 fewer acres would be harvested. Fire as an ecological disturbance process in the project area would most likely not occur in these stands given fire suppression. These stands would continue through successional pathways without changes to structural diversity or natural ecological processes that would be present with thinning and prescribed fire. All fuel treatments described in Alternative 2 would apply to Alternative 3.

Cumulative Effects

Cumulative effects of the Flat Country project alternatives were analyzed in the McKenzie 5th field watershed. Past and present, or reasonably foreseeable fuel treatments alter wildfire activity and fuel continuity across the landscape.

Alternative 1

Because this is no action, there would be no additional impact on the environment from this project when added to the impacts of other past, present, or reasonably foreseeable future actions (40 CFR §1508.7). Fire suppression would continue thereby affecting the changes to the ecosystem with the continued removal of the natural disturbance.

Alternative 2 and Alternative 3

Effects to fire and fuels from actions proposed in the Flat Country project (Alternatives 2 and 3) overlap in time and space with effects from the following actions:

- Ollie CE: Commercial thinning unit and Underburn on approximately 41 acres to be completed between 2017-2020. Effects from the proposed actions combined with this project would help to reduce fuels in key locations across the project area.
- Muskee CE: Commercial thinning unit and Underburn on approximately 37 acres to be completed between 2017 and 2020. Effects from the proposed actions combined with this project would help to reduce fuels in key locations across the project area.

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 fuel treatments stands would be more fire resilient and moved closer to the desired future condition.

3.13 Air Quality

3.13.1 Summary of Effects

Smoke emissions (airborne particulate matter) from pile burning or underburning should not last more than one or two days after the burn. The fuel loading post-harvest and consumption amounts would be measured prior to burning and the timing of the burns (date of burn and length of ignition) would aim to avoid high amounts of smoke that trigger hazardous air quality readings on nephelometers. Smoke emissions were modeled in FOFEM (First Order Fire Effects Model) program using representative fuel loading after harvests. Direction of travel was modeled in BlueSky Playground program with average seasonal wind and with moderate amount of consumption smoke did not heavily impact the Smoke Sensitive Receptor Areas (<50 ppm of $PM_{2.5}$ particulate matter micrometers). Oregon Smoke

Management forecasters would be notified prior to the burn and they would authorize implementation based on the amount of emissions predicted and the current weather forecast wind directions. Fire management personnel would notify surrounding communities and those that may receive low to moderate amounts of smoke during the burn.

3.13.2 Scale of Analysis

The area defined for direct, indirect and cumulative effects analysis is the treatment units in the project area, as well as, the larger landscape where smoke emissions can travel. These are the locations of the Smoke Sensitive Receptor Areas, Class I Airsheds, and local communities. To compare prescribed and wildfire smoke emissions the amount of fuel burned was from a fuel treatment underburn post-harvest and a non-fuels treated post-harvest unit in a wildfire. The model runs used a Douglas-fir vegetation model with slash fuel loading approximately 16 tons/acre.

3.13.3 Affected Environment

Standards for ambient air quality are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter (and other pollutants) produced by both prescribed burning and wildfire, although smoke from wildfire is considered a natural event by the EPA's Natural Events Policy. Smoke generated from prescribed burning must meet federal and state air quality standards set forth in the 1970 Clean Air Act (CAA section 160).

The State of Oregon has been delegated authority for attainment standards set by the 1990 and 1977 Amendments of the Clean Air Act. To regulate these standards, Oregon developed the Oregon Clean Air Act State Implementation Plan (Oregon Department of Forestry 1995). These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission controls (USDA Forest Service 1990).

Under the Oregon regulations for prescribed fire smoke emissions, visibility and particulate matter (PM) ($PM_{2.5}$ and PM_{10} microns) are measured and regulated in designated areas including Smoke Sensitive Receptor Areas and Class I Airsheds. Priority areas near the Flat Country Project:

- Smoke Sensitive Receptor Areas (SSRA)
    - Oakridge – 44 air miles southwest
    - Willamette Valley, eastern edge is Deerhorn – 45 air miles southwest
    - Bend – 35 air miles southeast
- Class I Airsheds
    - Three Sisters Wilderness – Southern boundary of project area
    - Mount Washington Wilderness – Eastern boundary of project area
- McKenzie River communities (non-designated state areas)
    - McKenzie Bridge – Six miles southwest
    - Blue River – 15 miles west

3.13.4 Environmental Consequences

Air quality is important and a concern for people and airsheds. During prescribed fire, smoke emissions are short term (1-2 days) and smoke should move through areas of concern during the day. Blue River and other communities along the McKenzie River may receive smoke during the evening hours following the prescribed fires as diurnal wind patterns can carry smoke downhill or down the valley. Class 1 Airshed guidelines would be met and coordinated with the Smoke Management Forecaster.

Direct and Indirect Effects

Alternative 1 (No Action)

If no management actions take place in the Flat Country project area there would be no air quality impacts from fuel treatments. However, the risk of wildfire would still exist. Air quality impacts from wildfire are considerably higher than they are from prescribed fire. Greater consumption (burning) of debris on the ground and the canopy of trees occurs due to the hot weather and dry fuel. Smoke emissions are not short term and can often last for many weeks or months. The fire continues to spread and smolder in logs and heavy fuel continuing emissions, as demonstrated during Scott Mountain Fire in 2010 and Shadow Lake Fire in 2011. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of $PM_{2.5}$ and PM_{10} given the amount of fuel and time the fire burns.

Alternatives 2 and 3

Smoke emissions from post-harvest underburns and landing, grapple, or hand pile burning would be mitigated based on the timing of the burns, seasonality, forecasted winds and transport wind direction, and weather. The Oregon Smoke Management Plan requires scheduling prescribed fire on days which are suitable in relation to other Forest Service or private land owners burning, weather forecasts that carry the smoke and location of units to Class I Airsheds and communities. The importance of visibility in Class I Airsheds, such as Mount Washington Wilderness on the east side of the project area, is recognized and burn prescriptions and timing would be designed to minimize potential for smoke intrusion in these areas.

Communities near the Flat Country project area may be temporarily impacted by smoke from the post-harvest underburns or pile burning. The Oregon Smoke Management Plan states non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon Department of Forestry 1995). However, smoke can settle into the valley during evening inversions and may be of greater amounts than drift smoke which may impact community members who are sensitive to smoke. The time span that smoke is emitted is short (approximately 1 – 2 days) and the impact on community members would be monitored.

The local communities and public would be notified prior to burning. Additional guidance would be calling local community members, posting signs in the community areas, such as grocery stores, and signing along the road or near the treatment area. Prescribed fire notifications and implementation would also be designed to minimize the potential for impact to visitors in these areas within or bordering the project boundary:

- Olallie Campground – 6.6 miles northeast of McKenzie River Ranger Station (MRRD) at the west boundary of the project area
- Trail Bridge Campground – 7.7 miles northeast of MRRD at the west boundary of the project area
- Limberlost Campground – 3.4 miles east of MRRD at the southern boundary of the project area

- Alder Springs Campground – 10.3 miles east of MRRD at the west boundary of the project area along State Highway 242
- Tamolitch Falls – 10.6 miles northeast of MRRD at the west boundary of the project area
- Proxy Falls – 9.5 miles east of McKenzie River Ranger Station MRRD at the west boundary of the project area along State Highway 242

Based on post-burn data and recon from previous fuel treatment underburns on the McKenzie River Ranger District the average fuels consumed are: 80 percent of the fine fuels 0-1 inch diameter (1 and 10 hour fuels), 40-60 percent of the 1-3 inch fuels (100 hour fuels) and only about 20 percent of the 3-9 inch fuels (1,000 hour fuels). The fuel moisture of large woody material (> 9 inches) is too high to burn and only the bark is charred. It is important to note all fuel treatments do not occur as a single event therefore the smoke emissions from all the harvested units do not occur at the same time. Prescribed fire treatments would be one or two underburns or one or two piled units burned in one day and underburning and pile burning usually occur during different seasons. In comparison, during hot, dry weather wildfire emission would occur over several days or months if it escaped initial attack.

Smoke emissions of $PM_{2.5}$ and PM_{10} was modeled and compared between a fuel treatment underburn post-harvest and a non-fuels treated post-harvest wildfire. Results identified wildfire emitting approximately two times more PM during one burn period. The fuels burned during a wildfire are greater as it consumes large woody material and full tree crowns versus prescribed fire burning when less fuel is consumed due to weather conditions and higher fuel moisture. Additionally, wildfires continue to burn with the dry conditions and the majority of the litter and duff are consumed through smoldering which contributes greater amounts of emissions. The comparison for both fires used Douglas-fir forest vegetation classification with slash under weather conditions that characterize the parameters to burn for prescribed (moist) and wildfire (dry). Wildfires are modeled with no suppression, burning for only one burn day using hot, dry conditions.

Cumulative Effects

Alternatives 2 and 3

Impacts on air quality from smoke emissions would not exceed state mandated policy. Prescribed fire smoke emissions would be short duration (1-2 days). Prescribed fire burn prescription parameters would reduce the amount of slash burned and the quantity of emissions during the prescribed burns. Because smoke is of short duration and dissipates over the course of one or two days past management activities would not cumulatively add to air quality impacts from the proposed treatments.

If two units are being burned in or outside of the project area in one day or multiple burns (private land or Forest Service) smoke management forecasters coordinate with other land agencies or owners so air quality can be monitored and treatments delayed in order to maintain acceptable air quality. This coordination would ensure this project meets guidelines and regulations through Oregon DEQ. No other foreseeable management activities would affect air quality or scheduled to occur in the Flat Country project area or surrounding areas that could affect communities or wilderness.

Past management activities do not cumulatively add to air quality impacts from the proposed treatments.

3.14 Climate Change

3.14.1 Summary of Effects

This proposed action would affect 4,438 acres of forest by commercially thinning smaller trees from the stand, harvesting overstory trees, reducing surface fuels through prescribed fire, and thinning treatments in combination with prescribed fire, retaining a residual stand of about 40 percent of the original stand by canopy closure. This scope and degree of change would be minor, affecting roughly 6 percent of the 74,063 acres of forested land in the project area. In addition, the effect of the proposed action focuses on aboveground carbon stocks, which typically comprise a fraction of the total ecosystem carbon stocks in the proposed managed area; 50 percent or more of the ecosystem carbon is in the soils, a very stable and long-lived carbon pool (McKinley et al. 2011, Domke et al. 2017).

Climate change is a global phenomenon, because major greenhouse gasses (GHGs)[1] mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHGs in 2010 were estimated at 49 ± 4.5 gigatonnes[2] carbon dioxide (CO_2) equivalent[3] globally (IPCC 2014) and 6.9 gigatonnes CO_2 equivalent nationally (US EPA 2015), a project of this size makes an extremely small contribution to overall emissions. Because local GHGs emissions mix readily into the global pool of GHGs, it is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on global climate. Therefore, at the global and national scales, this proposed action's direct and indirect contribution to GHGs 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 global GHGs and climate change would also be negligible. Lastly, carbon emissions during the implementation of the proposed action would have only a momentary influence on atmospheric carbon concentrations, because carbon would be removed from the atmosphere with time as the forest regrows, further minimizing or mitigating any potential cumulative effects.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) summarized the contributions of global human activity sectors to climate change (IPCC 2014). From 2000 to 2009, forestry and other land uses contributed just 12 percent of the human-caused global CO_2 emissions[4]. The forestry sector's contribution to GHG emissions has declined over the last decade (IPCC 2014, Smith et al. 2014, and FAOSTAT 2013). The largest source of GHG emissions in the forestry sector globally is deforestation (Pan et al. 2011, Houghton et al. 2012, IPCC 2014), which is defined as the removal of all trees to convert forested land to other land uses that do not support trees or allow trees to regrow for an indefinite period of time (IPCC 2000) (e.g., conversion of forest land to agricultural or developed landscapes). However, forest land in the United States has had a net increase since the year 2000, and this trend is expected to continue for at least another decade (Wear et al. 2013, USDA Forest Service 2016). In addition, estimates of forested area on the Willamette National Forest have remained stable, or increased since the late 1990's.

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[1] Major greenhouse gases released as a result of human activity include carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, and perfluorocarbons.
[2] Gigatonne is one billion metric tons; equal to about 2.2 trillion pounds.
[3] Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas. Examples of such greenhouse gases are methane, perfluorocarbons, and nitrous oxide.
[4] Fluxes from forestry and other land use (FOLU) activities are dominated by CO_2 emissions. Non-CO_2 greenhouse gas emissions from FOLU are small and mostly due to peat degradation releasing methane and were not included in this estimate.

This land management project is not considered a major source of GHG emissions. Forested land would not be converted into a developed or agricultural condition or otherwise result in the loss of forested area. In fact, forest stands are being retained and while being thinned, harvested, and prescribed burned to mimic natural fire effects to maintain a vigorous condition that supports enhanced tree growth and productivity, thus contributing to long-term carbon uptake and storage. In 2010, forests in the United States removed about 757 megatonnes[5] of CO_2 from the atmosphere after accounting for natural emissions (e.g., wildfire and decomposition) (US EPA 2015).

Some assessments suggest that the effects of climate change in some United States forests may cause shifts in forest composition and productivity or prevent forests from fully recovering after severe disturbance (Anderson-Teixeira et al. 2013), thus impeding their ability to take up and store carbon[6] and retain other ecosystem functions and services. Climate change is likely already increasing the frequency and extent of droughts, fires, and insect outbreaks, which can influence forest carbon cycling (Kurz et al. 2009, Allen et al. 2010, and Joyce et al. 2014). In fact, reducing stand density, one of the goals of this proposed action, is consistent with adaptation practices to increase resilience of forests to climate-related environmental changes (Joyce et al. 2014). This proposed action is consistent with options proposed by the IPCC for minimizing the impacts of climate change on forests, thus meeting objectives for both adapting to climate change and mitigating GHG emissions (McKinley et al. 2011).

Forests have a "boom and bust" cycle with respect to carbon, as forests establish and grow, experience mortality with age or disturbances, and regrow over time. Forest management activities such as harvests and hazardous fuels reduction have characteristics similar to disturbances that reduce stand density and promote regrowth through thinning and removal, making stands and carbon stores more resilient to environmental change (McKinley et al. 2011). The relatively small quantity of carbon released to the atmosphere and the short-term nature of the effect of the proposed action on the forest ecosystem are justified, given the overall change in condition increases the resistance to wildfire, drought, insects and disease, or a combination of disturbance types that can reduce carbon storage and alter ecosystem functions (Millar et al. 2007, Amato et al. 2011). Furthermore, any initial carbon emissions from this proposed action would be balanced and possibly eliminated as the stand recovers and regenerates, because the remaining trees and newly established trees typically have higher rates of growth and carbon storage (Hurteau and North 2009, Dwyer et al. 2010, McKinley et al. 2011).

