United States Department of Agriculture
Forest Service

Toll Joe Project and Non-significant Forest Plan Amendment #55

Environmental Assessment

Sweet Home Ranger District, Willamette National Forest, Linn County, Oregon
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1937 Photo of Sevenmile Burn in Toll Joe Project Area taken from Jump-Off Joe Lookout

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Introduction

The Sweet Home Ranger District of the Willamette National Forest is proposing the Toll Joe Project which includes approximately 954 acres of commercial timber harvest, 139 acres of hazardous fuel reduction, and about 4 miles of road access as described below:

Commercial Timber Harvest

- Commercial thinning using variations in thinning intensities on about 910 acres to increase complexity both within and between stands in Matrix, Riparian Reserves, and the South Santiam Late-Successional Reserve. Ninety-five of these acres are in two plantations (45 and 47 years old) in the Three Creeks Old Growth Grove located within the South Santiam Late Successional Reserve. Thinning these two stands would require a Forest Plan amendment.
- Introducing about 24 acres of gaps into commercially-thinned stands to increase stand complexity by providing variations in stand densities within and among stands and allowing for understory development. Gaps range in size from $^{1/}_{10}$ to ½ acre in size.
- Regenerating approximately 20 acres in five-acre patch cuts leaving reserve trees. Three of these five-acre cuts are in a 98 year old stand and one is in a 91 year old stand. Both stands have reached culmination of mean annual increment as required by the Forest Plan and all four units are within Matrix/Scenic management allocations which allow maximum opening sizes of 5-acres.

Hazardous Fuel Reduction

- Reduction of hazardous fuels within 200 feet of Highway 20 (on the north side of the Highway in Matrix allocations) from Road 2047 to the eastern edge of the project area including: a) ground and ladder fuel treatments on about 95 acres and b) ground, ladder and canopy fuel treatments on approximately 44 acres. Canopy fuel treatments consist of commercial thinning leaving 60-110 trees per acre or 80-100 trees per acre. Canopy fuel treatments occur in portions of thinning units that fall within 200 feet of Highway 20. Treatments are prescribed similarly to the rest of the unit with respect to thinning intensities and no-harvest stream buffers. No ground and ladder fuel treatments would occur in Riparian Reserves.

Access Development

- Construction of about 1.3 miles of temporary roads and reopening of about 2.7 miles of non-system spur roads to access harvest units.

For more details of the proposed action, see the “Proposed Action and Alternatives” section of this document.

This environmental assessment (EA) was prepared to determine whether implementation of the proposed activities may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA).

Location and Size of the Project Area

The Toll Joe Project Area is located on the Sweet Home Ranger District of the Willamette National Forest in western Oregon (Figure 1). It lies about 30 miles east of the City of Sweet Home on the west side of the Cascade Mountains.

The legal description of the project area is T13S, R4E, Section 36; T13S, R5E, Sections 26, 28, 31-36; T13S, R6E, Section 31; T14S, R4E, Sections 1, 12 and 13; T14S, R5E, Sections 1-24, 27-29; and T14S, R6E, Sections 6, 7, 8, 17 and 18, Willamette Meridian.

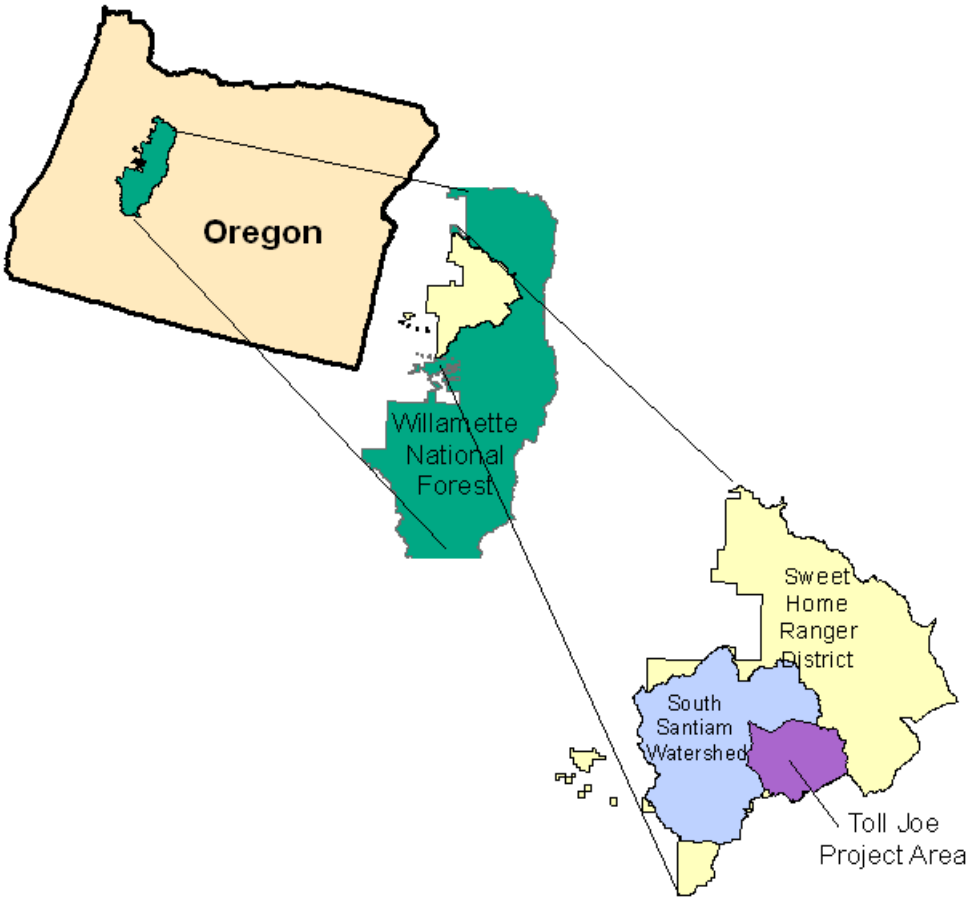

Figure 1: Vicinity Map

The project area (shown in purple in Figure 2 below) encompasses about 22,000 acres of the southwestern portion of the 102,000-acre South Santiam 5th field watershed. The project area includes Sevenmile Creek and the southern portion of Sheep Creek 6th field subwatersheds.

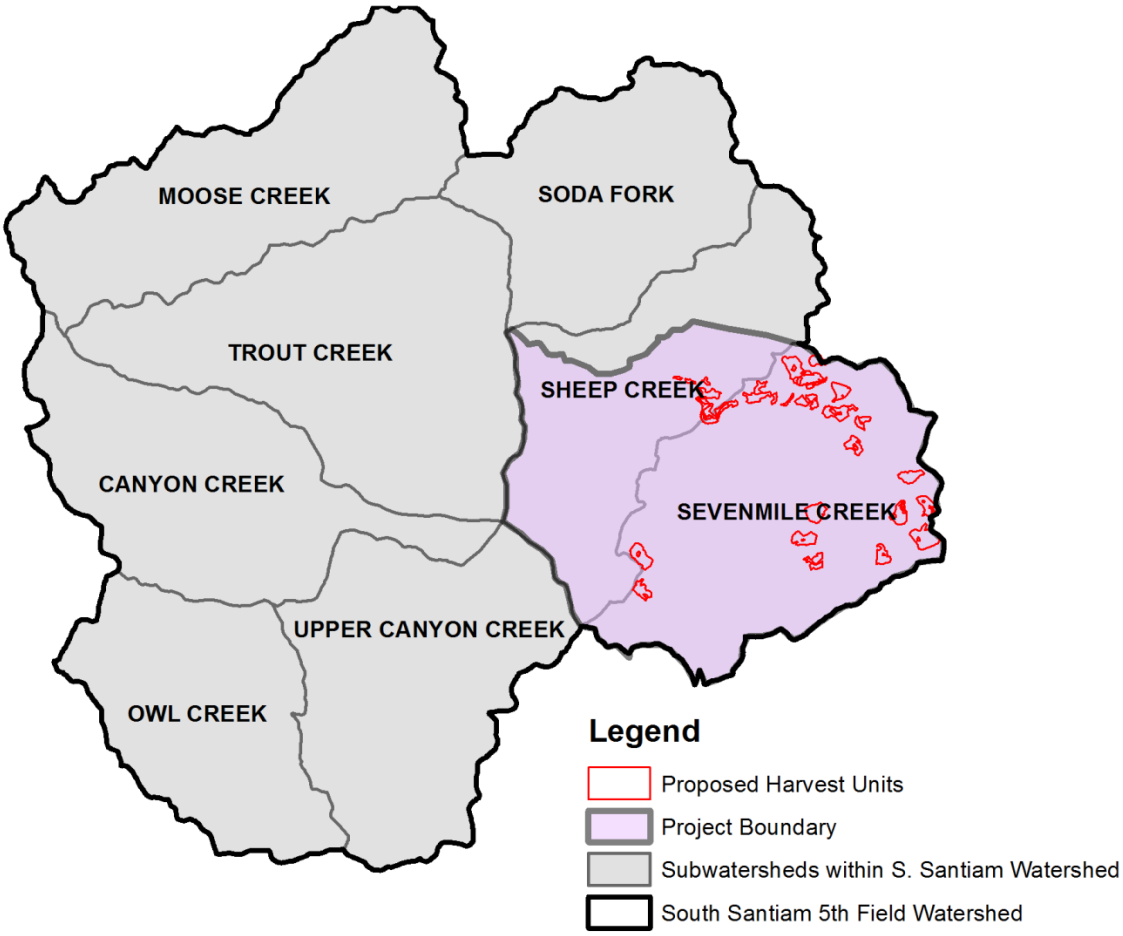

Figure 2: Location of Project Area within 5th Field Watershed

Planning and Management Direction

Planning for this project was done in accordance with National Environmental Policy Act (NEPA) of 1969 and other relevant Federal and state laws and regulations (see Appendix F). Procedures described in the Council of Environmental Quality's implementing regulations for NEPA (Title 40; CFR Parts 1500-1508) were used to ensure compliance with NEPA.

To avoid duplication of analysis that has already been completed, this document is tiered to and relies upon the analysis in:

- The 1990 Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Willamette National Forest Land and Resource Management Plan (hereafter referred to as the Forest Plan) (USDA, 1990)
- All subsequent NEPA analyses for plan amendments including the Final Supplemental Environmental Impact Statement on the Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl also referred to as the NW Forest Plan (USDA and USDI, 1994).

The Forest Plan, as amended, combines the forest-level strategy for managing land and resources on the forest with the Northwest Forest Plan's regional strategy for managing old-growth and late-successional forest ecosystems on federal lands. The plan provides resource management direction, defines various management areas, and outlines standards and guidelines under which lands and resources administered by the Willamette National Forest are managed.

Management Direction

Management Allocations: Figure 3 illustrates the arrangement of various management allocations (MA's) within the project area. Table 1 which follows lists the various MA's; displays the sizes of each area within the project boundaries; and identifies the MA's where management activities are being proposed with this project.

Figure 4 shows other management considerations within the project area: Inventoried Roadless Areas, Wild and Scenic Eligible River Corridors and Wilderness.

The U.S. Fish and Wildlife Service has designated Critical Habitat across the range of the northern spotted owl. The physical and biological features (referred to as the primary constituent elements) that support nesting, roosting, foraging, and dispersal are essential to the conservation of the species (USDI, 2012). All proposed units except 26, 28 and 43 are partially or entirely within the Western Cascades South Critical Habitat Unit, and management proposals have been reviewed with respective agencies (see Figure 5).

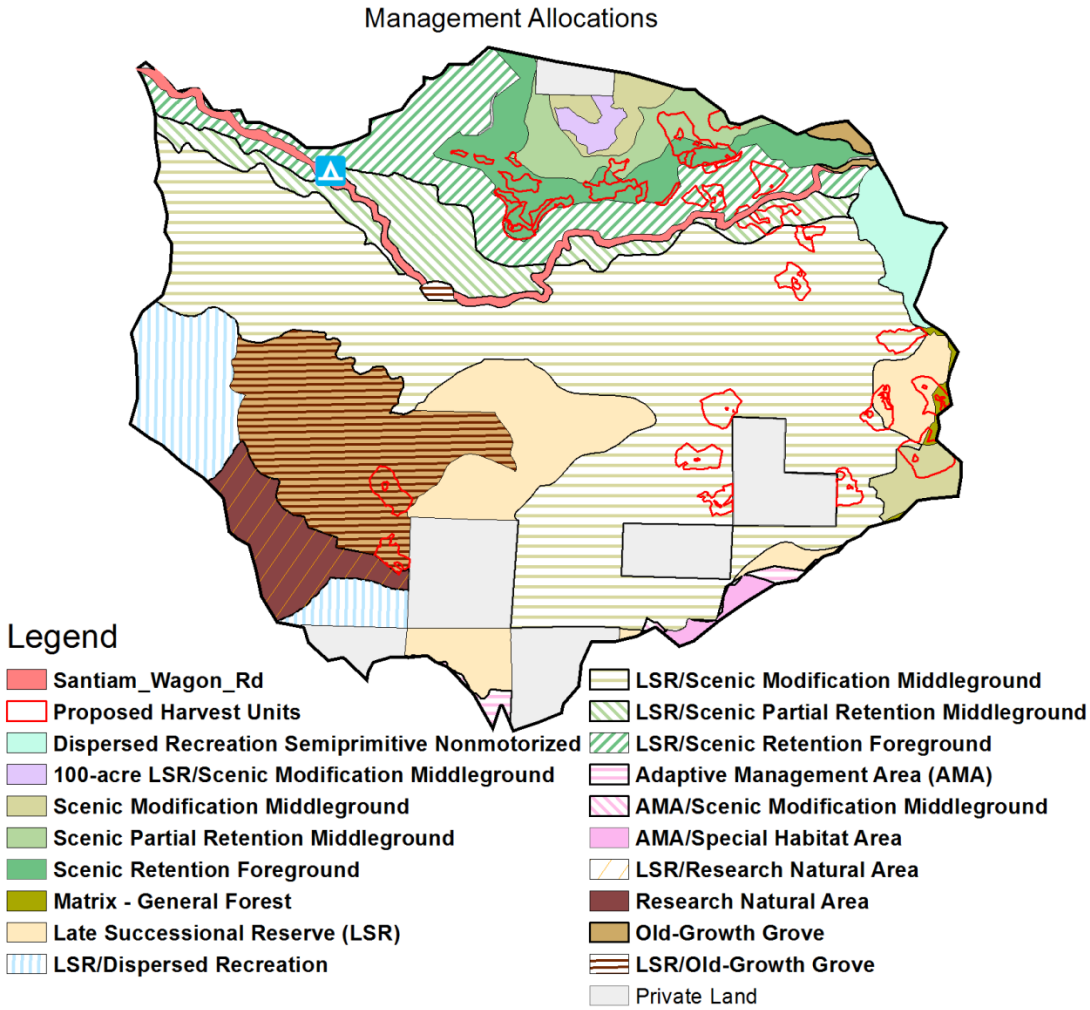

Figure 3: Management Allocations

Table 1: Management Allocations		
Management Allocation (MA)	**Acres in Project Area**	**Acres in Proposed Harvest Units**
Late-Successional Reserves (MA 16a) (Mgmt. allocations below are a subset of MA 16a)		
• Late Successional Reserve - Research Natural Area (MA 16A/MA 4)	690	0
• Late Successional Reserve - Old Growth Grove (MA16A/MA 7)	1,996	95
• Late Successional Reserve - Santiam Wagon Road SIA (MA 16A/MA 5A)	358	7
• Late Successional Reserve - Dispersed – Semiprimitive Non-Motorized (MA 16A/MA 10E)	1,102	0
• Late Successional Reserve - Scenic Mod. Middleground (MA 16A/MA 11A)	8,309	294
• Late Successional Reserve - Scenic Partial Retention Middleground (MA1 6A/MA11C)	1,201	42
• Late Successional Reserve - Scenic Retention Foreground (MA 16A/MA11F)	1,784	93
• Late Successional Reserve (MA16A)	1,755	56
• 100-acre Late Successional Reserve - Scenic Modification Middleground (MA 16B/MA 11F)	114	0
Totals for Late Successional Reserves	**17,309**	**587**
Matrix (MA 14A)		
• Matrix - Scenic Modification Middleground (MA14A/MA11A)	462	67
• Matrix - Scenic Partial Retention Middleground (MA14A/MA11C)	539	78
• Matrix - Scenic Retention Foreground (MA 14A/MA11f)	938	201
• Matrix (MA 14A)	71	21
Totals for Matrix	**2,010**	**367**
Other Management Allocations		
• Adaptive Management Area (MA 17)	111	0
• Adaptive Management Area - Special Wildlife Habitat (MA 17/MA/MA 9D)	108	0
• Adaptive Management Area - Scenic Modification Middleground (MA 17/MA 11A)	14	0
• Research Natural Area (MA 4)	3	0
• Special Interest Area (MA 5A)	81	0
• Dispersed Recreation – Semiprimitive Nonmotorized (MA 10E)	382	0
Totals for Other Management Allocations	**699**	**0**
Grand Totals for LSR, Matrix and Other Mgmt. Allocations	**20,018**	**954**
Other Ownerships		
• Private Land (not a management allocation)	2,165	0
Totals for Other Ownerships	**2,165**	**0**
Totals for Project Area	**22,183**	**954**
• Estimated Riparian Reserves (MA 15) (*this management allocation overlays other management allocations so not included in total acreage*)	12,000	515

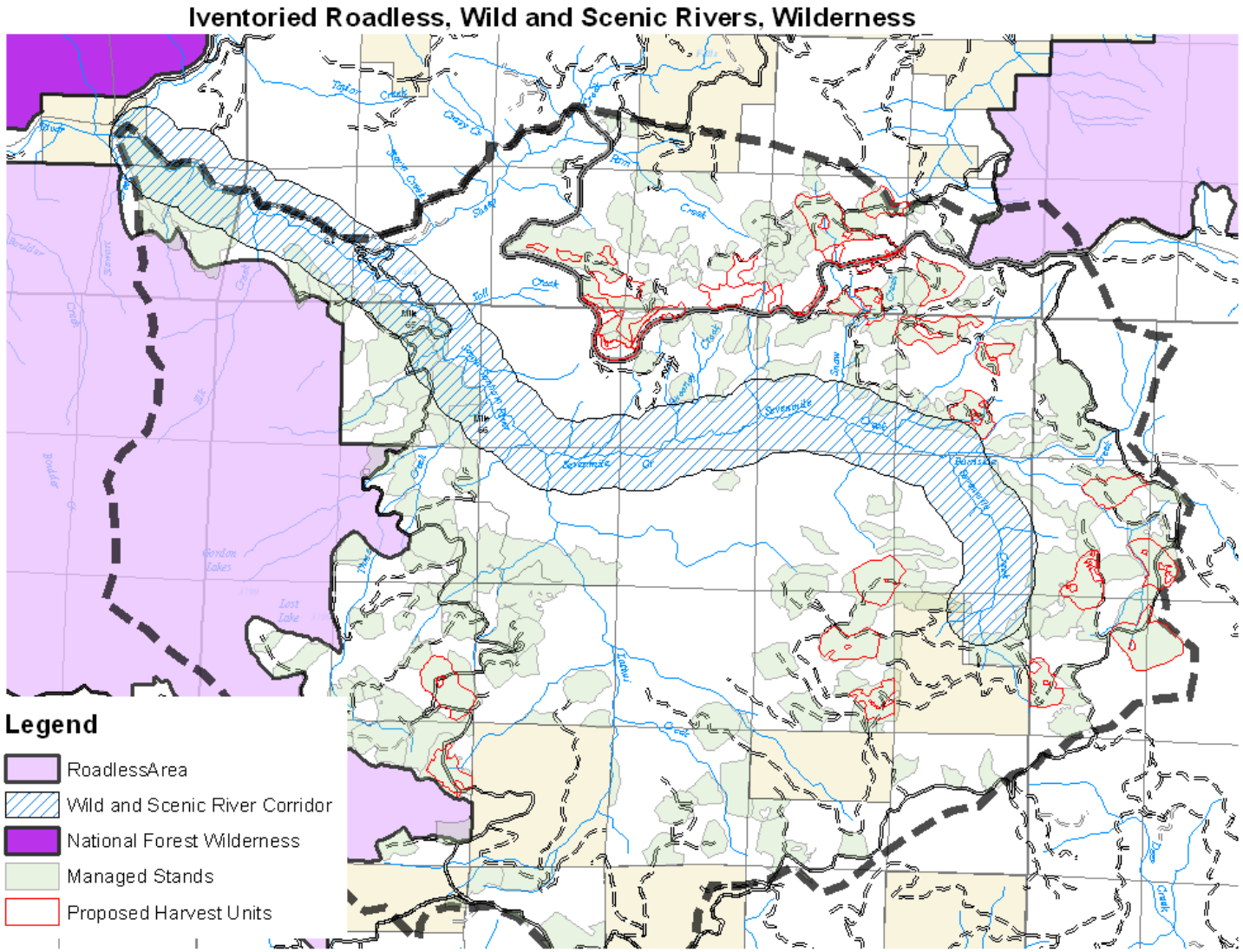

Figure 4: Inventoried Roadless, Wild and Scenic River Corridor, and nearby Wilderness

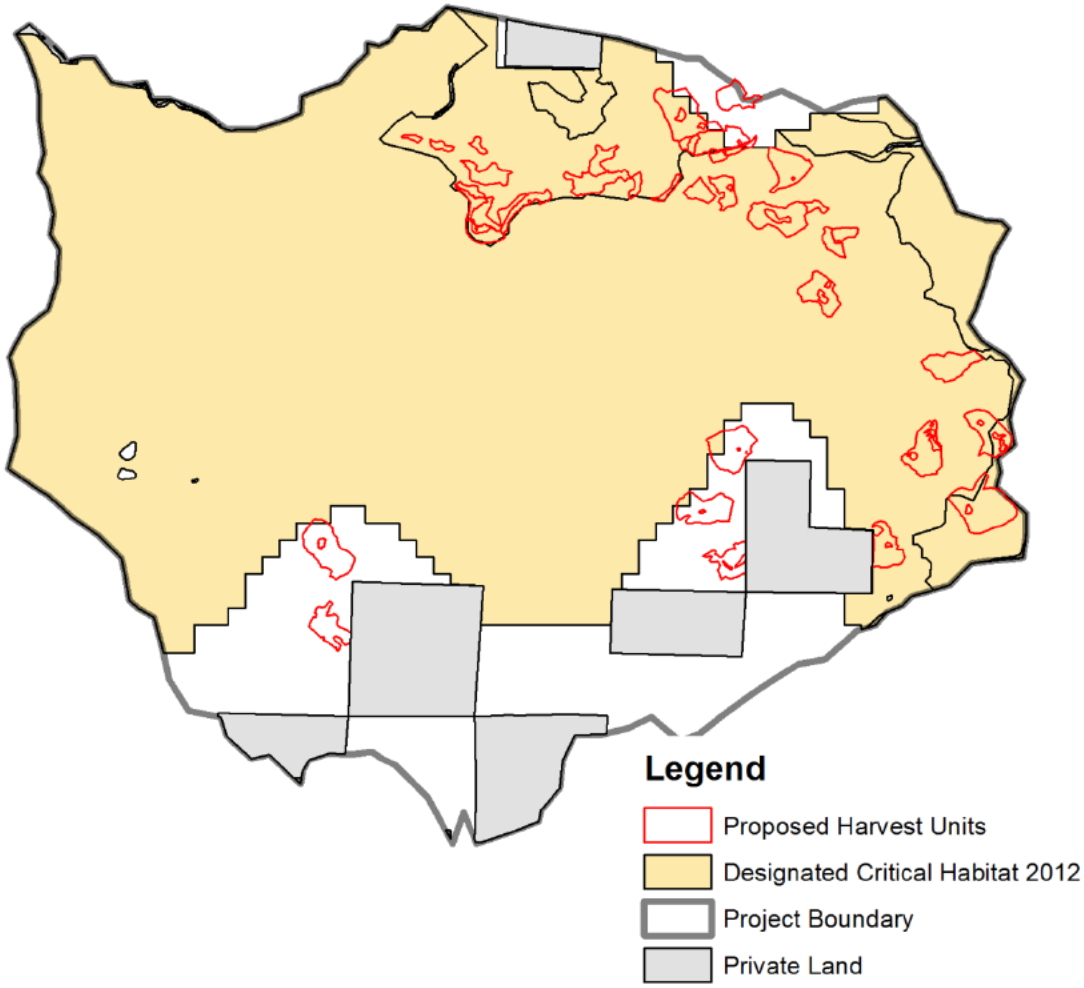

Figure 5: Designated Critical Habitat for Northern Spotted Owl (2012)

Purpose and Need for the Proposal

The purpose and need for the proposal is outlined below:

1. ***Accelerate development of structural complexity within and between stands in the Toll Joe Project Area to move stands closer to desired conditions defined for the various management allocations.***

South Santiam Late-Successional Reserve (LSR), Three Creeks Old Growth Grove and Santiam Wagon Road Special Interest Area (SIA)- All three of these management allocations have similar desired conditions with respect to structural complexity so they will be discussed together.

Desired Condition - Within the LSR, the desired condition is a functioning late-successional or old-growth forest ecosystem which serves as habitat for late-successional and old-growth related species (NW Forest Plan, p. C-9). Desired structural attributes (Figure 6) include: large live trees, standing dead trees (snags), fallen trees or logs on the forest floor, and logs in streams. Additional elements typically include multiple canopy layers, understory trees, canopy gaps and patchy understory (NW Forest Plan, p. B-2).

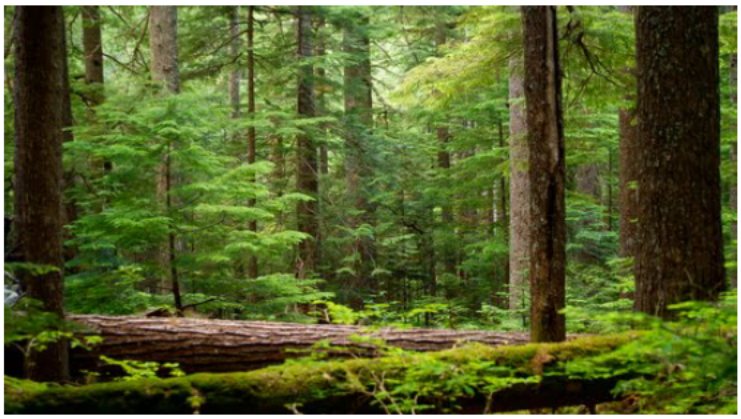

Figure 6: Desired Late Successional Stand Conditions

Both the Three Creeks Old Growth Grove and the Santiam Wagon Road Special Interest Area lie within the LSR. The Old Growth Grove was designated to represent an outstanding, highly-accessible example of a Western Cascades old-growth timber type, as well as to preserve the genetic base of native plant and animal communities and add to the structural diversity of the forest landscape (Forest Plan, pg.158). The desired condition for the Santiam Wagon Road SIA, a valued historic property listed on the National Register of Historic Places, includes preservation of the road and its important cultural characteristics and restoration of the vegetative conditions that existed during the peak period of use from 1890-1910. Desired vegetative conditions are depicted in an historic photo of the wagon road taken along Sevenmile Creek, which is within the project area (Figure 7).

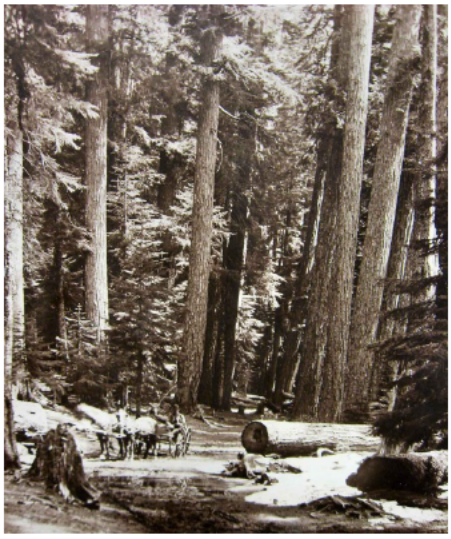

Figure 7: Historic Vegetative Conditions along Santiam Wagon Road

Current condition - The 587 acres of stands proposed for treatment in the Late Successional Reserve includes 95 acres in the Old Growth Grove and 7 acres within the Santiam Wagon Road Special Interest Area *(Note that the Santiam Wagon Road is also one of 16 Oregon Historic Trails (ORS 358.075) and is on the National Register of Historic Places (2010)).* Field reconnaissance and stand exam data show these stands range in age from 37-59 years old. They are relatively uniform, even-aged stands, often dominated by a single conifer species such as Douglas-fir, noble fir or western hemlock, depending on the stand (Figure 8). Table 2 shows the average stand conditions within the LSR (see Silvicultural Prescription in Appendix H for more information).

Figure 8: Current Condition - Young Densely-Stocked Stands

Table 2: Average Stand Conditions within the LSR

	Age in 2013	Overstory diameter	Overstory trees per acre	Overstory canopy cover
Average	47	12.5”	240	77%
Range	37-59	10.5-14.5”	146-489	64-97%

The stands are considered to be in the stem exclusion stage (Oliver and Larson, 1990) with a dense overstory that blocks out light to the forest floor and limits understory development. Canopy cover averages 60% or more in these stands. Trees are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limited understory vegetation. These young, single-storied stands are generally devoid of large live trees, large standing dead trees or down logs, and lack natural canopy gaps. They currently provide little or no habitat for late-successional species.

To further illustrate the current condition, the 1998 Mid-Willamette LSR Assessment identified an overall lack of late-successional habitat as a key issue in the South Santiam LSR since only about 1/3 of the LSR was mature or old growth habitat.

Why consider taking action? - The NW Forest Plan (1994), Mid-Willamette LSR Assessment (1998) and Recovery Action 6 in the Revised Recovery Plan for the Northern Spotted Owl (2011) focus on restoration of overstocked, uniform, young stands as the primary focus to accelerate development of structural complexity associated with the late-successional habitat desired in the LSR.

Likewise, the Three Creeks Old Growth Grove Implementation Guide (2003) identified opportunities to utilize silvicultural practices within existing managed stands to enhance late-successional characteristics. Commercial thinning was identified as an appropriate treatment in these managed stands to promote tree species diversity and stand complexity (USDA, 2004).

Furthermore, a 1992 Implementation Guide for the Santiam Wagon Road SIA identified the following as acceptable practices: 1) wildlife habitat improvement for threatened and endangered species if consistent with SIA objectives and 2) cutting and removal of vegetation to provide for the safety of users and to attain the SIA desired future condition (USDA, 1992).

Studies have shown that there is "strong evidence that thinning initiates and promotes tree regeneration, shrub growth, and the development of multi-storied stands even when the treatments focused mainly on management of overstory/crop tree density and spacing (Bailey and Tappeiner, 1998). Treatments designed to purposely favor legacy structures (large remnant trees, snags, and downed wood) and/or overstory hardwoods would further hasten development of old-growth forest characteristics" desired in Late-Successional Reserves.

Riparian Reserves

Riparian Reserves are areas where riparian-dependent species receive primary emphasis and also serve as dispersal habitat for certain terrestrial species (NW Forest Plan, p. A-5). They are a component of the Aquatic Conservation Strategy which was developed to restore and maintain the long-term ecological health of watersheds and aquatic ecosystems.

Figure 9: Desired Conditions in Riparian Reserves

Desired Condition **-** The desired condition within Riparian Reserves includes: large conifers (NW Forest Plan, p. 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 large wood for streams (Figure 9).

Figure 10: Example of Current Conditions in Riparian Reserves in Young Managed Stands

Current Condition **-** Approximately 15% of the Riparian Reserves in the project area were previously harvested. These young, densely-stocked, even-aged managed stands are in the stem exclusion stage (Oliver and Larson, 1990) and show very little of the diversity or complexity that is desired in the Riparian Reserves (Figure 10). Stand conditions are similar to those described for the LSR above.

Why consider taking action? **-** The goal in Riparian Reserves is to develop stands with increased complexity in terms of canopy structure and species diversity (USDA, 1994, p. B-11). The

NW Forest Plan allows silvicultural practices in Riparian Reserves specifically "to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain the Aquatic Conservation Strategy (ACS) objectives" (NW Forest Plan, p. C-32).

ACS objective #8 is to maintain and restore 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 sufficient to sustain physical complexity and stability" (NW Forest Plan, p. B-11). Since about 15% of the Riparian Reserves in the project area are not currently meeting desired conditions, there is both a need and management direction to target some of these young stands for treatments to accelerate development of desired stand characteristics.

Matrix and Matrix-Scenic Allocations

Desired Condition - The desired condition for Matrix lands, with respect to structural diversity, is to retain "moderate levels of ecologically valuable old-growth components such as snags, logs and relatively large green trees" (NW Forest Plan, page B-6).

The desired condition of Matrix-Scenic Allocations is similar to the above description, with the added requirement to maintain desired visual characteristics of the forest landscape through time and space (Forest Plan, pp. 201-215).

Current condition - Stands proposed for treatments to increase structural diversity in the Matrix consist of both managed and natural stands. All of these stands are in the stem exclusion stage of development (Oliver and Larson, 1990) where tree canopies close and all of the growing space becomes occupied. At this stage, usually one or more growth factors, such as light, is limiting so new plants are excluded from regenerating. Inter-tree competition increases, leading to density-dependent mortality or self-thinning.

Table 3 describes the average stand conditions in the Matrix.

Table 3: Average Stand Conditions in Matrix

	Age in 2013	Overstory diameter	Overstory trees per acre	Overstory canopy cover
Stands < 80 years old:				
Average	63	14.7"	234	78%
Range	46-77	11.3-16.4"	115-460	61-94%
Stands 80+ years old:				
Average	95	16.3"	286	79%
Range	87-105	12.6-20.3"	161-376	60-86%

Why consider taking action? - The Matrix and Matrix-Scenic allocation areas are not only supposed to provide for timber and other commodity production but should also meet other resource goals such as providing a moderate level of structural components, biodiversity and visual quality (NW Forest Plan, p. B-1 and B-2; Forest Plan, pp. 201-215). Since the desired condition is not being met, there is a need to take action.

2. ***Strategically manage hazardous fuels (ground, ladder and/or canopy fuels) along a 200-foot wide section on the north side of Highway 20, and in other high risk areas, to reduce the potential for large-scale fires that could adversely affect adjacent private land as well as visual quality along Highway 20, a designated State Scenic Byway.***

Desired condition - Ground, ladder and canopy fuels are reduced along a 200-foot wide section on the north side of Highway 20, and in other high-risk areas, decreasing the risk of fuel ignition, as well as fire spread and intensity (Figure 11).

Firefighters are able to operate safely and effectively, allowing for utilization of strategic fire control tactics to ensure protection of the integrity of adjacent private landholdings and visual quality along Highway 20, a designated State Scenic Byway.

Figure 11: Desired Fuel Conditions

Current Condition - The Highway 20 corridor is the main east-west travel route through the communities of Lebanon, Sweet Home, Foster and Cascadia. Highway 20 poses an elevated local fire hazard because of the volume of vehicle traffic, stand densities, and accumulated fuels which contribute to a high risk of fuel ignition, fire spread, and fire intensity given the right weather conditions.

Figure 12: Current Fuel Conditions

Humans have altered the natural disturbance regimes. Fire exclusion, vegetation growth and succession in the absence of frequent, low to moderate severity wildfire events have resulted in conditions where surface and ladder fuels are more extensive and the tree canopies are denser than without fire (Figure 12).

Most of the area along Highway 20, proposed for treatment, is in Fire Regime Condition Class 2 (see Figure 13) which means it is moderately departed from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances. It is also more susceptible to the local risk of human ignition along the highway corridor. There are also several recreational sites (i.e. trailheads) that

increase human activity and can also contribute to increased risk of human fire ignitions. Consequently there is an increased potential for high intensity wildfire activity that would be difficult to suppress.

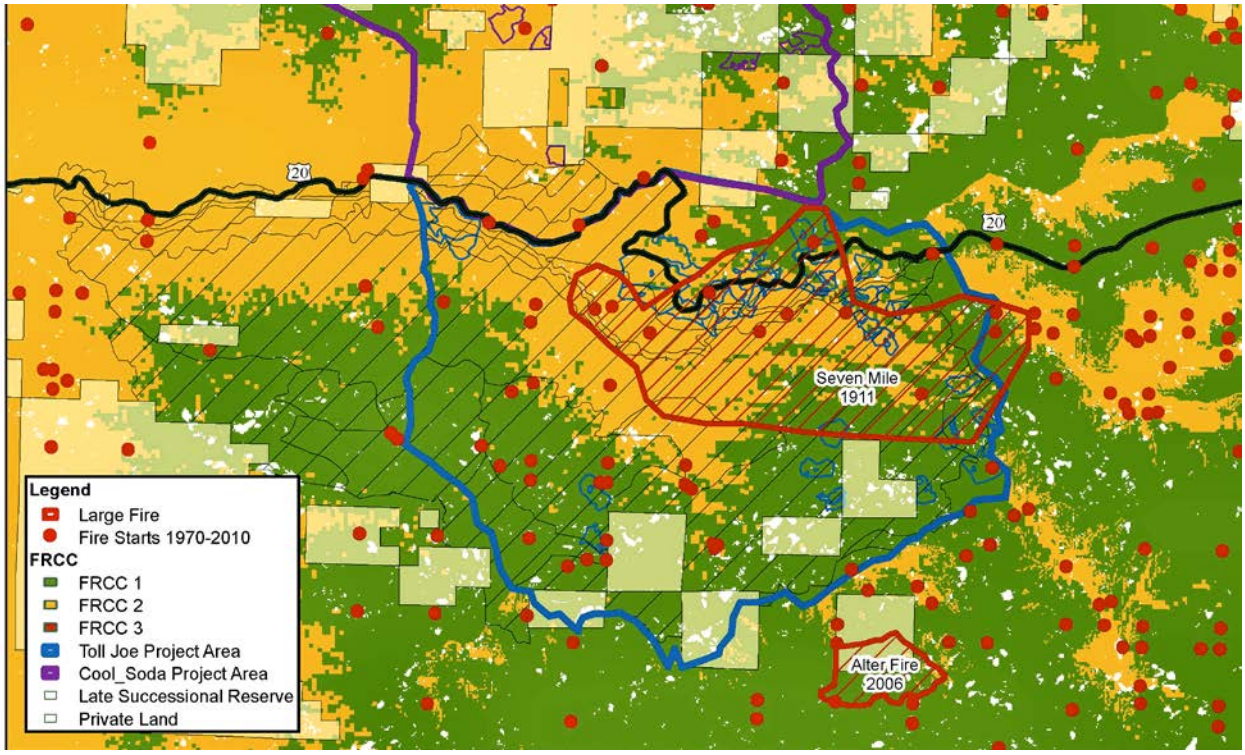

Figure 13: Fire Regime Condition Class and Fire Start History

Why consider taking action? **-** Given the traffic on the highway, there is an elevated risk of human-caused fire starts. District records show that between 1970 and 2010 there have been about 45 fire starts in the project area with seven of those occurring directly adjacent to Highway 20 (Figure 13). There have also been two large human-caused fires in the area: a 600 acre fire in 1936 and a 3,000 acre fire in 1911.

In addition, this area is moderately departed from the natural fire regime. Furthermore research suggests that climate-driven fire risk may increase on the west-side of the Cascades in moist forests (Littell et al., 2010), and Shafer et al. (2010) expect fire activity to increase in all forest types in Oregon.

Evidence suggests that: a) ground fuel treatments help reduce flame lengths, making fire control easier; b) ladder fuel treatments mean that flame lengths would have to be longer in order to cause torching in tree crowns; and c) canopy fuel treatments reduce the likelihood of sustaining crown fires that get into tree canopies. The various fuel treatments could provide wildland firefighters anchor points for indirect firefighting techniques while providing treated areas within and adjacent to the highway corridor for safer and more effective fire protection of the area.

3. ***Improve stand health and vigor in Matrix Allocations***.

Desired Condition - Stands in the Matrix-General Forest and Matrix-Scenic Allocations are managed to maintain vigor and growth using stand treatments including commercial thinning and protection from insects, disease and damage (Forest Plan, MA 14a DFC and FW 255).

Current Condition - Stands are densely-stocked and are considered to be in the stem-exclusion stage (Oliver and Larson, 1990). As inter-tree competition for light, water and nutrients increases, growth rates slow. The stands become less vigorous and more susceptible to insects and diseases.

Why consider taking action? - There is direction in the Forest Plan "to enhance the amount of timber in the future through increased growth rates and by reducing losses from fire, insects and diseases (Forest Plan, p. IV-5)." Healthy, vigorous stands are more resilient to insects and diseases and other disturbances; therefore taking action to improve stand health and vigor helps to achieve the goals of the Forest Plan.

4. ***Contribute wood products to local markets in Matrix Allocations***.