In the absence of commercial thinning, the forest where this proposed action would take place would thin naturally from mortality-inducing natural disturbances and other processes resulting in dead trees that would decay over time, emitting carbon to the atmosphere. Conversely, the wood and fiber removed from the forest in this proposed action would be transferred to the wood products sector for a variety of uses, each of which has different effects on carbon (Skog et al. 2014). Carbon can be stored in wood products for a variable length of time, depending on the commodity produced. It can also be burned to produce heat or electrical energy, or converted to liquid transportation fuels and chemicals that would otherwise come from fossil fuels. In addition, a substitution effect occurs when wood products are used in place of other products that emit more GHGs in manufacturing, such as concrete and steel (Gustavasson et al. 2006, Lippke et al. 2011, and McKinley et al. 2011). In fact, removing carbon from forests for human use can result in a lower net contribution of GHGs to the atmosphere than if the forest were not managed (McKinley et al. 2011, Bergman et al. 2014, and Skog et al. 2014). The IPCC recognizes wood and fiber

[5] A megatonne is one million metric tons; equal to about 2.2 billion pounds.
[6] The term "carbon" is used in this context to refer to carbon dioxide.

as a renewable resource that can provide lasting climate-related mitigation benefits that can increase over time with active management (IPCC 2000). Furthermore, by reducing stand density, the proposed action may also reduce the risk of more severe disturbances, such as insect and disease outbreak and severe wildfires, which may result in lower forest carbon stocks and greater GHG emissions. See Forest Stand and Structure (Section 3.1) and Fire and Fuels (Section 3.14) for more details on the effects on vegetation.

In summary, this proposed action affects a relatively small amount of forest land and carbon on the Willamette National Forest and, in the near term, might contribute an extremely small quantity of GHG emissions relative to national and global emissions. This proposed action would not convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the proposed action to have a temporary influence on atmospheric GHG concentrations, because carbon would be removed from the atmosphere over time as the forest regrows or would transfer carbon to the product sector where it may be stored for decades and substitute for more emission intensive materials or fuels. This proposed action is consistent with internationally recognized climate change adaptation and mitigation practices.

3.15 Economics

3.15.1 Summary of Effects

Both action alternatives would provide a positive benefit/cost ratio which compares the income generated with all optional and required activities. Alternative 2 would have a benefit/cost ratio of 1.41 or 27 percent more than 1.11 for alternative 3. In a matter of fiscal return on investment, Alternative 2 would cover all cost plus provide approximately $13.2 million for additional enhancement work within the Forest, while Alternative 3 would cover all cost and provide approximately $735,000 for additional enhancement work.

3.15.2 Scale of Analysis

The scale used to evaluate Economics associated with the Flat Country project is Lane and Linn Counties Oregon. The project lies entirely within the two counties and funds generated would contribute towards county payments. A majority of the purchasers who participate in timber sales on the McKenzie River Ranger District have offices and/or manufacturing facilities in Lane and Linn Counties.

3.15.2 Affected Environment

The Flat Country Project area is situated east of Highway 126, between the highway and the Mount Washington Wilderness, approximately seven mile east of the community of McKenzie Bridge, Oregon. Highway 126, a major travel route for commercial and recreation traffic passing through this community, follows along the McKenzie River. The project straddles the Lane and Linn county line, with most visitors coming from the closest larger community, Springfield, OR.

The economy of the local communities from the Springfield urban-growth boundary to McKenzie Bridge depends on a mixture of tourism, recreation, timber industry, and Forest Service jobs for stability. Local businesses that rely on tourism and recreation include: multiple inns and lodges, restaurants, stores, and gas stations, along with outfitters and guides. Timber industry jobs include a variety of forestry and mill jobs. Tourism and recreational activities connected with National Forest lands have been on the increase in recent years for the upper McKenzie River area. Employment connected with tourism and recreation-related services has also increased.

Although stabilizing over the last 5-10 years, the level of timber harvesting on the Willamette National Forest has dropped substantially from the levels of the mid-1980s. This decrease has contributed to a decline in the number of local jobs associated with the wood products industry and jobs which are dependent on other industries to spend money. Lane County which is the closest processing location to the project is the point used for the economic analysis, although Linn County mills would be very competitive for portions of the project as it is only a slightly longer haul distance. The economic impacts of forest sector jobs contribute approximately 5.4 percent, or 6,595 jobs to Lane County, in addition to approximately 11.5 percent or $1.2 billion to the county's economic base (OFRI, 2012, pg. 55). The same OFRI report states on pg. 41, that approximately 10.8 jobs are created with each incremental increase in million board feet made available for harvest. These jobs are direct effect jobs, or those associated in the harvest, indirect effect jobs, or those businesses that supply goods associated with harvest, and induced effect jobs, or those who work in the broader economy who benefit when people with direct or indirect jobs spend money (OFRI, 2012, pg. 21).

3.15.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1

The no action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy (including the counties). Current levels of employment in the wood products sector would not change under this alternative. If the Flat Country Project were not replaced by another project, the no action alternative could contribute to a continued overall decline in forestry and milling related jobs.

Alternatives 2 and 3

All action Alternatives are economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis utilized to make this determination is available in the Flat Country Project analysis file at the McKenzie River Ranger District office.

In general, the primary effect on timber harvest-related employment would occur from commercial timber harvest associated with the action Alternatives from an estimated selling year of 2021 through a final harvest year of 2025. As Table 7 (comparison of alternatives in Chapter 2) indicates, both action Alternatives would provide some opportunity for timber harvest and the related employment, and higher revenues. Alternative 2 would provide a higher net value than Alternative 3. Table 59 below discloses costs and revenues and the estimated present net value of each of the action Alternatives.

Though the combined economic benefit from implementation of any of the action Alternatives is expected to be positive, each of the Alternatives from the Flat Country Project would have a localized beneficial effect for the socio-economic environment of western and central Oregon with a greater impact to both Lane and Linn Counties. Both action Alternatives would also have a benefit in the form of revenues going towards the National Forest Fund (NFF). Portions of revenue generated by the sale of timber from the action Alternatives would be available to the county for roads and schools. Alternative 2 would be expected to generate almost 18 times the PNV of Alternative 3 (Table 60).

Table 59. Estimated Economic Alternatives

	Alternative 1	Alternative 2	Alternative 3
Timber Volume Produced	---	~ 102 MMBF	~ 14 MMBF
Discounted Cost[3]	---	$32,266,027	$6,591,159
Discounted Revenues	---	$45,451,561	$7,326,850
Present Net Value (PNV)	---	$13,185,534	$735,690
PNV per acre	---	$2,971	$565
Benefit/Cost Ratio	---	1.41	1.11

Revenue based on the 2015 4st quarter Oregon Department of Forestry pond values that have been discounted at 4 percent from 2015 until implementation. All values are for comparative purposes only. Actual values would be dependent on market values during time of sale and cost of associated activities at that time.

3 - By law, planning cost are not part of the cost comparison.

Cumulative Effects

Alternatives 2 and 3

Neither action alternative would have any economic cumulative effects, because there is no overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

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 and 3): 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 percent, 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 2.6) 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

Erickson, Jonathan – District Recreation Staff
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Recreation, Scenery, Wilderness and Inventoried Roadless Areas Analyses
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Contribution: Project Lead September 2016 to present, Writer/Editor, NEPA Compliance
Education/Experience: B.S. Forest Management: University of Wisconsin, Stevens Point. Four years of experience with the FS (Umpqua, Willamette) as the planning and NEPA coordinator.

Seitz, Ruby – Wildlife Biologist
USDA Forest Service, Willamette National Forest, McKenzie River Ranger District
Contribution: Wildlife Analysis
Education / Experience: B.S. Wildlife Management with minor in Fisheries: Humboldt State University; B.A. Liberal Studies: San Diego State University. Thirty years of experience with the FS (Willamette) as a wildlife biologist.

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 Draft Environmental Impact Statement (DEIS). A complete list of recipients, including names and contact information, is available in the Flat Country project file at the McKenzie River Ranger District.

Agencies and Governments

Confederated Tribes of Grand Ronde

Confederated Tribes of Siletz Indians

Confederated Tribes of Warm Springs

Eugene City Council

Eugene Water and Electric Board

Klamath Tribes

Lane County

Linn County

Office of Congressman Peter DeFazio

Office of Senator Jeff Merkley

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

Springfield City Council

United States Environmental Protection Agency

United States Fish and Wildlife Service

Organizations

American Forest Resource Council

Cascadia Wildlands Project

Forest Conservation Council

Forest Issues, Many Rivers Group, Sierra Club

Giustina Land & Timber

Giustina Resources

Lane County Audubon Society

McKenzie Clearwater Coalition

McKenzie Flyfishers

McKenzie River Chamber Of Commerce

Mule Deer Foundation

Native Forest Council

North American Butterfly Association

Obsidians

Oregon Council, Federation of Flyfishers

Oregon Hunters Association

Oregon Nordic Club, Willamette Chapter

Oregon Society of American Foresters

Oregon Wild

Pacific Crest Trail Association

Quail Unlimited

River Reflections

Rocky Mountain Elk Foundation

Rosboro Lumber Co.

Santiam Wilderness Committee

Individuals

A complete list of recipients, including names and contact information, is available in the Flat Country project file at the McKenzie River 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 Flat Country DEIS 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. 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 Flat Country DEIS 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 DEIS and Appendix E, 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 was conducted in 2017 and 2018. All known cultural sites in the Area of Potential Effect (project area) would be protected by avoidance, resulting in a determination of "Historic Properties Avoided" is expected late 2019. Documentation has been retained in the Forest and District Heritage files.

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 DEIS, TMDL requirements for the McKenzie Basin would be met in each alternative (See Chapter 3.3).

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 bull trout, and spring Chinook salmon.

Endangered Species Act formal consultation with the U.S. Fish and Wildlife Service (USFWS) for bull trout and with the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon has been completed. Consultation was completed using a programmatic document process. The Willamette National Forest submitted for formal consultation a Biological Assessment (BA) titled Timber Management Treatments on the Willamette National Forest (January 19, 2018). The Willamette National Forest received Biological Opinions (BO's) from the USFWS (June 5, 2018) and NMFS (June 13, 2018) in response to the BA. The BO's contained Project Design features (PDFs) and terms and conditions that are required in order to reduce effects on ESA-listed fish species.

The BA and BO's are located in the analysis file and are available upon request. The USFWS BO is titled Formal consultation for the activities of Timber Management Program on the Willamette National Forest which may affect bull trout, and/or bull trout Critical Habitat [FWS *reference*: 01EOFW00-2018-0219]. The NMFS BO is titled Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Willamette National Forest Timber Sale Program [WCR-2018-8761].

Table 1A. Effects of Flat Country Project on ESA-listed fish and Habitat

Listed Species or Habitat	ESA Status	ESA/EFH Determination
Upper Willamette River Chinook Salmon – Evolutionary Significant Unit (ESU)	Threatened	May Affect, Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Critical Habitat	Designated	May Affect, Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Essential Fish Habitat	Designated	Adversely Affect
Bull Trout – Distinct Population Segment (DPS)	Threatened	May Affect, Likely to Adversely Affect
Bull Trout – Critical Habitat	Designated	May Affect, Likely to Adversely Affect

Endangered Species Act (ESA) formal consultation with the USFWS for the northern spotted owl is complete. The Flat Country DEIS incorporates by reference this Biological Assessment (Willamette Planning Province Level I Terrestrial Team 2019) and Biological Opinion (USFWS 2019; Reference Number 01EOFW00-2020-F-0133).

Flat Country Project	May Affect and Likely to Adversely Affect the Northern Spotted Owl due to Habitat Modification
Flat Country Project	Not Likely to Jeopardize the Continued Existence of the Spotted Owl
Commercial Thinning in Critical Habitat (suitable habitat)	May Affect and Likely to Adversely Affect, Critical Habitat
Commercial Thinning in Critical Habitat (dispersal habitat)	May Affect, and Not Likely to Adversely Affect Critical Habitat
Effects due to Disruption	May Affect, Not Likely to Adversely Affect with recommended seasonal restrictions March 1-July 15 for hazardous fuels reduction and hazard tree cutting operations surrounding occupied nest patches.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams, and natural migration barriers. Cougar Dam has adult passage at Cougar Dam (adult collection facility). The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for "Essential Fish Habitat" (EFH) that requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. 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 McKenzie River is spring Chinook salmon. The Forest Service conducted this consultation concurrent with ESA consultation.

Changes in the supply of woody material to Scott Creek and Lost Creek would adversely affect EFH in the Flat Country project area. Changes to the sediment regime (increase) would indirectly cause adverse effects to Scott Creek EFH during timber haul operations in the wet-season.

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, no actions would occur in wilderness areas, with meadow enhancement and expansion actives occurring on 150 acres of Mount Washington West IRA, See Wilderness and IRA, Botany and Wildlife sections for more detail.

Wild and Scenic Rivers – The McKenzie Wild and Scenic River (12.7 miles long) is located on the McKenzie River Ranger District of the Willamette National Forest in Lane and Linn Counties of Oregon. The MWSR originates from Clear Lake and descends south and west towards its confluence with the Willamette River. The Flat Country project area overlaps with approximately 351 acres of the MWSR. During the Flat Country project boundary development, most of the MWSR was excluded intentionally to ensure MWSR integrity. Furthermore, no management, enhancement, or fuel treatment units were planned within the MWSR boundary to ensure that MWSR laws, policy, and forest plan standards and guides were followed.

Alternatives 2 and 3 would have no adverse effect on Wild and Scenic Rivers since all harvest related activities are located outside of designated Wild and Scenic River areas, and would be consistent with forest plan standards and guidelines for Wild and Scenic Rivers management.

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 common salmonid sport fish for which there is habitat on the McKenzie River

Ranger District are spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout. The Flat Country Project would maintain habitat conditions for aquatic management indicator species in the project area. Therefore, the Flat Country 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 Flat Country project would maintain habitat conditions for elk, deer, pileated woodpeckers, marten, bald eagles and peregrine falcons in the project area. The Flat Country project would not contribute to a negative trend in viability for any of the terrestrial wildlife management indicator species.

Sensitive Species (Aquatic) – Two aquatic sensitive species have not been documented in Flat Country project area (Pacific lamprey and *Fluminicola virens* [a freshwater snail]). The analysis found that the project may adversely impact individuals, but not likely to result in a loss of viability in the Flat Country Planning Area, nor cause a trend toward federal listing.

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 – On February 11, 1994, President Clinton signed Executive Order 12898. This order directs Federal agencies to address environmental justice by identifying and disclosing the effects of the proposed activities on minority and low-income populations. The effects of the alternatives on the economic conditions of the State and county are disclosed in the Economics section of this chapter.

According to 2013 statistical data for Lane County, about 10% of the population is made up of minorities. Unemployment and poverty in the county is higher than the State average. The project occurs well away from any large population center that would be directly affected by the project. Several small communities are located along the haul routes, some of which may see an increase in business during logging operations and an increase in traffic. The ongoing and reasonably foreseeable activities may also contribute to log truck traffic; overall, this increase in traffic may be measurable, but would not be comparable to the logging that occurred in the area in the late 1980s. No other adverse direct, indirect, or cumulative effects to these communities are expected to occur.

Areas that would be treated by the project may have some recreational value, as described in the recreation section. Where there is dispersed recreation, the effects to those recreating in the area would be greatest. Minority groups or low-income groups that use these areas may be impacted during logging operations by the increase in log truck traffic. These groups may choose to recreate elsewhere. Adverse impacts to these groups would end when logging and other connected actions are completed. Overall, none of the action alternatives imposes any other additional hardships on minority or low-income communities; therefore, there would be no direct, indirect, or cumulative effects to environmental justice with any action alternative. Alternatives would have no direct, indirect, or cumulative effects to any low-income or minority populations that utilize the area for recreation.

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 would promote the restoration of riparian function in stands in corridor and headwater aquatic reserves and to develop additional large wood to stream reaches that currently lack adequate amounts. This would improve fish habitat and would provide better future fishing opportunities for the public.

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 Flat Country Design Features (Chapter 2) 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) 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 –** The 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 – Proposed Treatment Descriptions for the Action Alternatives

Proposed treatments for the Flat Country project area are thinning, gaps, skips, Dominant Tree Release (DTR), regeneration harvest, and various post-harvest fuels reduction treatments.

Activities Common to Thinning

Thinning would maintain or increase the health and vigor of the remaining trees not harvested. Skips, gaps ranging from ¼ -3 acres, and DTRs would be placed in many of the stands to promote vertical and horizontal diversity (see Appendix C for a unit by unit prescription). The use of skips, gaps, and DTRs would help promoted an uneven-aged management approach, which creates a future stand with more than one age class. This uneven-aged approach would apply to units where "…such a silvicultural system is necessary to meet multiple use objectives…" (FW-187).

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees. Sugar pine and white pine would not be removed from the stand; however they may be cut for operational purposes. Generally, remnant large woody debris on the forest floor would be maintained or increased throughout the stand. Snags would be maintained on site if not a hazard to logging operations.

Project generated fuels may be removed with treatments such as yarding tops attached during harvest, biomass utilization, piling and burning, underburning, mastication, firewood collection, or chipping. Every unit would be treated, however, not every acre harvested within the unit would have fuel treatments prescribed. Areas which are projected to be below the standards and guidelines (FW-212 and 252) presented by the Forest Plan would likely have minimal fuel treatments prescribed. All post-harvest fuel treatments would reduce fuel loads within the stand.

Activities Common to Gaps and Regeneration Harvest

Retention trees would be left (see description below for specifics) in openings to function as legacy trees that would benefit a variety of resources. Live retained trees would be released for several reasons including aesthetics, to encourage large tree development, future snag creation, diversity in future stand structure, and development of future large downed woody debris.

Retention trees may be spaced both sparsely throughout the opening and also in clumps, increasing the diversity across the landscape. Emphasis would be placed on retaining multiple desired retention tree species where feasible. Live trees with 'elements of wood decay' may be selected as retention trees, which could include trees with features like dead tops, broken tops and heart rot. This would increase the diversity of the prescriptions across the landscape.

Live retention trees may or may not be used as snag (wildlife) enhancement projects; however, retention trees meeting criteria for wildlife trees (i.e. having Phellinus pini conks or other elements of wood decay) would serve as a wildlife tree and offset the need for further enhancement. In stands where snags or downed woody material would be created after harvest, additional trees may be left that can be utilized. Snags would be maintained on site, if not a hazard to logging operations.

Thinning

Thinning: Thinning treatments would reduce canopy cover within a stand between approximately 30-60 percent. The residual stand, post-harvest (not including gaps put in the stand), would have approximately 19-35 percent of the maximum Stand Density Index (SDI) (see Chapter 3.1 for discussion on SDI). The prescription aims to stay below 55 percent SDImax, which is where inner tree mortality likely begins to occur (Tappeiner et al. 2007). Gaps, dominant tree releases, as well as skips (areas not harvested) would likely be placed in the stands being commercially thinned.

Thinning would increase the health and vigor of the remaining trees and help increase the stands ability to adapt to environmental changes. Additional light, from reduced canopy cover, reaching the forest floor would help promote a second cohort of trees. Both shade-tolerant and intolerant species may be established; however, shade-tolerant species would thrive over time as the overstory crown closes. The canopy cover is estimated to increase 2 percent per year (Chan, 2006). This second generation of trees growing under the overstory canopy is expected to provide vertical, horizontal, age, and species diversity in the stand by primarily harvesting Douglas-fir which is over represented in the project area because of planting densities.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine; however these species may be cut for operational purposes. This prescription would also maintain or increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Thinning provides growing space for new trees to increase age, size and height diversity in a stand and at the project area scale. Young uniform stands such as the plantations and many natural stands proposed for treatment in the Flat Country project can be diversified with early thinning by allowing new generations of trees to establish. 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). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al 1991, Bailey and Tappeiner 1998, Miller and Emmingham 2001).

Treating mature stands in the Flat Country project is expected to increase availability of resources such as sunlight to the forest floor for increased diversity of shrubs, herbs, and understory tree establishment and growth with the effects lasting up to about 15-20 years as the overstory crown closes in (Chan, 2006). In addition to the understory response, increased growth in the overstory is expected to last up to about 25 year (Latham and Tappeiner, 2002). Williamson (1982) found that 19 years after heavy thinning, a 100 year old thinned stand, had a 30 percent higher response to volume growth than did the control units. Thinning across all crown classes in a stand provides the longest term benefits to both large and small trees because of the time it takes to fill in the overstory canopy (Williamson and Price 1966).

Heavier thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. The large older trees in a stand often showed signs of rapid growth in lower densities when they were young (30-100 years), producing large stems and crowns. Evidence (Franklin et al 1981, Tappeiner et al. 1997) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition. Old-growth stands typically have multiple canopy layers, and thinning promotes a second cohort, or canopy layer, by allowing for natural regeneration to occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al 2002a, 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

A short-term (less than one year) impact to understory vegetation and below ground fungi could occur from logging. These short-term adverse effects would be expected to recover within two years post-harvest as regrowth of herbs and shrubs occur. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al 2004). This adverse effect is reduced by minimizing additional soil impacts with the use of designated skid trails with ground–based yarding systems and log-suspension capabilities of skyline and helicopter yarding systems.

Gaps (GS): Gaps would be randomly placed unless it was necessary to strategically place the openings within a stand for other resource benefits as well as minimizing conflict for current and/or expected future logging operations. Gaps may also be placed to provide higher quality early-seral habitat for wildlife species like big game, or to provide scenic vistas. The gaps would be randomly shaped following features of the landscape when available, and would range in size from approximately 1/4-3 acres. When a root rot pocket is identified, a gap would be placed with a 50-foot buffer established around the outside of the root rot pocket which could result in a gap larger than three acres.

Gaps would be placed in stands to provide for horizontal and vertical diversity, or in stands that have been identified as potentially higher quality early-seral habitat areas by our district wildlife biologist. A thinning prescription would be applied to the area outside the gaps.

Gaps are a part of variable density thinning. Although not always, to provide diversity, 1-4 green trees in either scattered pockets and/or scattered would be retained throughout the opening post-harvest. These retention trees would be released to grow to encourage large tree development, future snag development, diversity in future stand structure, and development of future large downed woody debris. In 30 to 60 years the stand structure would be more complex with at least a two cohort stand making up the overstory. This would better mimic some late successional characteristics than what the current stand is projected to produce in the same time frame if no treatment occurred (Andrews et al. 2005).

Dominant Tree Release (DTR): DTR is a method that replicates small disturbances and increases structural variability. This prescription would provide for growth of a dominant tree or group of five to ten trees to promote larger trees scattered throughout the stands. The area around the dominant tree would be cut to a radius of 66 feet from the bole of an individual tree, or each tree in a group. Around an individual tree, the 66 feet equates to approximately ¼ acre (accounting for drip-line of trees) when one tree is identified. When five to ten trees in a clump are identified, the opening size would vary depending on the number and spacing of trees retained but would likely range from an estimated 1/3 to ½ acre. Sugar pine, and white pine would not be cut in the DTR. DTR trees would be randomly placed throughout stands, including riparian areas when the objective within the riparian area includes treatment.

Trees selected for DTR would be the largest trees that best represent site potential in a given area. When under represented species are identified in a stand, the DTR may target these species such as sugar pine, white pine, and western red cedar as the dominate tree to be released. Although the underrepresented species may not be a dominant tree, they would represent the dominant trees of their particular species and help increase diversity. Occasionally a group of two trees would be selected in one DTR. The canopy cover of the stand would be adjusted based on the ¼ acre DTR having a canopy cover of 4 percent.

Within all units, a sugar pine would be used as the dominant tree in an effort to help promote sugar pine's health and vigor as well as regeneration. Sugar pine that are 24 inches DBH and larger with a maximum of 5 trees selected per 10 acres would be used as Dominant Tree Release. All trees within a radius of one chain from the bole of the sugar pine would be cut and removed regardless of species with the exception of another sugar pine located within the cut area or a tree greater than the DBH of the sugar pine selected.

No Harvest Skips (NH): No harvest skips are areas within units that would not have trees removed however some trees within a skip may have trees cut and left on site such as in skyline corridors. There may also be wildlife trees or downed wood created within these areas. These areas include Riparian Reserve no harvest buffers, other resource concerns, or to meet minimum average residual canopy cover requirements.

Regeneration Harvest - Shelterwood with Reserves

Regeneration harvest is the cutting or removing of trees to provide growing space for a new stand of trees. In the Flat Country Project, these new trees would provide a sustainable supply of trees for the future. Shelterwood with reserves is a method of regeneration harvest where you remove most of the trees, however you retain (reserve) some trees to provide a more suitable microclimate for the regenerating new trees. The intent of reserved trees is that they would not be cut in the future but would be used for other benefits such as to provide diversity for wildlife, aesthetics, or to provide future large natural snags and downed wood.

Silviculturally these stands are currently at the culmination of mean annual increment. All stands are currently experiencing inter-tree competition, which creates stand stress and makes them susceptible to insect and disease outbreaks. On average there would be 20 trees retained per acre to help establish a future stand by providing a beneficial microclimate, and contribute towards creating snags and downed wood. The regeneration harvest would result in more complex stand structure in 30 to 50 years with a two aged canopy layer that more closely mirrors what may have happened with natural disturbances on the landscape.

The residual canopy would be composed of the largest trees in the stand, primarily Douglas-fir. As identified in the Standards and Guidelines of the Northwest Forest Plan, at least 15 percent of each stand (not including Riparian Reserves) would be retained in no-harvest patches to provide diversity and maintain existing snags (Northwest Forest Plan, pg. c-41). The retained patches would be scattered and variable in size. Large wood on the forest floor would be maintained or enhanced. Numerous snags would either be maintained on site if not a hazard to logging operations, or enhanced through snag creation techniques. Retention areas would be set aside with no commercial products removed from the area. Snag and downed woody debris creation would likely occur in the retention area and count towards the average snags and downed woody debris within unit (Northwest Forest Plan, p. C-41).

Stands treated as regeneration harvest would be treated for fuels reduction and planted with a variety of tree species after harvest.

Post-Harvest Tree Planting

Reforestation would be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the ingrowth of species such as western white pine and western red cedar. Skid roads in planting areas are expected to be subsoiled to a depth of 18-22 inches to reduce the effects of compaction with the exception of soils under a retention tree canopy because the roots of the given tree would be less disturbed. Compaction from skid roads has not shown a reduction in residual tree growth (Miller et al, 2007). Slash and other debris would be utilized as shade and as a deterrent to browse by ungulates. Planting in identified root rot pockets would be species that are less susceptible to root rot like western red cedar, sugar pine, white pine or red alder. No additional effects would be realized by completion of this project because planting has been accounted for in the Forest and Stand Structure analysis.

Natural regeneration is unpredictable based on timing of cone crops and occupation of the site by competing vegetation, therefore surveys would occur around three years after treatment to verify minimum stocking levels in the natural regeneration. If surveys show less than 200 trees per acre are present, planting with western red cedar, white pine, sugar pine, and/or Douglas-fir would occur to augment the natural regeneration.

Harvest Systems

The three types of logging systems proposed for Flat Country EIS units are ground based, skyline, and helicopter. Each of these systems operates under the same fundamental idea to reduce or eliminate soil compaction and excessive sediment deposition while simultaneously achieving optimal harvest yield.

Ground base logging is implemented using tractors, skidders, forwarder/processors, and shovel track equipment. Ground based equipment is accustomed to operating on slopes under 30 percent slope with short pitches up to 45 percent slopes if approved. These types of equipment are mounted on rubber tires or metal tracks that usually operate on top slash and have low compaction to soils due to wide weight distribution and low angle of operation.

Skyline logging is used in on slopes ranging from 35-90 percent where at least one end of the log is fully suspended two feet above the ground. In many cases as with yarding across perineal streams full suspension (both ends of the log above the ground) is achieved. Skyline logging is implemented using a system of yarders, running carriages and tail spar trees to minimize the contact of the harvested trees with the soil's surface. Corridors are installed to provide a path for the harvested timber to travel from stump to landing. Skyline corridors are 15 feet wide and spaced 150 feet apart at the tail hold ends. Taller towers such as the 90 foot towers proposed for use in the Flat Country EIS units are used whenever possible as they provide for longer reach, adequate deflection, increased payloads, and greater suspension leading to less soil impact.

Helicopter logging is reserved for units where cable yarding or ground based skidding is not possible due to factors such as slope, road location, limited or lack of possible landings or inadequate running space for downhill yarding. For safety purposes larger tree spacing is required for units designated for helicopter logging. Helicopter logging occurs from November to March (outside fire season) depending on ship availability included in wet-weather haul operation times (October 19 to May 14). Chinook Helicopters are the typical ship used during helicopter logging operations and have a maximum payload of 10,000-24,000lbs. Helicopter landings are 200' x 100' that is approximately ½ acre in size.

Pre-existing landings and road systems road would be recommended in the logging feasibility reports whenever possible to minimize additional ground disturbance and to reduce new construction costs. Additionally, skid trails and landings are water-barred after operations have ceased to provide adequate drainage and avoid unnecessary soil disturbance.