Desired condition - The NW Forest Plan, which amended the Willamette Forest Plan, recognized the need for a sustainable supply of timber and other forest products that help maintain the stability of local and regional economies and contribute valuable resources to the national economy, on a predictable and long-term basis" (NW Forest Plan, p. 26). The amended Forest Plan has a goal to produce an optimum and sustainable yield of timber, based on growth potential of the land, which is compatible with multiple use objectives and meets environmental requirements for soil, water, air and wildlife habitat quality (USDA, 1990). Matrix lands were set aside in the NW Forest Plan to be areas where most timber harvest and other silvicultural activities are conducted (NW Forest Plan, p. C-39).

Current condition - The Allowable Sale Quantity (ASQ) for the Willamette National Forest is set forth in the 1990 Land and Resource Management Plan as required by the National Forest Management Act of 1976. Sweet Home Ranger District is slated to contribute approximately 8 million board feet (MMBF) annually to the Willamette National Forest goal.

Why consider taking action? - A strategic goal of the Forest Service is to provide and sustain benefits to the American people. To accomplish this goal, one objective is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on National Forest System (NFS) lands.

Providing a predictable supply of wood products to local communities helps maintain infrastructure and processing capacity in local communities. It also provides stability to local and regional economies on a predictable and long-term basis.

Public Involvement and Tribal Consultation

The Forest Service consulted the following individuals, Federal, State, tribal, and local agencies during the development of this EA:

Public Involvement

The proposal was first listed in the Schedule of Proposed Actions (SOPA) in October 2011 and has been listed throughout the project planning process. The SOPA provides a way of informing the public about upcoming projects and keeps them abreast of progress of individual projects.

Scoping letters were sent to interested and affected members of the public and agencies on January 18, 2012 and March 16, 2012. These letters briefly described the project and invited the public to submit comments they had about the proposal. Comments were received from the American Forest Resource Council, Cascadia Wildlands and Oregon Wild.

In addition, two public field trips were held to look at the project on December 9, 2011 and January 30, 2012. Six members of the public and representatives from Cascadia Wildlands, Oregon Wild, American Forest Resource Council, Forest Service Employees for Environmental Ethics, and Oregon State University attended the field trips.

Formal consultation with the **U.S. Fish and Wildlife Service** was completed and a Biological Opinion was received on October 29, 2012. Under the "Effects of the Action" section of the Biological Opinion, the Service anticipates that the proposed project is "Likely to Adversely Affect" northern spotted owls. No "take" is anticipated. Reconsultation occurred as a result of 2012 designation of critical habitat. On January 3, 2013 US Fish and Wildlife Service sent a letter confirming completion of formal conferencing on proposed critical habitat. The letter stated that no projects exceeded the effects evaluated in the conference opinion.

Consultation with **National Marine Fisheries Service** was not required because this project has no effect on Spring Chinook salmon, Winter Steelhead or their Critical habitat.

Under the **Programmatic Agreement** among the USDA, Forest Service Pacific Northwest (Region 6), The Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service (2004) the Forest Heritage Specialist has project review authority and certifies that the project complies with Section 106 of the National Historic Preservation Act. Certification of this project as "No Historic Properties Affected" was completed on March 5, 2014.

On July 12, 2011 Louisa Evers (BLM/USFS Regional Fire Ecologist), Sue Livingston (USFW Wildlife Biologist), Jeanette Griese (BLM State Silviculturist), from the **Late Successional Reserve (LSR) Working Group Regional Ecosystem Office (REO)** went to look at the Toll Joe project with the Interdisciplinary Team. The purpose of the trip was to get an idea from the LSR working group about what was needed to get a Letter of Concurrence for the project, to identify issues they saw going through the stands, and to discuss lessons learned from previous thinning in this LSR.

On October 27, 2011, the IDT and Kim Mellen-McLean, Louisa Evers (Fire Ecologist), Sue Livingston (Wildlife Biologist), Jeanette Griese (Silviculturist) from the LSR Working Group had a phone conversation to discuss changes in the project and what needed to be done to build a strong case for a Letter of Concurrence on this project.

During an April 24, 2013 phone conversation with the LSR Working Group they concluded that since the Mid-Willamette LSR Assessment stated that the South Santiam LSR only had a moderate fire risk, the proposal to treat ground, canopy and ladder fuels within 200 feet of Highway 20 in the LSR was not consistent with the NW Forest Plan. The NW Forest Plan only allows fuel treatments in LSR's in high risk areas on the west side of the Cascades. This led to changes in project design which dropped fuel treatments adjacent to Highway 20 in the LSR.

Tribal Consultation

The Toll Joe Project was included in the Annual Program of Work Review with the Confederated Tribes of the Grand Ronde and the Confederated Tribes of Siletz Indians in 2010 and 2011. The project, when originally discussed with the tribes, was called Soda Joe. It was then split into two projects: Toll Joe and Cool Soda. In addition, pre-scoping letters were sent to Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz Indians, Confederated Tribes of Warm Springs Reservation of Oregon, and the Klamath Tribe. No comments were received from the tribes.

The Toll Joe project changed in scope in 2012 so an updated letter (March 15, 2012) describing the project was mailed to tribal contacts from the Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz Indians, Confederated Tribes of Warm Springs Reservation of Oregon, and the Klamath Tribe. No comments were received regarding project changes.

No new historic properties were identified during reconnaissance for this project. Twelve previously located sites have been protected from ground-disturbing activities by removing them from harvest units or buffering them from mechanical disturbance. No effects, as outlined in the American Indian Religious Freedom Act, are anticipated with any of the proposed activities.

Issues

To help focus planning efforts, the interdisciplinary team (IDT) used comments from the public, other agencies, and others consulted such as tribes, as well as information gained from field reconnaissance to identify issues for this project.

Planning regulations direct agencies to narrow the scope of environmental analysis by concentrating on the issues that are truly significant to the proposed action and to briefly discuss other non-significant issues. Therefore, the Forest Service separated the issues into two groups: Key and non-Key issues.

Key Issues

For this project, Key issues are those that drove the development of the action alternatives and are outlined in Table 4 below.

Table 4: Key Issue Summary

Key Issues	Alternative in Which Issue is Addressed How Addressed
Harvest in stands > 80 years of age (especially in the LSR and Riparian Reserves) since these are the best candidates to grow and develop into old-growth habitat in the shortest time.	Alternative 2 proposed harvest in stands > 80 years of age while Alternative 3 did not.
Regenerating stands that have reached culmination of mean annual increment (CMAI) in Matrix management allocations to provide a sustainable supply of timber to local economies.	Alternative 2 proposed regeneration of about 20 acres of stands that have reached CMAI in Matrix lands. Alternative 3 did not include regeneration harvest.

Non-Key Issues

The Council on Environmental Quality (CEQ) NEPA regulations require delineation of non-key issues summarized in Table 5. Sec. 1501.7 directs us to "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" The following is a list of reasons that identified issues are non-key:

#1 – issue is outside the scope of the proposed action;

#2 – issue is already decided by law, regulation, Forest Plan, or other higher level decision;

#3 – issue is adequately addressed in all alternatives; or

#4 – issue is conjectural and not supported by scientific or factual evidence.

Table 5: Non-Key Issue Summary	*(Note: The above numbers are used in this table under Reasoning).*	
Non-Key Issues	**Reason**	**Rationale**
Comments from American Forest Resource Council (AFRC)		
Having consistent and steady harvest operation times throughout the year to supply a steady source of timber for mills to keep employees working.	Reason #2	Seasonal operating restrictions are imposed as needed to address resource protection (fish, wildlife, recreation, soils, etc.). These dates are often decided by regulations, the Forest Plan or other higher level decisions, but there is some flexibility in the restriction dates with concurrence of the appropriate resource specialist/District Ranger as conditions warrant.
Consideration given to permanent road construction that would have both short and long- term benefits to the Forest Service and its customers.	Reason #3	The types of roads proposed, whether permanent or temporary, are considered in project design and take into account the frequency of use, potential access to additional areas needing treatment, resource protection, etc. This was done similarly in both action alternatives.
Proactive treatments in Riparian Reserves such as thinning to accelerate the stand trajectory toward a mature successional condition.	Reasons #2 and #3	Treatments in Riparian Reserves must meet requirements of the NW Forest Plan including the Aquatic Conservation Strategy Objectives. Areas selected for treatment in Riparian Reserves were determined based on the need to increase diversity and complexity in managed stands.
Allow flexibility in the type of yarding equipment used to accomplish resource objectives.	Reason #1	As long as equipment can be shown to meet or exceed the requirements outlined in the EA analysis it is possible that it could be used.
All timber sales should be economically viable	Reason #2	Forest Service Manual Direction (2430-2432) and Handbook 2409.18 Chapters 10-30 require that financial and economic efficiency information be made available to the decision maker prior to substantial investment of capital resources into timber sale projects. All action alternatives would have a positive economic benefit and would be economically viable. The action alternatives present the decision maker with the associated costs and benefits of the project and are discussed in Chapter 3.
Comments from Cascadia Wildlands (CW)		
CW supports restoration thinning in young, managed plantations	Reason #3	Thinning in young, managed plantations was addressed similarly in both action alternatives. Prescriptions were designed to meet project and resource objectives. Thinning design adhered to requirements issued by the Regional Ecosystem Office for commercial thinning in Late-Successional Reserves (LSR) as well as NW Forest Plan requirements for thinning in the LSR and Riparian Reserves.

Table 5: Non-Key Issue Summary	*(Note: The above numbers are used in this table under Reasoning).*	
Non-Key Issues	**Reason**	**Rationale**
Must show that thinning is needed in Riparian Reserves	Reason #3	Thinning is proposed in younger stands in the Riparian Reserves in both Action Alternatives to achieve ACS objectives. Areas selected for treatment in Riparian Reserves were determined based on the need to increase diversity and complexity in managed stands.
Thinning and road building in Riparian Reserves captures mortality, reducing recruitment of dead wood and retarding attainment of ACS objectives	Reason #3	We recognize the importance of wood in streams but identified a lack of diversity and complexity in managed stands in Riparian Reserves as a reason to treat about 2% of the Riparian Reserves in the project area. No-harvest buffers on streams, skips with harvest units and artificial snag creation address some of the down wood issues at the unit scale. But at the landscape scale there are many areas that can provide dead wood over the long-term such as the ¼ mile wide Wild and Scenic Eligible River Corridor on Sevenmile Creek, the mature and late-seral stands in Riparian areas in the LSR, Old Growth Grove, and Research Natural Area, etc. In addition, there is a considerable amount of unstable ground in the project area which serves as source areas for wood recruitment to streams.
The need for gaps given the proximity of harvest units to private land which is clearcut on a short-rotation basis.	Reason #3	Small gaps between $^{1}/_{10}$ and $^{1}/_{2}$ acre in size were proposed to promote complexity by increasing variable density within and among stands as well as allowing for understory development. This contributes to meeting project purposes.
Harvest and/or road building in the vicinity of trails and a horse camp.	Reason #2	No harvest or road building is proposed in the vicinity of the horse camp. Thinning is proposed along a short segment of the Santiam Wagon Road to accelerate development of stand conditions desired in this area.
Thinning and road construction within uninventoried roadless areas.	Reason #2	No harvest is proposed in inventoried roadless areas. There is an undeveloped area in the project area but it does not meet Forest Service criteria for potential wilderness FSH 1909.12. Harvest is not proposed in this area.
Ensure protection of scenic quality along Highway 20 during fuel reduction treatments.	Reason #2	The Forest Plan provides direction for maintenance of scenic quality. All alternatives meet or exceed Forest Plan standards and guidelines with respect to scenic quality.
Comments from Oregon Wild (OW)		
Resource impacts of temp. road construction and having a more robust road decommissioning effort, not just road storage.	Reason #3	Both action alternatives not only proposed 6.3 miles of road storage but also 1.3 miles of road decommissioning.

Table 5: Non-Key Issue Summary	*(Note: The above numbers are used in this table under Reasoning).*	
Non-Key Issues	**Reason**	**Rationale**
Support well-designed variable thinning in dense young stands given proper consideration of stand variability, treatment in Riparian Reserves, avoidance of road building, and potential adverse effects to spotted owl habitat or prey base.	Reason #2 and #3	Thinning prescriptions were designed for the action alternatives by a certified silviculturist and the interdisciplinary team to meet both project objectives and various resource needs. Thinning design also adhered to requirements issued by the Regional Ecosystem Office for commercial thinning in Late-Successional Reserves (LSR) as well as NW Forest Plan requirements for thinning in the LSR and Riparian Reserves.
Thinning in Riparian Reserves and impacts on dead wood in streams (especially stands > 80 years old)	Reason #2 and #3	Thinning in stands > 80 years old in Riparian Reserves is not proposed. We recognize the importance of wood in streams but identified a lack of diversity and complexity in managed stands in Riparian Reserves as a reason to treat about 2% of the Riparian Reserves in the project area. No-harvest buffers on streams, skips with harvest units and artificial snag creation address some of the down wood issues at the unit scale. But at the landscape scale there are many areas that can provide dead wood over the long-term such as the ¼ mile wide Wild and Scenic River Eligible River Corridor on Sevenmile Creek, the mature and late-seral stands in Riparian areas in the LSR, Old Growth Grove, and Research Natural Area, etc. In addition, there is a considerable amount of unstable ground in the project area which serves as source areas for wood recruitment to streams.
Any stand that appears to be on the right trajectory to reach potential late-successional forest habitat should not be treated	Reason #3	No stands that appeared to be on the right trajectory to reach late-successional forest habitat were harvested in the Late Successional Reserve or in Riparian Reserves in any of the alternatives.
Thinning too heavily and its impact and snag and down wood recruitment	Reason #2 and #3	The intensity of thinning prescriptions is adequately addressed in all alternatives by adhering to standards and guildelines and other regulations that limit the amount of residual canopy required in Riparian Reserves or in suitable northern spotted owl habitat, for example.
Commercial thinning can potentially reduce and/or delay the natural development of snags and down wood in these young stands	Reason #3	All action alternatives used similar measures to address snag and down wood needs. Skips, or unthinned areas, were left in stands for natural snag and down wood recruitment as well as artificial post-sale snag and down wood creation. The No Action Alternative addresses natural snag and down wood development to compare and contrast snag and down wood development in the action alternatives.

Table 5: Non-Key Issue Summary	*(Note: The above numbers are used in this table under Reasoning).*	
Non-Key Issues	**Reason**	**Rationale**
Roadside fuel reduction – the likelihood of wildfire is overstated	Reason #3	No fuel treatments are proposed in the LSR in either action alternative. The majority of fuel treatments along the north side of the highway are ground and ladder fuel treatments with no commercial harvest. About 44 acres of canopy treatments would occur in Alt.2 and 20 acres in Alt. 3. See fire/fuels discussion in Chapter 3 for effects of treatments.
Avoid unnecessary construction of temporary roads	Reason #3	The types of roads proposed, whether permanent or temporary, are considered in project design and take into account the frequency of use, potential access to additional areas needing treatment, resource protection, etc. This was done similarly in both action alternatives.
Ensure compliance with Aquatic Conservation Strategy Objectives and Survey and Manage.	Reason #2	All action alternatives meet or exceed Aquatic Conservation Strategy Objectives outlined in the Northwest Forest Plan. Surveys were done for Survey and Manage species and/or protection buffers were employed similarly under all action alternatives.
Ground-disturbing activities associated with harvest operations and road use/ construction/ reconstruction in managed stands may exacerbate the dispersal of non-native invasive plants.	Reason #2 and #3	All action alternatives meet or exceed amended Forest Plan standards & guidelines regarding invasive weeds. Alternatives include requirements to minimize the spread of invasive weeds as per: the following: a) Final EIS for Pacific Northwest Region, Preventing and Managing Invasive Plants (USDA Forest Service PNW Region, May, 2005; b) Amendment 259 of the Willamette Land and Resource Plan (USDA 1990) and c) Willamette National Forest Integrated Weed Management EA (USDA 2007)

What will be decided?

The need for the proposal outlined above sets the scope of the project and analysis to be completed. Based on the analysis, the Forest Supervisor will determine whether the proposed project and alternatives could result in a significant impact. If there is a finding of no significant impact, the Forest Supervisor will select an alternative deciding:

- Whether to implement proposed commercial timber harvest, hazardous fuel reduction and access development;
- Whether to amend the Forest Plan to allow commercial thinning in two young plantations in the Three Creeks Old Growth Grove;
- What specific design elements or mitigation measures are needed; and
- What specific project monitoring requirements are needed to assure design elements and mitigation measures are implemented and effective.

The decision will be based on:

- How well the selected alternative achieves the project purposes and needs;
- How well the selected alternative protects the environment and addresses issues and concerns; and
- How well the selected alternative complies with relevant policies, laws and regulations.

Proposed Action and Alternatives

Three alternatives were analyzed for this project, including taking No Action. This section provides a detailed description of the proposed action (*Alternative 2*) as well as alternative methods for achieving the stated project purposes. Both action alternatives propose commercial thinning in young, managed stands. Alternative 2 also proposes commercial thinning and regeneration harvest in selected stands > 80 years of age in Matrix management allocations. Alternative 3, on the other hand, does not harvest in stands > 80 years of age and proposes no regeneration harvest.

This section presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., various thinning intensities for instance) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e. the amount of potential erosion or impacts on snag and down wood habitat). It also includes mitigation measures designed to avoid, minimize, rectify, reduce, eliminate, or compensate for environmental effects caused by the project.

Table 14 (page 48) outlines design elements that have been built into action alternatives to ensure compliance with Forest Plan standards and guidelines, laws, regulations and other policies. See also Appendix A for individual unit maps and integrated prescriptions.

The proposed action and following alternatives were considered:

Alternative 1- No Action

Current management plans would continue to guide management of the project area. Future development of stands would be guided by natural processes. The project objectives of increasing stand complexity and improving growth and vigor of residual trees would be addressed passively rather than through active timber management. Dense overstory canopy cover would remain with limited understory vegetation. These stands would advance through the various changes in structure that naturally occur over time: from the stem-exclusion stage through understory re-initiation to late-successional/old growth stage. The rate at which these stands develop the desired stand characteristics would be dependent on growth rates and frequency of natural disturbances such as fire, insects and diseases.

No proactive efforts would be made to reduce fire risk along the north side of Highway 20. Dense underbrush, ladder fuels and dense-canopied stands would persist in the vicinity of Highway 20. Fire suppression efforts would continue as they have in the past.

The existing road network would remain unchanged. Road storage, decommissioning or storm-proofing as part of this project would not occur.

Finally, the objectives of increasing growth and vigor and providing wood products would not be realized at this time.

This alternative provides a basis for comparison to evaluate changes in the current condition associated with the action alternatives.

Both Action Alternatives

The following information applies to both of the action alternatives. Instead of repeating the information for each alternative it is described below. Acreages vary between alternatives and are summarized in Tables 8 (page 34) and 11 (page 42).

Thinning Intensities (see maps Figures 17 and 18): Three different thinning intensities are prescribed as outlined below:

- Thin, leaving 40-60 trees per acre to maximize individual tree growth and keep the overstory canopy cover open for a longer period of time to allow for understory development. This treatment is prescribed within portions of the stands being treated to 80-100 trees per acre as a means to increase stand complexity. A range of residual canopy covers from 31 to 40% is expected from this treatment with relative densities (Curtis, 1982) reduced below 20.
- Thin, leaving 80-100 trees per acre to maximize stand growth and allow more open conditions for understory development. A range of residual canopy covers from 40 to 60% is expected from this treatment with relative densities generally reduced below 35.
- Thin, leaving 60-110 trees per acre to provide a wide range of canopy covers within the stands while still maximizing areas of stand and individual tree growth. This treatment is prescribed in the stands adjacent to Highway 20 to reduce canopy fuel and break up the continuous canopy. A range of residual canopy covers from 40 to 60% is expected from this treatment with relative densities averaging around 35 overall.

As per direction in the July 9, 1996 and September 30, 1996 letters from the Regional Ecosystem Office regarding "*Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed LateSuccessional Areas from Regional Ecosystem Office Review*" additional treatment criteria for stands in the South Santiam Late Successional Reserve (LSR) include:

- 10% or more of each stand would be left in unthinned skips to retain processes and conditions such as high canopy cover, natural suppression and mortality and undisturbed areas.
- 3-10% of each stand would either be heavily thinned (i.e. less than 50 trees per acre) or in created openings up to ¼ acre in size, to maximize individual tree development, encourage understory vegetation development, and encourage structural complexity.
- The maximum cut diameter is 20."

Gaps: Gaps are proposed as a tool to promote complexity by providing variable density within and among stands as well as allowing for understory development. Gaps range from $^{1}/_{10}$ to ½ acre in size with retention elements that may include a dominant tree release and/or maintaining minor conifer species. Gap intensity would vary unit to unit from 3 to 15% of the stand acres. Stand selection for gap placement is based on a variety of factors including slope and plant association (see Silvicultural Prescription in Appendix H).

***Skips*:** No treatment areas, called skips, are proposed to promote structural complexity by providing variations in densities within and among stands. Skips left in harvest units could be the result of a variety of factors such as: 1) resource protection buffers adjacent for streams and/or special habitat areas, 2) logistical considerations such as logging feasibility, 3) areas not in need of thinning or 4) untreated areas embedded within a stand to promote complexity.

The 1998 Mid-Willamette LSR Assessment recommended buffering interior forests. Most all of the units proposed for thinning in the LSR were within that buffer distance of late-successional forest (see Silvicultural Prescription, Appendix H). Additional skips would be placed against the old growth to provide this buffering.

Stream Buffers*:* Areas within Riparian Reserves that are directly contributing to primary stream shade and channel bank stability would be left intact. In stands < 80 years of age, a 75-foot wide no-harvest buffer would be retained on all perennial streams in accordance with the Northwest Forest Plan Temperature TMDL Implementation Strategy, Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy (2012) and a 50-foot wide no-harvest buffer would be retained on intermittent streams. Treated acres within these Riparian Reserves would retain an average 50% canopy closure. No thinning is proposed in Riparian Reserves older than 80 years.

***Prebunching*:** In some harvest units**,** ground-based equipment would be used to gather felled trees to a point where they are yarded to the landing using skyline or other equipment. This makes the yarding more efficient and reduces logging costs**.** Prebunching is permitted as outlined in the integrated prescriptions in Appendix A. Prebunching roads would need to meet the same pre-location and pre-approval requirements as skid and forwarder roads.

***Road Maintenance and Reconstruction*:** The transportation system used in this project partially falls within the cost-share maintenance area (see Figure 14). In fact, about 30% of the access roads proposed for hauling activities are in the cost-share area. In this area, the cost and responsibility of

maintaining these roads is shared among various landowners in the vicinity. Responsibility for maintaining the cost-share roads varies by area. Road work outside of the cost-share area is the responsibility of the individual landowners.

The following road work would be required to facilitate haul during the recommended season of use and to comply with the current Road Management Objectives.

- About 33 miles of pre-haul maintenance along the entire haul route would be required. This includes: roadside brushing, ditch reconditioning, spot rocking, and culvert cleanout.
- About 5.5 miles of road reconstruction would be needed on road 2044 including: two live-stream culvert replacements and five ditch-relief culvert replacements.

***Additional Access*:** It would be necessary to reopen about 2.7 miles of existing non-system spur roads to access harvest units (Table 6).

***Agreements**:* Land use agreements may be needed for landings along the highway and near adjacent landowners.

Rock Sources: There are several potential rock sources within the project area that could supply the necessary aggregate (either crushed or pit run) for road maintenance and reconstruction. Proposed sources include Elbow Creek Pit, Soapgrass Pit, or nearby private rock sources. Minor clearing, generally of less than one acre may be needed for development of the rock sources. Clearing could include trees in plantations or brush, or the falling of adjacent snags and danger trees.

Table 6: Re-open Existing Non-System Spur Roads

Unit	Total Length (Feet)	Class IV Stream Crossing
25	1415	0
30	555	0
32	1105	0
35	660	0
38	935	0
40	1210	0
41	2070	0
44	1950	0
66	910	0
66	3075	0
74	360	3
Totals	**14,245 feet = 2.7 miles**	**3**

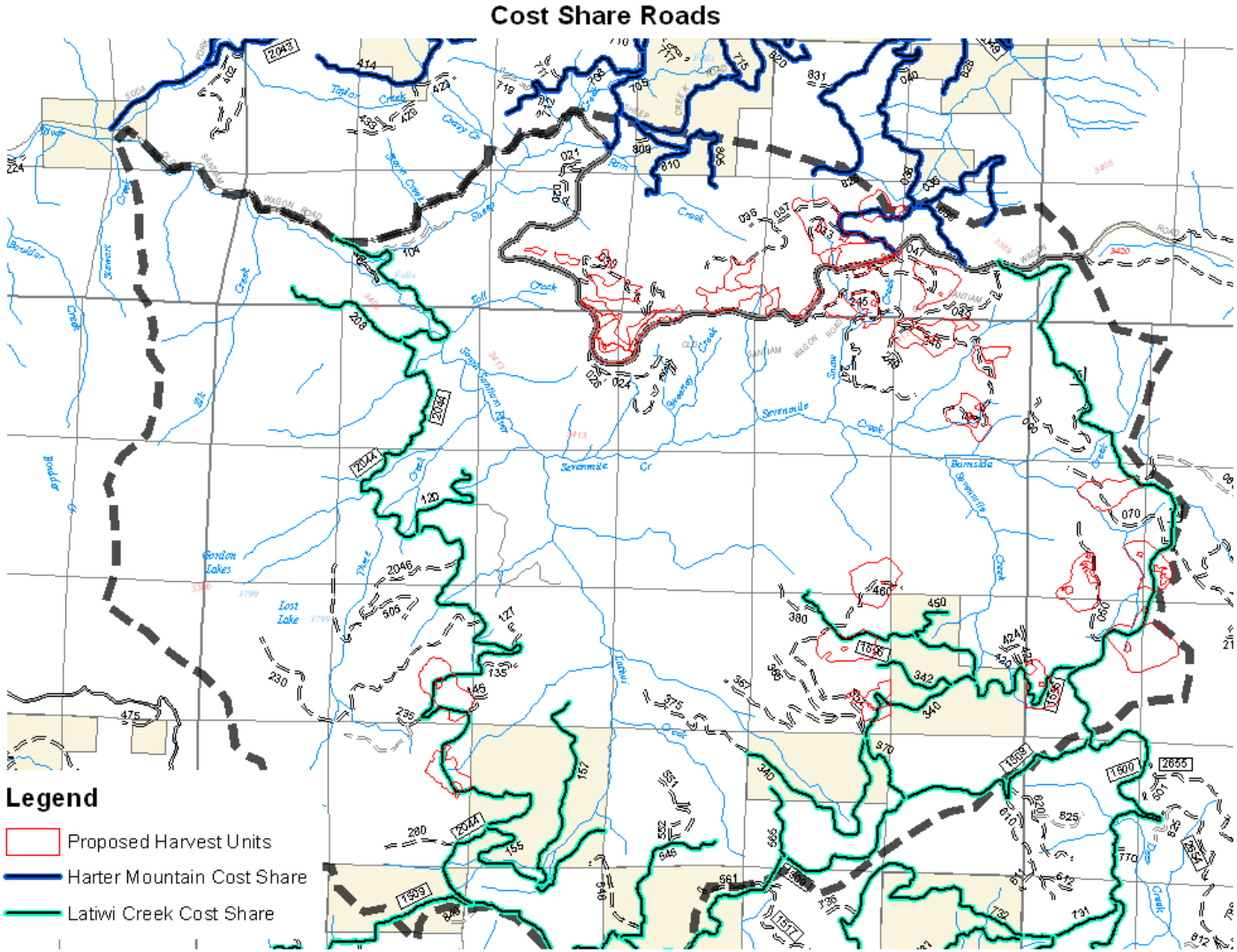

Figure 14: Cost Share Roads in Project Area

***Other Road Treatments**:* As funding becomes available, the following road storage, decommissioning, and stormproofing work is proposed in both action alternatives (see Table 7 and Figure 15).

Approximately 6.3 miles existing roads would be stored. This treatment would hydrologically stabilize roads so that maintenance is not needed and it preserves the road bed for future access. The treatment in this project area involves removing all stream crossing culverts and installing waterbars. Stored roads would remain system roads.

About 1.3 miles of road would be decommissioned, where the road is removed from the road system and to some extent from the landscape. It generally consists of removing all culverts and fills, pulling back unstable sidecast, and decompacting and re-vegetating, where appropriate. Decommissioned roads would be removed from the road system.

Finally, about 2.4 miles would be stormproofed in which drivable draindips and waterbars would be installed to prevent road surface erosion and provide water diversion in the event of road drainage failures. These storm-proofed roads would remain open for administrative use. Stormproofed roads would remain on the road system and could be used for travel.

Table 7: Road Storage, Decommissioning and Stormproofing

Road	Treatment	Maintenance Levels After Treatment	Number of stream culverts removed	Road Miles
2044-208 (end beyond spur)	Storage	1	1	0.4
2044-123	Storage	1	2	1.4
2044-238	Storage	1	1	0.6
1500-070	Storage	1	1	1.2
1500-050	Storage	1	1	1.0
1595-340 (end beyond 375)	Storage	1	1	0.4
2000-047 (unit 32)	Storage	1	3	0.9
2000-033	Storage	1	1	0.4
			Total miles storage	**6.3**
2044-104	Decommission	N/A	3	0.7
1595-367 (end beyond last stand)	Decommission	N/A	3	0.6
			Total miles decommissioning	**1.3**
2046-000	Stormproofing	2	N/A	1.8
2044-208 (up to spur junction)	Stormproofing	2	N/A	0.6
			Total miles of Stormproofing	**2.4**
			Total	**10.0**

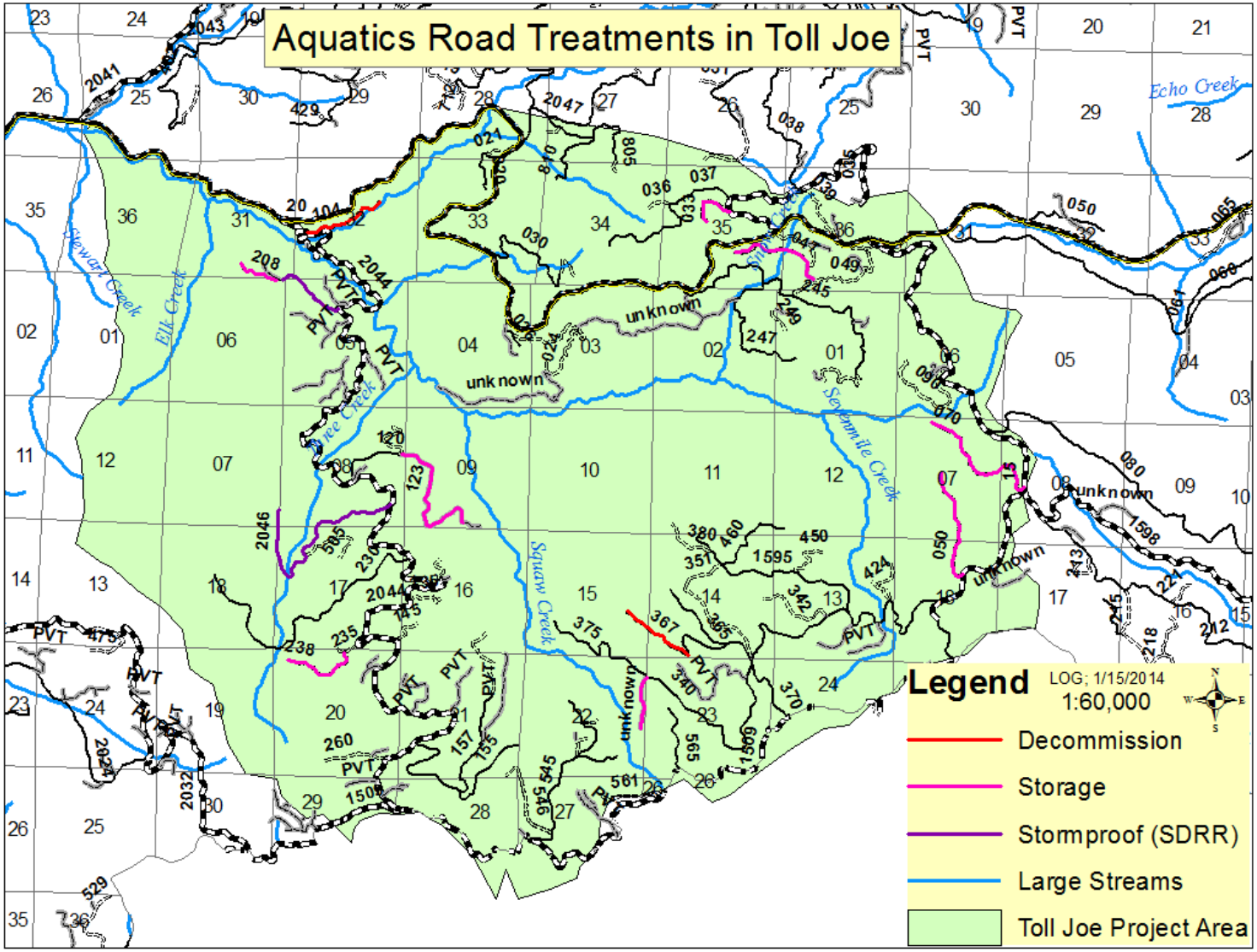

Figure 15: Proposed Road Storage, Decommissioning and Stormproofing

Non-Significant Forest Plan Amendment

A non-significant amendment to the Willamette National Forest Land and Resource Management Plan (1990) would be required to thin proposed Units 25 and 26 in both action alternatives. Both of these proposed harvest units lie within the Three Creeks Old Growth Grove, where management direction excludes programmed timber harvest (Forest Plan, Chapter IV, p. 159). The Old Growth Grove also lies within the South Santiam Late Successional Reserve.

Desired Condition - The desired condition in Old Growth Groves is a "network of outstanding, highly accessible examples of old-growth timber types of the Western Cascades (Forest Plan, Chapter Iv, p. 158).

Current Condition - About 40 % of the 1,967-acre Three Creeks Old Growth Grove is currently in plantations ranging in age from 15 to 65 years old. Most of the plantations lie within the southeastern portion of the Old Growth Grove (see Figure 16).

According to the Three Creeks Old Growth Grove Implementation Plan (USDA. 2003a, available upon request at Sweet Home Ranger District Office) there are "400 acres of 170 year-old stands, mostly in the western portion of the Grove, and 330 acres of 400-500 year-old stands, primarily in the eastern portion. The remaining intact forest includes 150, 400-500 and 650-800 year-old trees."

The plan states that many of the oldest stands are fragmented and surrounded by plantations. These plantations total 796 acres according to the Implementation Plan and 828 acres according to GIS mapping information (Figure 16). Three of these plantations were previously thinned under a Forest Plan amendment in Gordon Three Timber Sale. Proposed Units 25 and 26 comprise about 95 acres of young, even-aged, single-storied managed stands within the Three Creeks Old-Growth Grove. These stands are 45 and 47 years old respectively. Proposed management activities within these stands include commercial thinning with ¼-acre gaps and skips in Unit 25 and commercial thinning with skips but no gaps in Unit 26. The purpose of the treatments is to accelerate development of larger diameter trees and increase stand complexity to hasten attainment of the long-term resource goals in this management allocation.

Three Creeks Old Growth Grove

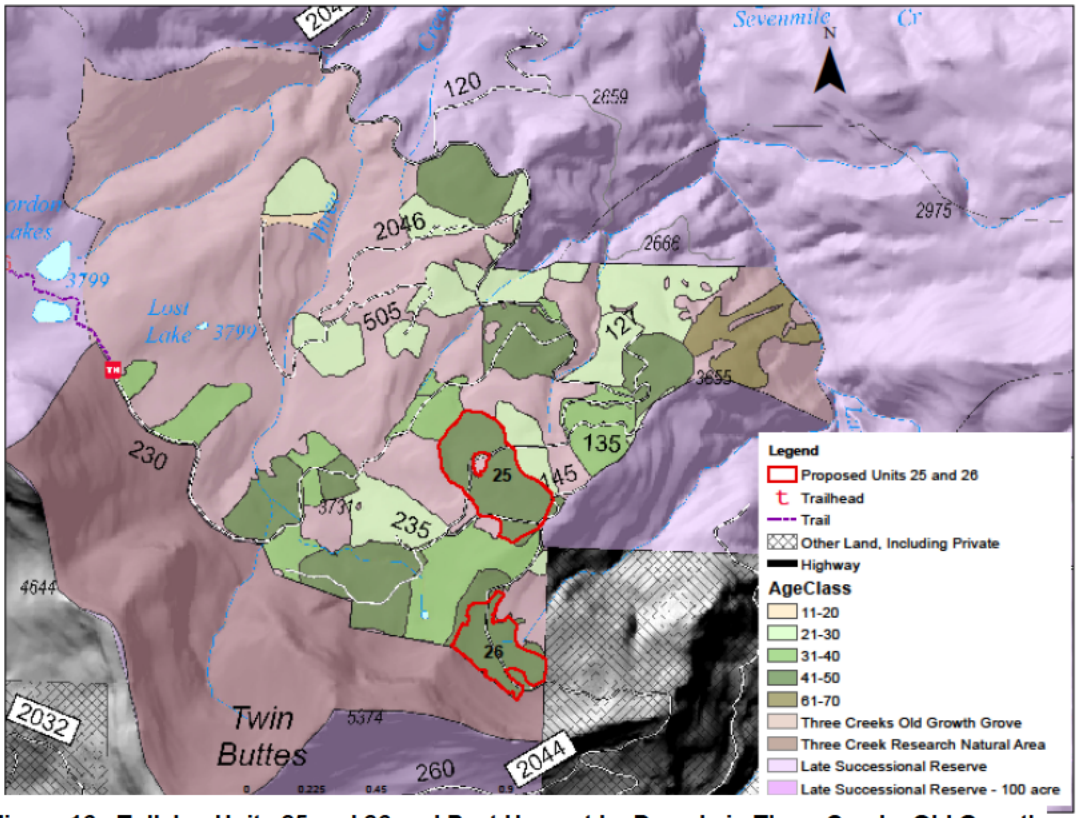

Figure 16: Toll Joe Units 25 and 26 and Past Harvest by Decade in Three Creeks Old Growth Grove

These treatments are supported on page 10 of the Three Creeks Old-Growth Grove implementation Guide which states that "silvicultural activities would be limited to the existing managed stands and should be done only to enhance late-successional characteristics."

The Implementation Guide goes on to say that "Silvicultural prescriptions shall be written to promote tree species diversity and stand complexity," both of which are goals of the treatments as outlined in the silvicultural prescription (Appendix H).

In addition, the treatments are supported in the Late Successional Reserve as outlined in the Purpose and Need (EA pages 9-15).

Similar actions – Post Sale Activities: The following actions are required as mitigation for project activities:

1. Reforestation in 5-acre patch cuts with reserve trees in Units 50 and 55. A total of about 20 acres would be reforested.
2. Subsoiling required to ensure compliance with Forest Plan standards and guidelines for compaction in Unit 30 and the eastern portion of Unit 39.

As funding is available, projects listed below would be implemented in priority order and are described in more detail in Appendix C.

Toll Joe Post-Sale Activities Prioritization

1. Wildlife snag and down wood creation within units in the Late Successional Reserve
2. Treating hazardous fuels along the strip, approximately 200 feet wide on the north side of Highway 20. Would work in conjunction with botany to minimize potential for spread of invasive weed species
3. Invasive weed survey and control
4. Seed native species along disturbed areas such as temporary roads, subsoiled areas and landings
5. Visual cleanup in the visual retention zone
6. Firewood
7. Wildlife snag and down wood creation in units outside the Late Successional Reserve
8. Subsoiling (not required mitigation).
9. Precommercial thinning
10. Aquatic risk road treatments
11. Rehabilitate helicopter landing (Unit 37)
12. Gate installation

Alternative 2 – Proposed Action

In addition to the actions described above for "Both Action Alternatives," the following activities are proposed in Alternative 2 to meet the purpose and need for the project:

Commercially thin about 910 acres with about 24 acres of dominant tree release gaps ranging from $^{1}/_{10}$ to ½ acre in size (depending on management allocation). Thinning would emphasize increasing complexity within stands and across the landscape using various thinning intensities, canopy gaps, skips and retention of minor species.

Regenerate about 15 acres in Unit 50 and five acres in Unit 55 using patch cuts with reserve trees. The remainder of Unit 50 has been previously thinned so would not be treated during this entry. The remainder of Unit 55 would be thinned. Both of these units are located in Matrix management allocations. These stands are 98 and 91 years old, respectively and have reached culmination of mean annual increment as required in the Forest Plan for regeneration harvest. Created openings would not exceed 5 acres in size to meet scenic allocation requirements, and would cover approximately 25% of the matrix area of these stands. These 5-acre patch cuts with reserve trees would promote complexity by providing variable stand density within and among stands. At least 15% of the area would remain uncut in a combination of clumps and individual trees. Down wood and snags would be left as per NW Forest Plan requirements.