Fuel Treatments

Post-harvest fuel treatments are intended to reduce fuels following harvest. Treatments are guided by the Forest Plan standards and guidelines for Maximum Acceptable Fuel Loadings of downed woody material. These guidelines are as follows (FW-212 and FW-252):

Within the proposed harvest units it is estimated (from field surveys and photo series) that current surface fuel loading on average is below the Forest Plan standards and guidelines. However, in many stands post-harvest fuel loadings are projected to be above standards and guidelines.

Table 1B. Guidelines for Downed Woody Material

Diameter (inches)	Tons/Acre
0-3	7-11
3-9	8-12
9-16	18-20
>16	8-15 pieces/acre >20 feet

Proposed post-harvest fuel treatments would consist of yarding tops, hand piling, mechanical treatments and/or underburning. The implementation of fuel treatment may vary in method from what is the proposed in the alternatives to meet standards and guidelines (i.e. grapple piling instead of underburning). However, the implemented fuel treatments would remain within the range of effects analyzed in the Environmental Impact Statement.

Hand Treatment and Mechanical Treatments: Hand treatment require manually hand piling created slash that is ≥1 inch in diameter and ≥3 feet in length. Mechanical treatments use machines to pile or chip/mulch fuels. Slash piles may occur within the unit or at landing(s). Piles would generally be placed in locations to minimize the damage of residual standing snags or live trees; however some piles could be located to cause tree mortality to create snags for wildlife habitat. Hand, grapple, and landing piles are covered with approved plastic following construction and burned at a later date after the slash has sufficiently dried (1-2 years post-harvest). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall or early winter when there is very low risk of the piles spreading into other fuels surrounding the piles.

Yarding Tops: Yarding tops occurs during harvest operations. Tree tops are removed from the harvest unit to the landing areas. The tops are then separated where they can either be utilized (i.e. firewood or biomass) or piled for burning within a few years post-harvest. This treatment aids in reducing the post-harvest fuel loading within the harvest unit.

Post-Harvest Underburn: Post-harvest underburns are intended to reduce fuels created by harvest activities and help promote structural and biological diversity in stands. Underburning would comply with Forest Plan standards and guidelines in regards to consumption of fuels and maintaining down-woody material, duff cover, and snags. Underburns would be conducted during optimal weather and fuels conditions, most likely in the spring or fall. The weather and fuels conditions would be specific to the unit’s location and fuel loading and tempered speeds of ignition to reduce mortality of residual canopy. An objective for the post-harvest underburning would be to minimize overstory tree mortality; however, some mortality of 0 to 10 percent would be acceptable and would also aid in wildlife snag enhancement. Mortality trees that occur adjacent to roads may be removed for safety reasons.

Underburns may require the construction of handlines around the unit perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Handlines are created by scraping fuel back to create an approximately 18 inch mineral soil line, and scattering fuels that lie within about 10 feet of the proposed line. If units are located on a steep slope water bars are created within the fireline to reduce erosion potential.

Road Treatments

Road Maintenance: For all action alternatives, existing forest roads needed for harvest activity would be maintained to allow safe access to harvest areas and to reduce adverse impacts to resources. 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.

Temporary Road Construction and Decommissioning*:* Temporary roads would be created in both action alternatives. These roads would be placed in areas to minimize impacts to resources and would be decommissioned 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 decommissioning would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is possible along skid trails and landings that have treatment.

System Road Storage and Decommissioning: Roads would be closed with a physical barrier and non-drivable water bars installed as needed. Culverts would be removed from stream channels with fills of shallow to moderate depth. Fill depth would be reduced for culverts in deep fill locations, and side cast material would be pulled back. Roads identified for decommissioning may include any of the following treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope recontouring, and sub-soiling. These roads are no longer needed and would be removed from the transportation system.

Rock Obtained from Expanding Existing Quarries: The development of rock quarries is needed for maintaining roads accessing the Flat Country project area. It is estimated that less than 20,000 cubic yards of crushed rock, rip rap and borrow material would be needed. Blasting would be required during rock quarry development, resulting in noise impacts on wildlife to be considered in the analysis. Rock quarry development could occur within five years of the project decision at the following two quarries: Chinook and Pebble. Rock quarry development and use requires coordination with district Botanist on a yearly basis to ensure noxious weeds do not get spread through use of material.

Appendix C – Detailed List of Project Activities by Unit for the Preferred Alternative

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning Acres	Gap Acres	DTR Acres	Shelterwood w/Reserves Acres	No Cut Skips Acres	Skips in RR Acres	Post-harvest TPA >7"	Net MBF for Unit	Net MBF per Harvest Acre
10	26	106	0	0	0	0	0	22	4	0	20	1270	72
50	16	34	2	8	2	2	1	0	3	0	58	192	17
70	41	36	3	29	3	5	1	0	3	0	86	631	19
80	57	32	15	26	13	12	0	0	4	2	91	810	17
90	38	32	10	20	8	5	0	0	3	2	59	388	14
110	22	79	4	13	0	5	1	0	1	2	56	520	29
140	21	43	0	17	0	0	2	0	2	0	43	289	18
160	32	31	5	23.5	5	0	1.5	0	2	0	75	279	11
180	34	33	0	30	0	0	0	0	4	0	65	286	12
190	56	109	0	47	0	5	0	0	4	0	68	870	19
210	42	35	0	30	0	10	0	0	2	0	57	725	22
250	28	29	15	6	12	5	0	0	2	3	99	265	12
260	16	34	0	13.5	0	0	0.5	0	2	0	70	169	11
300	13	149	7	0	0	0	0	5.25	0.75	7	20	210	50
310	46	37	11	25	9	10	0	0	0	2	76	1059	27
350	38	143	0	32	0	0	0	0	6	0	30	689	27
360	53	42	43	5	26	3	0	0	2	17	57	609	21
440	25	31	18	2	14	3	0	0	2	4	77	189	11
460	28	39	21	7	15	0	0	0	0	6	44	188	11
470	64	34	0	49	0	10	0	0	5	0	87	595	11
480	16	31	0	11	0	0	3	0	2	0	66	166	14
490	64	41	28	12	20	5	5	0	0	22	39	570	12
1020	15	33	0	12	0	0	2	0	1	0	53	166	14
1040	18	32	7	11	6	0	0	0	0	1	65	101	7
1050	24	32	0	23	0	0	1	0	0	0	68	184	9
1070	22	32	0	17	0	2	3	0	0	0	81	175	7
1090	19	36	5	13	4	0	1	0	0	1	86	279	19
1100	10	32	0	10	0	0	0	0	0	0	85	90	11
1110	312	136	21	42	0	20	10	176	43	21	36	11435	60
1120	27	141	0	19	0	3	3	0	2	0	33	1030	43
1130	17	133	4	9	0	0	1.5	0	1.5	5	31	213	17
1140	20	138	3	14	0	0	2	0	1	3	43	351	23
1150	31	146	1	23	0	2	1	0	4	1	20	259	10
1200	30	146	10	12	0	3	1	0	4	10	26	750	49

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning Acres	Gap Acres	DTR Acres	Shelterwood w/Reserves Acres	No Cut Skips Acres	Skips in RR Acres	Post-harvest TPA >7"	Net MBF for Unit	Net MBF per Harvest Acre
1210	7	118	1	5.5	0	0	0.5	0	0	1	30	265	54
1220	15	139	0	8	0	3	1	0	3	0	41	830	77
1230	20	29	10	5	6	2	1	0	2	4	75	118	9
1240	38	64	14	26	0	5	1	0	4	2	35	744	22
1260	38	138	24	13	0	0	1	0	0	24	32	896	78
1270	9	40	1	6	0	0	0	0	2	1	62	52	11
1280	49	120	9	29	0	5	0	0	6	9	44	2299	81
1300	165	118	113	45	0	7	0	0	0	113	43	3582	80
1310	14	79	1	7	0	3	1	0	2	1	40	569	53
1320	14	77	11	2	0	0	1	0	0	11	40	166	59
1330	11	66	5	3.5	4	0	1.5	0	1	1	77	181	40
1340	39	98	12	21	0	0	1	0	5	12	48	1320	73
1350	4	42	4	0	2	0	0	0	0	2	72	43	27
1360	7	50	0	5.5	0	0	1.5	0	0	0	65	65	8
1370	38	38	0	26	0	6	0	0	6	0	59	153	5
1380	22	34	0	16.5	0	3	0	0	2.5	0	75	201	12
1400	5	109	0	3	0	0	1	0	1	0	37	146	35
1410	29	34	0	20.5	0	4	0.5	0	4	0	75	131	6
1420	18	34	0	16	0	2	0	0	0	0	78	106	7
1430	20	32	0	15	0	5	0	0	0	0	67	165	7
1440	8	98	0	0	0	0	0	6.5	1.5	0	20	156	30
1450	17	115	0	0	0	0	0	14	3	0	20	344	31
1480	5	121	0	0	0	0	0	4	1	0	20	102	32
1500	23	30	0	15	0	0	2	0	6	0	89	60	4
1510	14	40	0	8	0	3	1	0	2	0	54	226	18
1520	40	98	5	0	0	0	0	30	5	5	18	572	24
1530	7	36	0	6	0	0	1	0	0	0	60	97	16
1540	20	110	1	17	0	0	0	0	2	1	25	490	36
1550	19	34	5	12	4	0	2	0	0	1	69	106	7
1560	12	32	1	11	1	0	0	0	0	0	74	37	4
1580	9	29	0	7	0	0	2	0	0	0	94	110	14
1590	44	102	18	14	0	9	1	0	2	18	41	871	34
1600	26	114	0	17	0	6	1	0	2	0	30	1452	69
1610	29	93	0	26	0	3	0	0	0	0	26	349	12
1650	7	122	0	0	0	0	0	5	2	0	18	208	52
1660	8	110	1	6	0	0	0	0	1	1	31	221	46
1670	14	67	0	10	0	3	0	0	1	0	72	591	52
1680	20	112	1	16	0	0	0	0	3	1	32	612	48

Unit	Total Stand Acres	Age	Total Riparian Reserve Acres	Thinning Acres	Riparian Reserve Thinning Acres	Gap Acres	DTR Acres	Shelterwood w/Reserves Acres	No Cut Skips Acres	Skips in RR Acres	Post-harvest TPA >7"	Net MBF for Unit	Net MBF per Harvest Acre
1690	41	38	0	29	0	10	0	0	2	0	97	419	11
1700	45	132	16	15	0	9	0	0	5	16	30	1375	61
1710	164	120	32	25	0	10	5	78	14	32	30	5949	62
1720	35	144	13	11	0	6	0	0	5	13	36	831	51
1730	33	147	18	10	0	3	2	0	0	18	54	225	11
1750	17	119	9	8	0	0	0	0	0	9	41	19	3
1770	21	108	6	15	0	0	0	0	0	6	40	21	2
1810	275	148	95	8	0	10	5	126	27	99	33	3489	29
1820	53	149	0	7	0	0	0	38	8	0	17	501	16
1830	78	118	7	0	0	0	0	43	21	14	17	539	16
1860	6	31	0	4	0	0	2	0	0	0	83	68	12
1870	14	76	9	5	0	0	0	0	0	9	71	163	41
1880	12	124	0	9	0	1	0	0	2	0	33	626	75
1900	27	141	0	22	0	0	0	0	5	0	45	1401	80
1910	24	126	1	21	0	0	1	0	1	1	26	1025	56
1920	22	148	6	14	0	0	1	0	1	6	31	394	31
1940	20	125	0	18	0	0	0	0	2	0	41	1349	94
1950	13	108	0	11	0	0	0	0	2	0	34	221	25
1960	47	34	1	46	0	0	0	0	0	1	40	470	13
1970	125	143	2	28	0	10	3	60	18	6	39	3840	37
1980	222	150	16	62	0	15	3	102	24	16	40	4627	35
2010	171	132	28	47	0	12	4	68	12	28	33	7406	73
2020	19	98	3	15	0	0	0	0	1	3	31	887	74
2030	7	102	0	0	0	0	0	5	2	0	18	163	41
2040	12	102	0	0	0	0	0	10.5	1.5	0	18	343	41
2060	8	141	0	0	0	0	0	4.5	3.5	0	17	354	98
2080	25	56	0	25	0	0	0	0	0	0	40	175	9
2110	82	132	5	60	0	9	3	0	5	5	36	6402	106
2120	116	134	34	11	0	4	2	34	31	34	81	2445	68
2130	59	149	0	32	0	12	0	0	15	0	30	2848	72
2140	63	136	13	35	0	6	4	0	5	13	40	1009	21
2160	193	144	10	20	0	5	5	129	24	10	32	4827	45
2170	45	123	0	35	0	6	2	0	2	0	63	907	23
2180	33	98	3	19	0	0	4	0	7	3	40	656	28
2190	75	75	13	42	10	10	10	0	0	3	50	1316	15
2200	30	147	11	13	0	6	0	0	0	11	41	1029	56

Appendix D – Road Treatment Proposals

Road Number	Length	Haul Route	Current Status	Proposed Treatment In Alternatives 2 & 3	Comment
2600550	0.15	Yes	Storage	Storage	
2649688	0.70	Yes	Storage	Storage	
2653685	0.60	Yes	Storage	Storage	
2653715	1.95	No	Storage	Storage	
2653718	0.50	No	Storage	Storage	
2653723	0.54	No	Storage	Storage	
2653758	0.30	Yes	Storage	Storage	
2600350	0.9	No	Closed	Decommission	
2600719	0.21	No	Closed	Decommission	
2600728	0.19	No	Closed	Decommission	
2600728	1.13	No	Closed	Decommission	
2647528	0.46	No	Closed	Decommission	Consult with Resource Specialist prior to implementation
2649655	0.04	No	Closed	Decommission	
2649672	0.89	Yes	Closed	Decommission	Consult with Resource Specialist prior to implementation
2649675	0.24	Yes	Closed	Decommission	Consult with Resource Specialist prior to implementation
2649684	0.07	Yes	Closed	Decommission	
2649686	0.8	No	Closed	Decommission	
2649687	0.14	No	Open	Decommission	
2649689	0.61	No	Closed	Decommission	
2649690	1.8	No	Open	Decommission	Consult with Resource Specialist prior to implementation
2649696	0.69	No	Closed	Decommission	
2649697	0.37	No	Closed	Decommission	
2649754	0.36	Yes	Closed	Decommission	Consult with Resource Specialist prior to implementation
2649767	0.08	Yes	Closed	Decommission	
2653690	0.27	No	Closed	Decommission	
2653701	0.08	No	Open	Decommission	

Road Number	Length	Haul Route	Current Status	Proposed Treatment In Alternatives 2 & 3	Comment
2653709	0.4	No	Closed	Decommission	Consult with Resource Specialist prior to implementation
2653731	0.08	No	Open	Decommission	
2653732	0.12	No	Open	Decommission	
2653733	0.34	No	Closed	Decommission	
2653736	0.11	No	Closed	Decommission	
2653738	0.09	No	Closed	Decommission	
2653739	0.24	Yes	Open	Decommission	
2653744	0.2	No	Closed	Decommission	Consult with Resource Specialist prior to implementation
2653753	0.17	No	Closed	Decommission	
2653757	0.23	No	Closed	Decommission	
2653759	0.14	No	Closed	Decommission	
2653763	0.12	No	Open	Decommission	
2653766	0.1	No	Open	Decommission	
2653768	0.05	No	Open	Decommission	
2653770	0.47	No	Closed	Decommission	Consult with Resource Specialist prior to implementation
2653797	0.18	No	Closed	Decommission	
2653806	0.22	No	Open	Decommission	
2653812	0.15	No	Closed	Decommission	
2657815	0.21	No	Open	Decommission	
2657853	0.16	Yes	Closed	Decommission	
2657861	0.4	No	Closed	Decommission	
2657900	0.21	Yes	Closed	Decommission	
2664507	0.41	No	Closed	Decommission	
4200220	0.19	No	Open	Decommission	Consult with Resource Specialist prior to implementation
4200221	0.18	No	Open	Decommission	Consult with Resource Specialist prior to implementation
4200222	0.14	No	Open	Decommission	Consult with Resource Specialist prior to implementation
4200227	0.11	No	Open	Decommission	Consult with Resource Specialist prior to implementation

Road Number	Length	Haul Route	Current Status	Proposed Treatment In Alternatives 2 & 3	Comment
4200249	0.03	No	Open	Decommission	Consult with Resource Specialist prior to implementation
4200253	0.21	No	Open	Decommission	Consult with Resource Specialist prior to implementation

Appendix E – An Evaluation of Activities Authorized by the Flat Country Project DEIS for Consistency with the Aquatic Conservation Strategy

Introduction

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy and any associated standards and guidelines. A variety of tactics to accomplish these goals and objectives are incorporated into four primary components. These components are:

Riparian Reserves
Key Watersheds
Watershed Analysis
Watershed Restoration

These four components, along with Late Successional Reserves, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl – FS and BLM 1994, [ROD], pages B9-B12).

Standards and Guidelines (S&Gs) were also developed for each of the components and for a variety of actions that the Forest Service or BLM could implement. Specific terminology used in the S&Gs identifies the type of direction and compliance required. Correct interpretation of the terms is critical to understanding the intent of the direction (Willamette LRMP Page IV-45).

The first intent is conveyed with the word **"shall."** With this degree of compliance the action is mandatory in all cases.

The second intent is conveyed by the word **"should."** With this degree of compliance the action is required, unless justifiable reason exists for not taking action. This direction is intended to require a practice unless it entails unacceptable hardship or expense. Exceptions to "should" restrictions are expected to occur infrequently.

The words "**may"** and **"will"** are commonly used in these explanatory statements and are not meant to be management direction. The word **"may"** is used to identify how the objective of a particular standard can be met by describing situations or circumstances typically encountered. The word **"will"** applies only to a statement of future condition or an expression of time. It does not convey a degree of compliance.

The S&Gs are designed to focus the review of proposed and certain existing projects to determine compatibility with the Aquatic Conservation Strategy (ACS) objectives. The standards and guidelines focus on "meeting" and "not preventing attainment" of ACS objectives. The intent is to ensure that the responsible official must find that the proposed management activity is consistent with the ACS objectives. (ROD pg. B-10).

The Four Components

1. Riparian Reserves

The Northwest Forest Plan defined Riparian Reserves as “portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply” (ROD pg. B12). Riparian Reserves include those portions of a watershed directly coupled to streams, ponds, lakes, and wetlands - that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water (ROD pgs. B-12 and B-13). The various widths based on stream type can be found on pages C-30 and C-31 of the ROD.

Table 1E. Riparian Reserve Widths from the ROD

Stream Type	Riparian Reserve Width
Fish-bearing	Two site-potential tree heights[1] or 300 feet, whichever is greater
Permanently flowing non-fish-bearing streams	One site-potential tree height or 150 feet, whichever is greater
Intermittent streams	One site-potential tree height or 150 feet, whichever is greater
Constructed ponds or reservoirs	One site-potential tree height or 150 feet, whichever is greater
Lakes and natural ponds	Two site-potential tree heights or 300 feet, whichever is greater

[1]One site potential tree height is 180 feet, as identified in the Upper McKenzie Watershed Analysis

The Willamette National Forest has completed Endangered Species Act (ESA) consultation for timber sale projects. This consultation was for Upper Willamette spring Chinook salmon (June 13, 2018) and for bull trout (June 5, 2018) and covered activities for the timber management program on the forest. This consultation is a “programmatic” consultation and has Project Design features (PDFs) that are required and intended to reduce incidental take of listed fish species. For harvest that is covered under S&G TM-1(c), the programmatic BO required the following no-harvest buffer widths in Riparian Reserves.

Table 2E. No-Harvest Buffer Widths in Riparian Reserves with Thinning

Stream Class	No-harvest Buffer Width
Class 1 - Streams with anadromous fish and/or bull trout	120 feet
Class 2 - Streams with resident fish like rainbow and cutthroat trout	100 feet within 1,000 feet of a Class 1 stream, 75 feet outside of 1,000 feet from a Class 1 stream
Class 3 - Permanently flowing non-fish-bearing streams	60 feet
Class 4 - Intermittent streams	30 feet

During the analysis for the Flat Country Project, no reductions of Riparian Reserve widths along any streams were proposed. However, silvicultural treatments were proposed within Riparian Reserves for young managed stands or plantations in order to control stocking and improve structural and vegetative diversity. Timber harvest is prohibited within Riparian Reserves but there are 3 exceptions provided in the ROD. One of which is Standard and Guideline TM-1(c).

Standards and Guidelines

TM-1(c). Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Standard and Guideline TM-1(c) in the ROD provides direction on when silvicultural activities can take place in Riparian Reserves. The task is to review all the Riparian Reserves in the project area and at the landscape level to determine if treatment is warranted. The only Riparian Reserves where treatments are proposed (thinning) are previously managed stands (i.e. plantations) that are densely stocked and have little or no hardwoods in the reserve. In these stands the no harvest widths prescribed in the programmatic BO were used (i.e. Table 2).

Thinning Riparian Reserves means that there would be an effect on the supply of coarse woody material and ACS objective #8 states that the Forest Service must maintain and restore amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. The plantations where thinning is proposed are dense and there is a need to control stocking in order to maintain a healthy stand of trees. The number of total trees per acre (i.e. this number is trees greater than 7 inches in diameter) range from 93 to 309. 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 (Tappeiner et al 1997; Poage & Tappeiner 2002). Having a no-cut buffer adjacent to every stream would maintain a high level of trees per acre compared to what has been found in these studies. In the thinned areas there would still be more trees per acre left after thinning than found in the studies. The previously harvested stands proposed for treatment in the Flat Country project area were harvested and replanted using direction that pre-dates even the Willamette Land and Resource Management Plan (1990) and prior to the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area. It is expected that the amount of woody material left in the no cut buffer and the remainder of the Riparian Reserve would be sufficient to sustain physical complexity and stability.

Aquatic specialists on the Willamette National Forest conducted a “hardwood analysis” for the all the Riparian Reserves in the Flat Country project area. For this analysis, spatial data [GNN (2012), NAIP (2016)] was used. There are an estimated 10,385 acres of Riparian Reserves in the project area. The analysis found that less than 1 percent of the Riparian Reserves in the project area had a deciduous and deciduous/shrub component. Thinning in Riparian Reserves in plantations would control stocking, increase stand structure, and improve conditions for hardwood species.

Table 3E. Results of Hardwood Analysis

Vegetation Class	Percentage of Acres in Project Area
Open/Sparse/Water	14%
Hardwood	<1%
Mixed	1.5%
Conifer	84.5%

At a watershed level coarse woody debris levels would be maintained. There are 10,385 acres of Riparian Reserve in the project area. Alternatives 2 and 3 would thin 164 acres of Riparian Reserve which is less than 2 percent of the Riparian Reserve acres in the project area.

The recommendations made for silvicultural treatments were based on the need to control stocking and achieve the desired vegetation and structural characteristics needed to obtain ACS objectives.

Swales: Identifying a perennial stream is obvious. Intermittent streams, however, can sometimes be more difficult to recognize so the ROD has a definition of an intermittent stream on page C-31 – "any nonpermanent flowing drainage feature having a definable channel and evidence of annual scour and deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria."

Swales are features that show evidence of flowing water but do not meet the definition of a stream in the ROD. Due to the permeable and porous nature of the soils in the High Cascades geologic area the streams in the project area are mostly intermittent streams and there are many swales across the landscape. They range from a barely noticeable depression in the ground to an entrenched swale. The ROD does not consider swales as streams and therefore they do not have Riparian Reserve protections. However, during field investigations for this project aquatic team members located deeply entrenched swales and recommended a small no-harvest buffer (i.e. a skip) because it is evident that water does flow down these swales even though there is no definable channel or evidence of annual scour and deposition. The photos below show examples of a deeply entrenched swale that did not meet the definition of a stream. Also provided is a LiDAR (Light Detection and Ranging) map that has removed all the vegetation and shows the swales.

Figure 1E. Entrenched Swale Unit 1240 and LiDAR Map Showing Swales

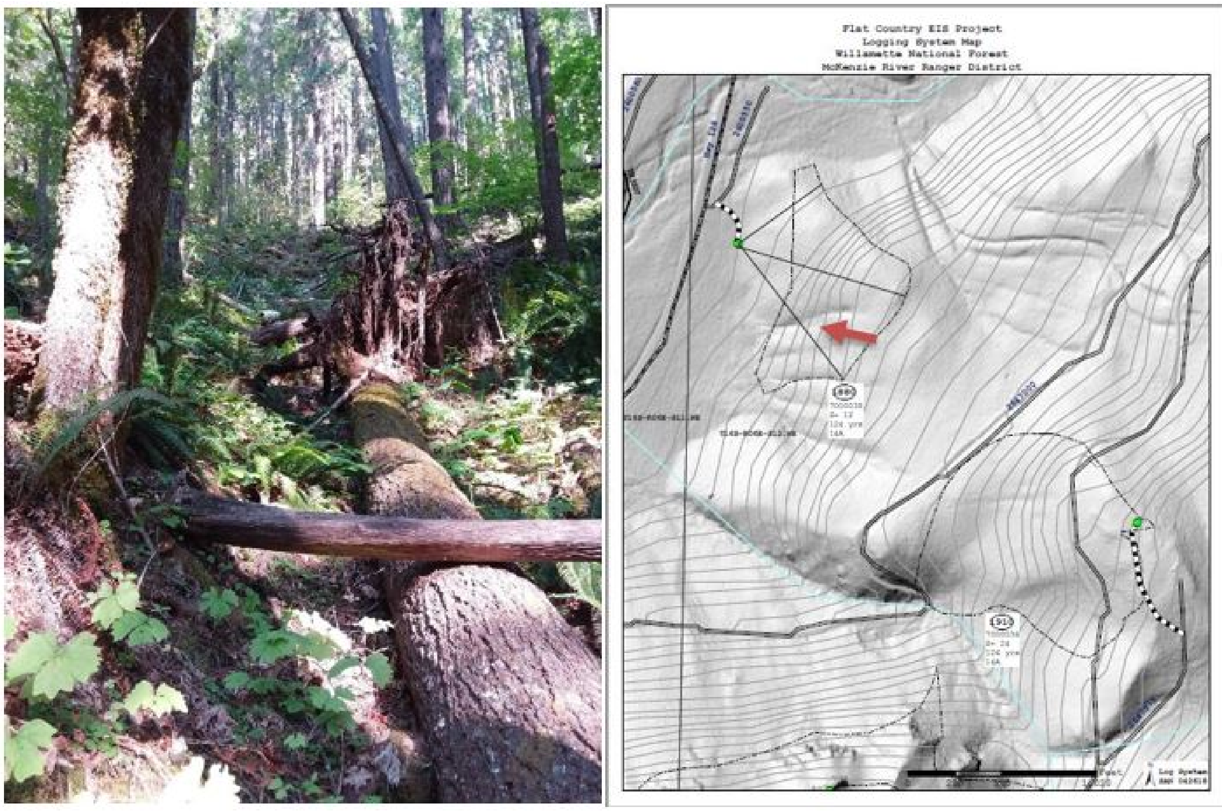

Figure 2E. Entrenched Swale Unit 1880 and LiDAR Map Showing Swales

2. Key Watersheds

The Northwest Forest Plan created an overlay of Key Watersheds that are intended to provide refugia for at-risk stocks of anadromous salmonids and resident fish species. Refugia are a cornerstone of the conservation strategy for these species, consisting of watersheds that provide high quality habitat or are expected to provide habitat. In key watersheds, completion of a watershed analysis is required prior to most management activities. Portions of the upper McKenzie River watershed are designated as a Key Watershed. One of the important components of Key Watershed is that there must be no net gain in roads. If new roads need to be built, then an equivalent mileage must be decommissioned.

Standards and Guidelines

S&G: **No new permanent roads would be built in roadless areas in Key Watersheds.**

- The Flat Country project is consistent with this S&G. No new permanent roads are proposed to be constructed in roadless areas or anywhere in the project area. Temporary roads would be decommissioned upon completion of harvest activities.

S&G: **Timber harvest cannot occur in Key Watersheds prior to completing a watershed analysis.**

- A watershed analysis was completed for the Upper McKenzie watershed in 1995.

3. Watershed Analysis

The Upper McKenzie Watershed Analysis (WA) was prepared for the McKenzie River Ranger District in 1995. The watershed was characterized in terms of past and current conditions, and a synthesis discussion was provided to guide development of management proposals to maintain and restore watershed conditions.

The Flat Country Project has incorporated information from the WA into the project design. Current vegetative landscape patterns reflect past management activities that did not consider what the landscape might look like under natural disturbance regimes. Many of the proposed projects seek to create vegetative patterns, late successional stand structures, and fuel loadings that would have been typical of this landscape under the natural disturbance regimes that historically occurred in the area.

4. Watershed Restoration

Watershed restoration has been ongoing in the Upper McKenzie River since 1995. For example, a large wood placement project has been implemented in the McKenzie River upstream of Trail Bridge Reservoir. Roads have been decommissioned in the watershed and more roads are proposed for these treatments in the Flat Country project.