Planting is prescribed for the 5-acre patch cuts with reserve trees on 10x10 foot spacing or about 436 trees per acre. The following is the recommended species mix of planting depending upon seedling availability: 50-70% Douglas-fir, 10-25% western white pine and 10-25% western redcedar. Burning should be used as site preparation where brush disposal (BD) treatments are prescribed. If BD does not provide site preparation, then monies would be collected to include slash treatment sufficient to provide planting spots. Trees would be planted using microsite protection features such as stumps, slash, and other natural features located in the stand, to help ensure their survival.

Hazardous fuel treatments are proposed within 200 feet of Highway 20, on the north side of the highway, from the junction with Road 2047 to the eastern edge of the project area. Reducing canopy density, ladder fuels and ground fuels would be accomplished through a variety of treatments outlined later in this section.

One or more timber sales, yielding a total of about 6.4 MMBF, would occur over the next 3-5 years.

Table 8 summarizes information for individual harvest units in this alternative. Figure 17 shows a map of Alternative 2. For a more complete description see Integrated Prescriptions in Appendix A and Design Elements in Table14 (page 48). Table 15 provides a comparison of the three alternatives for this project.

Table 8: Alternative 2

Unit #	Age in 2013	Total Unit Acres	Number of Gaps by Size			Thinned Acres	Target Leave Trees Per Acre for Thinning	Patch Cuts Acres	Total Ac. Treated in LSR	Total Ac. Treated In Riparian Reserves	Ground-based Acres	Cable Acres	Skyline Acres	Heli-copter Acres	Volume (MBF)
			1/10 Ac.	¼ Ac.	½ Ac.										
25	46	60		8		58	80-100		60	21	25	3	32		325
26	48	35				35	3 ac =40-60 32ac = 80-100		35	5	28		7		184
27	54	64				64	80-100		0	25	30	15	19		320
28	46	27			4	25	80-100		0	10	27				155
29	49	34				34	4 ac. = 40-60 30ac. = 80-100		34	20			34		202
30	47	47		5		46	2 ac.= 40-60 44ac. = 80-100		47	18	47				264
32	49	41				41	4 ac. = 40-60 37ac. = 80-100		41	17	14		27		217
33	37	6	5			5	80-100		6	3	6				38
34	47	12	10			11	80-100		12	4	5	7			80
35	37	10	10			9	80-100		10	4	6			4	60
37	47	34				34	3 ac. = 40-60 31ac. = 80-100		34	17	24		10		179
38	46	41	12			40	80-100		41	15	11	14	16		218
39	56	43				43	4 ac. = 40-60 39ac. = 80-100		28	7	43				227
40	49	44				44	4 ac. =40-60 40 ac. =80-100		44	11	44				232
41	56	83	20			81	6 ac. = 40-60 75ac. = 80-100		11	15	35	30	18		463
42	53	35	20			33	80-100		35	13	35				195

Unit #	Age in 2013	Total Unit Acres	Number of Gaps by Size			Thinned Acres	Target Leave Trees Per Acre for Thinning	Patch Cuts	Total Ac. Treated in LSR	Total Ac. Treated In Riparian Reserves	Ground-based Acres	Cable Acres	Skyline Acres	Helicopter Acres	Volume (MBF)
			1/10 Ac.	1/4 Ac.	1/2 Ac.										
43	44	30				30	3 ac. = 40-60 27ac. = 80-100		30	0	18	6	6		159
44	50	49				49	5 ac. = 40-60 44ac. = 80-100		49	19	24	4	21		265
45	50	56		8		54	80-100		56	15	44		12		270
50	98	15				0		15	0	0			15		300
51	89	25				25	80-100		0	0			20	5	250
54	104	9				9	60-110		0	0			9		135
55	91	21				16	60-110	5	0	0			21		465
60	87	16				16	60-110		0	0			16		240
66	63	32				32	80-100		0	16			32		160
67	58	16	10			15	80-100		0	8			16		105
68	77	7				7	80-100		0	2				7	35
70	77	6				6	60-110		3	2				6	90
73	59	11	10			10	60-110		11	4		4		7	80
74	63	40			4	38	80-100		0	20	36		4		250
800	101	5			10	0			0	0			5		175
Sub total		**954**	**~136 gaps = ~24 acres**			**910**		**20**	**587**	**291**	**502**	**83**	**340**	**29**	**6,363 MBF= *6.4 MMBF***

**Skip acres include original stand acres that were not treated plus buffer areas within the treated portion of the stand such as riparian or sensitive plant protection areas.*

Access: About 1.3 miles of temporary roads would be constructed to access harvest units. Roads vary in length from about 70 feet to 1,140 feet with the average being about 365 feet. About 0.5 miles of temporary roads would be within Riparian Reserves. It is anticipated that three stream crossings would be necessary on roads accessing Units 37, 38 and 44. Following this harvest entry, these non-system roads would be closed by berms, scarified and seeded with native seed.

Table 9: Proposed New Temporary Road Construction in Alternative 2

Unit	Slope Position	Total Length (Feet)	Estimated Acres of Thinning Accessed	Road Distance in Riparian Reserve	Class IV Stream Crossings
25	Ridgetop	350	3	0	0
25	Ridgetop	475	5	0	0
27	Ridgetop	125	4	125	0
27	Ridgetop	395	5	200	0
30	Flat	105	12	105	0
37	Flat	850	9	850	1
37	Flat	145	(same as above)	70	0
38	Mid-slope	600	18	385	1
41	Mid-slope	1140	30	0	0
41	Mid-slope	550	(same as above)	0	0
43	Mid-slope	515	6	0	0
44	Ridgetop	700	14	370	1
51	Ridgetop	135	21	0	0
52	Ridgetop	170	10	170	0
52	Ridgetop	90	10	90	0
53	Flat	240	5 (in unit 52)	70	0
53	Flat	120	3	120	0
53	Flat	70	3	0	0
58	Flat	170	6	0	0
Total		**6,945 feet =1.3 miles**	**About 164 ac.**	**2,555 feet = 0.5 miles**	**3**

Harvest-Generated Slash Treatments

- Post-harvest underburning is proposed for Units 50, 54, 55, 67 and 68. In all, about 68 acres would be underburned to reduce hazardous fuels to meet Forest Plan standards and guidelines. Underburning would be completed under spring-like conditions when 1,000 hour fuels and duff are still moist.
- Units that are not underburned would have the logging slash hand piled, grapple piled or yarded to the landing where it would be utilized as firewood or burned in the fall to meet Forest Plan standards and guidelines.

Hazardous Fuels Treatment within 200 feet on the north side of Highway 20

Hazardous fuel treatments would occur within a 200 foot-wide strip along the north side of Highway 20. Treatments would provide wildland firefighters anchor points for indirect firefighting techniques while providing treated areas within and adjacent to the highway corridor for safer and effective protection. There are two categories of fuel treatment here: a) one addresses ground and ladder fuels and b) one addresses ground, ladder and canopy fuels.

- Ground and ladder fuel treatment would occur on about 76 acres in the following units: B, C, E, F, G, I, J, M, and 19 acres in a portion of 50, for a total of 95 acres. Treatment in these stands includes thinning trees < 7" in diameter and/or brushing at approximately 15 to 30 foot spacing. Pruning ladder fuels in trees < 16 feet up the bole of the tree and less than 50% of the live crown. The resulting slash would be hand piled; grapple piled or chipped/mulched depending on cost or location. The treatment of chipping/mulching would not remove the fuel from the site but it would change the fuel loading to a more compact profile. Biomass/firewood may be utilized as well. Ground and ladder fuel reduction treatments would not occur in Riparian Reserves along Highway 20.
- Canopy fuels would be treated on about 44 acres through commercial thinning in units 54, 55, 60, 66, 68, 70 and 74 to reduce canopy bulk density. Stands would be thinned leaving either 60-110 trees per acre or 80-100 trees per acre (see Table 8). Understory treatments as described above would also occur on these units.
- Table 10 summarizes the fuel treatments that are proposed for each harvest unit.

Table 10: Fuel Treatments in Alternative 2

Unit #	Hand Pile & Burn Ac.	Grapple Pile & Burn Ac.	Yard Tops Attached and Burn Piles	Underburn Acres	Landing Piles to Burn	Ground & ladder only	Ground, ladder, & canopy
25		25	35		8		
26		28	7		6		
27		30	34		7		
28		27			2		
29			38		9		
30		47			4		
32		14	27		5		
33		6			1		
34		5	7		4		
35		6	4		1		
37		25	9		7		
38		11	30		5		
39		43			3		
40		44			4		
41		35	48		10		
42		35			3		
43		18	12		6		
44		24	25		8		
45		44	12		4		
50				15	0		
51			25		1		
54				9	1		6
55				21	0		9
60			16		0		9
66			32		1		4
67				16	3		
68				7	2		2
70	6				1		5
73			11		0		
74		36	4		1		9
800			5		2		
B						11	
C						29	
E						4	
F						2	
G						2	
I						3	
J						4	

Table 10: Fuel Treatments in Alternative 2

Unit #	Hand Pile & Burn Ac.	Grapple Pile & Burn Ac.	Yard Tops Attached and Burn Piles	Underburn Acres	Landing Piles to Burn	Ground & ladder only	Ground, ladder, & canopy
M						21	
50 Fuels						19	
Total	**6**	**503**	**381**	**68**	**109**	**95**	**44**

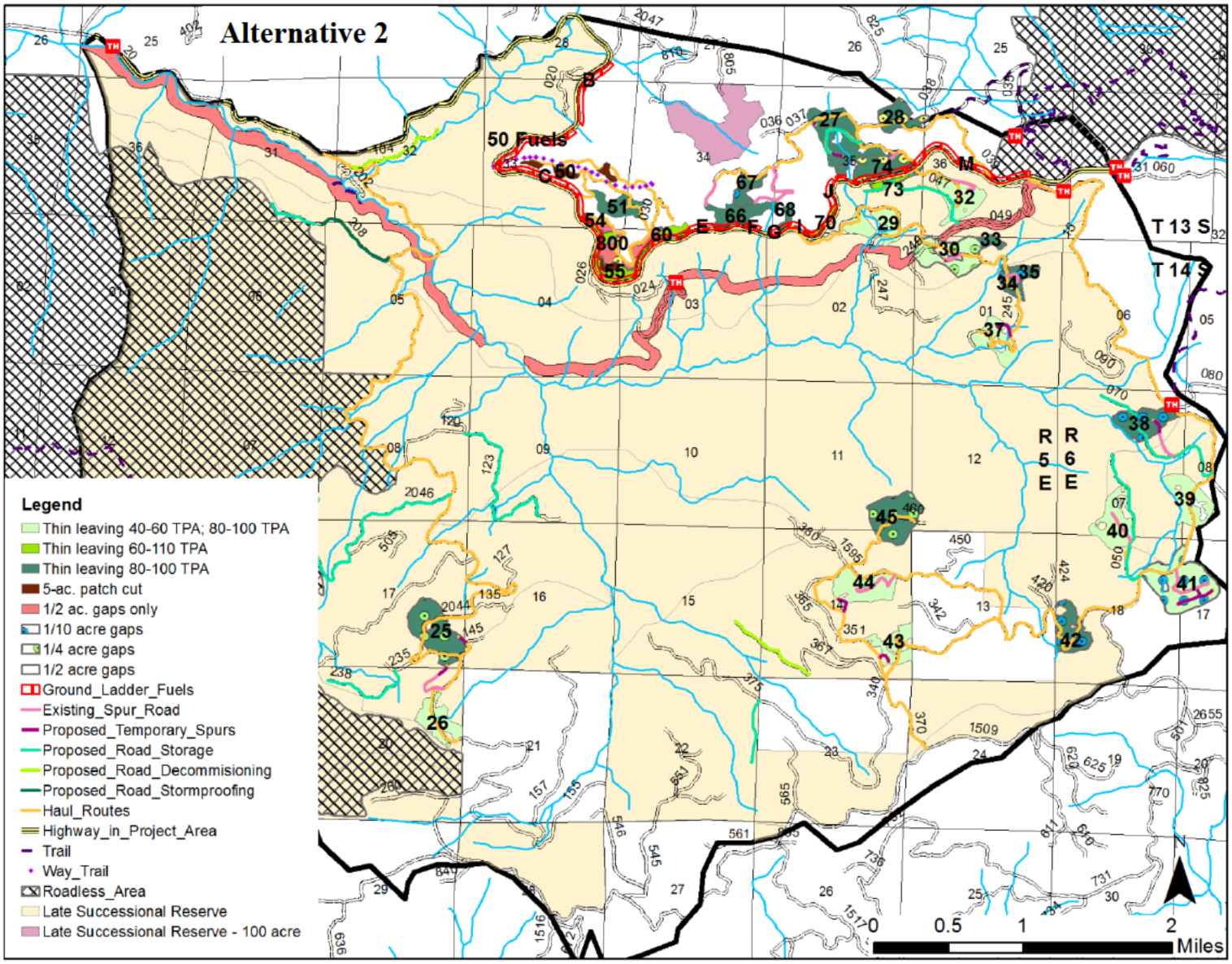

Figure 17: Alternative 2

Alternative 3

Alternative 3 proposes to achieve the project purposes by harvesting only in managed stands < 80 years old. This alternative to the proposed action provides a basis for evaluating the tradeoffs of not harvesting in natural stands or stands that exceed 80 years of age, which were issues brought up by the public.

In addition to the actions described previously for both action alternatives, the following activities are proposed for Alternative 3:

Commercial thinning of about 843 acres with about 19 acres of dominant tree release gaps ranging from $^{1/}_{10}$ to ½ acre in size (depending on management allocation). Thinning would emphasize increasing complexity within stands and across the landscape using various thinning intensities, canopy gaps, skips and retention of minor species.

Hazardous fuel treatment activities are proposed within 200 feet of north of Highway 20 from the junction with Road 2047 to the eastern edge of the project area. Reducing ground and ladder fuels would be accomplished through a variety of treatments outlined later in this section

One or more timber sales, yielding a total of about 4.8 MMBF, would occur over the next 3-5 years.

Table 11 summarizes information for individual harvest units in this alternative. Figure 18 (page 47) shows a map of Alternative 3. For a more complete description see Integrated Prescriptions in Appendix A and Design elements in Table 14. Table 15 provides a comparison of the various alternatives for this project.

Table 11: Alternative 3

Unit #	Age in 2013	Total Unit Acres	Number of Gaps by Size			Thinned Acres	Target Leave Trees Per Acre for Thinning	Total Ac. Treated in LSR	Total Ac. Treated In Riparian Reserves	Ground-based Acres	Cable Acres	Skyline Acres	Helicopter Acres	Volume (MBF)
			1/10 Ac.	1/4 Ac.	1/2 Ac.									
25	46	60		8		58	80-100	60	21	25	3	32		325
26	48	35				35	3 ac =40-60 32ac = 80-100	35	5	28		7		184
27	54	64				64	80-100	0	25	30	15	19		320
28	46	27			4	25	80-100	0	10	27				155
29	49	34				34	4 ac. = 40-60 30ac. = 80-100	34	20			34		202
30	47	47		5		46	2 ac.= 40-60 44ac. = 80-100	47	18	47				264
32	49	41				41	4 ac. = 40-60 37ac. = 80-100	41	17	14		27		217
33	37	5	5			5	80-100	6	3	6				38
34	47	12	10			11	80-100	12	4	5	7			80
35	37	10	10			9	80-100	10	4	6			4	60
37	47	34				34	3 ac. = 40-60 31ac. = 80-100	34	17	24		10		179
38	46	41	12			40	80-100	41	15	11	14	16		218
39	56	43				43	4 ac. = 40-60 39ac. = 80-100	27	7	43				227
40	49	44				44	4 ac. =40-60 40 ac. =80-100	44	11	44				232
41	56	83	20			81	6 ac. = 40-60 75ac. = 80-100	11	15	35	30	18		463
42	53	35	20			33	80-100	35	13	35				195
43	44	30				30	3 ac. = 40-60 27ac. = 80-100	30	0	18	6	6		159

Table 11: Alternative 3

Unit #	Age in 2013	Total Unit Acres	Number of Gaps by Size			Thinned Acres	Target Leave Trees Per Acre for Thinning	Total Ac. Treated in LSR	Total Ac. Treated In Riparian Reserves	Ground-based Acres	Cable Acres	Skyline Acres	Helicopter Acres	Volume (MBF)
			1/10 Ac.	1/4 Ac.	1/2 Ac.									
44	50	49				49	5 ac. = 40-60 44ac. = 80-100	49	19	24	4	21		265
45	50	56		8		54	80-100	56	15	44		12		270
66	63	32				32	80-100	0	16			32		160
67	58	16	10			15	80-100	0	8			16		105
68	77	7				7	80-100	0	2				7	35
70	77	6				6	60-110	1	2				6	90
73	59	11	10			10	60-110	11	4		4		7	80
74	63	40			4	38	80-100	0	20	36		4		250
Subtotal		**862**	**~126 gaps = ~19 acres**			**843**		**584**	**291**	**502**	**83**	**254**	**24**	**4,773 = 4.8 MMBF**

Access: About 1 mile of temporary roads would be constructed to access harvest units. Roads vary in length from about 105 feet to 1,140 feet with the average being about 440 feet. About 0.3 miles of temporary roads would be within Riparian Reserves. It is anticipated that three stream crossings would be necessary on roads accessing Units 37, 38 and 44. Following this harvest entry, these non-system roads would be closed by berms, scarified and seeded with native seed.

Table 12: Proposed New Temporary Road Construction in Alternative 3

Unit	Slope Position	Total Length (Feet)	Estimated Acres of Thinning Accessed	Road Distance in Riparian Reserve	Stream Crossings
25	Ridgetop	350	3	0	0
26	Ridgetop	475	5	0	0
27	Ridgetop	125	4	125	0
27	Ridgetop	395	5	200	0
30	Flat	105	12	105	0
37	Flat	850	9	850	1
37	Flat	145	(same as above)	70	0
38	Mid-slope	600	18	385	1
41	Mid-slope	1140	30	0	0
41	Mid-slope	560	(same as above)	0	0
43	Mid-sloped	515	6	0	0
44	Ridgetop	700	14	370	1
Total		**5,260 feet = ~1 mile**	**About 106 ac.**	**1,735 feet = 0.3 miles**	**3**

Harvest-Generated Slash Treatments

- Post-harvest underburning is proposed for Units 67 and 68. In all, about 23 acres would be underburned to reduce hazardous fuels to meet Forest Plan standards and guidelines. Underburning would be completed under spring-like conditions when 1,000 hour fuels and duff are still moist.
- Units that are not underburned would have the logging slash hand piled, grapple piled or yarded to the landing where it would be burned in the fall to meet Forest Plan standards and guidelines.

Hazardous Fuels Treatment within 200 feet on the north side of Highway 20

Hazardous fuel treatments would occur within a 200 foot-wide strip along the north side of Highway 20. Treatments would provide wildland firefighters anchor points for indirect firefighting techniques while providing treated areas within and adjacent to the highway corridor for safer and effective protection. The following fuel reduction actions are proposed in the project area.

- Ground and ladder fuel treatment would be the same as described in Alternative 2 above.
- Canopy fuels would be treated through commercial thinning about 20 acres in units 66, 68, 70, and 74 to reduce canopy bulk density. Stands would be thinned leaving either 60-110 trees per acre or 80-100 trees per acre (see Table 11). Understory treatments as described above would also occur on these units.

The following table describes the fuel treatments that are proposed for each harvest unit.

Table 13: Fuel Treatments in Alternative 3

Unit #	Hand Pile & Burn Ac.	Grapple Pile & Burn Ac.	Yard Tops Attached and Burn Piles	Underburn Acres	Landing* Piles to Burn	Ground & ladder only	Ground, ladder, & canopy
25		25	35		8		
26		28	7		6		
27		30	34		7		
28		27			2		
29			38		9		
30		47			4		
32		14	27		5		
33		6			1		
34		5	7		4		
35		6	4		1		
37		25	9		7		
38		11	30		5		
39		43			3		
40		44			4		
41		35	48		10		
42		35			3		
43		18	12		6		
44		24	25		8		
45		44	12		4		
50*						19	
54*						6	
55*						9	
60*						9	
66			32		1		4

Table 13: Fuel Treatments in Alternative 3

Unit #	Hand Pile & Burn Ac.	Grapple Pile & Burn Ac.	Yard Tops Attached and Burn Piles	Underburn Acres	Landing* Piles to Burn	Ground & ladder only	Ground, ladder, & canopy
67				16	3		
68				7	2		2
70	6				1		5
73			11		0		
74		36	4		1		9
B						11	
C						29	
E						4	
F						2	
G						2	
I						3	
J						4	
M						21	
Total	**6**	**503**	**351**	**23**	**104**	**119**	**20**

**Ground and ladder fuel treatments only.*

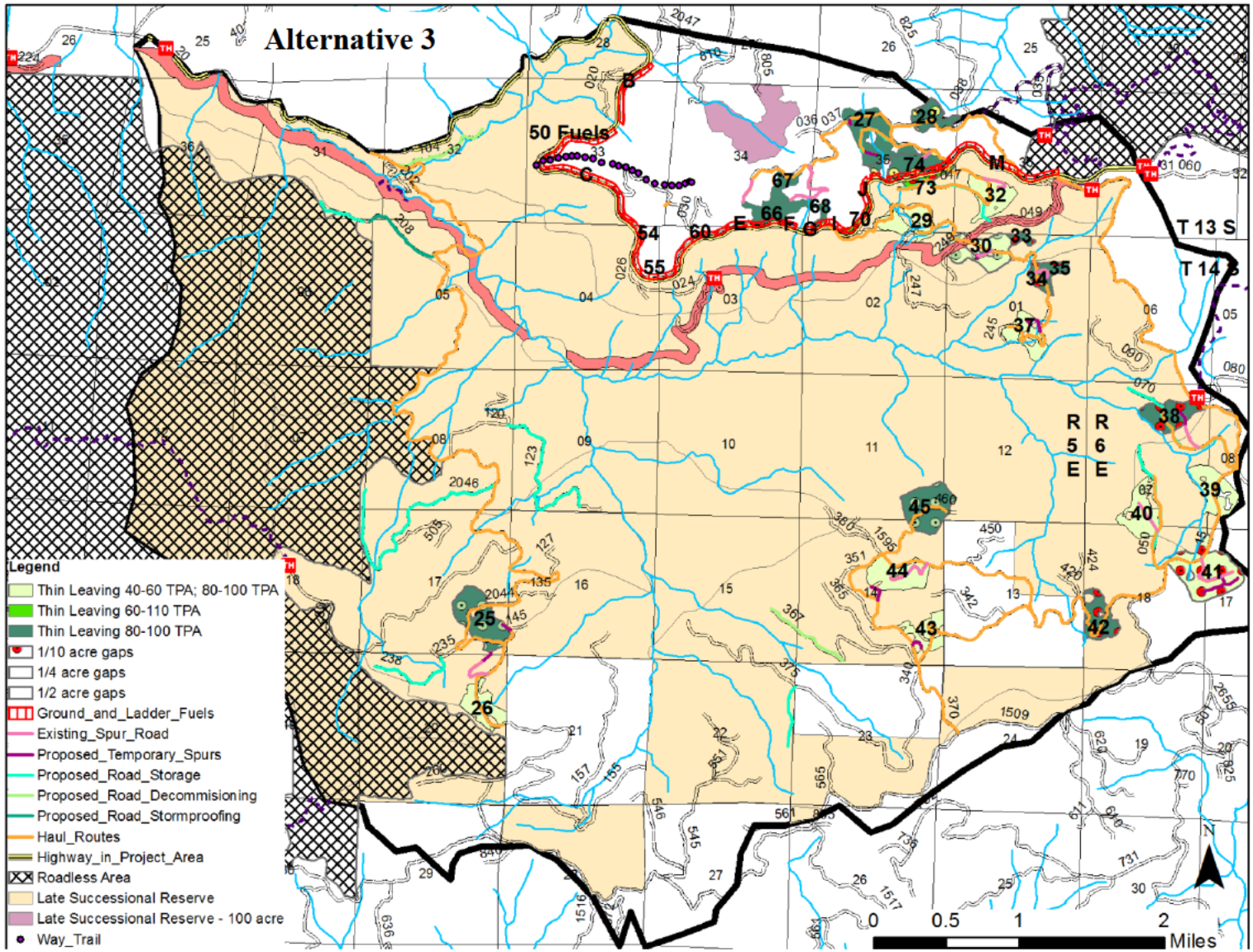

Figure 18: Alternative 3

Design Elements for Action Alternatives

The following have been built into the design of both action alternatives to ensure compliance with Forest Plan standards and guidelines, laws, regulations and other policies (See also Integrated Prescriptions in Appendix A).

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element	Dates
		Vegetation	
25, 26, 29, 30, 32-35, 37-45 (All units in LSR)	Meet LSR commercial thinning exemption criteria	• **10% or more of each stand must be in unthinned acreage**. Additional no cut areas may need to be delineated out of each stand if the stream and SHAB buffers don't meet this requirement. • **3-10% of each stand must be in small openings** (no larger than 1/4-acre gaps) **or in a heavier thin** (40-60 trees per acre). • **All trees ≥ 20" DBH should not be cut except for the purpose of creating openings, providing other habitat structure, elimination of a hazard, or cutting yarding corridors**. This is to meet the exemption criteria for commercial thinning in Late-Successional Reserves. If cut, they would be left on site. Trees > 20"DBH should be included in the spacing for the thinning.	
25, 26, 29, 30, 32-35, 37-45	Meet LSR Assessment Recommendations	• If operationally feasible, **avoid placing gaps and heavier thinning areas adjacent to late seral forest**.	
All units	General thinning guidelines	• **All legacy trees should be retained** unless removal is required during logging operations to meet safety requirements. Legacy trees are defined as trees left from previous stands that are typically larger than the remaining trees. Based upon stand examination information, legacy trees for the Toll Joe Project Area are **defined as all trees ≥ 28" DBH**. If cut, they would be left on site.	
All thinned units	General thinning guidelines	• **All hardwoods ≥ 7" DBH should be retained** and ignored in the spacing. • **Retain minor species** defined as: western redcedar, western white pine, sugar pine, and incense cedar ≥ 7" DBH and ignore in spacing.	

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element	Dates
Units with gaps	Gap creation guidelines	• If operationally feasible, locate all gaps **at least 100 feet from system roads** and from each other. • Use an **irregular gap pattern** that mimics a natural pattern across the landscape unless otherwise noted. Vary gap placement so they are not linear or in a grid-like pattern. • Designate the center of the gaps by marking and **retaining at least one dominant tree** at the center. This tree should be healthy and have at least 40% live crown ratio to reduce risk of blowdown. Favor selecting western redcedar, pines or Douglas-fir as the leave tree and avoid selecting true firs as the dominant tree because of their high risk of sunscald and lower fire resiliency. • **Cut all trees ≥ 7" DBH** except the dominant tree retained in the center and any hardwoods, western redcedar, western white pine, sugar pine, and incense cedar.	
50 and 55 (Alternative 2)	Patch cut with reserve tree guidelines	• **Location of patch cut with reserve trees areas was established during project development** to meet a variety of visual and other resource concerns. These areas are delineated on maps in the individual unit prescriptions. • Patch cuts with reserve trees **cannot exceed 5 acres** in size to meet Standard and Guidelines for Scenic allocations. • At least **15% of each patch cut with reserve trees shall meet green tree retention guidelines** from the NW Forest Plan (~70% in aggregates of 0.5 acres in size or greater and 30% as dispersed structures of less than 0.5 acres in size). For each 5-acre patch cut with reserve trees, scatter individual clumps of trees equal at least 0.25 acres, three per five-acre gap. • **Cut all trees ≥ 7" DBH within the patch except** hardwoods and the trees left as part of the 15% green tree retention requirements.	
27, 34, 37, 40, and 800 (unit 800 is only in Alt.2)	Protect rare botanical species	**Known sites should be buffered** to reduce negative effects on rare botanical species.	

Unit #	Species	Buffer Width
27	*Romanzoffia thompsonii*	100 feet
34	*Botrychium minganense*	300 feet
37	*Peltigera pacifica*	100 feet
40	*Ramaria celerivirscens* *Sparassis crispa*	100 feet 100 feet
800	*Gymnopilus punctifolius* *Ramaria celerivirscens*	150 feet skip 75 feet skip

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element			Dates
All units	Protect existing snags and coarse woody debris	All **existing coarse woody debris** (> 10" snags, > 6" down wood) should be retained **and protected from disturbance unless removal is required during logging operations,** (this is especially true for dead wood > 20" DBH).			
		Logging damaged trees should not be removed without Forest Service approval. These trees offer an opportunity to enhance coarse woody debris development.			
25-27, 29, 30, 32-34, 37,39-45,66 and 68	Protect Special Habitats	**Special habitats –** To be consistent with Forest Plan requirements, special habitats would be maintained through the use of buffering or identification of Areas to Protect (ATP) from physical disturbance during project activities.			
		Unit	**Special Habitat**	**Condition/Buffer**	
		25	Mesic openings (neither wet nor dry meadows)	Weedy, no buffer	
		26	Multiple wetlands on both side of Road 2044	100 feet	
		27	Rock garden with Romanzoffia Mesic meadow Beargrass frost pocket	100 feet 50 feet No buffer	
		29	Pond on east edge Wetland south east of slide	100 feet 100 feet	
		30	Large frost pocket below Rd 245	Weedy, no buffer	
		32	Pond on east edge Four seeps Rock outcrops	100 feet 50 feet Area to Protect[1]	
		33	Rock outcrop above the road	Area to Protect	
		34	Red alder stand on southern edge	Area to Protect	
		37	Two wetlands	100 feet	
		39	Two alder stands	Area to Protect	
		40	Frost pocket on west side Shrub/wet meadow complex on north side	No buffer 100 feet	
		41	Sitka alder wetland Small moist meadow in NE corner	100 feet 50 feet	
		42	Two mesic meadows, north one weedy Three Sitka alder/Devil's club areas	50 feet 50 feet	

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element			Dates
		Unit	**Special Habitat**	**Condition/Buffer**	
		43	Stringer of wet/mesic meadows bisect the unit	100 feet	
		44	Wet meadow, weedy Rock outcrops	100 feet Area to Protect	
		45	Blue wildrye/Bracken fern openings	No buffer	
		66	Large rock outcrop north of Highway 20	Area to Protect	
		68	Chinquapin grove on west side of unit	Area to Protect	
		[1]ATP – Area to Protect is defined as an area that would be protected from direct physical disturbance but is not buffered.			
All units	Minimize spread of invasive plants	• **Survey and control invasive weeds** on all harvest units, landings, and roads in the project area. • Continue to **pretreat invasive species** along the highway corridor, and survey for, and control weeds in harvest units and along roads. • **Pressure wash** all road construction and logging equipment prior to working in the area. Equipment-cleaning areas will be identified by the district botanist. • Obtain gravel for road construction and reconstruction from a **weed-free rock source**. • **Minimize areas of soil disturbance** during all harvest activities including spur road construction, re-opening existing temporary roads, fuels treatment, etc. • **Seed all disturbed areas** with native species, including landings and subsoiled skid roads to reduce weed establishment. • **Berm, gate, or rip and seed** any new temporary and re-opened roads to reduce disturbance and incoming weed seed on vehicular traffic. • **Map weed population in units and long roads on the sale map.**			
Aquatics					
All units with streams	Maintain water quality protection for all activities	• **Utilize Best Management Practices (BMP's)** which can be found in "USDA Forest Service National Best Management Practices for Water Quality Management on National Forest System Lands" April, 2012.			
All units	Protect fish and other aquatic species and their habitat	• **Include Best Management Practices in project design**, as necessary, to control off-site movement of sediment. This may include placement of sediment barriers, provision of flow bypass, and other applicable measures. Other stream protection measures integrated into the project design, and/or referenced in the hydrology and soil specialist reports are sufficient to minimize site-scale negative effects to the fishery resource.			

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element	Dates
Units with Riparian Reserves	Reduce potential for stream temperature increases and minimize sediment delivery to streams	• **Thinning** in Riparian Reserves **would occur outside of primary shade zones** on perennials or intermittent streams that flow during the summer or have riparian plant communities. The primary shade zones would be left intact to ensure adequate stream shade to maintain desirable stream temperatures (See table below for no-harvest buffer widths. All buffers are measured from the trees nearest the stream rather than the water's edge). **Stream Class** / **No-harvest buffer width** Class IV stream (intermittent) / 50 feet Class III stream (perennial) - no fish are present / 75 feet	
Units with Riparian Reserves	Reduce potential for stream temperature increases and minimize sediment delivery to streams	• Thinning intensities in the Riparian Reserve portion of units would be the same as prescribed for the upland portion of the stand. Between the thinned and unthinned portion of the Riparian Reserves the resulting average canopy closure would be at least 50%	
All haul routes	Protect fish and other aquatic species and their habitat	• Any project activity such as culvert replacement that must occur within fish bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife (ODFW) **seasonal restrictions on in-stream work activities**. In the South Santiam watershed above Foster Reservoir, in-stream work must occur between July 15 and August 31st. Best Management Practices (BMPs), including placement of sediment barriers, provision of flow bypass, and other applicable measures, would be included in project design as necessary to control off-site movement of sediment. • **Winter haul** would be immediately stopped if the timber administrator notices that the road surface shows any sign of deformation leading to sediment eroding into live streams. The objectives are to maintain water quality and fish habitat. • **Utilize Best Management Practices (BMP's)** which can be found in "USDA Forest Service National Best Management Practices for Water Quality Management on National Forest System Lands" April, 2012.	7/15 to 8/31
Fire/Fuels and Air Quality			
Alts. 2 & 3 – 25-30, 32-35, 37-45, 66, 70, 73 and 74 **Alt. 2 only –** 51, 60, and 800.	Hazardous fuel reduction	• **Harvest-generated fuels reduction** to meet Forest Plan S&G's includes hand and grapple piling, and yarding tops attached. Slash and landing piles would be burned in the fall and/or chipped/mulched depending on cost and location.	

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
Alt. 2 – 50, 54-55, 67 and 68. **Alt. 3** – 67 and 68	Hazardous fuel reduction and Northern Spotted Owl Protection	• Post-harvest **underburning** would be completed to reduce hazardous fuels levels to meet Forest Plan S&Gs. Underburning would be done under spring-like conditions when 1,000 hour fuels and duff are still moist. • A **post-harvest stand evaluation** would be conducted to measure residual tree diameters (DBH) on these stands to determine eligibility for underburning. If the majority of the trees are ≥ 14" DBH they are more resistant to a light/moderate underburn and the mortality of ≤10 % can be maintained. • **Underburning is restricted** from **March 1 to July 15** due to threatened and endangered species needs within 0.25 miles of a known or predicted owl site (see Table 50)	3/1 to 7/15
50, 54,55, 60, 66,68, 70, 73 and fuel treatment units B-M	Hazardous fuel reduction	• **Hazardous fuels treatment adjacent to Highway 20** includes: Reducing understory fuels by thinning trees ≤ 7" DBH and pruning ladder fuels either by hand or machine. The resulting slash would be hand piled, grappled piled or chipped/mulched depending on cost or location. The treatment of chipping/mulching would not remove the fuel from the site but it would change the fuel loading to a more compact profile. Biomass/firewood utilization would be considered.	
Units as appropriate	Protection of Air Quality in Class I Airshed	• **Prescribed fire would be avoided** from July 1 to Sept. 15 in units that have potential to degrade visual quality in Class I Airshed	7/1 – 9/15
Units as appropriate	Public Safety	• **Roads would be signed, as appropriate,** warning travelers of slash burning near treatment areas, especially Highway 20 • **The public would be notified prior to burning,** as appropriate, to protect public safety	
Recreation			
Alts. 2 and 3 - 25, 26, 29, 30, 32, 51, 54, 55, 60, 66, 68, 70, 73, 74 **Alt. 2** – units above plus unit 50	Meet Visual Quality Objectives (VQO) in Scenic Management Allocations with Preservation and Retention VQOs	• Randomize leave tree distribution to mimic natural conditions. • **Stumps would be flush cut to approximately 4" within 100 feet of Highway 20.** • Gaps should use surrounding landscape features as a guide in design. • Remove slash sufficient to meet both fuels and visual quality objectives. • **Limbed branches would be cut flush to the tree**, leaving just a small collar, or as close to flush as possible • **Landings** that are to be **built near the highway** or in preservation areas should be **cleaned up to the greatest extent possible** in order to insure visual qualities are met and no dispersed sites are created. The area should be scarified, blocked to motorized entry and possibly planted when operations are complete. • Topography would need to be considered in implementation as slope and sight distance vary in the retention area. For areas that are steep alongside the highway the distance design measures can be one chain or less. For areas where the view is sustained by travelers the	

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
		distance should be one to two chains.	
All other units		• Remove slash and locate units on the landscape to maintain visually subordinated character and mimic surrounding features where possible • **Rip/scarify** the road surface of **temporary roads** to prevent new road creation • Purchaser shall sign expected traffic delays as appropriate. • **No hauling on weekends** Memorial Day through Labor Day • **No operation** within ¼ mile of developed recreation sites on weekends and holidays (Memorial Day, 4th of July and Labor Day) if they fall on a week day • No operation or hauling on opening weekends of Cascade elk/deer rifle seasons. • **No plowing** of 2000-035 road from November 1st – March 31st to ensure proper base of snow for winter recreation activities. If plowing was to occur after March 31st; place appropriate signing to warn users of truck traffic, road condition and ensure proper turn around area where plowing ends	Weekends Memorial Day to Labor Days 11/1 – 4/31
Soils			
32	Minimize soil instability	• No gaps should be placed in this area and logging should be accomplished with a skyline system, not ground-based equipment. Hand falling should be utilized; prebunching is not recommended.	
38 western portion	Minimize soil instability	• No gaps should be placed in this area; logging should be accomplished with a skyline system, not ground-based equipment; no slash burning is recommended, except for hand piles immediately adjacent to the road corridor; thinning should be recommended with D by D prescription and approximately a 50% canopy cover should be maintained; no prebunching is recommended.	
Falling and Yarding			
All units	Minimize damage to soil resource and residual trees	• Trees, not designated for harvest in riparian buffers that need to be cut to facilitate harvest operations, should be **dropped into the stream if possible** to aid in woody debris recruitment. • **Avoid disturbance to the existing large down woody debris** concentrations created by the initial entry in the managed stands as much as practical.	
Units to be logged using ground-based systems	Reduce soil compaction, displacement, disturbance.	**Ground-based yarding systems requirements:** • **Ground-based equipment should generally operate in the dry season**, usually considered from May through October, unless otherwise restricted by other resource concerns or waived by Forest Service personnel, based on site specific evaluation. • **Ground-based harvest operations** would be restricted in Riparian Reserves during times when ground and weather conditions result in excessive erosion and sedimentation.	May-Oct.

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
		• Horses and ground-based equipment are usually **limited to sideslopes < 30%,** unless otherwise directed by Forest Service personnel. • Ground-based skidding equipment shall **stay on designated skid trails**. Ground-based skid trails would be predesignated and preapproved before use (LTSR). Existing skid roads should always be used before new skid road locations are approved. They should not usually exceed 15 feet in width, and the objective is to maintain a 10 to 12 foot width throughout the length. Where practical the skidder, cat, shovel or forwarder should travel on slash. Traveling on slash has been shown to reduce off site soil erosion or lessen soil compaction. Skid roads would generally be 100 to 200 feet apart with conventional line pulling operations, and 40 to 60 feet apart with processor / forwarder operations. • At the completion of harvest activities, spur roads, tractor skid roads or forwarder roads should be **water barred and scarified**, as is necessary. Where practical, main skid roads and landings should be subsoiled in order to reduce compaction and return the site to near original productivity. Subsoiling needs to be considered in light of the potential for root pruning, damage to existing regeneration, and the increased amount of soil disturbance. Consequently, "munching" is the preferred style of subsoiling. Munching refers to mechanically breaking up compacted soil without turning over or mixing it.	
All units except those requiring that attached tops be yarded to meet fuels requirements	Nutrient cycling and reduce potential for off-site soil erosion	• Where operable, **harvested trees should be topped and limbed in the units** in order to provide small limbs and needles for nutrient recycling. This objective has to be tempered with the need to reduce fuel loading to control potential wild fires, and to meet site specific standards for slash loadings. • Where practical, limbs and woody debris should be placed on areas of exposed soil to reduce the potential for off-site soil erosion.	
Units requiring skyline yarding	Minimize damage to soil resource and residual trees	**Skyline yarding systems requirements:** • Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the gentle to moderate slope of much of the terrain, small sections of ground lead may occur in some areas, such as along ridges or slope breaks, and this is generally acceptable. • Require parallel corridors and fall trees to the lead whenever possible. • Cable corridors spacing should be set to both minimize damage to standing timber, as well as the underlying vegetation and soil.	

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
All units that require stream crossings	Stream protection	• **Locations of** ground-based and skyline **stream crossings would be designated**, as per Best Management Practices and would occur perpendicular to stream channels. • In addition, **bump logs** would be used to reduce riparian disturbance at ground-based crossings. Logs would be **fully suspended** across all stream channels in skyline corridors. • **Trees, not designated for harvest** in riparian buffers that need to be cut to facilitate harvest operations, **should be dropped into the stream if possible** to aid in woody debris recruitment. If trees cannot be felled into stream channels, fell them away from riparian vegetation to minimize damage. These trees would be left on site.	
Heritage			
All units	Heritage resource protection	Information specific to heritage resource location and content is exempt under the National Historic Preservation Act sec. 304, from disclosure under the Freedom of Information Act (FSM 6271.2). In order to facilitate the decision-maker, the information will be made available to him/her. • **All National Register of Historic Places (NRHP) eligible sites** and potentially eligible sites must be **avoided** during all project activities. • The District Archaeologist shall be consulted if equipment staging is needed on roads 2015 or 2000. • **No surfacing would be allowed on the Santiam Wagon Road or the Jump Off Joe CCC road** without approval of the District Archaeologist. • **Changes to the current unit configurations** and/or the addition of any new units, would require consultation with the District Archaeologist in order to protect known and unknown heritage resources. This includes the 50 buffer along the historic trail (Check with District Archaeologist for location.) • **Project activities planned outside of the area defined in the heritage resource inventory schema** must be coordinated with the District Archaeologist prior to initiation. This includes the establishment of harvest landings, helicopter landings, guy-line equipment anchors, equipment staging areas, and rock storage areas, slash burning and silvicultural treatments. • **Prior to cultivating/ripping skid roads post-harvest a re-entry survey must be conducted** in those areas deemed high probability for the occurrence of heritage resources. Coordination with the district archaeologist is essential to ensure the protection of heritage resources. • In order to extend protection to **heritage resources** which have **not yet been discovered**, but which may be uncovered during the course of project activities, include contract clause in all project prospecti and contracts that outlines the procedures to follow in the event heritage resources are inadvertently discovered or disturbed during project activities. If cultural material is inadvertently discovered, suspend operations and consult the District Archaeologist to allow for development of the proper course of action.	

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
29, 30, 32	Protect Santiam Wagon Road SIA	• Thin leaving 80-100 trees per acre. Preserve SIA corridor width. Do no use Santiam Wagon Road for harvest activities.	
Consult with archaeologist	Protect historic way trail and historic trail	• No harvest within 50 feet of historic way trail or historic trail.	
Transportation			
Temporary/ unclassified roads	Control the amount of sediment leaving the road system.	• All new temporary roads that are constructed and/or previously utilized non-system roads that are re-opened to access harvest units would be **closed with a berm, scarified and seeded with native seeds following harvest activities** to reduce compaction and improve water infiltration thus reestablishing natural drainage patterns as much as possible. • **Use of temporary and/or unclassified roads should usually occur in the dry season**, generally considered May through October to avoid surface erosion from exposed soil (unless directed otherwise by Forest Service personnel). Open roads should be storm proofed if they have to sit through extended periods of wet weather. • **Unclassified or temporary roads used outside the standard operating season, should generally be rocked, snow covered, or frozen** to reduce the potential for erosion, unless other mitigating or extenuating circumstances are present. • **Close all unclassified and temporary roads used for this project** following harvest activities to reduce compaction and improve water infiltration thus reestablishing natural drainage patterns as much as possible.	May-Oct
Haul Routes	Safety	• **Danger trees** along haul routes would be identified, assessed, and felled (as needed) according to the Forest Service Pacific Northwest Region (Region 6) policy as detailed in FSM 7733, R6/PNW Supplement No. 7730-2005-1, December 12, 2005.	
Haul routes and landings	Protection of road resource; minimize erosion and sediment	• Road maintenance, reconstruction should usually **occur in the dry season**, generally considered May through October to avoid surface erosion from exposed soil (unless directed otherwise by Forest Service personnel). • **Haul** activities **outside of the normal operating season** would require additional work to preserve the desired maintenance objectives. Utilize appropriate provisions within the contract to **ensure that winter haul occurs on roads with adequate surface rock** and that erosion control techniques, such as mulching of bare soils associated with the road system, occur. • **Haul on native surface roads** would generally occur during the time of year when weather and soil moisture conditions do not result in road surface damage that can lead to sediment washing from damaged road surfaces into stream channels. This time period is usually during the normal operating season established for the timber sale (BMP R-20). • Road or landing aggregate, either crushed or pit run, that might be required for this project is available from several potential rock sources in the project area (Elbow Creek Pit, Soapgrass Pit, or nearby private rock sources). Minor clearing of less than one acre for any individual rock	May-Oct.

Table 14: Design Elements for Action Alternatives			
Unit #	**Objective**	**Design Element**	**Dates**
		source may be associated with the development of any of these rock sources. Clearing may include removal of trees in existing plantations or brush removal.	
		Wildlife	
All units	Protect Northern Spotted Owl	• No proposed activities would take place within the 300 meter nest patch.	
All Units	Protect Northern Spotted Owl	• Type I helicopter activity is restricted March 1 to Sept. 30. • Type II helicopter activity is restricted March 1 to July 15.	3/1 to 9/30 3/1 to 7/15
Blasting locations (TBD)	Protect Northern Spotted Owl	• Blasting within 1.0 miles of a known or predicted owl site. • Blasting within 0.25 miles of a known or predicted owl site.	3/1 to 7/15 7/16 to 9/30
All Units	Protect American Peregrine Falcon	• Type I or II helicopter activity is restricted January 15 to July 31.	1/15 to 7/31
	Protect Harlequin Duck	• Type I or II helicopter activity is restricted from March 15 to July 15.	3/1 to 7/15
All units as appropriate	Protect Mardon Skipper	• Buffer known meadow sites where suitable habitat exists by 100 feet from proposed activities in order to protect microclimate conditions.	
All units	Protect Fisher, Fringed Myotis and Townsend's Big-eared Bat, Pileated Woodpecker and other Cavity Nesters, American Marten	• Ensure that current snag, defective tree and down wood habitat is protected to the greatest extent feasible during proposed activities, especially down wood > 20" DBH. In addition, ensure that future coarse woody debris habitat is provided for as prescribed.	
Units adjacent to caves if discovered	Protect Fringed Myotis and Townsend's Big-eared Bat	• Buffer any cave habitat by 250 feet from proposed activities.	
Units with streams	Protect Crater Lake Tightcoil	• Ensure that perennial streams and riparian areas with vegetation that has year-round water access are protected with a minimum 10 meter (30 foot) no harvest buffer.	

Table 14: Design Elements for Action Alternatives

Unit #	Objective	Design Element	Dates
All units as appropriate	Protect Crater Lake Tightcoil	• Avoid soil compacting activities and those activities that would lower the water table at the micro-site, along with retaining existing litter and woody debris in suitable habitat. In addition, burning within occupied habitats should be avoided. Protect habitat with 10 meter buffers.	
Units where known sites occur	Protect Cascade Axetail Slug	• Ensure that all known sites are protected with a circular 2 acre no-harvest buffer and minimize alterations of micro-site habitat in Douglas fir-western hemlock plant series where large down wood (≥ 20") and litter debris create natural areas for water and moisture to collect. • To the greatest extent possible retain at least 40% of vine maple in proposed stands. • Avoid soil compacting activities and those activities that would degrade down wood and areas for needle litter to collect at the site are recommended, along with retaining existing Douglas fir-western hemlock plant series, vine maple, needle litter and woody debris in suitable habitat. • Burning within occupied habitats should be avoided. • Protect talus and rockslides that might create moisture pockets from road construction in suitable habitat.	
All units with streams and/or active red tree vole nest sites	Protect Red Tree Vole	• Retain Douglas-fir trees >16" DBH in riparian areas (within 100 feet of stream) to provide adequate microclimate conditions for red tree vole habitat. • Protect all known active nest sites and inactive sites that are located within 100 meters of an active site with a minimum buffer of 10 acres.	
Units adjacent to potential habitat if discovered	Protect Pileated Woodpecker and other Cavity Nesters, and American Marten	• Protect all known sites. See above for snag and down wood protection.	
As appropriate	Protect Big Game	• Maintain cover and foraging areas, along with natural openings, where botanical microsites are not a concern. Decrease open road mileage and maintain forage conditions where possible. In addition, maintain existing meadows from tree encroachment and sapling invasions, where appropriate.	
As appropriate	Protect Migratory Bird Species	• Ensure long-term viability of healthy populations, by providing habitat at all seral stages. Identify areas that express extreme homogeneity and introduce variability across the landscape that focuses on creating a multi-story, complex canopy structure with habitat components such as, down wood, snags and small openings. In addition, maintain meadow and riparian areas, along with unique habitats.	

Monitoring Requirements

See Appendix B for monitoring requirements.

Comparison of Alternatives

This section provides a comparison of alternatives with respect to the project purposes and the key issues. Information in the table is focused on activities where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 15: Comparison of Alternatives

Project Element	Unit of Measure	Alternative One	Alternative Two	Alternative Three
Purpose: Increase stand complexity				
Thin, leaving 40-60 trees/acre	Acres	0	38	38
Thin, leaving 80-100 trees/acre	Acres	0	789	789
Thin, leaving 60-110 trees/acre	Acres	0	16	16
Subtotals (≤ 80 yrs.)	**Acres**	**0**	**843**	**843**
Thin, leaving 40-60 trees/acre	Acres	0	0	0
Thin, leaving 80-100 trees/acre	Acres	0	25	0
Thin, leaving 60-110 trees/acre	Acres	0	41	0
5-acre patch cuts with reserve trees	Acres	0	20	0
Subtotals (> 80 yrs.)	**Acres**	**0**	**86**	**0**
$^{1}/_{10}$ acre gaps	Acres	0	~10	~10
¼ acre gaps	Acres	0	~5	~5
½ acre gaps	Acres	0	9	4
Subtotals	Acres	**0**	**24**	**19**
Totals (stands ≤ 80, stands > 80, gaps)	**Acres**	**0**	**954**	**862**
Skips (unthinned area in original stand bdrys.)	Acres	N/A	452	300
Incorporate snag and down wood component	Method	Natural processes	Artificially create/ skips	Artificially create/ skips
Purpose: Hazardous Fuels Reduction to the north of Highway 20				
Ground and ladder fuel treatments	Acres	0	95	119
Ground, ladder and canopy fuel treatments	Acres	0	44	20
Purpose: Contribute Wood Products to Local Market				
Estimated Volume of wood products	MMBF	0	6.4	4.8
Logging System				
Ground-based	Acres	0	502	502
Cable	Acres	0	83	83
Skyline	Acres	0	340	254
Helicopter	Acres	0	29	24
Transportation System				
Pre-haul maintenance	Miles	0	33	29

Table 15: Comparison of Alternatives				
Project Element	**Unit of Measure**	**Alternative One**	**Alternative Two**	**Alternative Three**
Road reconstruction	Miles	0	5.5	5.5
Reopen Existing non-System Spur Roads	Miles	0	2.7	2.7
New Temporary Road Construction	Miles	0	1.3	1.0
Subtotals	**Miles**	**0**	**42.5**	**38.2**
Road storage (hydrologically stabilize road, store for future use)	Miles	0	6.3	6.3
Road decommissioning (remove from system)	Miles	0	1.3	1.3
Storm damage risk reduction (SDRR)	Miles	0	2.4	2.4
Subtotals	**Mile**	**0**	**10.0**	**10.0**
Activity-Generated Fuel Treatments				
Conventional Landing Pile Burning	Landings	0	109	105
Hand pile and burn	Acres	0	6	6
Grapple pile and burn	Acres	0	503	503
Yard tops attached and treat	Acres	0	381	351
Underburn	Acres	0	68	23
Issue: Economic viability of sale				
Present net value	$	0	$166,615	$137,835
Benefit/cost ratio	b/c	0	1.37	1.59
Issues: Harvest in Stands > 80 years of Age				
Proposed treatments in stands > 80 years old	Acres	0	86	0
Issue: Regeneration Harvest in Stands that have met CMAI in Matrix Allocations				
Proposed regeneration harvest in stands reaching CMAI in Matrix allocations	Acres	0	20	0
Issue: Harvest in Riparian Reserves				
Estimated acres treated in Riparian Reserves	Acres	0	291	291
Percent of Riparian Reserves in project area treated.	%	0%	~ 2%	~ 2%

Alternatives Not Considered in Detail

An alternative was proposed to harvest stands > 80 years old in the Late-Successional Reserve (LSR) to improve stand complexity and accelerate development of LSR stand conditions was considered. After reviewing the area on the ground with both the public and the Regional Ecosystem Office LSR workgroup, the Ranger decided not to proceed with the alternative at this time. It was determined that the stands were already on a trajectory toward desired stand conditions in the LSR.

A second alternative was also considered but dropped from consideration. This alternative treated ground, ladder, and canopy fuels in the LSR within 200 feet of Highway 20. The LSR work group determined that since the Mid-Willamette LSR Assessment stated that the South Santiam LSR

only had a moderate fire risk, the proposal was not consistent with the NW Forest Plan which allows fuel treatments in LSRs in high risk areas on the west side of the Cascades.

Environmental Effects of the Proposed Action and Alternatives

This section summarizes the physical, biological, social and economic environments of the affected project area and describes the potential direct, indirect and cumulative effects to those environments due to implementation of the proposed alternatives. It presents the scientific and analytical basis for comparison of alternatives.

For additional information the Botanical, Wildlife, Aquatics, Soils, and Silvicultural Prescription are part of the project record for Toll Joe. These documents are incorporated by reference and summarized in the sections that follow. They are available for review at the Sweet Home Ranger District office.

Cumulative Effects

Cumulative effects discussed in this section include an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the proposed action and its alternatives may have a continuing, additive and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present, and reasonably foreseeable future actions. Individual effects of past actions have not been listed or analyzed and are not necessary to describe the cumulative effects of this proposal or the alternatives (Connaughton, 2005).

Current Conditions Proxy for Past Actions

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the effects of past actions. Current conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

The cumulative effects analysis in this document does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at current conditions, because there is limited information on the environmental effects of individual past

actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the effects of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. Looking at the current condition, helps to ensure that we capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, 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 EA is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

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

For these reasons, the analysis of past actions in this section of the document is based on current environmental conditions.

Setting the Stage

Extensive timber harvest, mostly regeneration harvesting, has occurred on both public and private lands in this project area and 5th field watershed. In order to access harvest areas, an extensive road system was developed. For some resources these past activities are still contributing to continuing effects and for some resources they are not.

Roughly 5,100 acres of timber harvest (Figure 19) has occurred on public lands in the project areas since the first timber harvests began in the 1940's. Most of the harvest that occurred was clearcutting followed by broadcast burning for slash treatment. It can be inferred that broadcast burning is on the same level of magnitude as timber harvest.

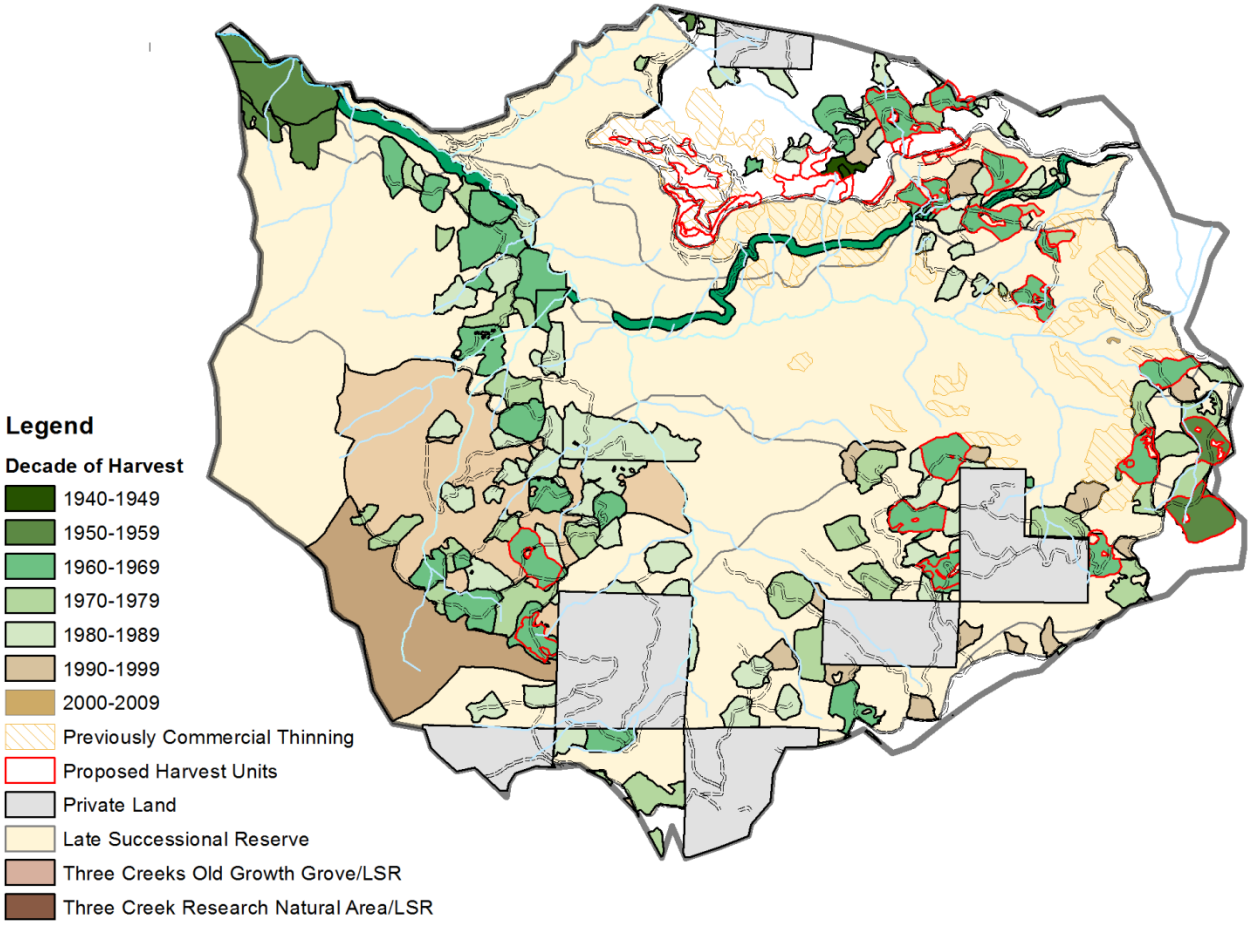

Figure 19: Past timber harvest by decade on public lands

Present Actions

The proposed action would thin about 843 acres of 40-80 year-old managed stands and about 66 acres of 90-104 year old natural stands in this watershed in the next four to five years. Within selected thinning units about 24 acres of gaps, ranging from about $^{1}/_{10}$ to ½ acre in size, would be created. In addition about 20 acres of patch cuts with reserve trees (each about 5 acres in size) would be harvested in selected stands > 80 years old that have reached culmination of mean annual increment.

Reasonably Foreseeable Future Actions

In the foreseeable future, the Sweet Home Ranger District is planning the Cool Soda Restoration Project which would commercially thin about 1,000 acres and regenerate about 15 acres and the Trout Creek Restoration Project which would thin about 2,000 acres and possibly regenerate about 100 acres within the South Santiam watershed. No additional commercial harvest is planned on public lands here in the foreseeable future but would more than likely occur on private lands.

About 200 acres of young managed stands on public lands in the project area are prime candidates for pre-commercial thinning (PCT) in the foreseeable future. PCT operations reduce stand densities to approximately 200-250 trees per acre. This work does not require new road construction or reconstruction to complete.

With slightly more than 2,165 acres of private land within the 22,000 acre project area, some commercial thinning and regeneration harvest would likely occur on these lands in the near future. Private land harvest would rely heavily on the existing road system, requiring very little new road construction.

Commercial harvest operations on both public and private lands can be expected to generate fuel reduction activities, such as slash burning. Most slash reduction would occur as pile burning, though some broadcast burning could occur on steeper private land after regeneration harvest.

It is also likely that windthrown trees from natural and managed stands would be salvaged in the next 10 years. Such salvage would likely be confined to existing road prisms, unless a sizable stand area is substantially affected (half of the trees). If a substantial area is affected, then more salvage could occur outside of the road prism.

Vegetation - General

Purpose and need objectives addressed in vegetation analysis

- Accelerate development of structural complexity within and between stands in the Toll Joe Project Area to move stands closer to desired conditions defined for the various management allocations.
- Improve stand health and vigor and contribute wood products to local markets in Matrix allocations.

Summary

The action alternatives would result in stands with a wider range of overstory canopy cover and understory light and microhabitat conditions to promote structural and species diversity than No Action. Since Alternative 2 proposes to treat 92 more acres than Alternative 3, it offers the greatest opportunity to promote structural and species diversity.

Both action alternatives would increase tree growth compared to the No Action alternative. By thinning, average diameter growth, an indication of tree vigor, would increase 2-5” over unthinned stands in the next 40 years. This is about a 40-45% increase in diameter growth over unthinned stands, depending upon thinning intensity. Since Alternative 2 proposes to thin 66 more acres than Alternative 3, it offers the greatest opportunity to improve tree growth for vigorously-growing, healthy stands.

Both action alternatives provide wood products whereas Alternative 1 does not. Since Alternative 2 provides 1.6 million more board-feet of timber than Alternative 3 and 6.4 million more board-feet of timber than Alternative 1, it offers the greatest opportunity to provide timber products to the local market.

The proposed thinning in this project would have no cumulative effect on the seral stage distribution. Proposed gaps and regeneration harvesting in the action alternatives could convert < 0.10% of the project area to an early seral stage.

Affected Environment

Current Condition

Landscape Conditions - The primary disturbance agents influencing landscape vegetation patterns in the South Santiam watershed and the Toll Joe Project Area have been fire and timber harvesting. Historically, fires in these mixed and high-severity fire regimes resulted in a wide range of seral stages and sizes across the landscape over time. For about the last 100 years fire suppression has reduced the prominence of fire in determining seral stage distribution and size. Since the 1940’s, when timber harvesting began in earnest in the watershed, vegetation patterns have been heavily influenced by harvest activities. Landscapes managed for timber production from the 1940’s to 1990’s were mostly clearcut, producing dispersed patches of early seral forests interspersed among blocks of older seral stages. Table 16 provides an estimate of the current seral stage distribution for both the watershed and the Late-Successional Reserve (LSR) within the watershed (USDA, 2006).

Table 16: Seral Stage Distribution in S. Santiam Watershed and S. Santiam LSR[1]		
Seral Stage[2]	**Watershed estimated Percent of acres**	**LSR estimated Percent of acres**
Early Seral/*Stand Initiation* (~0 to 20 years old)	14%	2%
Early Mid to Mid Seral/*Stem Exclusion to Understory Reinitiation* (~20 to150 years)	54%	57%
Late Successional/*Old Growth* (~151 years and older)	28%	37%
Non-Forest	4%	4%
[1]Percent of watershed acres is based on USFS land only while LSR acres include private land within the LSR boundaries.		
[2]Age classes are approximate and do not cover the full range of ages within a seral stage. Age classes are based on dry western hemlock and Pacific silver fir plant association groups that make up a majority of the watershed and the LSR.		

Stand Conditions - The 36 to 104 year-old stands proposed for treatment are a combination of plantations and fire- regenerated areas. The plantations (Units 25-45) were previously clearcut, planted, precommercially thinned and often fertilized and pruned to increase growth and future wood quality. The fire-regenerated stands were the result of two human-caused fires. In 1911, the 3,000-acre Sevenmile Burn was started along the Santiam Wagon Road. Historical records indicate that about 1,200 acres of the burn were planted from 1915 to 1917 and the remainder regenerated naturally. Stands proposed for treatment within this 1911 burn include Units 50-65, 69, 71 and 800. Scattered salvage and partial cutting has occurred in portions of some of these stands along Highway 20. Units 50 and 800 have been commercially thinned within the last fifteen years. In 1936, a 600-acre fire started from an escaped slash burn during the construction of Highway 20. There are no records to indicate this area was planted and likely regenerated naturally. Stands proposed for treatment within this burn include Units 66-68, 70, 73 and 74. The presence of stumps indicates that Units 67, 73, and 74 had some harvesting after the burn.

Stand Composition and Structure – Today, both the plantations and the fire-regenerated stands proposed for treatment are considered to be in the stem exclusion stage (Oliver and Larson, 1990) with a dense overstory canopy cover that blocks out light to the forest floor. All of these stands have a canopy cover averaging 60% or more.

Horizontal structure is not well developed in these stands. There are a few small gaps that are beginning to develop in laminated root rot (*Phellinus weirii*) centers. Vertical structure is limited in most of these stem exclusions stands because dense crowns block out light to the forest floor and limit understory development. The understory vegetation in most of these stands consists of Pacific rhododendron, vine maple, dwarf Oregon grape and/or salal.

The stands are dominated by a single conifer species, usually Douglas-fir, noble fir or western hemlock depending upon the stand. Minor amounts of other conifers present include pacific silver fir, grand fir, western redcedar, incense cedar, Pacific yew, and western white pine. Scattered areas of red alder can be found concentrated near some riparian areas but in general those areas are also

dominated by conifers. The predominant shade tolerant species include western hemlock, western redcedar, noble fir, and Pacific silver fir.

Average stand conditions can be found in Table 17 below.

Table 17: Average Stand Conditions

	Age in 2013	Overstory diameter	Overstory trees per acre	Overstory canopy cover
All Stands				
Average	67	14"	225	77%
Range	37-105	10-20"	115-489	60-97%
Within the South Santiam LSR				
Stands < 80 years old:				
Average	48	12"	240	77%
Range	37-59	10-14"	146-489	64-97%
Outside the South Santiam LSR				
Stands < 80 years old:				
Average	63	14"	234	78%
Range	46-77	11-16"	115-460	61-94%
Stands 80+ years old:				
Average	95	16"	286	79%
Range	87-101	12-20"	161-376	60-86%

Stand health and vigor: Two diseases causing tree damage were noted within the project area. Laminated root rot (*Phellinus weirii*) is causing low level mortality in conifers throughout the area. Small pockets of root rot were identified in stand 30. Dwarf mistletoe (*Arceuthobium* spp.) was also noted causing low levels of tree damage in the area. Moderate to severe mistletoe on western hemlock was identified in Unit 28 causing branch swelling and brooming. Although small pockets of blowdown or snow breakage do occur in this area, none were identified within the stands.

Trees in these dense stands are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. Curtis' relative densities of 50 or greater are indicative of stand stocking levels sufficient to cause competition mortality and reduced growth and vigor in stands (Curtis, 1982). The relative densities of the stands proposed for treatment in this project average 64 with all stands near or above 50.

Mean annual increment of volume production is a measure used to determine the need and timing of regeneration harvesting within General Forest and Matrix land allocations. The mean annual increment of volume of a stand is the total volume of timber divided by the number of years it has been growing. The culmination of the mean annual increment (CMAI) is the point where

maximum annual volume growth is reached. After that point there is a deceleration of volume growth. Units within General Forest or Matrix land allocations that are within 95% or past CMAI include Units 51, 54, 55, 60, 68 and portions of 50.

Desired Condition - The Matrix, General Forest and Scenic management areas would provide timber production while meeting other resource goals, such as maintaining biodiversity and visual quality. Within the Three Creeks Old Growth Grove and the South Santiam Late Successional Reserve (LSR), stands would be on an accelerated trajectory for developing late-successional conditions by developing multiple canopy layers and larger trees. Stands within the Santiam Wagon Road SIA would also be on a trajectory for developing multiple canopy layers and larger trees to represent the conditions traditionally associated with the historic landscape during the road's peak use. Within Riparian Reserves, stand treatments would be consistent with the Aquatic Conservation Strategy (ACS) and watershed restoration goals by increasing structural diversity and developing large conifers.

The desired future condition for all stands proposed for commercial harvesting in is to provide healthy, vigorously-growing stands that have a diverse native species composition and structural complexity. Stands of various conifer species would predominate with a variety of hardwoods, shrubs, herbs, and forbs occurring. Structural complexity would occur within and across the stands. Stands adjacent to the north side of Highway 20 would have lower ground, ladder, and canopy fuels in order to reduce the risk of fuel ignition, and fire spread and intensity from a fire started along the highway.

Environmental Effects

Table 18 outlines management indicators for assessing effects to vegetation.

Table 18: Management Indicators for Assessing Effects to Vegetation

Objective	Management Indicator	Justification
Structural complexity	Coefficient of Variation of Diameter	Spies & Franklin, 1991.
Stand health and vigor	Tree diameter growth	Tappeiner et al, 2007
Contribute wood products to local markets	Board foot volume	Willamette National Forest Plan

Methodology

Current stand conditions were quantified using stand examination data. The USDA Forest Vegetation Simulator Growth and Yield Model (FVS) was utilized to estimate post treatment conditions and future stand growth (USDA, 2011). In addition, ArcGIS version10 was used for mapping analysis.

Spatial and Temporal Context for Effects Analysis - Direct and indirect effects of the alternatives are analyzed at the stand scale and demonstrated using Units 38, 40, and 69. These units are used as sample stands because they are considered representative of the other stands in terms of

average diameter and density. Note that Unit 69 was dropped from the project but is still representative of other stands for analysis purposes.

Cumulative effects of the alternatives are analyzed at the landscape scale and focus on larger scale conditions in the 5th field South Santiam Watershed. This scale is appropriate for this analysis because 1) it encompasses the treatment areas and 2) is large enough to show the effects of the dominant large-scale disturbances on the various seral stages.

Project Objective 1 - Accelerate development of stand structural complexity

Direct/Indirect Effects

Management Indicator: Coefficient of Variation of Diameter.

Coefficient of variation (CV) describes the variance in values measured for a population and is described as a percentage of the average (mean) value. When this is applied to tree diameters within a stand, it can be a good indicator of the structural complexity of that stand in regards to tree size. As the range of tree diameters within a stand increases, so does the CV of diameter. Spies & Franklin (1991) analyzed which metrics would be good indicators of forest structure in young stands, mature stands, and old growth. Although their analysis used standard deviation (SD) of diameter instead of CV as one of their indicators, Spies indicated in a recent phone conversation that CV is a good substitute for SD, as both measurements are related. CV is SD divided by the mean, expressed as a percent. Model runs using the Forest Vegetation Simulator (FVS) for this project indicate that CV may be a better indicator of structural diversity changes within a stand over time than SD.

For example, if the mean diameter of a stand is 10”, and the standard deviation is 5”, that means that most (68%) of the trees in the stand are within the 5” to 15” diameter range. The coefficient of variation for this stand would be 50% (5 divided by 10). If this stand was more structurally diverse and the range of trees (68%) was 3 to 17”, then the CV would be 70%.

A low CV indicates that there is little difference in that value between individuals in a population and the mean of the population. A higher CV indicates that a population has a wider range of values in relation to the mean of the population. An even aged stand, in which most of the trees are generally the same size, has a relatively simple structure and thus a low CV for diameter. At the other extreme, a stand that meets the definition of old growth would have a very complex structure with a wide range of tree diameters. CV of diameter for an old growth stand would be higher than for an even aged stand.

Table 19 below demonstrates how thinning, along with the creation of skips and gaps, increases structural complexity. Initial increases are the result of the change in the number of trees in some diameter classes, future increases are the result of residual trees growing larger faster as well as regeneration establishing and growing into the overstory.

Table 19: Structural Complexity Comparison

Example Unit	Acres	Proposed Treatment	Year	Coefficient of Variation of Diameter		
				Alt. 1 No Action	Alt. 2	Alt. 3
Unit 38	41	Thin to 80-100 trees per acre with twelve $^{1}/_{10}$-acre gaps	2014*	55%	76%	76%
			2054	56%	166%	166%
Unit 40	47	Thin 40 acres to 80-100 trees per acre Thin 4 acres to 40-60 trees per acre Leave 3 acres unthinned (skip)	2014*	53%	73%	73%
			2054	70%	122%	122%
Unit 69	5	Thin to 60-110 trees per acre	2014*	54%	58%	54%**
			2054	54%	152%	54%**

*2014 is the year after treatment was modeled to show effects of that treatment
**No treatment

Alternative 1 – No Action

As demonstrated in Table 19, the No Action Alternative maintains lower structural diversity, or restricts the development of a more complex structural diversity over the next 40 years, as compared to the thinning alternatives. The high densities that currently exist in these stands mean that there is strong competition between trees for light, water, and nutrients. Canopy cover restricts light to the forest floor, inhibiting the development of vegetation in the understory. Tree seedlings that may initially establish are outcompeted and either stagnate in growth or die. Without a developing understory, most of the stand structure is restricted to the even-aged overstory trees which have little variation in size and species composition. Diameter growth of most of the trees would be inhibited by inter-tree competition as well. Although some trees would succumb to competition as density continues to increase, it would generally be the smaller suppressed trees that die.

Eventually small gaps would form in the overstory as trees die from competition, wind throw, or other disturbance. Advanced regeneration of more shade tolerant species, such as western hemlock, would take advantage of these openings and begin growing into the overstory. Gradually, structural and species diversity would increase in the stand. Left to natural process, an uneven-aged structure would eventually arise, but it would take many decades or centuries to develop.

Figure 20 shows Forest Vegetation Simulator (FVS) modeling results of taking No Action in 2014. Figure 21 shows the same stand 40 years later if no management action is taken.

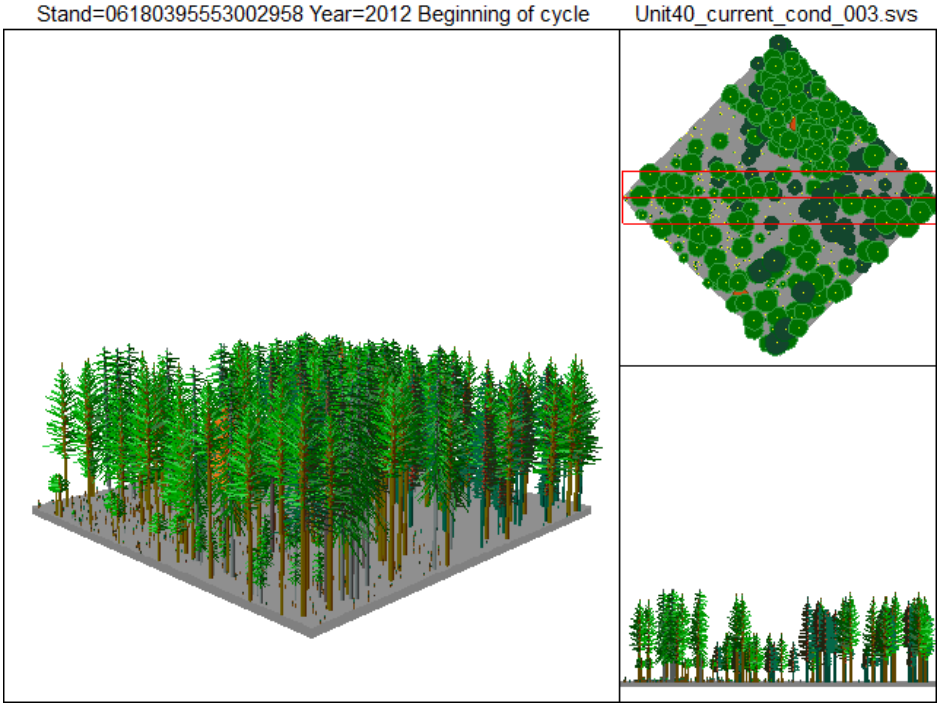

Figure 20: Unit 40 in 2014 (No Action)

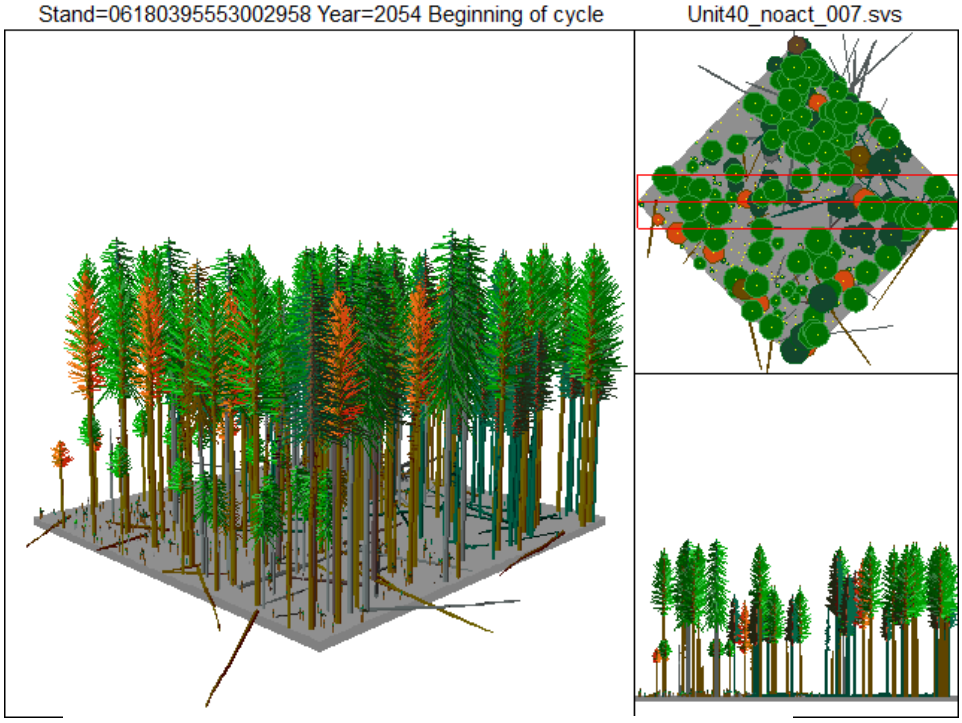

Figure 21: Unit 40 in 2054 (No Action)

Alternatives 2 and 3

Project activities affecting development of stand structural complexity include **commercial thinning to various densities**, leaving areas unthinned **(skips**), and leaving **gaps** in thinned areas. The effects on snags and down wood are discussed in Wildlife section.

Three different thinning intensities are proposed across the landscape:

- Thin to 80-100 residual trees per acre
- Thin to 40-60 residual trees per acre
- Thin to 60-110 residual trees per acre

Unit 40 was also modeled for both action alternatives. As described in Table 19, Unit 40 is approximately 47 acres in size and is proposed in both Alternatives 2 and 3. Within this unit, about 40 acres would be thinned leaving 80-100 trees per acre, four acres would be thinned leaving 40-60 trees per acre and three acres would be left unthinned (as a skip).

Figure 22 shows Unit 40 after being thinned, leaving 80-100 trees per acre, in 2014. Figure 23 shows the modeling prediction of how the stand responded to the thinning and how it developed 40 years later, in 2054.

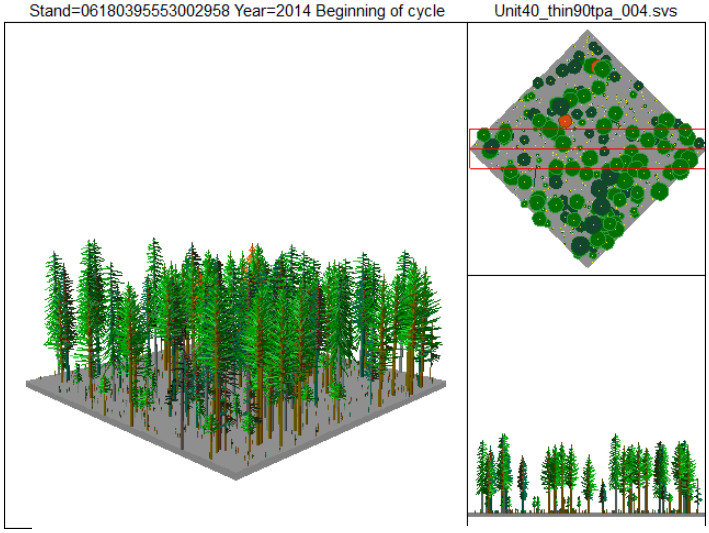

Figure 23: Unit 40 in 2014 (80-100 TPA - Alts. 2 and 3)

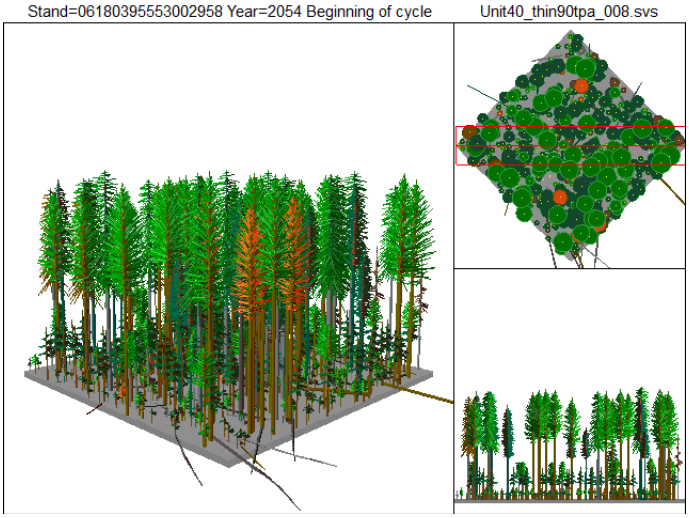

Figure 22: Unit 40 in 2054 (80-100 TPA - Alts 2 and 3)

Figure 24 shows Unit 40 after thinning, leaving 40-60 trees per acre, in 2014. Figure 25 shows the modeling prediction of how the stand responded to the thinning and how it developed 40 years later, in 2054.