Aquatic Conservation Strategy Objectives

The previous discussions highlighted the consistency of the Flat Country Project with the four components of the Aquatic Conservation Strategy. This section will outline how the activities proposed in the alternatives conform to the nine objectives of the ACS. The information presented is summarized from Chapters 2 and 3 of the Environmental Impact Statement, where greater detail can be found if needed.

<u>Objective #1</u> - 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.

<u>Alternative 1 (No Action)</u> – This alternative would maintain landscape complexity at the current condition. Several hundred acres of Riparian Reserves would remain in dense, overstocked, conifer-dominated stands with very little structural and species diversity and understory development until natural processes create openings and downed wood.

This could take several decades or up to a century. Aquatic habitats would continue to experience a low volume of large instream wood. Until a large disturbance event (fire or large flood), the Upper McKenzie watershed would continue to have a low percentage of hardwood vegetation in the Riparian Reserves.

<u>Alternatives 2 and 3</u> – There is a need to treat some portions of overstocked Riparian Reserves in the project area to increase the distribution, diversity and complexity of watershed and landscape-scale features in the project area. Alternatives 2 and 3 propose to treat approximately 164 acres of these young managed stands. All lakes and ponds in the planning area would have a minimum 180-foot no-harvest buffer, ranging up to 360 feet in stands already meeting ACS objectives. In young managed stands proposed for treatment, all streams would have a no-harvest buffer based on widths prescribed in the Willamette National Forest Biological Opinion (see Table 2 above) and would maintain 40 percent canopy cover in portions of the reserve that are thinned. In addition to these measures, project design features (PDFs) were developed by the interdisciplinary team (Chapter 2 of this DEIS) and are also

required by the biological opinion (in the project record and available by request). These PDFs would minimize impacts to riparian areas and streams.

A specific example of why this thinning is important here and now is unit 590 adjacent to Scott Creek. This segment of Scott Creek is designated as Critical Habitat for Upper Willamette River spring Chinook salmon. Stream surveys found that this segment (reach 1) was deficient in large woody material which is important in creating complex habitats for salmonid fish. This unit 590 would accelerate the growth of these trees and improve their future quality when they reach the channel. That is, they would taller and have greater diameters than unthinned areas.

The Flat Country project proposes to thin less than 2 percent of Riparian Reserve acres in the project area with the objective of setting the stands on a trajectory where they begin achieving Aquatic Conservation Strategy objectives. Adjacent to the project area is the Mount Washington Wilderness where natural processes are the management goal. The project area coupled with the wilderness provides a large landscape where large-scale features would be maintained. The Flat Country project would decommission 14.1 miles of road and store an additional 4.7 miles of road. Removing culverts from streams moves the watershed toward better achieving Aquatic Conservation Strategy objectives.

<u>Objective #2</u> - 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.

<u>Alternative 1 (No Action)</u> – The No Action alternative is the only alternative that would not move this objective toward achieving Aquatic Conservation Strategy objectives. Failing culverts and inadequately maintained roads would continue to affect the ability of some aquatic species to disperse. Otherwise, implementation of this alternative would maintain existing spatial and temporal connectivity.

<u>Alternatives 2 and 3</u> - The action alternatives would decommission roads and culvert removal from streams moves the watershed toward better achieving Aquatic Conservation Strategy objectives. Riparian Reserve strategies protect corridors, floodplains, ponds, headwater tributaries and intact refugia.

One example of how the Riparian Reserve strategy was designed to maintain these connections can be found in unit 1590. Due to the geologic history and soil conditions of the project area, there are very few perennial streams. This is especially true in the higher elevations of the project area but there is a perennial stream in unit 1590 that stands in contrast. Because perennial streams are so rare – in the summer – the stream in unit 1590 is critical for riparian and aquatic dependent species. During field investigations riparian dependent species such as the mountain beaver (*Aplodontia rufa*) were observed as well as the Pacific chorus frog (*Pseudacris regilla*) and the Cascades frog (*Rana cascadea*). These species would not be in this area without perennial stream flow and the associated riparian vegetation. The stand is 102 years-old so the no-harvest Riparian Reserve width is 180 feet. This stream originates in a wet meadow at the wilderness boundary (which is about 2,000 feet upstream of the unit) and by implementing a full Riparian Reserve width connectivity is being maintained between a high elevation wet area and stream channel habitat lower in elevation.

<u>Objective #3</u> - Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

<u>Alternative 1 (No Action)</u> – Implementation of this alternative would maintain existing conditions. Roads and drainage features would continue to fail creating potential for damage to channel integrity. Large

instream wood levels would remain low in many streams in the project area for several decades until natural processes occurred to create it. Small wood levels would remain at normal to high levels as the stands develop.

Alternatives 2 and 3 - The action alternatives would decommission roads and culvert removal from streams moves the watershed toward better achieving Aquatic Conservation Strategy objectives. Riparian Reserve strategies would protect all shorelines, banks, and bottom configurations. If temporary roads cross stream channels, those roads would be decommissioned when timber harvest and post-harvest activities are complete.

All proposed treatments were designed with channel stability in mind. All harvest activities restrict the use of ground disturbing equipment in and around streams and provide for retention of all vegetation that is contributing to the stability of banks and channels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as downed woody material.

Objective #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.

Alterative 1 (No Action) – Implementation of this alternative would maintain existing water quality conditions including current levels of shade for stream temperatures. As stands continue to develop towards more natural conditions, conditions would slowly (several decades) improve. Full water quality recovery could take several years to several decades.

Alternatives 2 and 3 - The subwatersheds where the project is located have a history of volcanic lava flows and glaciation that has created a landscape with mild topographic relief (i.e. it's relatively flat) and soils that are very permeable and porous. Because of this there are very few perennial streams in the project area and the majority of streams are seasonal-flowing. Where there is perennial streamflow, those streams tend to be spring-fed and lower in the watershed (i.e. near the McKenzie River).

Because of these natural conditions, Riparian Reserve strategies, and due to PDFs that would be required during project implementation, water quality would be maintained.

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.

Alterative 1 (No Action) – Approximately 35 percent of the Upper McKenzie 5th field watershed lies in designated wilderness. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing anthropogenic sediment input at their current levels for potentially several years. However, Alternative 1 would not correct existing road erosion problems nor reduce the risk of future road or culvert failure.

Alternative 2– Project design elements are intended to maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, as discussed above under ACS Objective #3. These design elements would also provide protection to water quality from the introduction of sediment into streams and resulting effects on stream turbidity.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Flat Country Project addresses this by designing the project so no permanent road construction is required and upgrading numerous culverts on existing roads. Approximately 109 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, would reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This would reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. During culvert replacement, some sediment may enter the stream system. However, the amount would be minimized by following Best Management Practices (BMPs), and the impact to the aquatic ecosystem would be relatively short lived (1-2 seasons) and only a few yards downstream. Approximately 15.5 miles of temporary roads would be constructed on stable locations, and all of these would be obliterated following harvest activities. Of those, only one mile (1.5 acres) are within Riparian Reserves. Additionally, approximately 15.1 miles of road would be decommissioned, and 4.7 miles would be stored in a hydrologically stable state.

All proposed treatments were designed with sediment transport potential in mind. All harvest activities follow BMP guidelines and restrict the use of ground disturbing equipment in and around streams and haul during wet weather conditions. This reduces the potential of water routing along skid roads or the creation of overland flow due to high compaction levels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as downed woody material.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2 with the exception of fewer road miles maintained or reconstructed (56 miles). This may result in impacts to the streams along roads not repaired. Fewer miles of temporary roads (6.7 miles) are proposed, and only about 0.1 miles of those are within the Riparian Reserves.

Objective #6 – Maintain and restore instream 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.

Alterative 1 (No Action) – Approximately 35 percent of the Upper McKenzie 5th field watershed lies in designated wilderness. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing instream flows.

Alternatives 2 and 3 – This alternative maintains current canopy cover at levels well above the Midpoint Aggregate Recovery Percentage (ARP). Therefore, no altered flows are anticipated from implementation of this alterative.

Objective #7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Alterative 1 (No Action) – As mentioned in previous objective, approximately 35 percent of the Upper McKenzie 5th field watershed lies in designated wilderness which helps provide for natural landscape processes Implementation of this alternative would maintain existing floodplain inundations and water table elevations.

Alternatives 2 and 3 – Implementation of a landscape design that is intended to restore vegetative structures within young dense stands, 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.

Floodplains and wetland areas were excluded from consideration for harvest activities and where treatment units occur adjacent to these features, ground based equipment that could impact the soil and result in altered groundwater movement are restricted.

Addition of instream wood has the potential to alter floodplains. However, research has shown that this type of alteration usually leads in increased channel complexity and improved aquatic habitat.

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.

Alternative 1 (No Action) – This alternative would keep landscape complexity at the current condition which has been negatively affected by past actions like clearcutting timber harvest techniques. Proposed treatment areas of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Aquatic habitats would continue to experience low rates of instream and terrestrial downed wood. However, small downed wood levels would remain at normal to high levels as stands develop

Current rates of wood recruitment, provided mostly by stem mortality (from competition, disease, wind fire and snow downed trees), would persist. Alternative 1 would provide a slightly higher volume of instream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent. In some streams, recruitment trees are of sufficient size to meet ACS Objectives, but in other streams with small diameter riparian stands the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. Instream wood abundance is low for most streams in the project area and is largely due to the lack of large enough wood to remain stable in channels.

The No-Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions – high species and structural diversity with large dead and downed wood– would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels. Accelerated restoration of riparian stands that currently do not meet ACS Objectives would not be accomplished. In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. A large disturbance event has the potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves.

Alternatives 2 and 3 - Riparian Reserve strategies would maintain this objective. There would be no harvest in any Riparian Reserve where ACS objectives would not be maintained or restored through treatment. Thinning would only occur in Riparian Reserves that are in young, managed stands and would have no-harvest buffers that are shown in Appendix G. These are previously managed stands that were harvested as “clearcuts” 30 to 70 years ago. They are currently in a condition where they are dense and overstocked with conifer trees and thinning is prescribed to accelerate the achievement of Aquatic Conservation Strategy objectives of diversity, complexity and ecosystem productivity. A slight reduction in short-term wood recruitment would be expected as a result of treatment, while 90 percent of wood recruitment zones would be protected as part of the action alternatives. Prescriptions would maintain 40 percent canopy cover at a minimum in the thinned portions of Riparian Reserves.

A specific example of why this thinning is important here and now is unit 590 adjacent to Scott Creek. This segment of Scott Creek is designated as Critical Habitat for Upper Willamette River spring Chinook salmon. Stream surveys found that this segment (reach 1) was deficient in large woody material which is important in creating complex habitats for salmonid fish. This unit 590 would accelerate the growth of these trees and improve their future quality when they reach the channel. That is, they would taller and have greater diameters than unthinned areas.

The Flat Country project would increase the amount of hardwoods in the subwatershed by thinning out overly-stocked conifers and it would protect existing hardwoods in fire regenerated stands. This activity would have the short-term effect (years to a couple of decades) of reducing coarse woody material loading in the Riparian Reserve outside the no-harvest buffer. However, given the unnaturally over-stocked conditions of these managed stands, in the long-term (decades to a century) there would still be adequate woody material to maintain rates within the natural range of variability.

Objective #9 – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Alternative 1 (No Action) – This alternative would maintain current habitat conditions for both aquatic and riparian-dependent species. Many of the aquatic and riparian-dependent species need complex stand structures like that found in old-growth stands in order to thrive while others need younger seral stages. However, proposed treatment areas of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Meanwhile aquatic and terrestrial habitats would continue to experience low volumes of downed wood and a lack of deciduous leaf litter in areas proposed for treatment.

Alternatives 2 and 3 -This objective would be maintained by implementing the Riparian Reserve strategy and the PDFs.

The subwatershed where the project is located has a history of volcanic lava flows and glaciation that has created a landscape with mild topographic relief (i.e. its flat) and soils that are very permeable and porous. Because of this there are very few perennial streams in the project area and the majority of streams are seasonal-flowing. Where there is perennial streamflow, those streams tend to be spring-fed and lower in the subwatershed (i.e. near the McKenzie River).

Sweetwater, Anderson, and Olallie Creeks are excellent examples of spring-fed streams that provide important habitat for a variety of species. For example, these types of streams can provide habitat for rare caddisflies from the genus *Rhyacophila*. The entire *Rhyacophila* genus, whose name is derived from the Greek roots *rhyaco* (stream or torrent) and *philia* (fondness), is confined to running water. In the Cascade Mountains of Oregon, these species are associated with very cold, larger spring-fed streams and elevations range from around 4,000 to 5,600 feet in Oregon (USDA Forest Service and USDI Bureau of Land Management 2012a). The 4,000-foot elevation is much higher in elevation than the spring-fed creeks in the project area (e.g. Sweetwater is about 2,500 in elevation). The Riparian Reserve widths associated with these creeks (360 feet) would protect habitat for rare invertebrates like these caddisflies.

These three spring-fed creeks also provide habitat for bull trout (*Salvelinus confluentus*) and all three streams are designated as “Critical Habitat” under the Endangered Species Act (ESA). These streams provide very cold, clean water and abundant amounts of woody material that create excellent habitat for bull trout. All three of these streams would have 360-foot no-harvest Riparian Reserves and no harvested timber would be yarded through the reserve. This, along with PDFs developed by the interdisciplinary team and required by the biological opinion for bull trout and spring Chinook salmon, would maintain habitat for this important vertebrate species.

Evidence of mountain beavers (i.e. dens, burrows, and food cashes) was observed near some of the perennial streams in the project area. Mountain beavers are not a species listed under the ESA and they are not considered rare. Mountain beavers cannot produce concentrated urine so they must drink water every day. Because of this they are considered a riparian dependent species and the Riparian Reserve strategies were designed to protect areas where mountain beavers were located.

Appendix F – 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 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)

The following table provides a summary of past, present, and reasonably foreseeable future actions that overlap in time and space with the Flat Country project and could contribute cumulative effects to the resources in the project area.

Table 1F. Past, Present, and Reasonably Foreseeable Future Actions in the Flat Country Project Area

Action	Agency	Description	Resources Affected
Past Actions			
Robinson Scott EIS 1997 – 2016	Forest Service	461 acres shelterwood, 1,875 acres thinning, 102 acres gaps, and 700 acres Pre-commercial Thin 80 of these acres (50 years old) were thinned in 2016, the rest were completed before 2010.	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.
Norse CE – 2013	Forest Service	Total treatment, 80 acres in one stand that is approximately 40 years old. Treatments included 65 acres of commercial thinning, 5 acres of gaps, and 10 acres of skips	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.
Pass CE – 2013	Forest Service	Total treatment, 34 acres in one stand that is approximately 40 years old. Treatments included 29 acres of commercial thinning, 5 acres of gaps.	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.
Muskee CE – 2015	Forest Service	Total treatment, 67 acres in one stand that is approximately 50 years old. Treatments included 51 acres of commercial thinning, 1 acre of gaps, and 15 acres of skips	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.
Ollie CE – 2018	Forest Service	Total treatment, 52 acres in one stand that is approximately 67 years old. Treatments included 44 acres of commercial thinning, four acres of gaps, and four acres of skips.	Vegetation, Fire and Fuels, Soil, and Wildlife
Dulce CE – 2017	Forest Service	Total treatment, 51 acres in one stand that is approximately 40 years old. Treatments included 32 acres of commercial thinning, 3 acres of gaps, and 15 acres of skips	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.
Present Actions			
Southfork EA – Cupola Unit – 2018 and ongoing	Forest Service	Total Treatment of 51 acres, 36 acres of thinning, 15 acres of gaps. In 2018 10 acres of thinning, 6 acres of gaps. 26 acres of thinning and 9 acres of gaps remain to be harvested in the next 5 years.	Vegetation, Fire and Fuels, Soil, Water, Wildlife, Fisheries, Roads.

Appendix G – Recommended Riparian Reserve Treatments

Table 1G. Stream Surveys and Summary Rationale for the Recommended Riparian Treatments

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
50	4	7/17/2017	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	34
70	4	7/17/2017	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	36
80	4	7/17/2017	Promote structural and vegetative diversity	30	32
90	4	7/26/2017	Promote structural and vegetative diversity	30	32
90	4	7/26/2017	Promote structural and vegetative diversity	30	32
110	4	8/17/2017	No treatment required to further ACS objectives	180	79
160	2	7/16/2018	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	31
250	4	7/16/2017	Promote structural and vegetative diversity	30	29
300	4	9/1/2017	No treatment required to further ACS objectives	180	149
300	4	9/1/2017	No treatment required to further ACS objectives	180	149
310	4	6/13/2018	Promote structural and vegetative diversity	30	37
360	3	8/31/2017	Promote structural and vegetative diversity	60	42
360	3	8/31/2017	Promote structural and vegetative diversity while protecting springs	60	42
360	3	8/31/2017	Promote structural and vegetative diversity	60	42
360	3	8/31/2017	Promote structural and vegetative diversity	60	42
360	3	8/31/2017	Promote structural and vegetative diversity while protecting springs	60	42
360	3	8/31/2017	Promote structural and vegetative diversity	60	42
360	3	8/31/2017	Promote structural and vegetative diversity	60	42
360	4	8/31/2017	Promote structural and vegetative diversity	30	42
360	4	8/31/2017	Promote structural and vegetative diversity	30	42
360	1	8/31/2017	Promote structural and vegetative diversity	120	42
440	4	8/31/2017	Promote structural and vegetative diversity	30	31

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
440	4	8/31/2017	Promote structural and vegetative diversity	30	31
460	3	8/31/2017	Promote structural and vegetative diversity	60	39
460	4	8/31/2017	Promote structural and vegetative diversity	60	39
490	4	9/1/2017	Promote structural and vegetative diversity	30	41
490	3	9/1/2017	Promote structural and vegetative diversity	60	41
490	Pond	9/1/2017	Promote structural and vegetative diversity while protecting natural pond/wetland complex	180	41
1040	4	7/28/2017	Promote structural and vegetative diversity	30	32
1090	4	7/17/2017	Promote structural and vegetative diversity	30	36
1090	4	7/17/2017	Promote structural and vegetative diversity	30	36
1100	4	8/6/2018	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	32
1110	4	8/18/2017	No treatment required to further ACS objectives	180	136
1130	4	7/18/2017	No treatment required to further ACS objectives	180	133
1130	Pond	7/18/2017	Pond to the north of the unit, protect with 360’ no cut. No treatment required to further ACS objectives	360	133
1140	4	7/28//2017	No treatment required to further ACS objectives	180	138
1200	3	8/23/2017	No treatment required to further ACS objectives	180	146
1210	4	8/23/2017	Class 4 outside the unit to the south, protect with 180’ no cut. No treatment required to further ACS objectives.	180	118
1230	3	8/23/2017	Promote structural and vegetative diversity	60	29
1240	4	8/22/2017	Headwaters of Anderson Creek to the west of the unit, protect with 180’ no cut buffer.	180	64
1260	1	6/14/2017	Sweetwater Creek flows through the unit, protect with full 360’ no cut buffer, no treatment required to further ACS objectives	360	138
1270	3	7/18/2018	Braided class 3/wetland complex in the north of the unit, protect with 60’ buffer from the edge of the wetted area. Thin remaining Riparian Reserve to promote structural and vegetative diversity.	60	40
1280	4	7/18/2018	No treatment required to further ACS objectives	180	120
1300	1	7/18/2018	Anderson Creek flows through the unit, protect with full 360’ no cut buffer. No treatment needed to further ACS objectives.	360	118

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
1300	3	7/18/2018	Braided class 3 in the south of the unit, protect with full 180' no cut buffer. No treatment needed to further ACS objectives.	180	118
1300	3	7/18/2018	Braided class 3 flowing into Anderson Creek, protect with full 180' no cut buffer. No treatment needed to further ACS objectives.	180	118
1300	3	7/18/2018	Class 3 flowing into Anderson Creek, protect with full 180' no cut buffer. No treatment needed to further ACS objectives.	180	118
1310	1	7/18/2018	Anderson Creek flows outside the unit to the north, protect with 360' no cut buffer. Fall and leave conifers to create 0.25 acre gap in second SPTH for wildlife.	360	79
1320	1	7/18/2018	Olallie Creek flows through the unit, protect with full 360' no cut buffer. No treatment needed to further ACS objectives.	360	77
1330	4	8/7/2018	Promote structural and vegetative diversity	30	66
1340	2	8/7/2018	Class 2 outside the unit to the west, protect with full 360' no cut buffer. No treatment needed to further ACS objectives.	360	98
1340	4	8/7/2018	No treatment needed to further ACS objectives.	180	98
1350	2	7/16/2018	Promote structural and vegetative diversity	75	42
1350	3	7/16/2018	Promote structural and vegetative diversity	60	42
1350	4	7/16/2018	Promote structural and vegetative diversity	30	42
1520	4	7/9/2018	No treatment needed to further ACS objectives	180	98
1540	4	7/16/2018	Small portion of Riparian Reserve from class 4 outside the unit to the north. Protect with 180' buffer.	180	110
1550	4	7/9/2018	Promote structural and vegetative diversity	30	34
1560	4	7/9/2018	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	32
1590	3	7/3/2018	Multiple springs/class 3 streams in the western portion of the unit. Protect with full 180' no cut from the edge of the wetted area. Fall conifers into channels every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood.	180	102
1680	4	6/13/2018	Class 4 outside the unit to the southwest, protect with 180' no cut buffer.	180	112
1700	4	8/24/2017	Boulder Creek headwaters flows through the unit, protect with full 180' no cut buffer. No treatment needed to further ACS objectives.	180	120
1710	4	8/15/2017	Boulder Creek headwaters flows through the unit, protect with full 180' no cut buffer. No treatment needed to further ACS objectives.	180	120

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
1710	4	8/15/2017	No treatment needed to further ACS objectives.	180	120
1710	4	8/15/2017	No treatment needed to further ACS objectives.	180	120
1720	4	8/9/2017	Fall conifers into channel every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood.	180	144
1730	4	8/8/2017	Braided class 4, buffer from outside edge of outside channel. Fall conifers into channels every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood.	180	147
1750	4	8/9/2018	Braided class 4, no treatment needed to further ACS objectives	180	119
1770	3	8/25/2017	No treatment needed to further ACS objectives.	180	108
1770	3	8/25/2017	No treatment needed to further ACS objectives.	180	108
1810	4	8/29/2017	Multiple branching class 4 streams in the unit. Protect with full 180’ no cut from the edge of the wetted area. Fall conifers into channels every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood, avoid the area around ponds.	180	148
1810	3	8/29/2017	Pond/wetland complex in the north half of the unit. Protect with full 360’ no cut from the edge of the wetted area. No treatment needed to further ACS objectives	360	148
1830	3	8/28/2017	Pond/wetland complex in the south portion of the unit. Protect with full 360’ no cut from the edge of the wetted area. No treatment needed to further ACS objectives	360	118
1870	2	6/13/2018	Boulder Creek headwaters flows to the north of the unit, protect with full 360’ no cut buffer. No treatment needed to further ACS objectives.	360	76
1870	3	6/13/2018	Class 3 in the south end of the unit, protect with full 180’ no cut buffer. No treatment needed to further ACS objectives.	180	76
1910	4	6/1/2018	Class 4 outside the unit to the south, protect with full 180’ no cut buffer. No treatment needed to further ACS objectives.	180	126
1920	4	6/1/2018	No treatment needed to further ACS objectives.	180	148
1960	1	6/8/2018	Some overlapping Riparian Reserve acres from streams outside the unit, ok to thin Riparian Reserves within unit to promote structural and vegetative diversity	--	34
1970	Pond	6/11/2018	Pond outside the unit, protect with full 360’ no cut buffer. No treatment needed to further ACS objectives.	360	143
1980	4	6/11/2018	No treatment needed to further ACS objectives	180	150
1980	4	6/11/2018	No treatment needed to further ACS objectives	180	150
1980	3	6/11/2018	No treatment needed to further ACS objectives	180	150

Unit	Class	Survey Date	Rational	No Cut Buffer	Stand Age
2010	4	9/1/2017	Fall conifers into channels every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood.	180	132
2010	4	9/1/2017	No treatment needed to further ACS objectives	180	132
2010	4	9/1/2017	No treatment needed to further ACS objectives	180	132
2112	4	8/14/2017	No treatment needed to further ACS objectives	180	132
2120	4	8/14/2017	No treatment needed to further ACS objectives	180	134
2140	4	8/30/2017	No treatment needed to further ACS objectives	180	136
2140	4	8/30/2017	No treatment needed to further ACS objectives	180	136
2160	4	8/15/2018	No treatment needed to further ACS objectives	180	144
2160	4	8/15/2018	Fall conifers into channels every 50-100 feet, alternating sides and avoiding bank trees to enhance large downed wood.	180	144
2180	2	7/16/2018	Class 2 outside the unit to the north, protect with full 360’ no cut buffer. Fall and leave conifers to create 0.25 acre gap in second SPTH for wildlife.	360	98
2190	4	8/14/2018	Promote structural and vegetative diversity	30	75
2190	4	8/14/2018	Promote structural and vegetative diversity	30	75
2190	4	8/14/2018	Promote structural and vegetative diversity	30	75
2200	4	8/10/2018	No treatment needed to further ACS objectives	180	147
2200	4	8/10/2018	No treatment needed to further ACS objectives	180	147

Appendix H – Comparison of Treatments Proposed in Riparian Reserves for Alternatives 2 and 3

The treatments proposed in Riparian Reserves for Alternatives 2 and 3 are described and displayed below in Table 1. All units were surveyed by fisheries, hydrology, wildlife, and botany specialists. Each unit was gridded to capture streams, springs, wetlands and other waterbodies that may not be mapped on the GIS layer. Based on stream and riparian characteristics, a recommendation was made for no-treatment buffers and other potential treatments (e.g., downed wood creation) for each waterbody. After surveys were conducted individually, specialists met as a team to discuss findings and develop an integrated Riparian Reserve management plan for each unit. Due to differences in stand conditions, unit-specific management prescriptions are grouped into five treatment types:

No Treatment: Portion of the Riparian Reserves within the project area are currently functioning and meeting Aquatic Conservation Strategy (ACS) Objectives. Therefore, no management within the full Riparian Reserve width (180-360 feet) is recommended.

Thinning for Vegetation Diversity: Stands within these Riparian Reserves are overstocked, conifer-dominant, lacking structural and species diversity, and not currently meeting ACS Objectives. Thinning was recommended to improve vegetation conditions outside of the primary shade zone on perennial waterbodies to protect water quality and outside of the primary wood recruitment zone (discussed in detail in Section 3.3.3) to protect potential instream wood inputs. Thinning would accelerate development of large wood and late forest stand structure and increase species diversity, which would improve the ability of Riparian Reserves to provide adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife.

Dead and Downed wood Creation: Stands within these Riparian Reserves are overstocked, conifer-dominant, lacking structural and species diversity, and not currently meeting ACSOs. Near perennial waterbodies, thinning was recommended to improve vegetation conditions outside of the primary shade zone to protect water quality and outside of the primary wood recruitment zone to protect potential instream wood inputs. On intermittent streams and springs, thinning was recommended within the primary wood recruitment zone to improve vegetation diversity, but dead and downed wood objectives would be met by falling and leaving at least eight trees per acre and creating two snags per acre.

Other Treatments: Within some treatment units, the introduction of low severity fire into patches of Riparian Reserves is anticipated during fuel treatments. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fireline around the Reserves which would potentially result in erosion. With local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. 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 as compared to untreated plantations.

Roadside hazardous fuels reduction treatments are proposed on approximately 2,307 acres in the project area as part of both Alternative 2 and 3. These treatments would cut the understory up to 7 inches DBH on previously managed stands, and up to 10 inches DBH on older stands. The cut material would chipped, or piled and burned. On about 11 miles of roads, treatments would occur within 300 feet of road systems surrounding the Mount Washington Wilderness Area. Elsewhere in the project area, on about 26 miles of roads, treatments would occur within 150 feet of road systems. See section 3.12 for more details on proposed treatments. Of the 2,307 acres proposed for treatment, approximately 429 acres fall within Riparian Reserves. Waterbodies overlapping with fuels reduction treatments would include no-treatment buffers to protect near stream vegetative diversity and microclimate (Table 2) and cut fuels would be piled for burning no closer than 15 feet from no-treatment buffers. The total Riparian Reserve acres that would be treated for roadside fuels reduction would be 345 acres, meaning approximately 84 acres would be excluded from treatment.

For more information on how these management prescriptions comply with ACS Objectives, see Appendix E.