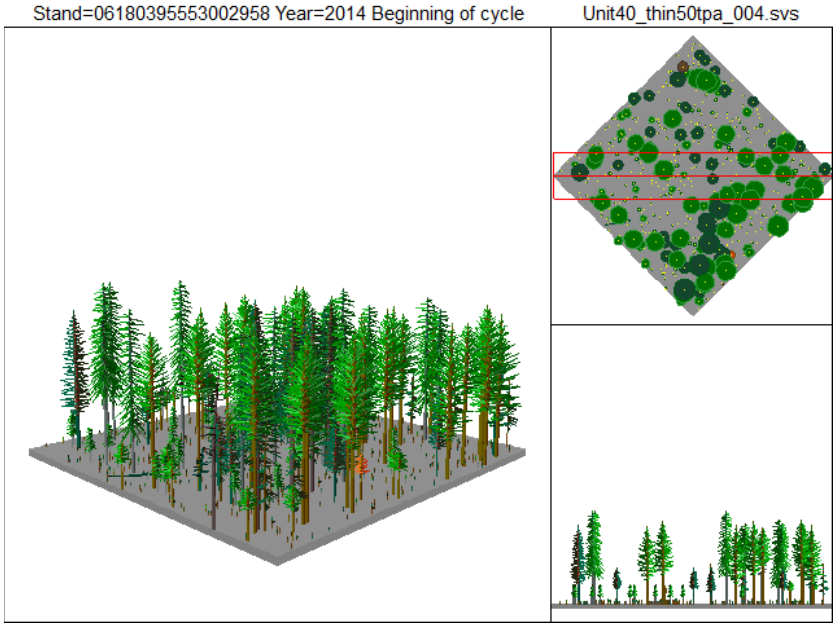

Figure 24: Unit 40 in 2014 (40-60 TPA - Alts. 2 and 3)

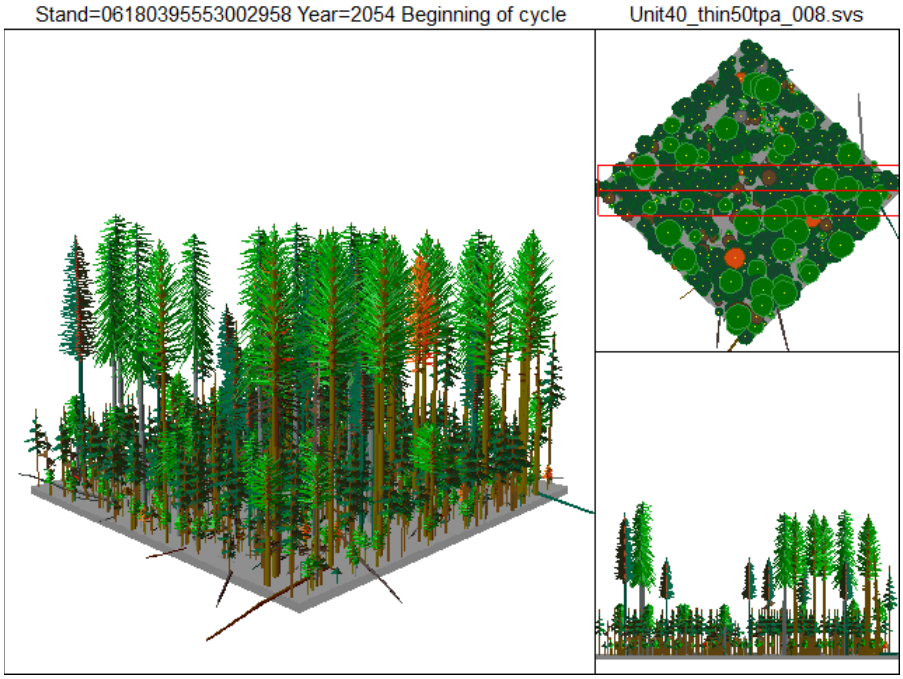

Figure 25: Unit 40 in 2054 (40-60 TPA - Alts. 2 and 3)

An immediate direct effect of the action alternatives is reduced overstory canopy cover. Thinning, establishing gaps or regeneration harvest reduces tree densities and opens up the canopy within portions of the stands. This allows additional light to reach the forest floor thereby promoting understory vegetation development and natural tree regeneration, which can lead to multiple canopy layers and more structurally complex stands (Bailey and Tappeiner, 1998; Bailey et al, 1998; Muir et al, 2002; Harrington et al, 2005; Chan et al, 2006; Ares et al, 2009; Davis and Puettman, 2009).

Indirect effects would include increased tree diameter growth, increased understory growth, and attainment of an uneven-aged structure in a shorter time frame. Reductions in stand density would reduce inter-tree competition, allowing individual trees to use more sunlight, water, and nutrients. As trees grow in height, they would be able to increase the relative size of their crowns resulting in increased tree diameter (Oliver and Larson, 1996). Increased light availability to understory trees would increase their height growth, allowing them to move into the mid canopy and overstory. In many situations these trees are of a different, more shade-tolerant species than the overstory. Releasing them to grow would increase the species diversity in the upper levels of the crowns as well as the vertical structure of the stand.

No-treatment areas (skips) within the stands that are commercially thinned would promote complexity by providing further variations in density within and among stands, thus increasing spatial heterogeneity.

Gaps can introduce fine-scale variation in homogeneous forest canopies which can widen the range of understory light and microhabitat conditions suitable for diverse understory development (Aukema and Carey, 2008). This creation of spatial heterogeneity in canopies can promote heterogeneity in understory composition and structure (Carey et al, 1999).

Figure 26 depicts an unthinned stand compared to a stand thinned to variable densities. The blue areas in the unthinned stand on the left represent about 210 trees per acre. On the thinned stand to the right, the blue areas represent unthinned skips, the green areas illustrate thinning to about 80 trees per acre with several small gaps (blue circles) interspersed throughout the stand.

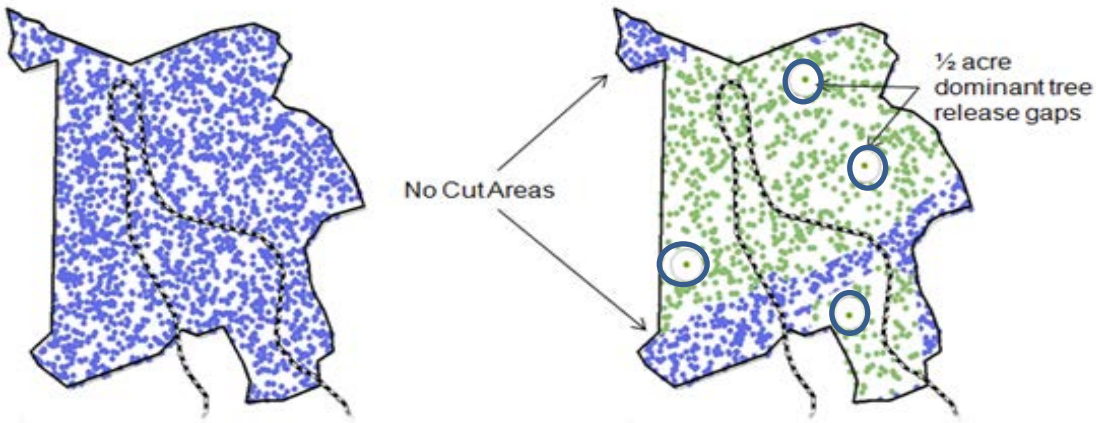

Figure 26: Thinning and Gaps

Alternative 2 – Proposed Action

Commercially, thinning leaving 80-100 trees per acre on approximately 814 acres would maximize stand growth and allow more open conditions for understory development. A range of residual canopy covers from 40 to 60% is expected from this treatment.

Approximately 38 acres of commercial thinning, leaving 40-60 trees per acre, would maximize individual tree growth and keep the overstory canopy cover open for a longer period of time to allow for understory development. This treatment is prescribed within portions of the stands being treated to 80-100 trees per acre as a means to increase stand complexity. A range of residual canopy covers from 31 to 40% is expected from this treatment.

Thinning leaving 60-110 trees per acre on approximately 57 acres would provide a wide range of canopy covers within the stands while still maximizing areas of stand and individual tree growth. This treatment is prescribed in the stands adjacent to Highway 20 to reduce canopy fuel and break up the continuous canopy. A range of residual canopy covers from 40 to 60% is expected from this treatment.

Twenty-four acres of gaps would promote complexity by providing variable density within and among stands as well as allowing for understory development. Gaps range from $^{1}/_{10}$ to ½ acre in size with retention elements that may include a dominant tree release and/or maintaining minor conifer species. Stand selection for gap placement is based on a variety of factors including slope and plant association. Gap intensity would vary unit to unit from 3 to 15% of the stand acres.

Five-acre patch cuts with reserve trees are planned in portions of Units 50 and 55 that are in the Matrix land allocation. Similar to the small gaps, these patch cuts with reserve trees are proposed as a tool to promote complexity by providing variable density within and among stands. Due to the size of these proposed openings they are considered regeneration harvesting. For Unit 50 there are no additional proposed commercial harvesting treatments beyond the patch cuts with reserve trees, as this unit has been previously thinned. Unit 55, however, is also proposed for commercial thinning in areas outside the patch cuts with reserve trees. Within the patch cuts, green tree retention would be emphasized by retaining at least 15% of the patch uncut in a combination of clumps and individual trees. For each 5-acre patch cut with reserve trees, this would result in one ½-acre clump and ¼-acres worth of individual trees retained.

Alternative 3

Alternative 3 is similar to Alternative 2 except no harvesting would take place in stands > 80 years old. This would eliminate harvesting on 92 acres (thinning, patch cuts with reserve trees and gaps in these older stands) within the project as compared to Alternative 2. Direct and indirect effects for those stands treated in Alternative 3 would be the same as in Alternative 2.

For areas not treated, there would be no direct effects. Indirect effects would include continued slowing tree growth, competition induced mortality, and in many cases, the continuation of an even-aged stand structure.

Cumulative Effects

Alternative 1 – No Action

The No Action Alternative would not change the stand structural complexity in the near term and therefore would have no cumulative effect to structural complexity in the watershed.

Alternatives 2 and 3

The watershed encompassing the project area was subject to intensive even-aged management for several decades prior to the 1990's. The resulting landscape is a patchwork of even-aged Douglas-fir stands of varying shapes, sizes, and ages intermixed with older stands that have larger trees and a more complex structure. These alternatives and similar projects in the future would increase the complexity of structure throughout the landscape and reduce the amount of area in a single-storied state. The variety of tree species would increase as more shade tolerant species are released and grow into the overstory. Eventually, the amount of area in an uneven-aged structure would increase as well.

Conclusion: The action alternatives reduce overstory canopy cover, leave skips, and create openings within stands to provide a greater opportunity to promote structural and species diversity than the No Action alternative. The action alternatives result in stands with a wider range of overstory canopy cover and understory light and microhabitat conditions to promote structural and species diversity. Figures 22 - 25 illustrate that by incorporating skips and openings, structural and species diversity can be further enhanced. Since Alternative 2 proposes to treat 92 more acres than Alternative 3, it offers the greatest opportunity to promote structural and species diversity.

Project Objective 2: Improve stand health and vigor and contribute wood products to local markets in Matrix allocations.

Direct/Indirect Effects

Management Indicator- Average Overstory Diameter

Table 20 shows examples of the average overstory stand diameter growth modeled over forty years in three representative stands.

Table 20: Average Overstory Diameter Over Time by Treatment			
	No Thinning (Alternative 1)	Thinning Treatments (Alternative 2)	Thinning Treatments (Alternative 3)
Unit 38 (Thinned to 80-100 trees per acre with 1/10th ac. gaps)			
Average diameter at age 47 in 2014	14.7"	16.6"^	16.6"^
Average diameter at age 87 in 2054	20.8"	22.3"	22.3"
Unit 40 (Thinned to both 80-100 and 40-60 trees per acre)			
Average diameter at age 50 in 2014	13.2"	15.9"^	15.9"^
Average diameter at age 90 in 2054	17.0"	17.1"*	17.1"*
Unit 69 (Thinned to 60-110 trees per acre):			
Average diameter at age 98 in 2014	17.3"	21.2"^	17.3"+
Average diameter at age 138 in 2054	20.5"	25.2"	20.5"+

^ *Reflects average diameter the year after treatment. The increase over the Alternative 1 is a reflection of the removal of smaller diameter trees.*

* *Growth of regeneration into the overstory reduces average diameter for the stand. Thinning stands to 40-60 trees per acre increases the amount of regeneration growing into the overstory, reducing the apparent effect of the thinning on diameter growth.*

\+ *Unit 69 was dropped from the project but remains representative of other stands in the project for analysis purposes.*

Alternative 1 – No Action

Table 20 demonstrates that diameter growth rates of the overstory would be lower in the No Action Alternative than in the action alternatives. The stands would continue to grow, but at slower rates as trees continue to compete for growing space and resources. Diameter growth would decline as this competition continues resulting in smaller less vigorous trees with a higher susceptibility to insect and diseases.

Alternatives 2 and 3

Table 20 shows that diameter growth rates of the overstory would increase as a result of thinning and that the action alternatives provide increased tree growth. Thinning accelerates the development of large diameter trees and promotes vigorous growing, healthy stands (Tappeiner et al, 2007) with a more diverse, multilayered understory.

Alternative 2

About 86 acres of proposed stands are > 80 years old. There are several studies that indicate that although the growth response of older forests may not be as great as younger forests, there can be a positive response to thinning stands over 100-years old (Steele, 1948; Williamson and Price, 1971; Williamson, 1982; Newton and Cole, 1987; Latham and Tappeiner, 2002).

Cumulative Effects

Alternative 1 – No Action

The no action alternative would not change the diameter growth of the trees in the near term and therefore would have no cumulative effect on diameter growth in the watershed.

Alternatives 2 and 3

For Alternatives 2 and 3, improving health and vigor to the stands in this project would supplement other stands in the watershed that have been similarly treated. Future projects would also have the same effect. As more stands in the area are managed to increase health and vigor, the resilience of the landscape to insect and disease infestations would be increased.

Conclusion: Both action alternatives increase tree growth over the No Action alternative. Table 20 shows, using three example stands, that in forty years the average overstory diameter can be expected to grow 3 to 6 more inches in the No Action alternative. By thinning, the average diameter can be expected to grow an additional 2 to 5 more inches in the next forty years. The result is that by thinning we can expect a 40 - 45% increase in diameter growth depending upon treatment. Since Alternative 2 proposes to thin 92 more acres than Alternative 3, it offers the greatest opportunity to improve tree growth for vigorously growing, healthy stands and accelerates large tree development in Riparian Reserves.

Cumulative Effects – Seral Stage Distribution

Past, present and reasonably foreseeable vegetation management activities can alter vegetation patterns across the landscape by changing the distribution of seral stages. As stated previously, fire and timber harvesting have been the dominant disturbance agents in the South Santiam Watershed resulting in a mix of seral stages (see Landscape Conditions). Reasonably foreseeable future actions in the next five years affecting vegetation within the watershed include commercial thinning, precommercial thinning, and regeneration harvesting. Thinning would not change seral stage distribution but gaps and/or regeneration harvesting would move forest land into the early forest/stand initiation phase. The South Santiam watershed is about 102,000 acres with about 14,245 acres currently in early seral forest. It is estimated that gap and regeneration harvesting with this project would contribute minutely to changes in seral stages in this watershed.

Alternative 1 – No Action

The no action alternative would not change the stands' current seral stage and therefore would have no cumulative impact on the seral stage distribution in the watershed.

Alternatives 2 – Proposed Action

Proposed commercial thinning changes the density of the trees in the treated stands, but does not alter the current seral stage. The proposed gaps and regeneration harvests, however, would change

the seral stage from mid to early seral forest. Alternative 2 proposes 24 acres of gaps (0.023% of the watershed) and about 20 acres of patch cuts with reserve trees.

Alternative 3

Alternative 3 proposes 18 acres of gaps (0.018% of the watershed)

Conclusion: It is estimated that less than 0.10% of the mid to late seral forest stand acres in the South Santiam watershed on National Forest system land may convert to early seral forest in the next five years through timber harvesting. The proposed thinning in this project would have no cumulative effect on the seral stage distribution. However, the proposed gaps and regeneration harvesting in the action alternatives could convert < 0.10% of the watershed, causing no substantial cumulative effect on seral stage distribution.

Project Objective 3- contribute wood products to local markets in Matrix allocations through timber harvest.

Direct/Indirect Effects

Management Indicator: Million Board Foot Volume (MMBF)

Table 21: Total Estimated Volume by Alternative

Alternative 1	Alternative 2	Alternative 3
No commercial timber products produced	6.4 MMBF	4.8 MMBF

Table 21 shows that the No Action alternative would not contribute wood products to local markets while Alternative 2 provides approximately 6.4 MMBF and Alternative 3 provides approximately 4.8 MMBF of timber to local markets.

Conclusion: Both action alternatives provide timber products whereas Alternative 1 does not. Since Alternative 2 provides 1.6 million board-feet more of timber than Alternative 3 and 6.4 million board-feet of timber more than Alternative 1, it offers the greatest opportunity to provide timber products to the local market.

Rare Botanical Species

Introduction

Rare botanical species include those listed as Sensitive on the Regional Forester's Sensitive Species List and those designated as Survey and Manage Species in the Northwest Forest Plan. A Biological Evaluation for botanical Threatened, Endangered, Sensitive and Proposed species and a Survey and Manage Tracking Form were completed as part of this analysis. The entire Biological Evaluation and Tracking Form are incorporated by reference and are located in the project record,

located at the Sweet Home Ranger District. The analysis and conclusions of the evaluation are summarized below. Reference material is contained in the full Biological Evaluation.

Summary

The botany Biological Evaluation determination for sensitive vascular plants, lichens and bryophytes is no impact. The project would have no environmental effect on habitat, individuals, a population, or a species. The Biological Evaluation determination for sensitive fungi is that it 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 Survey and Manage species are buffered in all action alternatives.

Affected Environment

Current Condition - Prior to the 2010/2011 surveys, five Region 6 sensitive species had been documented in this portion of the South Santiam Watershed. These include *Arabis hastatula, Lobaria linita, Romanzoffia thompsonii*, and *Tholurna dissimilis.* The only population of *Botrychium minganense* known to occur on the Willamette National Forest is located in the middle of the project area. This species was dropped from the Regional Forester's Sensitive Species List in December 2011, but remains on the Survey and Manage list.

Additionally, thirteen Survey and Manage botanical species had been documented in the project area, primarily from previous surveys of Sheep Soda Thin and Seven Ram ATV (Table 22).

Table 22: Previously Documented Survey and Manage Botanical Species in Project Area

Species	Number of sites	Category
Botrychium minganense	1	Vascular Plant
Gymnopilus punctifolius	1	Fungus
Leucogaster microsporus	1 (historical)	Fungus
Ramaria araiospora	1	Fungus
Ramaria aurantisiccescens	1	Fungus
Ramaria celerivirescens	2	Fungus
Ramaria largentii	1	Fungus
Ramaria maculapites	2	Fungus
Ramaria stuntzii	5	Fungus
Sowerbyella rhenana	2	Fungus
Lobaria linita	2	Lichen
Pseudocyphellaria rainierensis	3	Lichen
Tholurna dissimilis	1	Lichen

The project area contains habitat for 44 of the 93 species on the current Regional Forester's Sensitive Species List (dated January 2012). Of these 44 species, 15 are fungi for which no surveys were conducted. Fungal surveys are considered impractical because fungi fruit inconsistently from year to year. Fungal surveys are required for habitat disturbing projects in old growth forest;

however, the Toll Joe Project does not propose activities in old growth. Surveys were conducted for the remaining 29 species.

No additional populations of Region 6 sensitive species were located as a result of the surveys. However, one of the known sites of *Romanzoffia thompsonii* is directly adjacent to Unit 27.

Five Survey and Manage species were found, as follows:

Table 23: Survey and Manage Species in or Near Proposed Harvest Units

Survey and Manage Species	Location(s)	Category
Botrychium minganense	In Riparian Reserve of Unit 34	Vascular Plant
Ramaria celerivirescens	Unit 40	Fungus
Sparassis crispa	Unit 40	Fungus
Peltigera pacifica	Unit 37	Lichen

Two of the previously-documented Survey and Manage species sites are located in Unit 800. These are *Gymnopilus punctifolius* and *Ramaria celerivirescens*. Both species were buffered in a past timber sale. *Gymnopius punctifolius* has since been dropped from the Survey and Manage List.

Desired Condition - The desired future condition for rare botanical species is to maintain existing occurrences and to promote the stand structure diversity and complexity that would provide more suitable habitat for many of these species in the future.

Environmental Effects

Methodology

Management proposals were investigated to determine whether potential 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 Threatened, Endangered, sensitive and proposed plant species database (NRIS TESP-IS), scientific literature, aerial photos, topographic maps, and knowledge provided by individuals familiar with the area.

Multiple surveys were conducted within the project area for botanical species in the Regional Forester's Special Status Species List (Revised January 2012), and the Survey and Manage List (From 2011 Settlement Agreement in Conservation Northwest v. Sherman). During the 2010 and 2011 field season, surveys were conducted using the intuitive controlled method. All survey protocols for Survey and Manage species groups were followed.

The spatial extent of analysis is the entire project area, including the Sheep and Sevenmile subwatersheds. Rare botanical species include those on the Region 6 Sensitive Species List and those on the Survey and Manage List.

Direct/Indirect Effects

Management Indicator: Project activities such timber harvest, falling, yarding, and hauling may impact habitat, individuals, a population, or a rare botanical species.

Table 24: Management Indicators for Assessing Effects to Rare Botanical Species

Issue	Management Indicator	Justification
Potential effects to rare botanical species	Suitable habitat and/or discovered populations within or adjacent to project area	Forest Service Manual direction, Forest Plan (1990) as amended

Alternative 1 – No Action

Alternative 1 would provide the most benefit to rare fungi because most of them form mycorrhizal relationships with conifers and thinning has been shown to have negative short-term (5-7 years) effects to fungi (Pilz et al 2003). The effect of foregoing thinning on rare lichens and bryophytes is less clear. Lichens prefer slow growing substrates that overstocked stands would provide but they also prefer some species such as Pacific yew that would be better developed and more abundant in a thinned stand. Bryophytes thrive under low light conditions and high levels of down wood that can be expected under the No Action Alternative.

No harvest would occur with this alternative. The stands would undergo a slow decline before 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. Indirect effects to fungi would be minimal.

The proposed stands provide habitat for several rare plant species, including *Botrychium minganense* and *Botrychium montanum*. These two species inhabit forested stands dominated by western redcedar or incense cedar. Potential habitat in managed stands (Units 25-45) would deteriorate due to the current lack of cedar in the overstory. Incense cedar is typically associated with early seral habitat and would not be expected to regenerate under a dense canopy. Although shade tolerant, low light levels in these overstocked stands would preclude establishment and growth of western redcedar, at least until the overstory has self-thinned.

Both Action Alternatives

The two action alternatives differ primarily in the amount of acres thinned, treatments in stands > 80 years of age, and presence of patch cuts with reserve trees. Both action alternatives propose thinning 843 acres of stands under 80 years old with $^{1}/_{10}$- ½ acre gaps in some stands (about 24 acres of gaps in Alternative 2 and 19 acres of gaps in Alternative 3). Another 86 acres of natural stands up to 104 years old are treated in Alternative 2 (66 acres thinned and 20 acres regenerated). The 20 acres of regeneration units are comprised of four patch cuts with reserve trees that are each about 5 acres in size. In contrast, Alternative 3 does not harvest in stands > 80 years old and does not harvest 5-acre patch cuts with reserve trees.

Both action alternatives treat approximately 139 acres of fuels within 200 feet of the north side of Highway. In Alternative 2, 95 acres of ground and ladder fuels are treated and 44 acres of ground, ladder and canopy fuels are treated. Those 44 acres are within thinned stands. In Alternative 3, 119 acres of ground and ladder fuels are treated and an additional 20 acres of ground, ladder and canopy fuels are treated in thinned stands.

Known sites of botanical Survey and Manage species are buffered in all action alternatives. Due to mitigation measures in the action alternatives, no direct effects to known sensitive species sites or known Survey and Manage sites are anticipated. Known sites are buffered from 75 feet to 300 feet, depending on the species and the harvest prescription of the stand (Refer to Design Elements, Table 14 on page 48). It is likely that currently unknown sites of fungi may be negatively affected in the short-term by host tree removal, physical disturbance, soil compaction, and disruption of mycelial networks if the fungi are present (Kranabetter and Wylie, 1998; Ameranthus and Perry, 1994). Most of the sensitive fungi are mycorrhizal and require a host plant. 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). A study of hypogeous (fruiting below ground) fungi found that thinning substanitally reduced the diversity and amount of fruiting bodies (Gomez and Anthony, 2003). Seven of the sensitive fungi are hypogenous. Given this, Alternative 2 would have a greater impact on fungi if they occur in these stands because more acres are thinned. Alternative 2 also contains 86 acres of 80-101 year old natural stands that are of sufficient age to support a diverse fungal community.

Indirect effects to rare botanical species and their habitats vary. Minor forest tree species are favored in the prescription 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. In the short-term, the proposed action may reduce habitat for sensitive mycorrhizal fungi due to host tree removal and a reduction in moisture retention capabilities due to the drying effect of overstory removal. There is an optimal amount of organic debris and moisture and too little or too much of either can be detrimental (Harvey et.al., 1981; O'Dell et.al., 1999). Further, one tree species that is being favored by the thinning prescriptions is western redcedar (*Thuja plicata*) and this species does not support ectomycorrizal species. A large proportion of western redcedar in a stand reduces contact between root systems of host trees (Kranabetter and Kroeger, 2001).

Soil compaction resulting from harvesting equipment and the creation of temporary access roads can reduce host tree root growth and root tip availability for fungi (Amaranthus et.al., 1996; Amaranthus and Perry, 1994; Williamson and Neilson, 2000). Compaction may occur with ground-based yarding, new temporary road construction, landing construction, and grapple piling of fuels. Kranabetter and Kroeger (2001) note that thinning prescriptions that leave some stand basal area with good tree vigor may accommodate both commercial timber harvest and mycorrhizal fungi. The addition of understory trees and shrubs may benefit the sensitive mycorrhizal species. Duff retention and coarse woody debris creation would benefit both the sensitive mycorrhizal and saprophytic species (Lindblad 1998).

Very little habitat exists for rare bryophytes in the project area; there are no known locations and no sites were located in the course of surveys, therefore no effects to these species are anticipated.

Thinning may affect lichens by removing substrate and altering the microclimate (Sarr et al., 2005). Some rare lichens are thought to be dispersal-limited rather than sensitive to microclimatic changes (Sillett, 1995). Alternative 2 may have more indirect effects to epiphytic lichens by removal of their substrate over more acres than Alternative 3. In addition, Alternative 2 proposes three 5-acre patch cuts with reserves trees that could cause dispersal limitations.

Given these possible scenarios, Alternative 2 may have more indirect effects to rare botanical species than Alternative 3; however, neither action alternative is expected to adversely impact rare botanical species over the long-term.

Cumulative Effects

The area analyzed for cumulative effects was the South Santiam watershed. Some of the key recent and planned projects considered in cumulative effects include the Sheep Soda Thin (209 ac.), Seven Ram ATV (107 ac.), Seven Jump (108 ac.), Seven Sides (330 ac), Seven Sheep (212 ac.) and Three Thin Reoffer (306 ac.) Timber Sales. These have occurred within the last 20 years and were primarily thinning sales in managed and natural stands.

All Alternatives

About 56,000 acres of old-growth forest was clearcut in the 102,000 acre South Santiam watershed in the last 50 years. Of this about 5,100 acres were harvested on National Forest system lands in the project area, which lies within the larger South Santiam Watershed. 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. Numerous western redcedar stumps attest to the past presence of a greater amount of cedar that may have provided habitat for the *Botrychium* species.

Even with substantial past harvest activity there are 51,550 acres of mature and old-growth forests still remaining in the watershed. These forests serve as refugia for many rare botanical species that would be able to re-colonize younger stands as they mature and become more complex in structure and diversity. Thinning proposed in the Toll Joe Project Environmental Assessment would have little cumulative effect on rare botanical species in the South Santiam watershed.

Invasive Plant Species

Introduction

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 by invading wetlands, disrupt mycorrhizal associations, alter nutrient dynamics, and increase soil erosion. Invasive plants can also reduce the quality of recreational experiences.

Summary

The Toll Joe project has a moderate risk of introducing or spreading known populations of noxious weeds, primarily due to its proximity to Highway 20 and the inclusion of fuels reduction along the highway corridor. Weed control measures are identified under the Project Design Elements in Table 14 (Page 48).

Affected Environment

Current Condition - Roads serve as invasive species corridors due to their disturbed soils, greater light levels, and vehicle traffic (Parendes 1997). There are currently 131 miles of roads in the project area. Highway 20 intersects the project area and there are many established weed populations along its route. Forty-one invasive weed species have been documented in the watershed. The most serious weed infestations in the Toll Joe Project Area are false brome (*Brachypodium sylvaticum*), spotted knapweed (*Centaurea biebersteinii*), Scotch broom (*Cytisis scoparius*), and yellow toadflax (*Linaria vulgaris*). Several other common weeds are prevalent in the sale area including St. John's-wort (*Hypericum perforatum*), Himalayan blackberry (*Rubus armenicus*), reed canary grass (*Phalaris arundinacea*), white sweet-clover (*Melilotus alba*), tansy ragwort (*Scenecio jacobea*), Canada thistle (*Circium arvense*) and ox-eye daisy (*Leucanthemum vulgare*).

False brome is a highly invasive grass that has the capability to dominate the forest floor to the exclusion of native species. Its broad ecological amplitude allows it to succeed in heavy shade or in openings, such as meadows and roadsides. It does not have forage value for big game and so receives little or no grazing pressure because it contains a neurotoxic fungal endophyte in its leaves, making it toxic for wildlife (Bitty Roy, pers. comm.). Multiple small sites of false brome are located along the Santiam Wagon Road in the Sevenmile area.

Spotted knapweed is located at several sites along Highway 20 within the project area. It thrives on sunny cutbanks and in the cinders that line the highway. It is a major weed in the Bend, Oregon area and vehicles travelling west spread the seed along the highway corridor.

Scotch broom is a fast growing perennial shrub in the legume family. Its seeds survive in the soil seed bank for at least 70 years, thus once a population is established it is extremely persistent. There are two sites in the sale area; one is located along a steep cutslope on Highway 20 that is difficult to access, and therefore difficult to control. Seedlings have been manually removed repeatedly but due to the difficulty accessing the seed source the weed continues to persist. Scotch broom is not shade tolerant and declines as the overstory canopies close, however, there is usually enough light along roadsides for it to persist.

Yellow toadflax is a perennial with creeping rhizomes that invades open areas such as meadows and roadsides. It is located in a mesic meadow in Unit 42. Its extensive root system makes it difficult to control.

Timber sale contracts are now required to include provisions to minimize the introduction and spread of invasive plants. Weed populations in the units and along transportation routes must be mapped on the sale map and equipment-cleaning areas need to be identified.

Desired Condition - The desired future condition is prevention of new invader establishments and a cessation of established weed spread with a corresponding reduction in established weed presence. Allowing for the return of disturbed areas to a more natural condition helps retain sensitive species habitat and other special native habitats and impedes noxious weeds from dominating these areas. This condition can be advanced through implementation of good management practices, minimizing disturbance where possible, and executing mitigation measures, such as invasive weed removal and native species re-vegetation.

Environmental Effects

Methodology

Surveys for invasive species populations, including noxious weeds, were conducted in all stands along with surveys for rare botanical species in 2010 and 2011. Priority treatment sites covered by the Willamette National Forest Integrated Weed Management Plan are mapped in a GIS layer and tracked in a corresponding database. The results of the survey form the basis for analyzing effects.

Analysis included reviewing all proposed harvest units in the field to determine existing weed infestations. The pattern of known invasive weed sites was then reviewed along with the mechanisms for introduction, establishment and/or expansion of invasive weeds and comparing this with similar past, present and future foreseeable actions to determine potential effects.

Direct and Indirect Effects

Table 25: Management Indicators for Assessing Effects to Invasive Plants

Issue	Management Indicator	Justification
Introduction and/or spread of invasive plant species	Mechanisms for introduction, establishment and/or expansions of invasive weeds.	FEIS Pacific NW Region Invasive Plant Program, Preventing and Managing Invasive Plants (2005), Willamette NF Integrated Weed Management Plan (2207)

Alternative One - No Action

The No Action Alternative has the least risk of spreading weeds. There would be no new ground disturbances within the project area other than what is already occurring. There would be no new weed populations established or spread in the forested landscape as a result of this action. Without ground disturbing activities, exposed 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. Highway 20 bisects the Toll Joe Project Area and serves as a weed corridor due to vehicular traffic and maintenance activities unrelated to this project.

Action Alternatives

Invasive weeds are expected to spread under both action alternatives due to the increased light and disturbance created by thinning, gap creation, fuels reduction, and removal of competing vegetation.

The greater the number of acres thinned using ground-based yarding and treated for slash, the greater potential for weed spread. Weed invasion along Highway 20 is expected to increase due to the combination of disturbance from thinning and fuels reduction along the highway. Alternative 2 proposes treating about two times as many acres of canopy fuels (44 acres vs. 20 acres in Alternative 3), creating more disturbance than ground and ladder fuel treatments only, and thereby would cause more disturbance along the highway corridor than Alternative 3. Alternative 2 also includes 20 acres of patch cuts with reserve trees which maximizes disturbance to those acres. Refer to the following table for a comparison of the alternatives with respect to weed introduction risk.

Table 26: Risk Matrix - Comparison of Invasive Weed Introduction Potential by Alternative

Activity	Alt. 1	Alt. 2	Alt. 3
Acres thinned *(910 in Alt. 2 and 843 in Alt. 3)*	0	3	2
Acres of regeneration harvest *(5 ac. patch cuts with reserve trees =20 ac. total in Alt. 2 and 0 in Alt. 3)*	0	3	0
Acres of gap formation *(24 in Alt. 2 and 18 in Alt. 3)*	0	3	2
Acres of Hwy 20 fuel reduction *(95 ground and ladder, plus 44 canopy, ground and ladder in Alt.2 and 119 ground and ladder, plus 20 canopy, ground and ladder in Alt. 3)*	0	2	2
Proposed new temporary road construction *(1.3 miles in Alt. 2 and 1.2 miles in Alt.3)*	0	2	2
Acres of ground-based yarding *(502 acres in Alt. 2 and 3)*	0	2	2
Reopen existing temporary *road* *(2.7 miles in Alt. 2 and 3)*	0	2	2
Road maintenance *(33 miles in Alt. 2 and 3)*	0	2	2
Road Reconstruction *(5.5 miles in Alt. 2 and 3)*	0	2	2
Landings, new and existing *(108 in Alt. 2 and 104 in Alt. 3)*	1	3	3
Landings, existing helicopter *(4 in Alt. 2 and 3)*	1	1	1
Acres of grapple piling *(503 acres in Alt. 2 and 3)*	0	2	2
Total	**2**	**27**	**22**

Assigned risk values of 0 = no risk; 1 = small risk; 2= moderate risk; 3 = large risk. Derived from relative risk of invasive weed introduction and establishment by alternative based on the level of weed prompting activities in each alternative.

Cumulative Effects

The area analyzed for cumulative effects is the Toll Joe Project Area and the road system accessing it. 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 (approximately 131 miles in the project area), timber harvest (approximately 56,000 acres in the South Santiam watershed; and 5,100 acres in the project area), and recreation use, combined with almost no protective measures in the past, have resulted in numerous weed sites. The prevalence of ground-based harvest in the past likely resulted in numerous weed populations getting established within the stands. This project would open and reclose approximately 2.7 miles of non-system road, construct 1.3 miles of new non-system road, and thin approximately 910 acres. Not part of this project, but other contributing factors include road maintenance and vehicular traffic on Highway 20 that can spread or introduce weed seed, resulting in new infestations along the route. Post-harvest monitoring and weed control measures would reduce cumulative effects related to this project; however traffic on Highway 20 through the project area would continue to contribute to new infestations.

Special Habitats

Introduction

Special habitats are non-forested areas and include: meadows, ponds, caves, rock gardens, frost pockets, wetlands, talus and cliffs. These sites are important reservoirs of biodiversity and provide habitat for a wide variety of plants, fungi, and animals, many of which are not found in forested areas. In fact, while special habitats cover only about 5% of the area in the Cascades Range, 85% of native flowering plants are found in these areas (Hickman 1976). In addition, special habitats provide habitat for many species currently on the Region 6 Sensitive Species List.

Summary

Buffering special habitats and protecting the microclimate of the wetter sites would generally protect these sites from physical disturbances in both action alternatives. These protection measures are consistent with Forest Plan direction, which states that these sites shall be maintained.

Affected Environment

Current Condition - Many of the units in the Toll Joe Project Area contain special habitats. Scattered rock openings, frost pockets, wetlands, and seasonal ponds are the most common special habitats in the area. These special habitats provide habitat for various plant communities and contribute to species diversity of the area, which is otherwise fairly uniform. Special habitats within managed stands (Units 25-45) tend to have more weed species due to past disturbance.

Desired Conditions - The desired condition for special habitats is to minimize direct and indirect influence from project disturbance, and to maintain microclimatic and site conditions within

the historical range. A large part of maintaining the integrity of special habitats is to preclude the introduction and establishment of non-native invasive weeds.

Environmental Effects

Methodology

Digital orthographic quads were consulted in GIS to determine if any large unique habitats were located in the project area prior to surveys. Habitats were surveyed along with rare botanical species and weeds because they are often where rare species are located.

Direct/Indirect Effects

Table 27: Management Indicators for Assessing Effects to Special Habitats

Issue	Management Indicator	Justification
Special habitat protection	Presence of a special habitat including: meadows, ponds, caves, rock gardens, talus and cliffs	Forest Plan (1990) as amended, Willamette NF Special Habitat Management Guide (2010)

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 alternatives due to the lack of thinning. Existing weed populations in special habitats would likely continue to spread, altering the plant composition of those sites. Many of the special habitats in Toll Joe are adjacent to roads.

Action Alternatives

Special habitats are generally protected from physical disturbance in both action alternatives (refer to Table 14 on page 48). Buffers, when prescribed, should be sufficient to protect the microclimate and prevent invasive weed introduction. Buffers are not prescribed for rock outcrops, talus or other dry, rocky features because the prescription is for thinning and it is unlikely that opening up the canopy would substantially affect the plant community provided that the site is protected from physical disturbance, i.e. cable logging, skyline corridor. Several of the special habitats have invasive species in them and some control measures would be taken with the action alternatives. Hydrological changes to wet special habitats may occur due to road construction, reconstruction, culvert placement and tree removal.

Cumulative Effects

The project area was used to analyze cumulative effects on special habitat.

All Alternatives

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. Invasive species control that would occur under the action alternatives would help to mitigate past

cumulative effects. Given the protective measures included in this action, additional cumulative effects from this project are not anticipated.

Economics

A financial efficiency analysis was completed for this project and the results are discussed in the environmental consequences section below (see worksheets for that analysis in Appendix D). The analysis compares estimated financial revenues from the project with estimated direct expenditures to determine the benefit/cost ratio and net present value of the various alternatives. The economic efficiency of this and similar projects is primarily dependent on the costs associated with planning the project, preparing it for sale, implementing the project, and the tangible and intangible benefits of doing the project. The analysis did not include an estimate of non-market amenity values due to the unpredictable nature of these values. Non-market values are required "only when excess demand exists for non-market goods (Forest Service Handbook 2409.18 32.24) or the project has detrimental effects on non-market output. For a comprehensive discussion of the social and economic considerations at the forest level, refer to the Willamette Forest Plan FEIS, Chapter III, pages 213-235 and Chapter IV, pages 119-130.

Direct/Indirect Effects

Alternative 1 – No Action

The no action alternative would have a negative economic return due to the sunk costs (of about $200,000) spent on the planning effort without a return on that investment from implementing the project.

Alternatives 2 and 3

The economic viability of this project was analyzed as a whole for each of the action alternatives instead of by individual timber sales that could result from the alternatives. All potential thinning units, harvest volumes, harvest acres, logging systems, and costs were lumped together for each alternative. Table 28 summarizes the economic viability of the alternatives in today's timber market.

Table 28: Comparison of Economic Efficiency of Action Alternatives

Alternative	Harvest volume (MMBF)	Present Net Value	Benefit/ Cost Ratio	Predicted high bid ($/MBF)	Total timber value at predicted high bid rate ($)	Total timber value at base rate ($)
2	6.4 MMBF	164,7897	1.37	$114.96	$703,296	$29,182
3	4.8 MMBF	$210,205	1.59	$131.85	$626,432	$22,752

The difference between the value of the timber at the predicted high bid rate and the value at the base rate can be used as measure of the economic viability of a given alternative. Both action

alternatives are viable offerings and would generate benefits to the local economy by providing timber products and direct and indirect employment opportunities. Some of the individual treatment units considered alone may not be economically viable. However units can be combined and packaged into timber sales that are viable.

Cumulative Effects

All Alternatives

The cumulative effects of an alternative on the socioeconomic environment are quite difficult to estimate (WNFP FEIS, page IV-127). The sale of timber from this project is such a small part of the overall timber land base tributary to the area, that this project would have no measurable cumulative effect on the local economy.

Climate Change

Potential changes in the Earth's climate are likely to have effects on forests and related ecosystems the extent and magnitude of which is uncertain. There is insufficient information to predict and detect changes in health, diversity, and productivity of the ecosystems within the project area due to global climate change or to estimate site-specific effects.

The proposed action would affect a total of 954 acres of forest land. About 843 acres would be commercially thinned in stands less than 80 years old and 86 acres would be thinned in stands > 80 years old, removing the smaller trees and retaining a residual stand of about 60% of the original stand canopy cover. In addition 24 acres of gaps, ranging in size from $^{1}/_{10}$ to ½ acres, would be interspersed within 3 to 15% of the thinned stands. Within the gaps a dominant tree and/or minor conifer species > 7”DBH would be retained. Finally, about 20 acres of 5-acre patch cuts with green tree retention would retain at least 15% of the patch uncut in a combination of clumps and individual trees. For each 5-acre patch cut this would result in one ½-acre clump and ¼-acres of individual trees retained. The scope and degree of change would be minor relative to the amount of forested land within the 102,000 acre watershed as a whole. A project of this magnitude would have such minimal contributions of greenhouse gasses that its impact on global climate change would be infinitesimal. Therefore, at the global scale, the proposed action’s direct and indirect contribution to greenhouse gasses and climate change would be negligible.

In addition, because the direct and indirect effects would be negligible, the proposed action’s contribution to cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fourth Assessment Report (IPCC 2007). The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion (56.6% of global total), deforestation (17.3%), and agriculture/waste/energy (14.3%). IPCC subdivides the deforestation category into land use conversions, and large scale

deforestation. Deforestation is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

This project does not fall within any of these main contributors of greenhouse gas emissions. Forested land would not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous forested condition that can continue to support trees and sequester carbon long-term.

Given the IPCC findings and the small scale and limited effects of this project on vegetative cover and in terms of its combustion of fossil fuels by log movement and other machinery used for land management, the incremental contribution of greenhouse gases and climate change is so small it is not measurable.

This project is also consistent with IPCC recommendations for land use to help mitigate climate change. The 2007 IPCC report summarizes sector-specific key mitigation "technologies". For the forestry sector, the report recommends forest management including management to "improve tree species" and increase biomass. The proposed action is consistent with these recommendations because thinning accelerates the development of large diameter trees and promotes vigorously growing, healthy stands (Tappeiner et al, 2007). Biomass would be increased by thinning since the average diameter is expected to grow 2 to 5 more inches in the next forty years than without thinning, about a 40 - 45% increase in diameter growth, depending upon treatment.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The proposed action falls into this category.

The United States, through the Office of Science and Technology Policy has developed a national plan for global climate and atmospheric change research. The USDA activities are identified in that plan, and are outlined in "Our Changing Planet: The FY l991 U.S. Global Change Research Program." The Department of Agriculture is developing a Strategic Plan for Global Change which includes assessment and development of policy options, and research on the effects of management of forest and agricultural ecosystems on carbon dioxide and greenhouse gas cycling.

The USDA is committed to a long-term research effort. Until research removes scientific uncertainties, the National Environmental Policy Act (NEPA) disclosure documents at the regional or project levels are not the appropriate means for addressing global climate change issues. The USDA endorses the concept that atmospheric and climate effects from major Federal actions be considered in national planning. Such analysis is incorporated as part of the two National analyses coordinated by USDA, the Resources Planning Act (RPA) Assessment and Program of l990 and the Resources Conservation Act Appraisal of l995. Evaluation of global climate change effects in NEPA documents at the regional or project levels would be speculative and rarely provide

meaningful information for the decision maker or the public. Evaluation of global climate change effects for long-term regional programs may be appropriate in the future when research removes major scientific uncertainties. The USDA would continue an active leadership role in agriculture and forestry regarding the reduction of emissions of greenhouse gases.

Regional climate change modeling (see for example, Spies, et. al., 2010) generally predict, for the west slope of the Cascade Mountains, that average temperatures increases would result in longer and more intense summer dry periods, increasing summer soil moisture deficits and intensifying wildfire activity and frequency. Variable trends in precipitation are projected, which could result in more intense precipitation events resulting in changes to peak flow regimes, and a rising of snowpack elevations.

The actions that are proposed in the Toll Joe Project Area would, to some extent, preserve plant communities since less dense and diversified second-growth stands would be more resilient in the face of insect and disease infestation and wildfire that could increase in frequency due to a changing climate. The proposed action would have no effect on the current hydrologic regime in the project area as a whole, and would maintain vegetation currently providing shade to perennial streams channels, so it would not affect stream temperature that could increase as a result of climate change. It is not known what could be done to maintain peak flow regimes in the face of changing precipitation patterns, nor how the amount of shade produced by riparian stands could be increased in the face of a warming, drier climate.

According to Mote, et al. (1999) successful forest management approaches in the face of potential increases in temperature and decreases in precipitation and snowpack accumulation include maintaining the full range of biodiversity, managing forest densities for reduced susceptibility to drought stress, plant species with a known broad physiological climate response curve, and using prescribed fire to reduce susceptibility to high-intensity, large disturbances. All these management approaches are included in the Proposed Action that has been developed for the Toll Joe project.

Recent studies have indicated there is considerable potential to increase carbon storage in Douglas-fir/western hemlock forests (Harmon, et al., 2009, Hudiburg, et. al., 2009, and Mitchell, et al., 2009); the point being to increase vegetative carbon sequestration to lower, or at least avoid continued increases in the amount of carbon dioxide in the atmosphere. These studies suggest that routine forest management activities, such as fuels reduction, thinning, and relatively short rotation harvests result in a reduction of the potential amount of carbon that a forest can store in the long-term. The later of these studies specifically states that even taking into account potential future losses of a dense forest to stand replacement fire and the use of forest products for durable goods (another form of sequestration) or renewable fuels, such management still results in a reduced rate of carbon storage. These results are intuitive in that removal of any vegetative material from a forest, whether by harvest or application of prescribed fire, results, at least in the short-term, in a reduction of total biomass. However, this does not fully take into account the dynamic nature of forests, both biologically and socially in terms of human goals and objectives.

The purpose and need for this project is to maintain and enhance forest health, growth, and vigor, not to provide for storage of a theoretical maximum amount of carbon. As Hudiburg, et. al. (2009) establish, the way to sequester the most carbon in westside Pacific Northwest Forests is to maintain the most trees on a site for the longest period of time. Such a strategy does not provide much room for other species, and does not provide for development of dominant tree crown structures that can provide various types of plant and animal habitat over the long-term.

There currently is neither a general Forest Service policy mandate nor specific Forest Plan direction to manage forests primarily, or even secondarily, as maximum carbon reserves. Such an objective would be counter to the identified purpose and need for action for the Toll Joe project, which is generally to promote health, growth, and vigor of forest stands in the project area. There is specific National (FSM 2020) and Forest Plan (FW-201) direction to manage for maintenance of biodiversity. Maximization of carbon storage in this area would inevitably result in favoring dense, uniform stands of conifer trees to the exclusion of more diverse vegetation communities. Biodiversity enhancement is mandated on National Forest lands both by statute and Forest Service policy. Management of second growth stands for maximum carbon storage would not provide for multiple use, would not provide for diverse and resilient forests, and stands maintained in as dense a condition as physically possible could likely result in ephemeral storage if these stands were affected by wildfire, a relatively common event in the western and southern Cascades Mountains of Oregon.

Additionally, the manipulation of vegetation is not likely an effective method of reducing concentrations of carbon dioxide in the atmosphere as long as large amounts of fossil fuels continue to be burned. As Herzog et al. (2000) points out; one would have to plant an unforested area the size of the Indian subcontinent each year to balance current carbon dioxide emissions that are almost entirely generated from the combustion of fossil fuels. Even if there was enough non-forested land to use for effective carbon sequestration through afforestation, these forests also are not really storing carbon for any reliably long period of time; they are still part of the active carbon cycle and are subject to various disturbances that can abruptly end the storage function. This is especially true of coniferous forests in the western Unites States, such as those in the Toll Joe Project Area, which are subject to periodic wildfire during summer droughts. One severe wildfire on this landscape would release as much carbon dioxide immediately, and much more would be generated chronically as the killed tree stems decompose.

Riparian Reserves

Introduction

Analysis of Riparian Reserves for this project will discuss the current condition of the Reserves, describe the need for action, and disclose the effects of actively managing within the Reserves to meet Aquatic Conservation Strategy Objectives (ACSOs).

The NW Forest plan included the Aquatic Conservation Strategy (ACS) to protect the ecological health of the watershed and aquatic ecosystems on public lands. Meeting the intent of the ACS and restoration of habitat for federally-listed species is an important aspect of thinning projects on the

Willamette National Forest. Properly functioning Riparian Reserves are critical to the recovery of listed species. Thinning treatments to benefit Riparian Reserves is justified by scientific literature and stand development theory in dense uniform plantations (Spies, et al. 2013).

Summary

There is potential to benefit the Riparian Reserves and accelerate attainment of some ACSOs in young plantations (Spies et al. 2013). The volume of wood available for recruitment to the Riparian Reserves would initially decrease as a result of thinning, but in the long-term wood recruitment would return much closer to historic levels. Natural forests acting as source areas are expected to continue to provide ample supplies of wood over the short term until the treated plantations reach the stem exclusion phase and begin to contribute wood to the Riparian Reserves again.

Affected Environment

Current Condition - Riparian Reserves in the project area are dominated by Douglas-fir with minor amounts of other conifers including western hemlock, western redcedar, noble fir, Pacific silver fir, grand fir and western white pine. A variety of shrub species are also present. The plant groups in Riparian Reserves vary, depending on proximity to surface water, slope position, elevation and aspect. Scattered areas of red alder and big leaf maple can be found concentrated in riparian areas. Of the approximately 22,000 acre project area, approximately 12,000 acres are in Riparian Reserves.

The project area (predominantly Sevenmile Creek sub-watershed) has 27% of the Riparian Reserve in stem exclusion stage as opposed to sub-watersheds in a more natural condition, which have about 5-10% in stem exclusion (South Santiam Watershed Analysis, updated 2006). The trees in the stem exclusion stage are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. Suppressed understories are mostly limited to shrubs and herbs with a few small trees scattered throughout. These stands lack structural diversity and complexity.

Of the approximately 22,000 acre project area, about 5,100 acres were previously clearcut and replanted to primarily Douglas-fir. These plantations are even aged, dense, and show very little diversity or complexity of species and habitats desired in the Riparian Reserves. Approximately 1,760 acres in these plantations are in Riparian Reserves, representing approximately 15% of the project area. The remaining 85% are in a natural state.

Approximately 256 acres of the 1,760 acres of Riparian Reserves in young managed stands have been thinned (sales sold from Gordon Three and Sheep Soda environmental assessments) to increase stand structure and species diversity. An unknown number of these stands have been pre-commercially thinned. Just over a 1,000 of these acres are from plantations established after 1970, and they are not ready for silvicultural treatment.

Desired Condition - Riparian Reserves serve to maintain the ecologic integrity of streams and stream corridors as well as provide corridors between Late Successional Reserve Areas (NWFP 1994; p B-13). The desired condition within Riparian Reserves includes: large conifers (NW

Forest Plan, p. 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 large wood for streams. This condition is important to be maintained for the benefit of aquatic plants, aquatic organisms, and terrestrial wildlife.

Environmental Effects

Methodology

Maps and GIS analysis methods were used to analyze the current condition and the proposed treatments at the project scale. The analysis of current Riparian Reserve condition and management actions to restore Riparian Reserve condition was completed in an interdisciplinary format. The Riparian Reserve network at the project scale is estimated because surveys of actual stream locations at this scale have not been completed.

Spatial and Temporal Context for Effects Analysis

The area of analysis is the project area, rather than the 6th field sub-watershed scale. Since there are only a couple of stands in the Sheep Creek sub-watershed it was apparent that the best way to analyze effects of this project was at the project scale.

Direct/Indirect Effects

The objective for thinning in younger Riparian Reserves (< 80 years) is the attainment of Aquatic Conservation Strategy Objectives (ACSOs) by creating species diversity and structure at the stand scale while maintaining habitat complexity and connectivity across the landscape.

Alternative 1 – No Action

Riparian Reserves would passively correct the overstocked condition found in the younger stands (< 80 years) through natural disturbance and plant succession processes. As passive management produces suppression mortality, the stand would self-thin.

Alternatives 2 and 3

Alternatives 2 and 3 propose to thin 291 acres in Riparian Reserves within stands less than 80 years old to accelerate attainment of species diversity and habitat complexity, while maintaining adequate supply of coarse woody debris.

Thinning in these Riparian Reserves presents potential for short-term effects, including degradation of water quality and habitat conditions. This risk is low and can be minimized by the use of site-specific design elements (see Table 14) and best management practices. No-harvest buffers prevent sedimentation from ground disturbance and maintains shade and bank stability. Woody debris source material is sustained and quality of wood structure is improved over time.

A loss of intermediate-sized wood from the upland portion of the Riparian Reserve would occur due to the removal of material from Riparian Reserves outside of no-cut buffers. It is possible that thinning would create a 10 to 30 year period when wood recruitment rates would be reduced at the

stand scale. It is expected however, that the remaining untreated Riparian Reserves in the project area would continue to provide a source for wood recruitment to the stream channel. Furthermore, no-cut buffers have been established along all streams which would allow for natural recruitment of near stream wood. Loss of direct wood recruitment to streams and streamside riparian areas would be minimal and would still fall within the range of natural variability, given that only approximately 2.4% (*291 ac. treated/12,000 acres in project area x 100%*) of Riparian Reserves in the project area would be treated.

Thinning in younger Riparian Reserves would meet the objective of accelerating attainment of ACSOs by creating species diversity and structure at the stand scale while maintaining habitat complexity and connectivity across the landscape. The treatment would promote variable density within Riparian Reserves by leaving skips and varying thinning intensities.

Riparian plant communities may experience increased light and warmer summer temperatures as a result of thinning in Riparian Reserves. No-harvest buffers of 50 feet on intermittent streams and 75 feet on perennial streams would help mitigate direct effects to these communities.

Cumulative Effects

The area of analysis is the project area.

Both Action Alternatives

Cumulative effects are determined from the time logging and road building began in the watershed up to and including any planned management activities because this time frame includes effects to Riparian Reserves related to Aquatic Conservation Strategy Objectives (ACSOs).

In most of the managed stands in the project area, the ACSOs are not currently being attained. Past timber harvest practices, including harvesting to the edge of stream channels and removing large wood from streams, have created current stream conditions that lack channel complexity and high-quality aquatic habitat. In addition, land management practices on private land have had an impact on the overall ability to meet ACSOs at the project scale. Past harvest has impacted approximately 15% of Riparian Reserves in the project area. Large wood recruitment is the most important habitat-forming feature missing from streams and rivers in the project area. This project would thin a portion of this 15%, increasing the complexity and overall health of 291 acres over the long-term. No-harvest buffers would prevent sedimentation from ground disturbance, maintain shade retention and bank stability, and woody debris source material would be sustained while improving the quality of the wood over time. Since only previously managed stands are being harvested in this project and the treatment would hasten the development of stands to the desired condition, cumulative effects would be minimal.

Past road building has also had an impact on Riparian Reserves and the ability to restore and maintain ACSOs. There are approximately 88 miles of roads in Riparian Reserves in the project area, affecting about 320 acres of Riparian Reserves (2.6%), assuming an average of 30 foot road impact width. Both alternatives would build temporary roads in Riparian Reserves, with Alternative 2 building approximately 0.2 miles more than Alternative 3. In addition, approximately 10 miles of

aquatic risk roads treatments would take place under either action alternative, which would decrease the impact of roads on aquatic systems.

Aquatics – Stream Shade and Temperature

Summary

No measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area as a result of this project. Riparian management on private land is not expected to change, therefore cumulative effects of private land management practices to stream temperatures are not expected to increase.

The magnitude of cumulative stream temperature increases resulting from past management activities was disclosed in the Affected Environment discussion that follows. There are no reasonably foreseeable actions on National Forest System land that would not comply with Total Maximum Daily Load (TMDL) requirements for the South Santiam Basin.

Affected Environment

Current Condition - Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest System lands in the 1970s and 1980s. Much of this activity, which occurred prior to implementation of the Willamette Forest Plan in July 1990, resulted in removal of riparian vegetation that provided shade for streams in the project area. The removal of shade likely resulted in elevated stream temperatures. These riparian areas are still not fully recovered so are not providing adequate shade to prevent elevated temperatures. Elevated temperatures are represented in current temperature data.

Reaches of the South Santiam River have been identified as having impaired water quality within the Toll Joe Project Area. Table 29 displays the listing information and applicable standards. In 2010 this reach of the South Santiam River and several other streams in the Willamette Basin were changed from Category 5 (water quality limited, TMDL needed) to Category 4a (water quality limited, TMDL approved).

Table 29: Temperature Limited Stream Reaches on Dept. of Environmental Quality 303 (d) List

Stream Name	River Miles	Standard (^{0}F)	Beneficial Use
South Santiam River	39.8-60.4	60.8	Core cold water habitat

From June through September of 2006 through 2009 stream temperature data were collected at four locations in the project area to support project analysis. The critical monitoring season for summer water temperature generally runs from early June to early September for approximately 90 days. A summary of this data is provided in Table 30.

Table 30: 7-Day Average Maximum Water Temperature Summary for Streams in Project Area				
Location	Temperatures in ^{0}F			
	2006	2007	2008	2009
South Santiam below Three Creek	64.4	No data	65.7	66.9
Sheep Creek	69.6	68.1	68.3	70.2
Sevenmile Creek	59.9	57.9	58.2	60.6
Latiwi Creek	62.8	55.3	60.8	No data

Current conditions for stream temperatures in the Toll Joe Project Area are slightly elevated above the water quality standard (60.8 ^{0}F) for core cold water habitat for salmonids. More years of data would be required to make a concrete conclusion and there is no historic data against which to compare.

Summer temperature monitoring done in 2006 found the mouth of Three Creek to be at 60 ^{o}F, which is below the standard. Therefore, it appears there is not a problem with elevated stream temperatures in Sevenmile Creek, Latiwi Creek, or Three Creek.

There is a minor elevation above the standard in the South Santiam River and Sheep Creek is well above the standard. Several factors contribute to the elevated stream temperate in Sheep Creek including: harvest on private land in the headwaters, the southern aspect of the drainage and a large hillslope failure, approximately 12 years ago, which sluiced out a majority of the riparian hardwood forest and stripped the streambed down to bedrock in some areas. This is likely the greatest factor for the elevated temperature problems found in Sheep Creek.

Projects to help alleviate the temperature problem in Sheep Creek have included riparian planting and large wood placement. During periods of elevated water temperature, thermal pockets of cold water refugia are critically important and are provided by hydrologic complexity.

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

Desired Condition - The desired condition is stream temperatures providing quality habitat to wild fish and other aquatic species at or below state standards. Specifically, cool enough summer temperatures to enable the recovery of Endangered Species Act (ESA) - listed anadromous fish. As described in the Water Quality Restoration Plan (2008), this recovery would occur by both passive and active restoration on federal lands. Private lands managed on shorter rotations would continue to follow the Oregon Forest Practices Act.

Environmental Effects

Spatial and Temporal Context for Effects Analysis

Unless otherwise noted, the geographic scale used to assess direct, indirect and cumulative effects includes the project activity units, the project area and the Sevenmile Creek and Sheep Creek sub-watersheds.

Direct/Indirect Effects

Management Indicator: Issues identified by public scoping relevant to aquatics include the effects of thinning on future recruitment of large wood to streams, and the effects of roads on aquatic resources. This analysis also includes evaluation of cumulative effects of past and proposed harvest on peak stream flow, the effects of harvest on shade for effects to stream temperature, and the effects of project activities on Management Indicator Species (MIS) of fish.

Table 31: Management Indicators for Assessing Effects to Stream Shade and Temperature

Issue	Management Indicator	Justification
Stream temperature	Harvest within the primary shade zone	Northwest Forest Plan Temperature TMDL Implementation Strategy (May 25, 2012)

Alternative 1 – No Action

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

Alternatives 2 and 3

For both action alternatives, treatments within riparian areas have been designed to comply with the Northwest Forest Plan Temperature TMDL Implementation Strategy, Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy (2012) for water quality limited streams. In addition, the Willamette National Forest has submitted a Water Quality Management Plan to the Department of Environment Quality (DEQ) in 2008, which outlines both passive and active means of managing Riparian Reserves.

Based on the Implementation Strategy (2012) a buffer of 75 feet would be retained on all perennial streams (Class 1 -3) to maintain effective shade within thinning units. Intermittent (Class 4) streams are dry during the portion of the year when elevated temperatures occur. However, bank stability trees and a 50 foot buffer would provide substantial shade with potential to protect habitat for amphibians and plants in headwater areas. All no-harvest stream buffers would be measured from the closest tree to the stream, not the stream itself. For all classes of stream, 50% crown canopy closure (~40% canopy cover) would be retained within the remainder of the Riparian Reserve, including that portion which may provide secondary shading benefits.

Based on implementation of the design criteria outlined in Table 14 (Page 48) and field observations during project reconnaissance, no measurable direct or indirect effects on increases of stream temperature are anticipated within the project area, as a result of the action alternatives.

Cumulative Effects

All Alternatives

No measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area as a result of this project. Riparian management on private land is not expected to change, therefore cumulative effects of private land management practices to stream temperatures are not expected to increase.

Aquatics – Stream Flows

Summary

Aggregate Recovery Percentage (ARP) levels are maintained above recommended values by the most extractive alternative (Alternative 2) in the affected sub-watersheds, even immediately after implementation when the potential for effects to vegetative recovery would be greatest. Therefore, no altered peak stream flow regimes are anticipated from implementation of the proposed actions. As a result of this project, there are no anticipated effects on stream channels.

Affected Environment

Current Condition - Current Aggregate Recovery Percentage (ARP) levels in the Toll Joe Project Area subwatersheds are: Sevenmile Creek 92% and Sheep Creek 92%. These numbers are above the midpoint values of 70% from the 1990 Forest Plan.

Desired Condition - ARP levels at or above the midpoint values identified in the Forest Plan
Environmental Effects

Environmental Effects

Methodology

Projects involving timber harvest were analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage (ARP), as specified by the Forest Plan. The ARP model compares the amount of a project 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 sub-watershed. They are intended to represent a minimum level of vegetative recovery in the sub-watersheds to prevent increases in peak flows regimes that would degrade channels. Recovery generally occurs when stand diameters average 8” DBH and crown closures

exceed 70%. The transient snow zone is considered to include land between the elevations of 1,500 and 4,000 feet. The analysis is based on data extracted from the Forest's VEGIS database, which includes information about all past harvest activities in the sub-watershed. In the Toll Joe Project Area the occurrence of private land makes calculation of ARP values based solely on VEGIS slightly skewed. Data on private land stand recovery were obtained and included in the analysis.

Direct/Indirect/Cumulative Effects

Table 32: Management Indicators for Assessing Effects to Stream Flows

Issue	Management Indicator	Justification
Peak Stream Flow and Disturbance History	Aggregate Recovery Percent	ARP Mid-point values are specified in the Forest Plan

Alternative 1 – No Action

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

Alternatives 2 and 3

This analysis was completed for the most extractive potential alternative (Alternative 2). Table 33 summarizes levels of recovery, immediately after implementation of the project, which are well above the midpoint values in the Forest Plan in both alternatives. There are no reasonably foreseeable future actions within the project area that would result in effects that differ from those already disclosed for each of the action alternatives.

Table 33: Aggregate Recovery Percentage After Harvest

Sub-watershed	Midpoint ARP	Alt. 2 (Most Extractive)
Sevenmile Creek	70%	89%
Sheep Creek	70%	80%

Aquatics – Sedimentation and Roads

Summary

It is likely that no more than about four cubic yards of sediment would enter streams in the project area as a result of the action alternatives. Since haul and road reconstruction is more than a mile upstream of Listed Fish Habitat (LFH), there is not expected to be any sediment entering streams with anadromous fish as a result of implementing this project.

There would be some sediment entering streams from road reconstruction, but the work would help stabilize road fills at stream crossings and help prevent future catastrophic road failure-related sediment inputs. There may be a less than one percent increase in sediment entering streams as a result of implementing log haul for this project.

Finally, although there are short term increases in road-related stream sedimentation, this project would stabilize and decommission several miles of system roads, which would have a long-term effect of reducing the amount of road-related sediment entering streams. There would also be a number of fills stabilized, with road reconstruction activities that would no longer be at risk of catastrophic failure.

Affected Environment

Current Condition - The geologic formation and soils of the Toll Joe Project Area have historically been prone to extensive erosion and slumping due to deep soils and unstable earth flows (See Soils Effects section of the EA and Soils Report in the project record). Many of these earthflows have stabilized during the last several thousand years, but some remain active. Several active earthflows, continually moving toward Sheep Creek and the South Santiam, result in mass slumping of natural sediment into these systems.

In the 1940s road construction and timber harvest began in the project area, peaking on National Forest system lands in the 1970s and 1980s. During these times, timber harvest and road building techniques led to elevated sedimentation levels in streams.

Road development in the Toll Joe Project Area is extensive (approximately 3.8 miles/square mile), and most large blocks of forest have been accessed. Most major road systems were constructed from the 1940s to the 1970s with older road construction standards when few location and construction controls were in place. Some of these roads were built on steep side slopes with sidecast construction standards, where most of the excavated material was pushed over the edge onto the steep sideslopes below. The remnants of this sidecast are still evident, and failing sidecast continues to be a source of mass sedimentation into streams in the project area. These roads continued to produce sediment during storm events as unstable portions of road fills fail and result in debris torrents. Road maintenance activities have worked to eliminate many of these unstable road fills, since implementation of the Forest Plan in 1990. Many were repaired to the higher road construction standards after their initial failure. Even so, roads continue to be the largest source of human-caused sedimentation in the project area, especially at stream crossings where road sediment can enter streams and undersized culverts can fail during flood events. Of the 131 miles of system roads in the project area, there are approximately 88 miles of system roads and an unknown number of non-system roads in Riparian Reserves, equating to approximately 68% of the total roads in the project area.

The Upper Santiam River Sub-Basin, including the Toll Joe Project Area, provides municipal water to the City of Sweet Home through the water intake in Foster Reservoir in Sweet Home, approximately 25 miles downstream from the project area. Stream sediments and associated turbidity are the most likely consequences of the Toll Joe project that could affect municipal water quality, but there is expected to be no effect, particularly since Foster Reservoir acts as a buffer to the city's intake, allowing both naturally high and any project-caused turbidity to settle out before the water intake.

There are approximately 24 miles of roads that pose an aquatic threat in the Toll Joe Project Area. Many of these roads have been identified as high-aquatic risk and are not needed for future access in the near-term. Road treatments to reduce aquatic risk are planned for approximately 10 miles of road in this project area and would be scheduled for implementation after the other project activities have been completed to allow for needed access.

Environmental Effects

Methodology

Sediment outputs from roads were based on observations of existing road conditions during field reconnaissance for the project and estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The same analysis was conducted for the project area road system for each of the alternatives, incorporating all project related road maintenance and temporary construction activities, as well as product haul routes.

Direct/Indirect Effects

Table 34: Management Indicators for Assessing Effects to Sedimentation and Roads

Issue	Management Indicator	Justification
Effects of Roads on aquatic resources would be analyzed looking at sedimentation from roads	WEPP sediment modeling and professional judgment	Best Science

Alternative 1 – No Action

Alternative 1 continues current road maintenance practices in the project area. This alternative would not change the potential for sediment delivery to streams from roads in the project area. There are a number of culverts at risk of failing that would not be repaired under the No Action Alternative. This could result in large fill failures leading to increased sedimentation of streams. The high aquatic-risk roads would not be stored and decommissioned and would continue to be a threat to aquatic resources.

Alternatives 2 and 3

Sediment inputs from log haul into listed fish habitat (LFH) is a critical element of the effects of the project. For this project, haul routes are so far from LFH that no sediment is expected to enter LFH. An observation of haul route roads in the project area shows most haul routes on forest roads are > 5 miles upstream of LFH. The exception is Latiwi Road (road 2044), which is approximately one mile above LFH. This route would only be used to haul logs from two young stand units (units 25 and 26). Based on observation and professional experience it is possible that about a cup of sediment could enter the stream through the bridge drainage as a result of this log haul. However, based on professional experience, it is not possible that this could result in any sediment entering LFH because LFH is so far downstream from this crossing.

Road work associated with the Toll Joe project includes replacement of two live-stream and five ditch-relief culverts that are currently in poor condition. It is not possible to do this work without some sediment input into streams, and model estimates (e.g. WEPP) are not predictably accurate. Depending on variable factors, including weather, sediment yields should fall between 0.1 and 1.5 cubic yards per culvert replacement. The culverts to be replaced are in poor condition and currently represent an elevated risk of fill failure. Based on an average 8 feet fill depth, an estimated average fill volume is 35 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culvert fails. Estimates for short-term effects of sediment are based on worst case scenario (1.5 cubic yards of sediment enters the stream per installation). Table 35 provides a summary of the live stream replacements and the potential amount of fill material that would have a reduced risk of entering streams, as well as estimates of the amount of sediment produced from the culvert replacements.

Table 35: Approximate Number of Culvert Replacements in Live Streams

	Number of Live Stream Culverts Replaced	Estimated Cubic Yards of Fill Stabilized	Estimated Maximum Sediment Yield from Culvert Replacements (yds.^{3})
Alternative 1	0	0	0
Alternatives 2 and 3	2	70	3

All action alternatives would implement the road maintenance activities listed in the description of each action alternative, including ditch reconditioning. Ditch reconditioning would yield temporary increases in sediment delivered to streams until ditches re-vegetate and filtering of sediment resumes.

Also included is the replacement of five ditch-relief culverts that are currently in poor condition. These actions would reduce the likelihood of sediment leaving the road with runoff through proper road maintenance, but can result in a minimal flush of sediment during the first fall rains. An estimate of three cubic feet of sediment per relief culvert replacement could result in a total of approximately 1 cubic yard of sediment entering streams during the first fall rains resulting from road maintenance activities. This estimate could vary considerably depending on the weather and how many culverts are actually replaced.

Cumulative Effects

All Alternatives

Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. The results are summarized in Table 36.

Rates of road related sediment yield reflect the extent of the road system in this area. Many of the roads are privately-owned and the main roads are predominately cost share. As a result, the

roads in the project area are well-maintained and safe, but cumulatively contribute over 200 cubic yards per year of sediment to streams. As can be seen in the modeling results there is a slight (1%) temporary increase during operations, but after the project is implemented an overall slight decrease (2%) in sediment is expected.

Table 36: Sediment Production Estimates

	Alt. 1 (No Action)	Action Alt.
Road Sediment Yield During Implementation (CuYd/Yr)	220	222
Road Sediment Yield after Implementation (CuYd/Yr)	220	216

Aquatics – Management Indicator Species of Fish (MIS)

Summary

The effects of implementing Alternatives 2 and 3 have no probability of affecting anadromous Management Indicator Species (MIS) in the South Santiam River. Log haul and road management would result in some minimal short-term input of sediment into resident MIS habitat. However, MIS habitat would be maintained within the range of natural variability and is consistent with the Willamette National Forest Land and Resource Management Plan (LRMP). The project considered cumulative effects at the watershed scale is expected to improve large wood recruitment and reduce fine sediment in MIS habitat over time.

The largest current contributor to degraded water quality and fish habitat in the project area is sedimentation resulting from the existing road system. As demonstrated in the previous analysis, this project would improve the road system and result in less sedimentation in the foreseeable future.

The largest past contributor to degraded hydrologic function and fish habitat in the project area is the loss of large wood from stream clean out practices in the past. As demonstrated in the Riparian Reserve analysis, this project would improve the condition of large wood in streams over time as a result of riparian protection.

Affected Environment

Current Condition - The Willamette National Forest Land and Resource Management Plan (LRMP) identifies Management Indicator Species (MIS) species as anadromous fish and resident trout (US Forest Service, 1990; p. IV-73). They were selected because they are important for commercial and sport fishing and because their habitat can be easily affected by timber management. The four MIS fish species that are affected by this project area are winter steelhead, spring Chinook, resident cutthroat, and resident rainbow (Table 37). A hybridized cross between cutthroat and rainbow trout also exists in the project area.

Table 37: Management Indicator Species and Habitat Description

MIS	Habitat Description	Habitat Present in Project Area	Species Present in Project Area
Spring Chinook	Streams/riparian habitats	Yes	Yes
Winter Steelhead		Yes	Yes
Cutthroat Trout		Yes	Yes
Resident Rainbow Trout		Yes	Yes

Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The aquatic MIS were also selected to indicate healthy stream and riparian ecosystems across the landscape (see Desired Condition described below). The fish-bearing stream systems in the project area are the South Santiam River above the confluence with Soda Fork Creek, Sheep Creek, Latiwi Creek, Three Creek and Sevenmile Creek drainages. Habitat for each MIS species exists within the project area.

Winter steelhead and spring Chinook are listed as threatened under the Endangered Species Act (ESA). They are spawning naturally in the main stem of the South Santiam River up to approximately river mile 63 where further upstream passage is blocked by a cascading falls below the confluence with Elk Creek. This upstream extent of ESA-listed species of fish is important for assessing effects of this project. Out-migrating juveniles must pass through Foster Reservoir and Dam. The returning adults are collected by the hatchery below Foster Dam and transported upstream to two out-planting locations on the South Santiam River downstream of the project area.

In general, the aquatic MIS selected for the Willamette National Forest have similar stream and riparian ecosystem requirements (e.g. cold water habitat). The primary difference is that the anadromous fish require the ability to migrate out to the ocean and return to spawn. This access is restricted by Foster Dam. In the 1960s Foster Dam was constructed, eliminating over 18 miles of anadromous fish habitat.

In the 1960s through the 1980s a practice of removing large wood from stream channels removed most of the large wood available for fish habitat. The amount of large wood in streams is now an important indicator of fish habitat that is not properly functioning. It is generally accepted that 80 pieces of large wood per mile indicates properly-functioning fish habitat for salmonids.

Habitat surveys conducted on Latiwi Creek and Sevenmile Creeks in 1993 found cutthroat trout inhabiting the first half mile of each of these tributaries. This indicates the upstream extent of MIS presence, which is important for assessing effects of this project. The same survey found an average of about 30 pieces of large wood per mile. A 2012 stream survey of the South Santiam River found an average of approximately two pieces of large wood per mile.

The current condition for MIS habitat which supports rainbow trout and cutthroat trout is stable or improving and therefore the populations are considered stable or improving. Because the Spring Chinook and Winter Steelhead anadromous fish populations rely on the trap and haul of individuals around Foster dams, the populations are considered unstable.

Desired Condition - A healthy aquatic ecosystem including: cold and clean water; clean channel substrates; stable streambanks; healthy streamside vegetation; complex channel habitat created by large wood, cobles, boulders, streamside vegetation, and undercut banks; deep pools; and improved upstream and downstream passage at Foster Dam for anadromous fish. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for instream wood recruitment.

Environmental Effects

Direct/Indirect Effects

Alternative 1 – No Action

There would be no direct effects to MIS habitat in Alternative 1. Indirect effects to habitat would occur over time as trees mature and recruit into the stream channels in the project area. Passive restoration by protection of Riparian Reserves would result in long-term recovery to desired future conditions. Alternative 1 is not likely to have any measurable effect on MIS fish habitat. There is potential for lack of road maintenance to lead to increases in fine sediment, but it would still be within the range of natural variability.

Alternatives 2 and 3

Alternatives 2 and 3 would both have the same effects to MIS fish. The table below describes the distances of project activities to MIS and anadromous fish habitat.

Table 38: Distances from Project Activities to Fish Habitat

Project Activity	Distance Upstream from Habitat	Species
Harvest units	1 mile from MIS habitat	cuttroat and rainbow trout
Harvest units	3 miles from anadromous habitat	winter steelhead, spring chinook
Culvert replacements	4 miles from anadromous habitat 1 mile from resident fish habitat	winter steelhead, spring Chinook cuttroat and rainbow trout
Road maintenance	1 mile from anadromous habitat	winter steelhead, spring chinook
Log truck traffic	1 mile from anadromous habitat	winter steelhead, spring chinook
Planned road decommissioning and storage	½ mile from resident MIS habitat 1.5 miles from anadromous habitat	cuttroat and rainbow trout winter steelhead, spring chinook

All of the proposed harvest would occur at least one mile upstream from MIS fish habitat. Therefore, there is no potential for direct effects to any MIS from the thinning.

There is potential for direct and indirect input of sediment into MIS habitat because of road management activities (maintenance, reconstruction, decommissioning, and storage). However based on professional experience there is no potential for effects to anadromous fish habitat because the road management activities are at least 1½ miles upstream from listed fish habitat (LFH). Planned road management activities would likely result in a temporary flush of sediment to resident

fish habitat after the first fall rains. This effect is temporary and minimal. Since planned road management activities reduce the aquatic risk of road failure over the long term, the result would be less effect to MIS habitat than the existing condition. Resident MIS life stages present in the area of exposure from the project include juvenile, adult, and eggs.

There is potential for direct and indirect input of sediment into MIS habitat because of log haul operations on the 2044 road (see Sedimentation and Roads). The haul over the 2044 bridge could result in sediment entering the stream through the drainage holes on the bridge. However, based on professional experience there is no potential for effects from this sediment to reach anadromous fish habitat because the haul is approximately 1 mile upstream from LFH. The sediment from the bridge would enter into resident MIS habitat. This effect is temporary during haul operations and minimal. Resident MIS life stages present in the area of exposure from the project include juvenile, adult, and eggs.

Cumulative Effects

Alternative 1 – No Action

Past timber harvest adjacent to channels and large wood removal from stream channels contributed to the current degraded condition of MIS fish habitat in the project area. The No Action Alternative would allow for some long-term recovery of fish habitat as trees grow and recruit into stream channels.

In the No Action Alternative, the future plan to decommission and store aquatic risk roads would not occur. These projects are designed to limit sediment effects to MIS fish habitat. Without these projects the potential exists for increased sedimentation of MIS fish habitat. At the watershed scale MIS fish habitat would be maintained with implementation of this alternative.

Alternatives 2 and 3

Effects of the proposed action on MIS species or their habitat across the project area, when considered cumulatively in the project area, would be beneficial to MIS habitat. A net decrease to fine sediment levels is expected due to the planned road storage and decommissioning, which would improve habitat conditions for MIS and their habitat. Reduced sediment delivery improves important aquatic elements such as cleaner water, higher quality substrates for spawning and rearing habitat, and less pool infilling. Thinning densely-stocked Riparian Reserve stands, outside of no-harvest buffers, improves vegetative conditions leading to increased large wood recruitment in the long-term and creates more fire-resilient stands along streams.

Fire/Fuels

Introduction

Fire suppression over the past century has resulted in an increased fuel loading throughout forest ecosystems including portions of the Toll Joe Project Area. This increased fuel loading consists of

surface fuels, ladder fuels, and dense overstory canopies. Managing hazardous fuels has become a priority both nationally and locally to reduce the potential for large wildfire effects.

One of the projects purposes is to strategically manage hazardous fuels (ground, ladder and canopy fuels) along a 200-foot wide section on the north side of Highway 20, and in other high risk areas, to reduce the potential for large-scale fires that could adversely affect adjacent private land as well as visual quality along Highway 20, a designated State Scenic Byway.

This section discusses the effects of treating these hazardous fuels to reduce the risk of wildfire.