Table H1. Treatments Proposed in Riparian Reserves with Alternative 2

Description	Units	Stream Class	Riparian Reserve Boundary[1]	Thinning Treatment	Ground-Based Equipment Buffer[2]	Underburn Buffer[3]	Dead Wood Creation Buffer[4]
No Treatment No harvest within Riparian Reserve width	110, 300, 1110, 1130, 1140, 1200, 1210, 1240, 1260, 1280, 1300, 1310, 1320, 1340, 1520, 1540, 1590, 1680, 1700, 1710, 1720, 1730, 1750, 1770, 1810, 1830, 1870, 1910, 1920, 1970, 1980, 2010, 2112, 2120, 2140, 2160, 2180, 2200	Fish-bearing Streams (Class 1 & 2)	360’	No harvest within 360’	360’	No underburn within 360'	No dead or downed wood creation within 360’
		Perennial Non Fish-bearing Streams (Class 3)	180’	No harvest within 180'	180’	No underburn within 180'	No dead or downed wood creation within 180’
		Intermittent Streams (Class 4)	180’	No harvest within 180'	180’	No underburn within 180'	No dead or downed wood creation within 180’
		Ponds	360’	No harvest within 360'	360’	No underburn within 180'	No dead or downed wood creation within 180’
		Wetlands and Springs	180’	No harvest within 180'	180’	No underburn within 180'	No dead or downed wood creation within 180’
Thinning for Vegetation Diversity Thinning to improve vegetation diversity for wildlife while protecting shade and wood recruitment zones.	50, 70, 80, 90, 160, 250, 310, 360, 440, 460, 490, 1040, 1090, 1100, 1230, 1270, 1330, 1350, 1550, 1560, 1960, 2190	Fish-bearing Streams (Class 1)	360’	Units 360 and 1960: No harvest within 120'; >50% canopy closure from 120'-360'	120’	No underburn within 120'	No dead or downed wood creation within 120’
		Fish-bearing Streams (Class 2)	360’	Units 160 and 1350: No harvest within 75'; >50% canopy closure from 75'-360'	75’	No underburn within 75'	No dead or downed wood creation within 75’
		Perennial Non Fish-bearing Streams (Class 3)	180’	No harvest within 60'; >50% canopy closure from 60'-180'	60’	No underburn within 60'	No dead or downed wood creation within 60’

		Intermittent Streams (Class 4)	180’	No harvest within 30'; >50% canopy closure from 30'-180'	50’	No underburn within 30'	No dead or downed wood creation within 60’
		Ponds	360’	Unit 490: No harvest within 180'; >50% canopy closure from 180'-360'	180’	No underburn within 75'	No dead or downed wood creation within 180’
		Wetlands and Springs	180’	Units: 360 and 1270 No harvest within 60'; >50% canopy closure from 60'-180'	60’	No underburn within 60'	No dead or downed wood creation within 60’
Fall and Leave Conifer Trees into Streams to Increase LWD Fall conifers into channel every 50-100 feet alternating banks and avoiding bank trees.	1590, 1720, 1730, 1810, 2010	Perennial Non Fish-bearing and Intermittent Streams (Class 3 and 4)	180’	No harvest within 180’	180’	No underburn within 180’	--
Fall and Leave Conifer Trees to Create 0.25 acre gap Fall a group of conifers to create gap in second site potential tree height to enhance terrestrial habitat.	1310, 2180	Fish-bearing Streams (Class 1 and 2)	360’	No harvest within 360’	360’	No underburn within 360’	--

1 One site potential tree height is 180 feet.

2 No ground-based equipment within 50 feet of any waterbody. For units with >50 foot no-harvest buffer, the equipment exclusion zone is the same as the no harvest buffer.

3 In addition to underburn treatment buffer, there would be no fireline construction within Riparian Reserves.

4 For unit by unit dead and downed wood prescriptions, see Table 9 in chapter 2.7

Table H2. Proposed Roadside Hazardous Fuels Reduction Treatments in Riparian Reserves

Total Acres of Roadside Hazardous Fuels Reduction Treatments Proposed in Riparian Reserves	Waterbody Type	No-Treatment Buffer Width
345 acres	Class 1 Stream	120 feet
	Class 2 Stream	75 feet
	Class 3 Stream	60 feet
	Class 4 Stream	30 feet
	Lakes	75 feet

Appendix I – Regeneration Guidance

Regeneration according to the SAF Dictionary is "the act of renewing tree cover by establishing young trees naturally or artificially." In other words your intent of the harvest is to establish a new stand. If your goal of improving growing conditions for existing trees that would be thinning. If we thin heavy and still have a fully stocked stand, you may still use planting to establish diversity with other species, but the key is your purpose for the harvest. Are you "renewing tree cover" or just making what is there better?

The following guidelines should be applied to regeneration cuts on the Willamette NF.

1. Do not use the words required or essential reforestation in a NEPA document when the harvest type is not Regeneration. These words insinuate we are replanting to meet NFMA requirements as a result of a regeneration harvest which is not covered by the 2006 Pechman Exemptions for Survey and Manage species. For more information on the Pechman Exemptions, please consult your wildlife biologist or botanist.
2. Forest Policy is that created openings <= 3 acres are gaps that represent diversity within a stand and would not be considered a Regeneration Harvest.
    a. If a created opening is > 3 acres, the opening constitutes a new stand and should be managed in FSVeg Spatial as a new stand. All NFMA requirements for reforestation apply and essential reforestation applies to the harvest unit.
3. GTRs are required for regeneration on Matrix lands (NWFP MA-14), and should be considered within AMA.
    a. Represent at least 15 percent of the stand in a combination of skips (aggregated retention) and individual trees (dispersed retention).
    b. Only those land allocations where harvest is allowed count towards a GTR, so a no-cut Riparian Reserve does not count towards the 15 percent.
    c. SHAB buffers where programmed tree harvest is not allowed under the Forest Plan do not count toward the 15 percent GTR.
    d. Buffers established in matrix in a harvest unit to protect S&M species should count toward GTR if the habitat in the buffer meets the intent of the GTR.
    e. Trees retained to create snags and downed wood do not count towards dispersed retention.
    f. As a general rule target 70 percent of the GTR as aggregated.
        i. Exceptions should be documented in the project NEPA. For example, a "Clearcut with Reserves" may retain most if not all the required retention in dispersed retention.
        ii. A spreadsheet titled "Regeneration – GTR Acres" is available to help with distributing a combination of aggregated and dispersed retention within a stand.
        iii. Aggregated retention should be greater than .5 acres where possible.
        iv. Aggregated retention should be away from roads where possible to reduce potential impacts from situations such as weeds, firewood cutting, and fuel breaks.
    g. Should protect the largest, oldest live trees, decadent or leaning trees or snags. Consider other resource needs when placing aggregated retention, i.e. logging systems, buffer of a wolf or legacy tree, protect a patch of existing snags within a unit, protecting sensitive species, etc...
    h. They should be protected for multiple rotations.

4. Regeneration harvest requires retaining snags within the harvest unit to meet at least 40 percent population potential of cavity-nesting birds (about 2 snags/acre). Retain as used here implies creating it if it is not present post-treatment. Thus some trees may be needed to be retained for snag creation. The requirement is evaluated at a 40-acre scale (NWFP S&G p. C-42) except that at least about 1/snag/acre needs to be retained at a 5-acre scale (WNF S&G p. IV-66). (Thus a 40 acre regeneration unit would need 80 snags with at least 5 snags in every 5 acres.) Snags contained within GTR aggregates count toward the minimum number of snags.
5. There is an additional snag requirement in the 2001 Survey and Manage Standards and Guidelines for black-backed woodpecker that applies to mixed conifer and lodgepole pine forests in the higher elevations of the Cascade Range. Snags must be provided to meet 100 percent population potential which equates to 0.12 hard snags per acre greater than 17 inches DBH or the largest available. This requirement applies to all harvest including regeneration harvest. The S&G reads "If snag requirement cannot be met, then harvest must not take place." (S&M S&G, C-46)
6. Regeneration harvest requires leaving at least 240 linear feet of logs greater or equal to 20 inches diameter per acre (NWFP S&G p. C-40). These logs should be in Decay Class 1 and 2 and, if trees of that diameter are not present in the stand, then the logs should be from the largest diameter cohort present. Leave as used here also means to create if not present post-treatment. As noted above, these would be in addition to the 15 percent GTR.
7. IDTs may decide to leave additional green trees/acre to meet the snag and downed wood requirements for regeneration harvest.
8. GTRs are to be tracked in FSVeg Spatial, the database of record for our corporate vegetation data.
    a. Aggregated retention polygons > ½ acres are to be mapped in FSVeg Spatial for tracking purposes.
        i. In FSVeg Spatial
            1. The attribute "Parent Stand" of the new GTR polygon will need populated with the stand number of the parent stand.
            2. The "Theme" attribute will need to be calculated to "GTR".
            3. The attribute "Habitat Feature 1" with "AR" for aggregated retention.
    b. Dispersed retention is tracked on the polygon of the regenerated stand.
        i. In FSVeg Spatial calculate the attribute "Habitat Feature 1" with "CS" which stands for clumped and dispersed retention.

For future project filter on the "Habitat Feature 1" attribute looking for those stands which have a value of "AR" or "CS". This will help decision makers know if they are proposing harvest in a GTR so they can balance resource concerns.

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Glossary

A

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

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.

C

Canopy - The uppermost spreading branchy

Canopy Closure - Canopy closure is the proportion of the sky hemisphere (measured from all angles) obscured by vegetation when layer of a forest.

Canopy Cover - Canopy cover is a measure of the percentage of ground covered by a vertical projection of the tree canopy.

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.

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)

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 [spotted owl] - a 0.5-mile radius circle (500 acre area) 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 percent of owl reproducing season activity occurred in about 20 percent 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.

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: • Ensures sufficient habitat to support stable, healthy populations across the range, and also within each of the 11 recovery units; • Ensures distribution of northern spotted owl populations across the range of habitat conditions used by the species; • Incorporates uncertainty, including potential effects of barred owls, climate change, and wildfire disturbance risk; and • Recognizes that these protections are meant to work in concert with other recovery actions, such as barred owl management.

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.

D

Desirable Species - Any species of plant or animal which is considered to be compatible with meeting management goals and objectives.

Diameter Breast Height (DBH) - Diameter of a tree measured 4.5 feet up from the ground on the uphill side.

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.

Dispersal Habitat [spotted owl] - habitat that provides for successful dispersal prior to finding suitable habitat on which to establish a territory. According to the Recovery Plan, this consists of, "stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities…The Interagency Scientific Committee defined dispersal habitat as forest stands with average tree diameters greater than 11 inches and conifer overstory trees with closed canopies (greater than 40 percent canopy closure in moist forests and greater than 30 in dry forests) and with open space beneath the canopy to allow spotted owls to fly" (USFWS 2011). Dispersal habitat includes habitat that will provide some roosting and foraging opportunities during the dispersal phase, but not at a scale that will 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.

Disturbance - Events that disrupt the stand structure and/or change resource availability or the physical environment (Oliver 1996).

Downed Wood - Dead wood on the ground. Fall-and-leave trees become downed wood. Snags (standing dead trees) eventually become downed wood after they fall to the ground.

E

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.

F

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.

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.

H

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 [spotted owl] - An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2-mile radius circle (2,955 acre area) around a known or predicted owl site (Thomas et al. 1990, USDI et al. 2008). A home range is used by northern spotted owls to obtain cover and food, and for reproduction and rearing of young. Home ranges of multiple northern spotted owl pairs may overlap with habitat shared between adjacent resident northern spotted owl pairs and dispersing northern spotted owls. These areas are important for the survival and productivity of northern spotted owls because they are non-migratory.

Hyporheic Flow - Hyporheic flow is the mixing of shallow groundwater and surface beneath and alongside a stream bed.

I

Incidental Take (ESA) - Take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity

Initial Attack - The fire suppression effort that takes place as soon as possible following a wildland fire report.

Invasive Weed - see Noxious Weeds

K

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. A known site may be determined to be inactive only in accordance with the

L

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)

M

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.

Management Indicator Species (MIS) - 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 use of MIS in project planning was established by the 1982 National Forest Management Act planning regulations. The Final Environmental Impact Statement for the 1990 Willamette National Forest Land and Resource Management Plan identified MIS and the rationale for their selection (Forest Service 1990: III-69, Table 47)

Meadow Enhancement – Reducing conifer encroachment through mechanical removal to encourage meadow species over forest species.

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' by 15' 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-Layered - a stand with two or more age classes or cohorts.

N

Nest Patch [spotted owl] - Within the core area, a 300-meter radius circle (70 acre area) 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. The two key elements of habitat within a nest patch are: (1) canopy closure of dominant, co-dominant, and intermediate conifer and hardwood trees and (2) the amount of downed wood (USFWS et al. 2008). Modification of habitat within this area is considered likely to affect the reproductive success of nesting northern spotted owls and is used in determination of incidental take (USFWS et al. 2008).

Net Present Value - Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.

Non-Habitat [spotted owl] - areas that do not have the potential to function as spotted owl habitat, for example, lava flows, large rock outcrops, and lakes. For the purposes of this document, non-habitat areas also include “habitat-capable” areas. Habitat-capable areas are areas capable of growing spotted owl habitat, but that do not currently function as either suitable habitat or dispersal habitat. Examples of habitat-capable areas include non-forest areas and sapling stands (USFWS 2011).

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.

O

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)

P

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),

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.

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 - Fire which is planned and used as a tool to meet specific management objectives.

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.

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.

R

RA32 [spotted owl] - Recovery Action 32 of the 2011 Recovery Plan identified a need to maintain high-quality spotted owl habitat characterized as “older, more structurally complex multi-layered conifer forests” containing “large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees” (USFWS 2011). Guidance for identifying such stands has been developed for the Willamette National Forest with review by USFWS and the Bureau of Land Management (Doerr 2012).

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.

S

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.

Sensitive Species - Species that are not federally listed under the Endangered Species Act, but that 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 that they would not become federally threatened or endangered.

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 silva, which means "forest" and from cultura, 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.

Skip - An area within a treatment unit that is intentionally left untreated to benefit a resource or host of resources.

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.

Spotted Owl Habitat Types - 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 percent); 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.
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).
At a minimum, **dispersal habitat** 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 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (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 Structure - The physical and temporal distribution of trees and other plants in a stand (Oliver 1996).

Stream Classes - Class 1 and 2 = perennial fish bearing streams; Class 3 = perennial non-fish bearing streams; Class 4 = intermittent, seasonally flowing streams.

Suitable Habitat [spotted owl] - (also referred to by USFWS as “NRF”) is habitat that provides for nesting, roosting, and/or foraging. According to the Recovery Plan, “features that support nesting and roosting typically include a moderate to high canopy closure (60-90 percent); 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…Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs” (USFWS 2011).

Subsoiling - The use of specialized equipment to break up compacted layers 18-24 inches below the ground surface and return the soil’s structure to a more natural state.

Suppression - All the work of extinguishing or confining a fire beginning with its discovery.

Survey and Manage Species - Certain rare or endemic species that are associated with late-successional forest habitat and that are covered by direction in the Northwest Forest Plan standards and guidelines for conducting project surveys and managing known sites (Forest Service and BLM 2001).

T

“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.

U

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.

V

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.

W

Woody Debris - Dead pieces of woody vegetation such as stems, limbs, or leaves which are on a site.

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