Summary

Fuel treatments would be conducted following Forest Plan Standards and Guidelines. Hazardous fuels would be reduced along the north side of Highway 20 to meet the desired future condition. The Fire Regime Condition Class 2 (moderately departed) would move closer to the range of natural/historical variability of vegetation characteristics, fuel composition, fire frequency, fire severity, and associated disturbances. Treatments along the highway corridor would aid in creating a more fire-resilient landscape and safer conditions for firefighters and the public and all treatments would reintroduce the disturbance process of fire into the ecosystem.

Affected Environment

Current Condition - Fire exclusion, vegetation growth and succession in the absence of frequent, low to moderate severity wildfire events has resulted in conditions where surface and ladder fuels are more extensive and the lower, middle and upper canopies are denser than they would be without fire (see Figure 27). The Fire Regime Condition Class (FRCC) along the highway corridor is moderately departed from the expected and historic range of variability (see Figure 28) so is more susceptible to the local risk of human ignition. Consequently there is an increased potential for high intensity wildfire activity that would be difficult to suppress. This makes the successful protection of the area extremely risky to firefighters and the public, but also problematic and costly.

Figure 27: Current Fuel Conditions in Stand Adjacent to Highway 20

Because of the traffic on State Highway 20, there is an elevated risk for human-caused fire starts in this area. Records show that between 1970 and 2010 there have been about 45 fire starts in the project area of which seven of those fires were adjacent to Highway 20. In addition, historically there have been two large human-caused fires in this area: a 3,000 acre fire in 1911 and a 600 acre fire in 1936.

Desired Condition - The desired condition is a fire-resilient landscape, especially along the Highway 20 travel corridor, and other high risk areas. The desired fire regime condition class (FRCC) is Class 1, which is within the range of natural/historical variability of vegetation characteristics, fuel composition, fire frequency, fire severity, and associated disturbances.

Additionally the desired condition for areas along the highway corridor would be a place where firefighters can operate safely and effectively, allowing for strategic fire control tactics to be utilized, insuring protection of the adjacent landscape including private landholdings and the State Scenic Byway.

For activity-generated fuels, Forest Plan Standards and Guidelines (S&G) establish levels of allowable woody material following timber harvest. Two specific guidelines related to fire and fuels are Forest Wide (FW) 212 and 252 which state 7-11 tons/acre of 0-3" diameter fuels in stands post-harvest are allowed. These guidelines allow for successful direct attack with ground forces under average high fire danger weather (90th percentile fire weather conditions).

Environmental Effects

Methodology

The following is a list of models and analysis techniques that were used for this report:

- Arcmap/GIS – program to utilize spatial data for fuel models, vegetation, FRCC, alternatives, etc. Data were gathered on the ground or from Willamette NF, FSVeg, LANDFIRE, and NW Oregon FRCC corporate GIS layers.
- BehavePlus 5.0 – program to determine a range of fire behavior characteristics including surface fire and passive or active crown fire to show how desired treatments change or reduce the intensity and severity of wildfire; change or reduce the effects from wildfire.
- Fire Behavior Prediction System Fuels Models (FBPS) - photo and data reference for quantifying fuel types.
- Fire Regime Condition Class (FRCC) - Northwest Oregon GIS coverage (from LANDFIRE) that determines stand characteristics and historical/current fire regimes. The current vegetation is from a combination of GIS vegetation queries, aerial photos, and local knowledge.
- FOFEM – program used to determine the range of effects, including effects on soil, tree mortality, and smoke emissions.
- LANDFIRE - Nationally consistent data of fuel models, FRCC, etc. that can be altered to fit a particular area
- Photo Series for Natural Forest Residue for PNW – used to identify current fuel loading in Toll Joe Project Area (Maxwell, et.al.1980)
- Near-Term Fire Behavior (NFTB) – two- dimensional fire growth model that uses spatial information on topography, fuels, weather and wind to model fire growth.
- The Wildland Fire Decision Support System (WFDSS) was used to model near-term fire behavior of a simulated fire start adjacent to Highway 20 under late-summer conditions

(90th percentile fire weather conditions) when most fires occur in this area. The simulation was done with and without ground and ladder fuel treatments.

Direct/Indirect Effects

Alternative 1 – No Action

No fuels would be generated from harvest activity in this alternative. Fire suppression policies would continue to dictate fire exclusion from the project area. A lack of disturbance would mean that stands would continue growing into an overstocked condition. Slow growing and weakened trees would contribute to the fuel build-up on the forest floor. Stands that are currently within the range of natural/historical variability of vegetation characteristics, fuel composition, fire frequency, fire severity, and associated disturbances (FRCC 1) would begin to depart from that natural fire regime. The landscape would transition into one reflecting vegetation, fuels and disturbances uncharacteristic of the natural regime (FRCC 2 and 3), thus reducing the natural forest resiliency to disturbance.

Over time, the increasing fuel loads and dense canopies could be associated with higher fire intensity, severity and rates of spread. Fire occurrence on the landscape would continue but in the form of uncontrolled wildfires. The risk of large, stand-replacing fires would increase and pose a future danger to the Late Successional Reserve, highway corridor, historic wagon road, and adjacent private lands.

Fuel loading would continue to increase and vegetation would continue through successional pathways as stands continue to grow. Increased fuel loadings on the ground, combined with ladder fuels and closed-canopy stands, escalate the potential for wildfire behavior. Private property, and the firefighters that protect property, would be at risk from increased wildfire intensity. In the absence of prescribed fire and treatments, ladder fuels and canopy cover would be high, and lead to high-intensity wildfires.

Alternative 1 would not meet the desired future condition, would not reduce firefighter risk, and would lead to higher suppression and environmental cost of high severity fires.

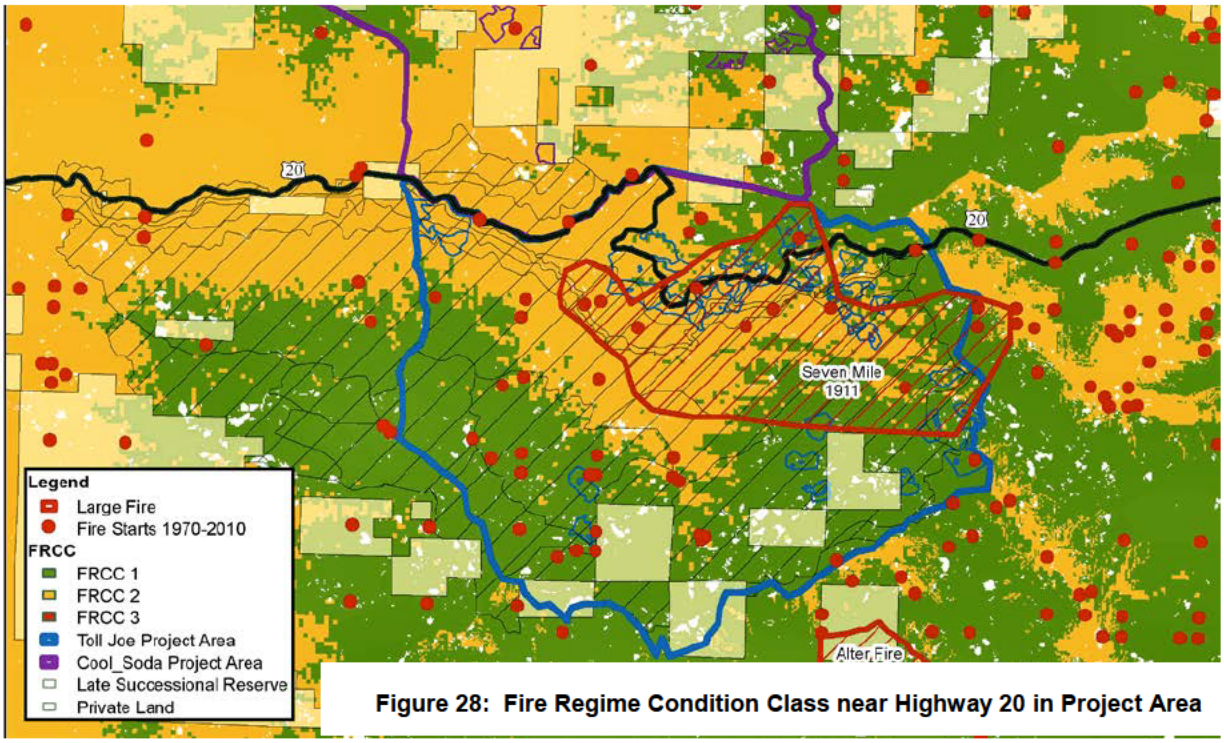

Figure 28: Fire Regime Condition Class near Highway 20 in Project Area

Alternatives 2 and 3

Hazardous Fuel Reduction on the north side of Highway 20

Figure 29 below, shows the results of modeling a fire start along Highway 20, using the Wildland Fire Decision Support System, under two different fuel treatment scenarios. The fire start was simulated during hot, dry, late summer conditions with and without ground and ladder fuel treatments. The map below illustrates the differences in fire spread without ground and ladder fuel treatments in purple and with ground and ladder fuel treatments in pink. Without ground and ladder fuel treatments, as would occur under No Action, fire spread is about 33% greater than with ground and ladder fuel treatments (Alternatives 2 and 3).

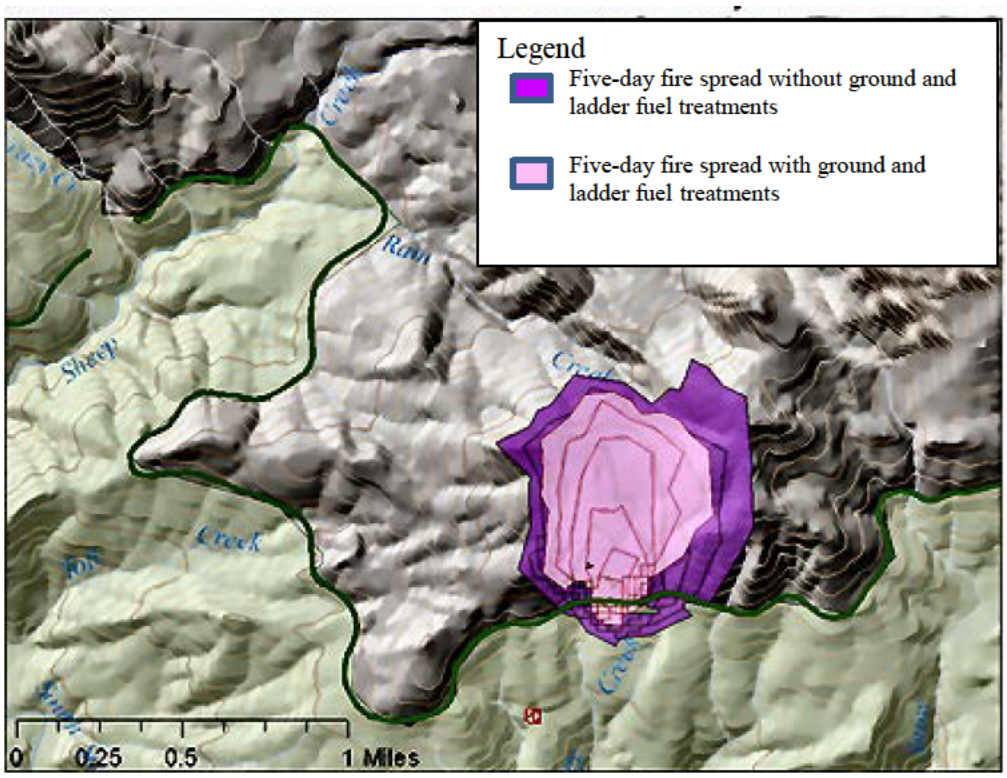

Figure 29: Modeled Fire Spread Along Hwy. 20 with and without Ground and Ladder Fuel Treatments

Alternative 2 – Proposed Action

Hazardous Fuel Reduction on the north side of Highway 20

In addition to using ground and ladder fuel treatments discussed above, Alternative 2 also would treat canopy fuels by thinning about 44 acres in selected stands within 200 feet of the north side of Highway 20 in Units 54, 55, 60, 66, 68, 70 and 74 (green portion of units shown on map below). Ground and ladder fuels would be treated in the red stripped areas on the north side of the highway (95 acres).

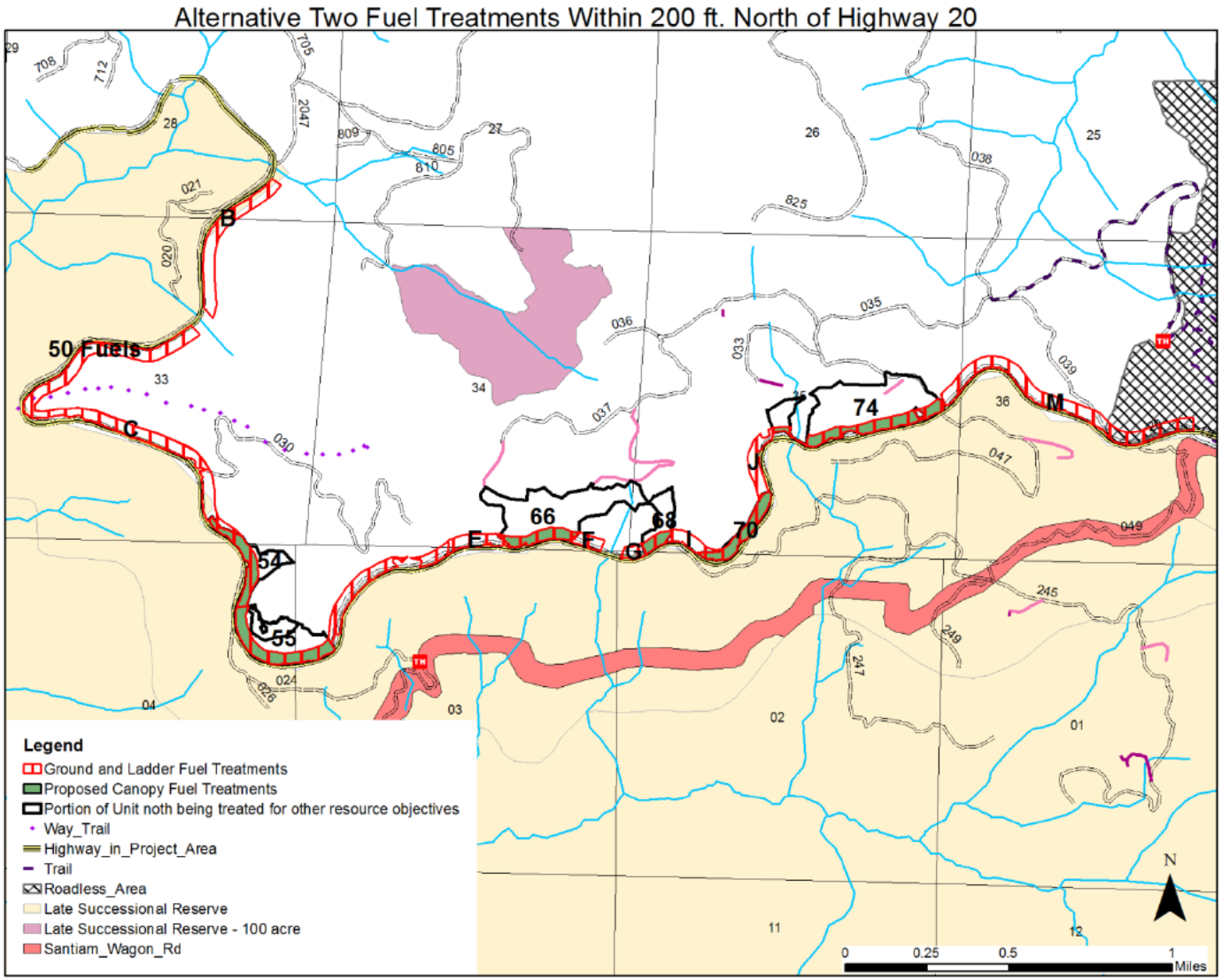

Figure 30: Fuel treatments adjacent to Highway 20 - Alternative 2

According to Agee et al. (2000), heavy thinning can be used to reduce canopy fuels in order to create a structure that is resistant to crown fire spread. Stands treated in this way have been reported to disrupt rolling crown fires (Agee, 1996). Empirical data shows that crown fires were not sustained in stands thinned to crown bulk densities (CBD) below approximately 0.10 kg/m^3. The chart below represents how proposed silvicultural treatments would alter crown structure for units being thinned within 200 feet on the north side of Highway 20. Canopy bulk density was calculated for several units proposed for treatment, outside of the LSR. The blue lines on the graph below shows that the current conditions are well above the target of .10 kg/m^3. Through thinning, most stands are near the target of .10 kg/m.^{3}

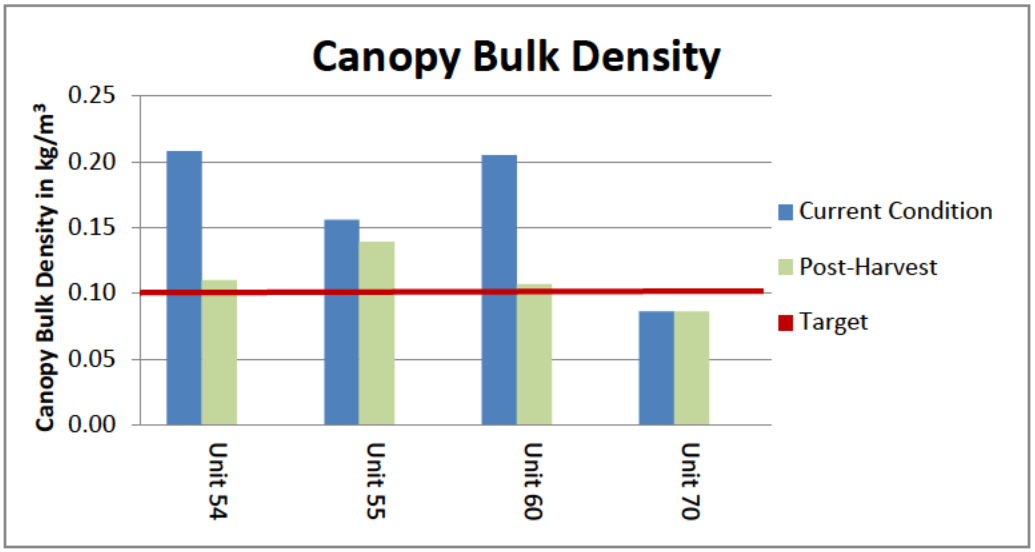

Figure 31: Comparison of Canopy Bulk Density with and without Canopy Fuel Treatments

No one treatment can be prescribed for all situations. A combination of treatments helps to increase treatment effectiveness. Ground fuel treatments help to reduce flame lengths, making fire control easier. Ladder fuels treatments mean that flame lengths would have to be longer in order to cause torching in tree crowns. Finally, reducing canopy bulk density by thinning reduces the likelihood of sustaining crown fires that get into tree canopies. Figure 29 illustrates reduction in fire spread from ground and ladder fuel treatments and Figure 31 illustrates how thinning reduces canopy bulk densities to levels that minimize sustained crown fires.

Stands in the treatment areas would be fairly open and dominated by larger, more fire tolerant trees. Treating surface and ladder fuels would make it less likely for a crown fire ignition (under 90th percentile fire weather conditions) after thinning. Thinned stands, where ladder fuels are reduced through pruning, would have crown fuels that are open and discontinuous both horizontally and vertically resulting in a lower probability of a sustained crown fire.

Under 90th percentile fire weather conditions, treated stands north of the highway corridor would be expected to have fire behavior with flame lengths that are less than four feet high. They would also have reduced hazards, such as snags, to be managed by firefighters in locations likely to be used

for control in prescribed fire and fire suppression. These treated stands would be more consistent with safe-practice guidelines and have production rates for fireline construction double those of pre-treatment levels. In the project treatment area the landscape would shift from Fire Regime Condition Class 2, toward Fire Regime Condition Class 1, improving the overall resiliency of the forest to large scale disturbance.

From the decrease in surface fuel loading, reduction in ladder fuels, and variability in vegetation structure following treatments, wildfire behavior would decrease. Fire spreading on the ground would not easily transfer into tree canopies, given the more open canopy. Treatments would reduce canopy continuity and ladder fuels (vertical and horizontal continuity), decreasing the potential for crown fire initiation and spread. Upon project completion, firefighter and public safety would improve and would offer an environment where quick fire suppression operations could be made reducing the size of wildfires.

Altering stand structure can make forests more resilient to fires but under extreme wildfire conditions these preventive measures would not guarantee a fireproof condition.

Activity-generated Fuel Treatments

Sixty-eight acres of post-harvest underburning in Alternative 2, plus hand piling, grapple piling and yarding tops to the landing and burning slash piles would reduce activity-generated fuels to meet Forest Plan standards and guidelines.

Alternative 3 Action

Hazardous Fuel Reduction on the north side of Highway 20

The effects for Alternative 3 are similar to Alternative 2 except in the number of acres being treated. Only 20 acres would be thinned to treat canopy fuels north of Highway 20 because harvest is restricted to stands less than 80 years old in this alternative. These are 30% of the acres treated in Alternative 2. Ground and ladder fuels would be treated on about 119 acres in Alternative 3. This is about 44 more acres than in Alternative 2.

Activity-generated Fuel Treatments

Twenty-three acres of post-harvest underburning, plus hand piling, grapple piling and yarding tops to the landing and burning slash piles would reduce activity-generated fuels to meet Forest Plan standards and guidelines.

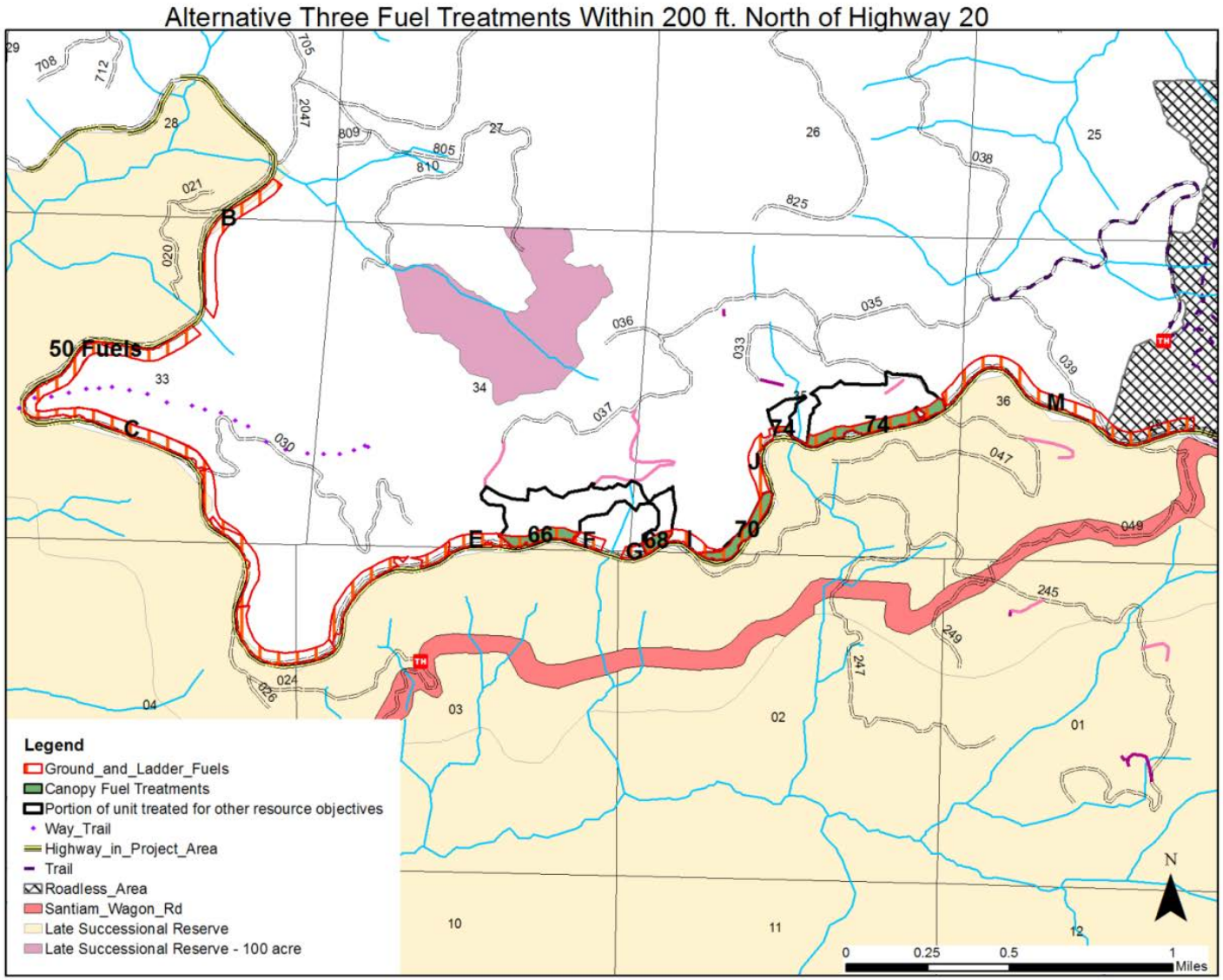

Figure 33: Fuel Treatments on North Side of Highway 20 in Alternative

Cumulative Effects

The spatial boundary for analyzing the cumulative effects to fire is the Toll Joe Project Area. The area analyzed displays the direct and indirect effects of fire on the treated units which translate to the variation of fuels profiles over the larger disturbance landscape. Cumulative effects are based on management activities that would or have occurred in the Toll Joe Project Area.

Alternatives 2 and 3

Proposed fuel treatments, in concert with harvest activities, would help diversify the fuel profile across the landscape. Future wildfire suppression actions would continue; however the proposed treatments aid in returning the natural disturbance to the landscape. No other foreseeable future fuels management activities are planned within the Toll Joe Project Area that would contribute incrementally to the cumulative effects from past or currently proposed activities. No adverse effects on the fuel profile or on fire behavior would result from the proposed fuel treatments.

Air Quality

Introduction

The State of Oregon has delegated authority for attainment standards set by the 1977 and 1990 Clean Air Acts and associated amendments. To regulate these standards, the state developed the Oregon Smoke Management Plan and State Implementation Plan. These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission control (LRMP, 1990).

The Smoke Management Plan established Designated Areas and Class 1 Airsheds as priority areas regulated to protect air quality. Mount Jefferson and Mount Washington are the closest Class 1 Airsheds to the Toll Joe Project Area (12-15 miles respectively). Class 1 Airsheds must be protected from visibility impairment July 1- Sept. 15.

Affected Environment

Current Condition - Air quality within the project area is similar to both the State of Oregon and Sweet Home, Oregon, which is located about 35 miles west of the project area. According to the U.S. Environmental Protection Agency data, the average air quality index (AQI) from 1999-2009 is considered good air quality with little potential to affect public health. AQI is a combination of five major air pollutants regulated by the Clean Air Act: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide and nitrogen dioxide.

Existing particulate matter 5 micrometers or less (PM 2.5), an element of AQI and of concern during burning, ranges from 6.5 to about 9 and is very similar between the State of Oregon and Sweet Home. Existing particulate matter 10 micrometers or less (PM 10) ranges from about 11 to 20.8 and Sweet Home is similar to the State averages but is about a 1 to 3 points lower.

Desired Condition - The overall desire is to maximize opportunities for essential forest land burning to achieve management objectives while also minimizing smoke emissions from accumulating in designated areas. This is being done to protect air quality and public health and to conform to State and Federal air quality and visibility requirements.

Environmental Effects

Direct, Indirect and Cumulative Effects

Alternative 1- No Action

If no management actions take place in the Toll Joe Project Area no air quality effects would occur. However the risk of wildfire would still exist. In the event of a wildfire, air quality effects from wildfire smoke emissions are considerably higher than with prescribed fire (see Table 39). Smoke emissions are not short term and can often last for many weeks to months. Emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of particulate matter (PM) 2.5 – 10 microns in size, posing a health risk to the public traveling the highway corridor, recreationists and firefighters.

Table 39: Summary of Particulate Matter Emissions in Tons/Acre

	No Action-Wildfire	Alternative 2	Alternative 3
PM 2.5 total	3,080	282	246
PM 10 total	3,740	331	289

Table 39 summarizes particulate matter predicted for fuels treatment activities. It is important to note that with prescribed fire operations the emissions do not occur all at one time. Prescribe fire operations usually occur one unit at a time and are implemented in the fall or spring when fuel moistures are higher and weather is moderate to wet. Acreage used for the above wildfire calculation was 954 acres, the number of harvest and treated acres in Alternative 2.

Effects Common to Alternatives 2 and 3

Prescribed fire activity in the Toll Joe Project Area would comply with Oregon Smoke Management Plan regulations. Smoke emissions would be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. Regulations enforce specific days which are suitable to burn in relation to other land owners burning or weather forecasts. Prescribed fire would be avoided between July 1 and September 15 in order to protect visibility standards for Class 1 Airsheds. Recreationists and the public using Highway 20 near the Toll Joe Project Area may be temporarily impacted by smoke from prescribed fire underburns or pile burning. In the Oregon Smoke Management Plan, non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon SMP 1995). Mitigation measures, such as signing along the

road or near the treatment area, would be taken in order to notify forest users of nuisance smoke and notifications to the public would be made prior to burning.

Alternative 2 and 3

Cumulative Effects

The area defined for cumulative effects to air quality is the Toll Joe Project Area where the treatments occur, as well as the larger landscape where smoke emissions can travel. At the larger landscape, the cumulative effects analysis area includes the Designated Areas and Class 1 Airsheds.

No adverse effects to air quality would result from the proposed fuel treatments. Neither Designated Areas nor Class 1 Airsheds would be affected from the fuel treatments. Smoke emissions would be short duration and mitigation measures would reduce the quantity of emissions during prescribed burns. Past management activities do not cumulatively add to air quality effects from proposed treatments. No other foreseeable management activities that would affect air quality are schedule to occur in the Toll Joe Project Area.

Recreation – Scenic and Recreation Resources

Summary

The Toll Joe project is expected to create minor modifications in the texture and color of treated stands as seen from some viewpoints, Highway 20 and other forest roads. Treated stands would retain sufficient stand densities to make vegetation changes difficult to pick out within the characteristic landscape from viewpoints like Iron Mountain. Vegetation changes that can be seen from viewpoints would not dominate the surrounding landscape features and would eventually blend in as a result of stand growth.

Harvest activities could create short-term delays to forest visitors on roads used for log haul. Minor forest visitor displacement could occur as some visitors do not like to travel roads used for haul. There are no major recreation sites adjacent to or in close proximity to the proposed harvest units so the probability of displacing recreationists would be low.

Forest roads that area open to non-highway legal vehicles would be closed to this activity during harvest and haul, creating a direct impact to these users.

Such interruptions to public access would be short-term and have been designed to avoid the busiest periods of use in the project area. Implementation of design elements outlined in Table 14 would minimize project effects on recreation facilities and visitors during and after harvest operations.

Affected Environment

Current Condition Scenic Resources - The forest condition, color and texture vary over the landscape in this area due to past fires, rock outcroppings, mixed ownership and past management activities. Views across the landscape are limited from Highway 20 and views consist mostly of

various age classes of trees. Views from highpoints are dramatic and encompass a wide array of colors and patterns. Rocky outcroppings and clearcuts on private timber land break up the views so the view is not of a continuous forest.

The project area contains five scenic management allocations and several developed recreation sites. For this project, the scenic management areas are connected to viewsheds for Highway 20 and from the top of Iron Mountain and Jumpoff Joe Mountain. The sensitivity of these scenic viewsheds is notable because Highway 20 is a Scenic Byway (*Over the Rivers and Through the Woods*) and the Iron Mountain trail is popular with visitors from around the Willamette Valley and Central Oregon.

Travelers along Highway 20 have limited opportunities to see beyond foreground views due to dense vegetation along the highway and steep topography. The topography of the area and the location of the highway limit the views across the landscape. Views from the highway are mostly of forested stands of various age classes and densities. Most past management activities have left a buffer along the highway making these areas mostly unnoticeable to the majority of travelers. The view from the top of Iron Mountain offers a good view in all directions and, due to topography, the view from Jumpoff Joe is mainly north and west.

Desired Condition Scenic Resources - Direction for the desired scenic condition for the area is described in the Willamette Forest Plan and varies by management allocation. Proposed harvest units fall within five different management allocations in the project area. These allocations vary greatly in the desired condition and the amount of activity that can dominate the landscape. This range is briefly described in Table 40 below and shown in the map that follows (Figure 34).

Since Highway 20 is a Scenic Byway, another desired condition is to maintain visual quality along the highway by using management practices that would limit fire potential, offer a mix of forest types, and some open vistas.

Table 40: Management Allocation Comparison

Management Allocation	Proposed Action Harvest Units Acres	Landscape condition	Desired Condition
Maximum Modification (14a)	66	Heavily altered	- Activities that alter vegetation and dominate the landscape area allowed - Visual characteristics varied whether being viewed background, foreground or middleground
Modification Middleground (11a)	305	Moderately altered	- Managed to retain natural features - Activities done at a scale compatible with natural surroundings - Management activities may visually dominate landscape, but should borrow from natural form, line, color and texture - Unnatural features – roads, slash, structure – should remain visually subordinate
Partial Retention Middleground (11c)	114	Slightly altered	- Managed to maintain a near natural setting - Forest management activities are expected to be noticeable in the middle and background zones as viewed from major travel routes and recreation sites - Treatments should be visually subordinate to characteristic landscape
Retention Foreground (11f)	382	Appears unaltered and intact	- Travel corridors would maintain a natural or near natural setting - Activities should be conducted so they are subordinate to character of the landscape - Activities should repeat form, line, color and texture of elements found in the landscape
Preservation	87	Appears unaltered and intact	- This Visual Quality Objective (VQO) allows for ecological changes only - Activities, except for very low visual-impact recreation facilities should be prohibited

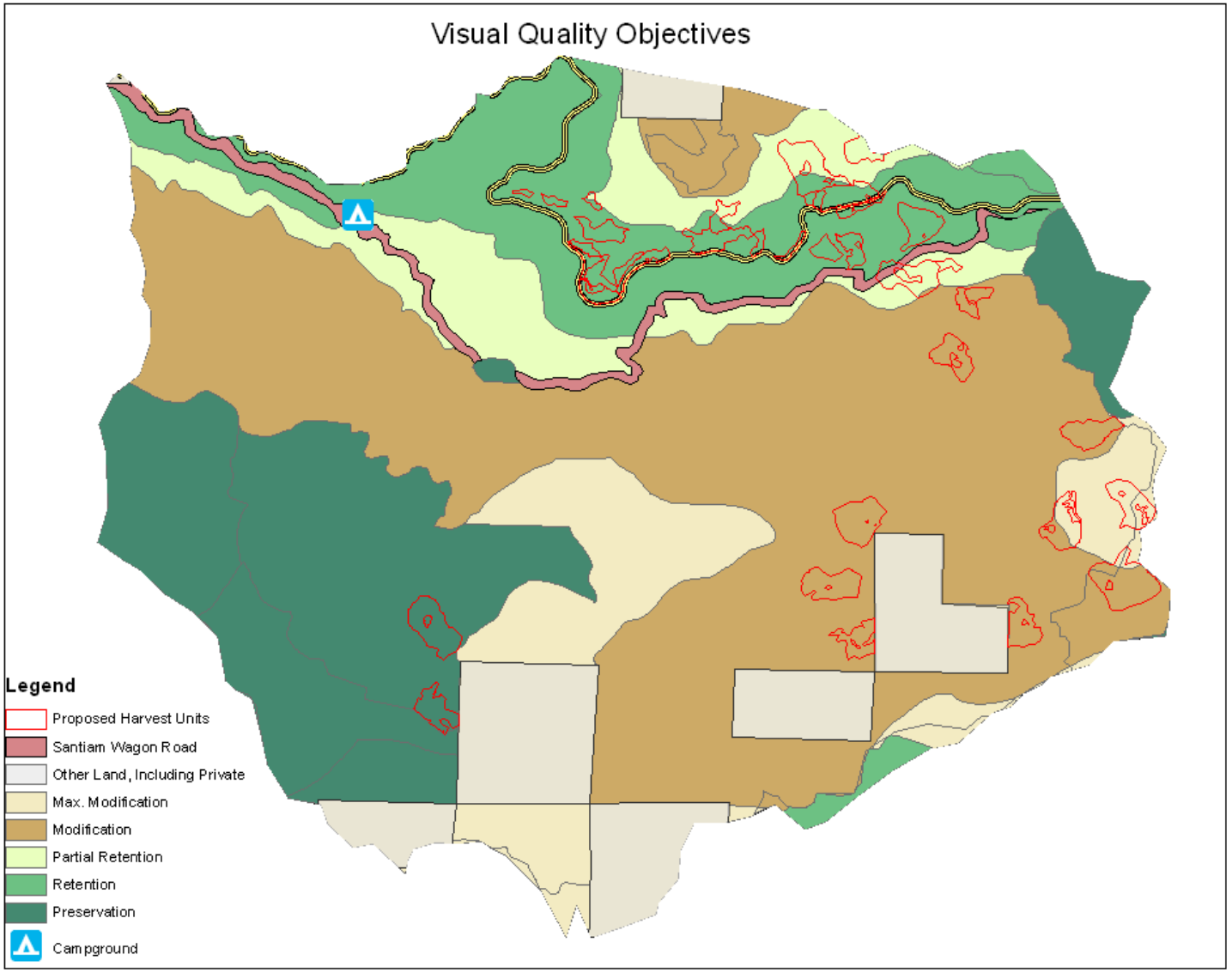

Figure 34: Visual Quality Objectives

Environmental Effects

Methodology

The analysis methods used to evaluate the effects of the alternatives on scenery resources were based on a review of the Forest Plan for consistency with applicable standards and guidelines, and Scenery Management Systems handbook direction. Field reviews of proposed harvest units from critical viewpoints, in conjunction with GIS geo-spatial mapping, and a digital perspective analysis using Google Earth™ were used to determine design elements and to evaluate project effects on visual quality. The current visual condition was evaluated in the South Santiam Watershed Assessments and with GIS information on recent harvest units. Silvicultural prescriptions were developed to meet visual quality objectives. Current stand condition, treatment alternatives, and stand and fuel modeling results were provided by the silviculturist and fuels planner to help evaluate potential effects on scenery.

Incomplete and Unavailable Information

Information about the public's perception of visual changes to the forest is unavailable and somewhat difficult to predict.

Direct/Indirect Effects

Alternative 1 – No Action

There are no direct effects to scenic quality or recreation with the No Action alternative. Vegetation densities or characteristics would not be modified under Alternative 1. Unaltered vegetation densities could add to the risk of a wildfire being more intense and able to spread easier (see example in fire effects section). If a wildfire were to occur in the Toll Joe Project Area the scenic quality of the area would be changed; the amount of change would depend on the severity of the fire. Scenic landscape values and attributes would be lost in the case of such an event.

Both action alternatives

Scenic resources in foreground views usually recover quickly as vegetation grows and slash decomposes. Longer term effects to scenic resources (4-10 years) could be evident from certain vistas, but are not expected to dominate the landscape. Previous forest management activities are prevalent from the viewpoints on both Forest Service and private land (see Figure 35). Due to long-term rotational cycles of harvest on national forest system lands, effects of activities on scenic values are expected to be minimal over the course of time.

Scenic resources could be impacted in the short term (1-3 years) by the evidence of slash, stumps, smoke and dust; the latter two are usually limited to the operational time frame.

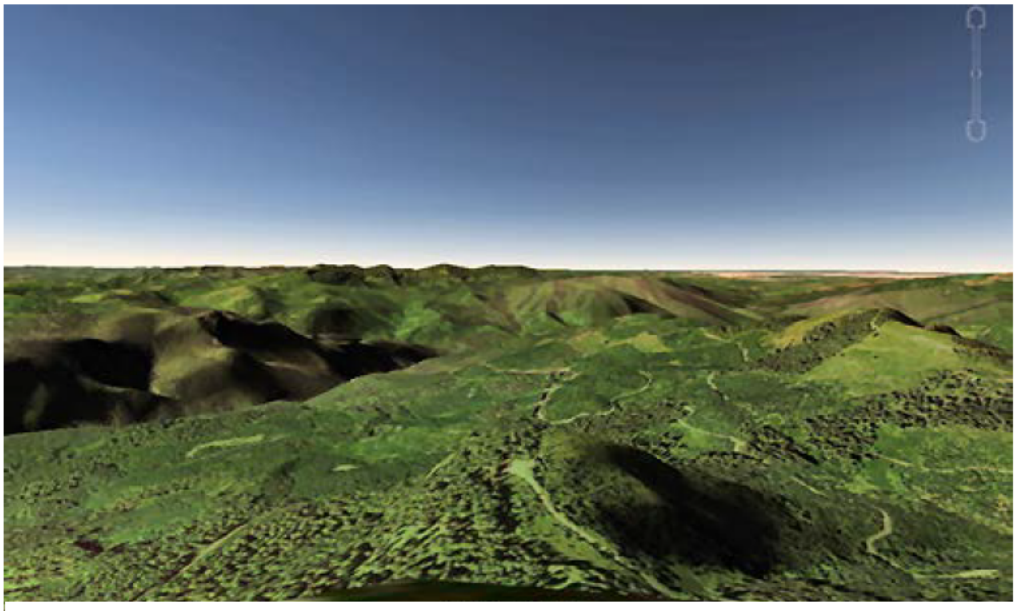

Figure 35: View from Iron Mountain, showing roads and older clearcuts.

Alternative 2 – Proposed Action

Alternative 2 would commercially treat approximately 954 acres through various techniques and to different degrees along the various scenic allocations in the project area. Various techniques include traditional thinning using various marking methods and patch cuts interspersed in some units. In addition, hazardous fuel reduction work would occur on approximately 95 acres additional acres, mostly north of Highway 20.

The majority of the thinned acres would retain 40 to 60% canopy cover which is a sufficient density to retain Visual Quality Objectives (VQO's) for all areas. Proposed harvest operations would produce openings in the forest through patch cuts with reserve trees, gap creation, and the construction of temporary roads and landings.

The proposed 5-acre patch cuts would retain green tree areas that would limit scenic effects. About 17% of proposed gap creation occurs within the retention VQO area. Using prescribed design elements such as flush cutting stumps, cleaning slash and not creating large slash piles would limit direct effects to scenic quality (see Design Elements, Table14) so these gaps would fit VQO's for retention. All of the openings created through harvest activities are expected to blend into the landscape and be subordinate to the viewer. The percentages harvested in all scenic allocations would be within Forest Plan standards and guidelines.

Ridgetop roads and landings have the most potential to impact scenic quality. Approximately 1.3 miles of temporary spur road construction is planned to access the harvest units. Since the road sections are short (most less than 500 feet in length) they are not expected to disrupt the visual landscape long term. Temporary roads are to be scarified and closed to traffic allowing natural process to recover the area. A short linear feature may be visible from view points for a short time

(1-4 years). There are numerous existing roads already visible within the viewshed so these lines would not be out of place with current conditions (see Figure 35). Ground effects from roads would be rehabilitated after harvest activities have been completed to limit long-term effects. The proposed landings for Alternative 2 are not expected to create sizeable openings and would remain characteristic to the natural landscape. Some landings may be adjacent to Highway 20 which could open views to the surrounding landscape.

Direct effects of harvest activities would be short-term (less than 2 years) changes to the forest visual character (slash, stumps, piles). In addition, slightly longer direct effects to the visual character (3-10 years) may occur in some viewsheds as gaps, patch cuts with reserve trees and road openings take longer to fill in. These areas may be viewed by visitors from roads, trails and scenic vistas. Indirect effects to scenic areas could be increased wind damage to stands after harvest.

Alternative 3

Alternative 3 would commercially thin approximately 862 acres through various techniques and to different degrees within scenic allocations in the project area. In addition, hazardous fuel reduction work would occur on an additional 119 acres, north of Highway 20. The alternative does not include patch cuts with reserve trees and it does not harvest stands > 80 years of age, so there are 92 fewer harvest acres than Alternative 2. There is also about $^{1}/_{3}$ mile less temporary road construction planned. With less harvest, no patch cuts, and fewer roads, the potential visual effects from this alternative would be less than those described above for Alternative 2.

Cumulative Effects

Alternative 1 – No Action

The No Action alternative would not contribute to cumulative effects on scenic resources.

Both Action Alternatives

Forest Plan direction regulates actions in scenic allocations by decade and this is the first harvest in this area during this decade. Past harvest in this area occurred between 11-80 years ago, as outlined in Figure 19. The past harvest is considered visually recovered under Forest Plan guidelines. There are no reasonably foreseeable actions proposed in the area that would contribute to visual effects. Therefore, proposed harvest, when combined with past actions, would not degrade any of the scenic allocations out of compliance with the Forest Plan, so there would be no cumulative effects.

Recreation Resources

Current Condition - Recreation uses in the project area consist mainly of hunting, driving, mushroom gathering, hiking, and other activities. The historic Santiam Wagon Road (now a non-motorized trail) and trails to Iron Mountain are located in this area.

The ***desired condition*** for recreation resources is described in the Willamette Forest Plan and varies by management allocation. Forest Plan direction uses the Recreation Opportunity Spectrum (ROS) to describe the setting and use for different levels of recreation. Two different ROS classes are in the project area: Roaded Modified and Roaded Natural. Table 41 describes the desired condition for each class and associated acres in the project area.

Table 41: Desired Condition by Recreation Opportunity Spectrum (ROS)

ROS Class	Desired Condition for Setting	Desired Condition for Activities
Roaded Modified	- Opportunity to get away from others, but with easy access - Substantially modified environment - Access and travel is conventional motorized vehicle - Shape and blend vegetation alterations, foreground should be natural appearing	- Access for people with disabilities is a moderate challenge - Rustic facilities provide some comfort and site protection - Moderate site modification can occur
Roaded Natural	- 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	- Access for people with disabilities is difficult - No on site facilities except occasional signing - Site modification by users

Incomplete and Unavailable Information

Limited data are available for many recreation activities such as hunting and Off Highway Vehicle (OHV) riding. Observations were made in the field when conducting analyses; however this was limited.

Direct and Indirect Effects

Alternative 1 – No Action

There are no direct or indirect effects to No Action for recreation resources.

Both action alternatives

Direct effects on recreation users would consist of potential road delays, truck traffic, and closure of dispersed sites, reduction in access to OHV users and other recreationists by decommissioning 1.3 miles of road and storing 6.3 miles of road, and noise and dust from operations. Most of the roads open to OHV use in this area are short dead end roads that get little use; therefore direct effects to this user group are expected to be limited and in short duration, usually (2-5 months) during the operational period.

This alternative also proposes to perform road maintenance on 33 miles of forest roads and an additional reconstruction on 5.5 miles of roads. If these activities occur it could make travel safer for forest visitors and increase access to forest areas.

Alternative 2 – Proposed Action

Alternative 2 would commercially treat approximately 954 acres through various techniques and to different degrees in the two Recreation Opportunity Spectrum (ROS) classes along Highway 20 and in the project area. In addition hazardous fuel reduction work would occur on an additional 95 acres, mostly north of Highway 20.

Direct effects from noise, dust, smoke, and traffic associated with harvest operations and slash treatments could impact users of developed sites, trails and the general forest. As units are not immediately adjacent to recreation sites, direct effects are expected to be minimal to users at those sites.

A few dispersed recreation sites were located along roads in the project area but most showed little use. Some users of these dispersed sites would be directly impacted by harvest operations and truck traffic associated with project implementation. Effects are expected to be of short duration (1-3 months) and would affect only a few users. Adjacent areas are available for users who want to avoid the area.

There are approximately 3 miles of winter ski/snowmobile trails associated with haul routes in the project area. If snow plowing is allowed on haul routes, direct effects to recreationists would occur, as they would not be able to use these ski/snowmobile trails. However, use is limited along these trails since they are not near a sno-park.

Possible direct effects to users could come through road closures or delays; these are expected to be short in duration (20 minute delays and less than a week closure). Harvest operations could have indirect short-term effects to visitors to Deer Creek and Iron Mountain trailheads and Sevenmile Horse Camp as visitors may not use these sites when they observe logging or hauling nearby. Typically harvest operations and haul happen in the fall and early winter. If this continues, effects would be mostly to hunters and general forest users. This area is popular during the general rifle seasons for deer and elk.

Alternative 3

Effects would be similar to Alternative 2, except to a slightly lesser degree due since about 92 fewer acres would be harvested.

Cumulative Effects

Alternatives 2 and 3

The proposed treatments when combined with past actions (see Figure 19) would be within management direction for the ROS classes as designated by the Forest Plan. There are no reasonably foreseeable actions in this project area. Road work on Highway 20 usually occurs in the area in the summer and fall and could be occurring at the same time, adding delays to highway users. Harvest schedules from private land are not available. However if this were to occur at the same time it would add noise, dust and traffic to the area.

Effects of Alternative 3 would be similar to Alternative 2, except to a slightly lesser degree due to reduction in harvest of about 92 acres.

Recreation - Inventoried Roadless Areas, Wild and Scenic Rivers, Wilderness and Potential Wilderness Areas

Introduction

Inventoried Roadless Areas - During public involvement for this project, and in past similar projects, a wide range of terms have been used by respondents, the courts, and the Forest Service when referring to these topics such as roadless, unroaded, uninventoried roadless, and undeveloped areas. The term and definition, as stated below, is used in this analysis.

Inventoried Roadless Areas (IRA) are areas 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.

Wild and Scenic Rivers - The headwaters of Sevenmile Creek from the NE ¼ of Sec. 13, T.14 S., R.5 E. downstream to where the stream enters private land in Sec. 9, T.14 S., R.5 E. and the South Santiam River from the confluence with Latiwi and Sevenmile Creeks where it enters Forest Service land in Sec. 5, T.14 S., R.5 E., downstream to the western forest boundary have been determined to be eligible for inclusion into the National Wild and Scenic River System. Until suitability is determined, the area within ¼ mile either side of these rivers is to be managed to meet Wild and Scenic River (Recreation) Standards and Guidelines as outlined in Management Area 6c in the Forest Plan (Figure 36).

The Outstanding Remarkable Values (ORV's) protected for these rivers include: scenery, fish, wildlife and history. Both waterways are adjacent to old growth groves, provide habitat for fish and wildlife, and are in proximity to the historic Santiam Wagon Road.

Wilderness Areas - A wilderness area is designated by Congressional action. Wilderness is undeveloped Federal land retaining primeval character and influence without permanent improvements or human habitation (Willamette Forest Plan, page III-133). There is no wilderness in the project area but the Menagerie Wilderness is adjacent to the northwest portion of the project area.

Potential Wilderness Areas - Forest Service Handbook 1909.12 directs the identification of Potential Wilderness Areas (PWA) during project level analysis and provides guidance on what constitutes a PWA. The inventory of PWAs is completed to identify lands that meet the criteria for

being evaluated for wilderness suitability and possible recommendation to Congress for wilderness study or designation. Evaluation would occur during Forest Plan development or revisions. The following criteria were used to identify PWAs (FSH 1909.12 Chapter 71).

- The area contains > 5,000 acres FSH 1901.12 Chapter 71.1(1)
- The area contains no forest roads or permanently authorized roads (non-forest roads on private lands were also considered in the analysis). FSH 1909.12 Chapter 71.1(3)
- The area is adjacent to Wilderness or IRA. FSH 1909.12 Chapter 71.1(2)(c)
- The area contains no evident results of past timber harvest (where stumps, skid trails or roads are substantially unrecognizable). FSH 1901.12 Chapter 71.11 (9)
- The area contains at least 70% ownership, except if adjacent to Wilderness or IRA. FSH 1909.12 Chapter 71.11(6)

Current Condition - The map that follows (Figure 36) illustrates the location of Inventoried Roadless Areas, Wild and Scenic Eligible River Corridors, and Wilderness within and adjacent to the project area. It also shows past and proposed harvest units.

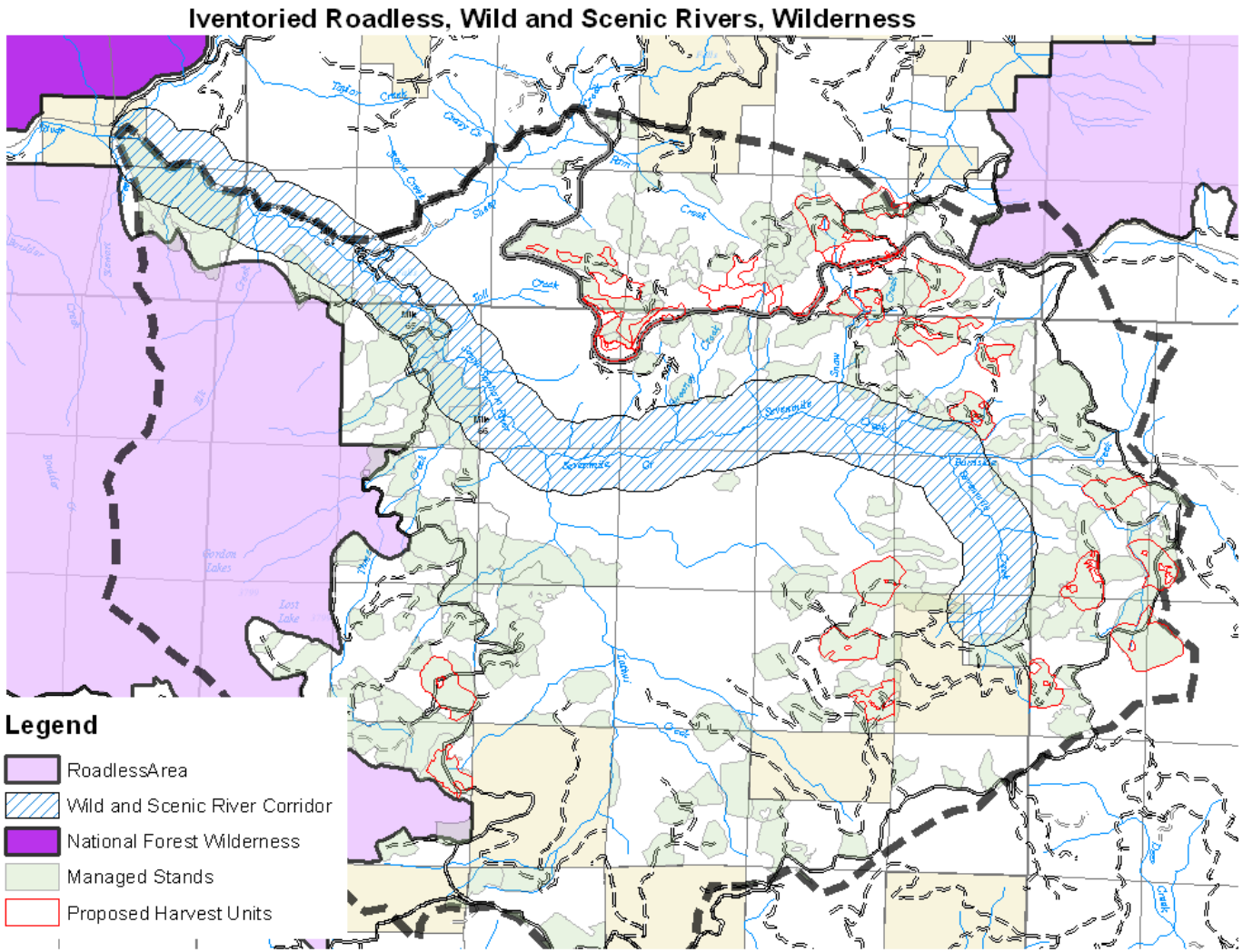

Figure 36: Inventoried Roadless, Wild and Scenic River Corridor and Wilderness

Environmental Effects

Direct/Indirect and Cumulative Effects

All Alternatives

The Inventoried Roadless Areas (IRAs) in the project area are protected and no operations would occur in those areas.

Wild and Scenic eligible rivers would not be affected by project activities. No activities would occur within ¼ mile of either side of eligible rivers, therefore would not degrade any of the Outstandingly Remarkable Values for those rivers. In addition there would be no modification of the free-flowing character of the river, water quality, or the river's classification through project activities.

There are no wilderness areas in the project area.

No areas within the Toll Joe project meet the criteria for Potential Wilderness areas.

There are no direct, indirect or cumulative effects to Inventoried Roadless Areas, Wild and Scenic Eligible River Corridors, Wildernesses or Potential Wildernesses.

Heritage

Introduction

The following section presents analysis of the effects of proposed treatment activities on heritage cultural resources. Heritage resources are fragile and irreplaceable resources that chronicle the history of people utilizing their environment. They may include archaeological sites, above ground structures, trails, and associated features.

Summary

The Cultural Resources Inventory and field survey for the Toll Joe Project Area did not locate any new archaeological sites. Previous surveys in the project area, associated with salvage sale preparation, located 12 lithic scatter sites within the Area of Potential Effect (APE) which are considered 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.

All of these sites have been protected by redesigning unit boundaries, and/or restricting ancillary activities to protect the sites from project activities so there would be no direct, indirect or cumulative effects to heritage resources.

Affected Environment

Current Condition - The prehistory and history of the Sevenmile Creek, Latiwi Creek, and Snow Creek subbasins of the (upper) South Santiam watershed have previously been summarized in the Cultural Resource Overview of the Willamette National Forest, Western Oregon (Minor, 1987) and the South Santiam Watershed Analysis (August 1996). This documentation is of sufficient

detail to serve as the basic reference of ethnographic and historic background for this report. These documents are incorporated by reference and available for review at the Sweet Home Ranger District office.

Ethnographic evidence suggests that highly mobile groups indigenous to the western Cascade Mountains 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. Extensive trail networks were important for traversing the Cascade Mountains, linking the Molala Indian bands with each other, surrounding tribes, and important resource procurement and trade centers. A common activity at many of the sites is the manufacture and maintenance of lithic tools and biface reduction. The site distribution pattern within the Toll Joe Project Area suggests that past Indian groups were traveling and camping along the ridgelines and along riverine terraces to access high elevation meadows, huckleberry fields, obsidian sources, trading locales, and big game.

The 1931 Santiam National Forest map and the 1947 Willamette National Forest map reveal the old Santiam Wagon Road traversing east/west through the project area, and a segment of the Sheep Ridge Way trail running parallel to Highway 20, through Unit 50 (Figure 37). These trails served to allow indigenous travel through and within the Forest. The Santiam Wagon Road provided travel from the South Santiam River area resources through the old Cascades pass near Tombstone Prairie to the high Cascades plateau resources, including obsidian and huckleberries. Historic linear features are considered potentially eligible to the National Register, as noted in the Willamette National Forest Land and Resource Management Plan Standards and Guides.

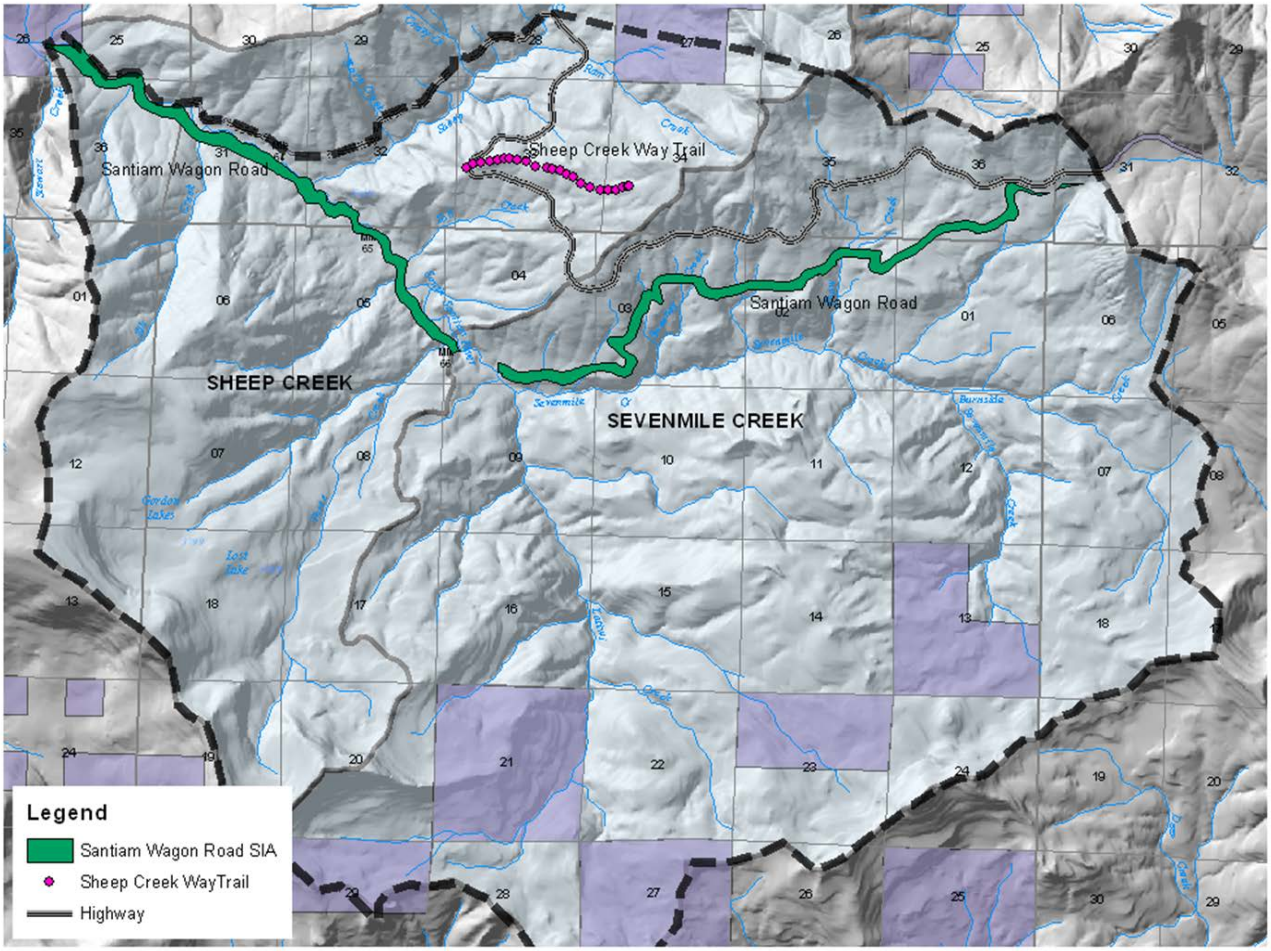

Figure 37: Santiam Wagon Road and Sheep Creek Way Trail

Desired Condition - It is desired that all National Register of Historic Places (NRHP) eligible sites and potentially eligible sites be avoided during all project activities.

Environmental Effects

Methodology

District Archaeologist Tony Farque designed a modified unit-based heritage resource inventory based on information gleaned from the District heritage resource files (inventory reports, site reports, historic maps, GLO maps and ethnographic information), topographic maps, and Geographic Information Systems (GIS).

Two objectives were considered in creating the survey. First, it must cover the possible discovery of the various site types known to occur within the project area; and second, it must cover heritage properties known or believed to exist within the project area for purposes of monitoring their conditions or verifying their location.

Along with the above objectives three requirements were incorporated into the overall survey design as per the Forest Inventory Plan and SHPO Guidelines:

1. 100% of high probability ground and 20% of low probability ground must be covered unless it has been covered by a recent inventory survey, which meets current standards, given that no change in surface visibility has occurred since the time of the survey. Low probability ground > 65% slope should be considered but does not need to be surveyed.
2. The effect on heritage resources, both discovered and undiscovered, expected to occur during the course of the proposed Toll Joe Project Area harvest shall be determined.
3. All heritage resources would be avoided when they are found to be in conflict with the proposed timber harvest units and associated roads and landings. Determination of property avoidance would be made after all the fieldwork is completed.

Previous Surveys Used for Coverage **-** The proposed harvest units consist entirely of either fire-regenerated unmanaged stands 80-120 years of age, or existing plantations that are 40 to 60 years of age. None of the proposed units in plantations were surveyed prior to being clearcut, and the fire-regenerated stands have not been previously surveyed for heritage resources within the last ten years. Within the plantations all were clearcut harvests. Harvest methods varied from tractor logging to cable harvest. In many instances high probability ground was highly disturbed from ground based heavy equipment activities during this initial harvest. No post-harvest monitoring occurred. Subsequent salvage sale and thinning projects within the project area required cultural resource surveys. However, none are current within the last ten years.

The survey of the Toll Joe Project Area was planned and conducted under the direction of District Archaeologist Tony Farque. The survey was conducted during the 2010, 2011, and 2012 summer months by District Archaeologist Tony Farque, Cultural Resource Technicians (CRTs) Ken Loree, Doug Shank, Nancy Curtis and Jason McGovern. All of the high probability areas were covered during the survey. Low probability ground was covered both by design and opportunistically between high probability areas. Some of these areas are too small to depict on the survey design and results map.

Description of Field Surveys **-** Ground surveys for the proposed Toll Joe Project Area occurred during 21 days in 2010 (July – November), 25 days in 2011 (July – September), and 22 days in 2012 (June – October), mainly on sunny to partly cloudy days. Surveys were conducted at parallel, compass-oriented transects spaced from 15 to 20 meters apart, in accordance with current survey standards. When possible, surveyors would zigzag within their respective swaths in order to inspect areas of either high visibility such as exposed mineral soil, or areas of high probability, such as obvious trails or landmarks. Every thirty meters within the high probability ground each surveyor exposed to mineral soil a surface area of 1x1 meter square. This was done with greater frequency in locations especially likely to contain heritage resources. The old plantation unit boundaries were generally easily determined by variation in vegetation (cutting boundaries and fire line post residual flora). This helped ensure that survey areas were covered in the field as designed.

A total of 530 acres of high probability ground were surveyed for the Toll Joe Project Area. As a result of this inventory, no new archaeological sites were discovered. Prior to this inventory, during past salvage sale preparation, 12 heritage properties had been recorded within or near to the selected timber stand planning units and their associated access routes. These 12 archaeological sites were cleared for avoidance during the project survey and included in the consideration of project effects on heritage resources. The Santiam Wagon road and Sheep Ridge Way Trail would also be protected.

Direct/Indirect Effects

Alternative 1 – No Action

Implementation of the No Action Alternative would not directly, nor indirectly, affect heritage resources since there would be no change to the integrity of heritage resource sites.

Alternatives 2 and 3

Implementation of Alternatives 2, or 3 would not directly, nor indirectly, affect heritage resources. All potentially eligible sites have been protected by redesigning timber sale unit boundaries, and/or restricting ancillary activities to protect the sites from timber harvest and associated project activities.

In addition the Santiam Wagon Road (SWR), which is located within the project, is listed on the National Register of Historic Places. In consideration of this level of significance, the project has been designed to protect the integrity of the road surface and adjacent corridor. Any modification of the SWR corridor/canopy is designed to accelerate the restoration goal for attaining the canopy condition (old growth forest) more rapidly and without visual intrusion to users or loss of historic character. The historic landscape target for restoration is identified as the peak period of SWR use, 1880 – 1910 (old growth forest). A segment of the Sheep Ridge Way Trail would be buffered.

Cumulative Effects

Previous effects to the 12 potentially eligible cultural resource sites within the Toll Joe Project Area include timber harvest, road construction, and wildfire, all of which occurred prior to the Forest Service implementing Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992).

All Alternatives

It is not anticipated that there would be cumulative effects to the potentially eligible heritage resources in the Toll Joe Project Area from any of the proposed activities. No additional cumulative effects are anticipated to occur to these cultural sites from any of the proposed actions under the Toll Joe project since appropriate and approved surveys and cultural site protection measures are already in place.

Irreversible/Irretrievable Commitments of Resources

There are no irreversible and irretrievable commitments that would affect heritage resources by implementing any of the proposed alternatives.

Soils

Summary

Soils in the project area were assessed based on four management indicators: displacement, compaction, nutrient content, and stability. The anticipated direct and cumulative effects of the project to the soils resource would be within the Willamette National Forest Standards and Guidelines. The full technical report is located in the project record, located at Sweet Home Ranger District. The analysis and conclusions of the evaluation are summarized below.

Affected Environment

Current Condition - The project area is located in the Western Cascades and is characterized by three major strata, each consisting largely of volcanic deposits. Most of the units in the project area, especially those at the lower elevations, are located on the oldest rocks. Some of the units at higher elevations are located on the other two rock types; the upland volcanic deposits and the ridge capping basalt flows, which is the youngest of the three layers (Walker and Duncan 1989).

The project area currently shows no sign of displacement from previous management activity. Evidence of compaction from previous entry is still present. Two units (30 and a portion of 39) approached or exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted by compaction. All of the remaining units in the project area were below, to well below, the Forest standard.

Many of the natural stands in this project area have had an active fire history in the last 100 to 150 years. Often, large expanses never had much down woody debris, or all of the accumulating down woody debris was removed by the fires. On the other hand, many of the more recent fires, as well as bug kill and snow down, have created areas with considerable amounts of down woody material. As a result, a wide range in the above-ground tonnage of decomposing organic matter exists.

The South Santiam drainage is generally considered a moderately stable basin, although active slope instability from debris chutes and slump/earth flow complexes does occur in most subwatersheds. The Toll Joe Project Area contains some of the most complex ground and has a number of potential units with unstable slopes.

Desired Condition - The desired future condition is to maintain long-term soil productivity and slope stability. The total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within an activity area (unit), generally including roads and landings.

Environmental Effects

Direct/Indirect Effects

Management Indicators: The major short-term effects to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. The total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings.

Table 42: Management Indicators for Assessing Effects to Soils

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

Alternative 1 – No Action

Under Alternative 1 stands would continue to develop. Many of the stands proposed for treatment currently have little understory vegetation because of the lack of sunlight to the forest floor. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Blow down and snow down would continue to increase fuel loading in the short to intermediate term. The likelihood of a stand replacement fire would increase. Uncontrolled wildfire at high fuel loadings and adverse weather conditions could produce moderate to high severity burns across much of the landscape. Such was the case of what is locally called the "Moose Mountain" fire that occurred in the late 1850s. Large areas of the South Santiam Canyon were consumed by fire and localized soil effects are still present. More recently, the Sevenmile Burn of 1911 again removed much organic matter from the landscape and caused local, long-term, adverse effects to soil productivity.

In general, plant diversity would diminish as well as soil biota because of the lack of sunlight. In areas already compacted or disturbed, the soil building process would continue to return the soil to near pre-harvest conditions in the longer term. Short to intermediate term effects from harvest, such as soil disturbance, dust (or mud), slash accumulation and disposal, and longer term effects such as compaction and nutrient loss, would not occur as a result of implementation of design criteria and Best Management Practices. Localized areas of active slope instability are common in many areas, both managed and unmanaged. This geologic process would continue to occur in most units whether any activity occurred in them or not.

Action Alternatives

Both action alternatives have the same basic effects and the same soil protection measures.

Displacement - Displacement occurs with three separate timber harvest activities: yarding, slash treatment, and road building and maintenance. Based on transects run across several portions of treatment areas, little physical evidence can be found in any unit to indicate displacement from previous management activity has been a problem. Under each alternative, disturbance from yarding would be well within the Regional and Forest standards, and significant adverse effects are not anticipated. 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.

Compaction – Compaction from previous entry is evident as described under the Current Condition. The major source of compaction (and also much disturbance) is ground-based skidding equipment. With the use of designated skid roads, the reuse of the existing skid road system, and the subsoiling of landings and primary skid roads, compaction is not anticipated to exceed the 20% value in any unit and should be below 15% (or much lower) in most units. Units would be monitored as needed during project implementation, and those units with the highest initial compaction levels would be the highest priority for post-sale subsoiling dollars. This entry would reduce overall compaction in most units. It is possible that compaction levels in a few units could still approach the Forest standard at the completion of management activities, but the end result is that adverse effects to these units would be lower than prior to entry.

It should be noted that the use of temporary roads considerably reduces the amount of compaction for most units by reducing both the number of trips across the ground and shortening the skidding distance. The existing road system in the area would be used where possible. If it is necessary to construct new temporary roads, they would be located on flatter ground to reduce soil disturbance. Given that, most newly created, temporary truck haul roads would be subsoiled at the completion of harvest activities. Subsoiling may be curtailed in some areas to reduce the amount of root pruning of leave trees, avoid excessive amounts of exposed soil, or avoid stumps or large rocks.

Skyline operations in thinning units with small wood and intermediate supports usually effects less than 1% of the unit area. Skyline yarding with one-end suspension is proposed for part or all of most units. In no case is helicopter yarding recommended as a soil protection measure. Helicopter usage may be planned to reduce the development of the transportation system required by conventional logging methods, or for other resource protection. Transects in skyline areas on side slopes from 25 to 50%, as well as extensive field reconnaissance of the steeper ground in almost all other units, indicates that these units had relatively low existing compaction levels.

Nutrient Loss – For both action alternatives slash would be scattered in the units, piled and burned, or perhaps broadcast or under burned. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, pile burning is usually done in the fall or winter months when

duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect.

Another aspect of long-term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. Management activities would be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling. No additional large down woody debris is required from a soil management perspective.

Instability – Potentially highly unstable and actively unstable terrains are now considered unsuited for timber harvest. If harvest is proposed, the primary objective on these lands is the maintenance of long-term slope stability. In this case thinning enhances the growth of leave trees and promotes a healthier stand with firmer roots and greater evapotranspiration activity. These factors contribute towards long term slope stability. However, this situation is compounded by the fact that several of the proposed units are located along the Highway 20 road corridor. Because of the potential danger to the driving public or the long term integrity of the roadway from slope instability, little or no risk is acceptable with potential timber management. Based on considerable field reconnaissance, 18 units (or portions thereof) could have instability concerns. For the most part, essentially all potentially unstable, potentially highly unstable or actively unstable terrain have been deleted from their respective units. The critical portions of Units 50, 60, 66, 73, and 74 which could affect Highway 20, would be deleted at layout.

Within the proposed thinning units where potentially highly unstable or actively unstable terrain, is avoided, slope instability is unlikely. Potential adverse off-site effects from the harvest are not anticipated. In those few units with potentially unstable terrain where harvest is proposed, the recommended thinning would improve slope stability or reduce the potential for adverse off-site effects from future failures. For almost all affected units, the potentially highly unstable or actively unstable terrain would be deleted from the unit. Consequently, potential slope instability with proposed management in any unit is not considered a concern with the design elements in place (Table 14, page 48). No additional specific mitigation is proposed for these units, other than the unit boundary placement, as none is needed.

Cumulative Effects

For the soils resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the “unit,” i.e. the stand polygon proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the “unit” affected.

Alternatives 2 and 3

Both action alternatives have the same continuing effects and the same soil protection measures.

One of the primary objectives with this entry is to provide the opportunity to reduce the amount of impacted soil over the existing condition. The primary previous impact to the soil resource from management on an area basis is compaction, the effects of which can remain apparent for decades.

Potential cumulative effects from displacement, nutrient loss, and instability with previous management were not observed to any degree in the field reconnaissance, and their cumulative area is not considered substantial for any unit. Existing compaction levels have been documented and discussed for the applicable units. No unit with a stability concern also has a concomitant compaction problem, except Unit 39. Unit 39 on the east side of Road 15 (39E) has excessive compaction concerns. However, the small unstable area in Unit 39 on the west side of Road 15 would be deleted at layout.

At this time, no single unit measure of long-term soil productivity is widely used. Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship of short-term changes to long-term productivity is not fully understood at present. Experience indicates that the potential effects on soils are best evaluated on a site specific, project-by-project basis. The major soils concerns – displacement, compaction, nutrient loss, and instability - are most effectively reviewed, for both short and long-term effects, at the project level. With proper project implementation, as specified in project design standards, unacceptable cumulative effects on the soils resource are not anticipated from any of the action alternatives (BMP W-5). Consequently, the utilization of soil protection measures and best management practices as defined in this report would generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would be the primary trigger for a cumulative effects review.

Irreversible or irretrievable Commitment of Resources

No irreversible and /or irretrievable use of the soils or geology resource is anticipated, beyond that which has been previously identified in the Willamette National Forest Land and Resource Management Plan, as amended. Road or landing aggregate, either crushed or pit run, that might be required for this sale could come from various rock sources in or near this project area. Other uses could include select pit run, select borrow or rip rap. Those rock sources could provide the various rock products for road maintenance and road reconstruction associated with the harvest and haul needs. Minor clearing, generally of less than one acre for any individual pit could be associated with the development of these rock sources. Clearing could include managed stand trees in plantations or brush, or the falling of adjacent snags and danger trees. Proposed sources include Elbow Creek Pit, Soapgrass Pit, or nearby private rock sources.

Transportation

Introduction

Past timber harvest activities in and near the Toll Joe Project Area have developed the current network of Forest Roads. This system of roads provides sustainable access to the area for administration, protection, public recreation, and forest product utilization, consistent with the Willamette Forest Plan. This section incorporates by reference the Willamette National Forest Road

Analysis Report (USDA Forest Service 2003), which provides detailed information regarding the Forest roads, describing maintenance levels, maintenance costs, and management direction.

Affected Environment

Current conditions - There are approximately 131 miles of Forest System roads in the project area with average road densities of about 3.8 miles/square mile.

About 25 miles of these roads have been identified in the Willamette National Forest Roads Analysis Report (USDA, 2003) as Key Forest Roads (Figure 38). These roads provide the long-term transportation network to meet forest management objectives and provide access to recreational opportunities and private lands. These are the priority roads maintained for vehicular traffic.

Table 43: Key Forest Roads

Road Number	Road Name
2044	Latiwi Creek Road
15	Browder Ridge Road
035	Iron Mountain Road
1509	Bear Pass Road
2044-230	Gordon Lakes Road

The roads in this project area have a wide range of conditions. The cost-share roads (see map, Figure 38), where road maintenance costs are shared by various landowners, are generally well-maintained. Key Forest roads are maintained for recreational, administrative and private land access. However, over the last decade, limited road maintenance funds have resulted in a backlog of maintenance to reduce brush, clean out drainages, and repair road surfaces on many roads in the project area. There are drainage improvements that need to be implemented prior to commercial haul to protect water quality. Some of the culverts are in poor condition and in need of replacement. Due to the high elevation in the eastern and southern portions of the project area, there are few perennial streams. Roads and culverts in this area are in good repair.

There are currently 29 miles of closed system roads within the project area. These and an unknown number of non-system and private roads are closed by means of gates, berms or other physical barriers implemented through road management, or naturally by brush growth or blown down timber.

Desired Condition - A safe and cost-effective transportation system for administration, utilization, enjoyment, and protection of National Forest System lands. The transportation system would provide for sustainable public and agency access:

- to achieve the desired conditions in the applicable land management plan;
- to promote ecosystem health; and
- to address public safety and efficiency with anticipated funding levels

Environmental Effects

Methodology

Scale of Analysis - Unless otherwise noted, the geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the Toll Joe Project Area.

Direct/Indirect Effects

Alternative 1 – No Action

Alternative 1 would not change the use pattern of roads, or correct existing road erosion problems under this project. There is currently a backlog of road maintenance and some local roads are becoming impassible due to fallen trees or the growth of brush. Temporary road construction and projects proposed for storage and decommissioning, as part of this project, would not move forward with the no action alternative.

Alternatives 2 and 3

Approximately 33 miles of road maintenance would be needed in Alternatives 2 and 3 to help protect the road infrastructure, and improve the safety of the road. The biggest maintenance need is primarily brushing, but could also include: felling hazard trees, clearing and grubbing, surface blading, replacing drainage structures, reshaping ditches, and placement of aggregate surfacing.

Most existing culverts exceed the design life for galvanized steel pipe of 25-30 years resulting in a need for some culverts to be replaced. There are two live-stream and five cross-drain culverts identified that need to be replaced on the 2044 road for this project to access units 25 and 26.

Low standard local roads on the haul routes would receive pre-haul maintenance prior to use for harvest activity. Additional maintenance issues would likely be uncovered during the course of this project. The scope of these unknown repairs needed for safe road use would be similar to the items already identified above.

Both action alternatives would open or reuse already open existing non-system spur roads (2.7 miles) to access harvest units. In addition, 1.3 miles of temporary road would be constructed in Alternative 2, including 0.5 mile in Riparian Reserves. About 1 mile of temporary road would be constructed in Alternative 3 of which 0.4 mile would be in Riparian Reserves. Following this harvest entry, these non-system roads would be closed, sub-soiled and seeded. In addition, the temporary roads in the Late Successional Reserve would be obliterated, including sub-soiling and re-contouring of cut slopes.

Action alternatives may cause a temporary increase in sedimentation while the work is being done, but in the long term would decrease the sediment load into streams in the project area. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts would result in a temporary increase of sediment into streams until road surfaces and ditches stabilize and re-vegetate.

For more in-depth analysis of sedimentation effects see Aquatic Resources –Sedimentation and Roads.

Maintenance activities could cause some short-term delays or detours for road users while roadwork is being performed. Road maintenance would protect the investment in the existing road infrastructure, improve safety of the road, and decrease the potential for road washout-caused sedimentation.

Brushing roads would increase sight distance and visibility for safe driving. Blading, ditch maintenance, culvert replacement, surface rocking, and installing dips or waterbars would correct or improve water drainage.

Cumulative Effects

Alternatives 2 and 3

Past management actions have created a 131-mile road system within the Toll Joe Project Area that requires consistent road maintenance to provide adequate resource protection. The action alternatives would provide some of this needed road maintenance.

The incremental cumulative effects of the action alternatives would be to reduce the miles of road available for access and decrease the effects to aquatic resources by approximately 10 miles. There would be a slight reduction in public access, but minimal impact to recreational use.

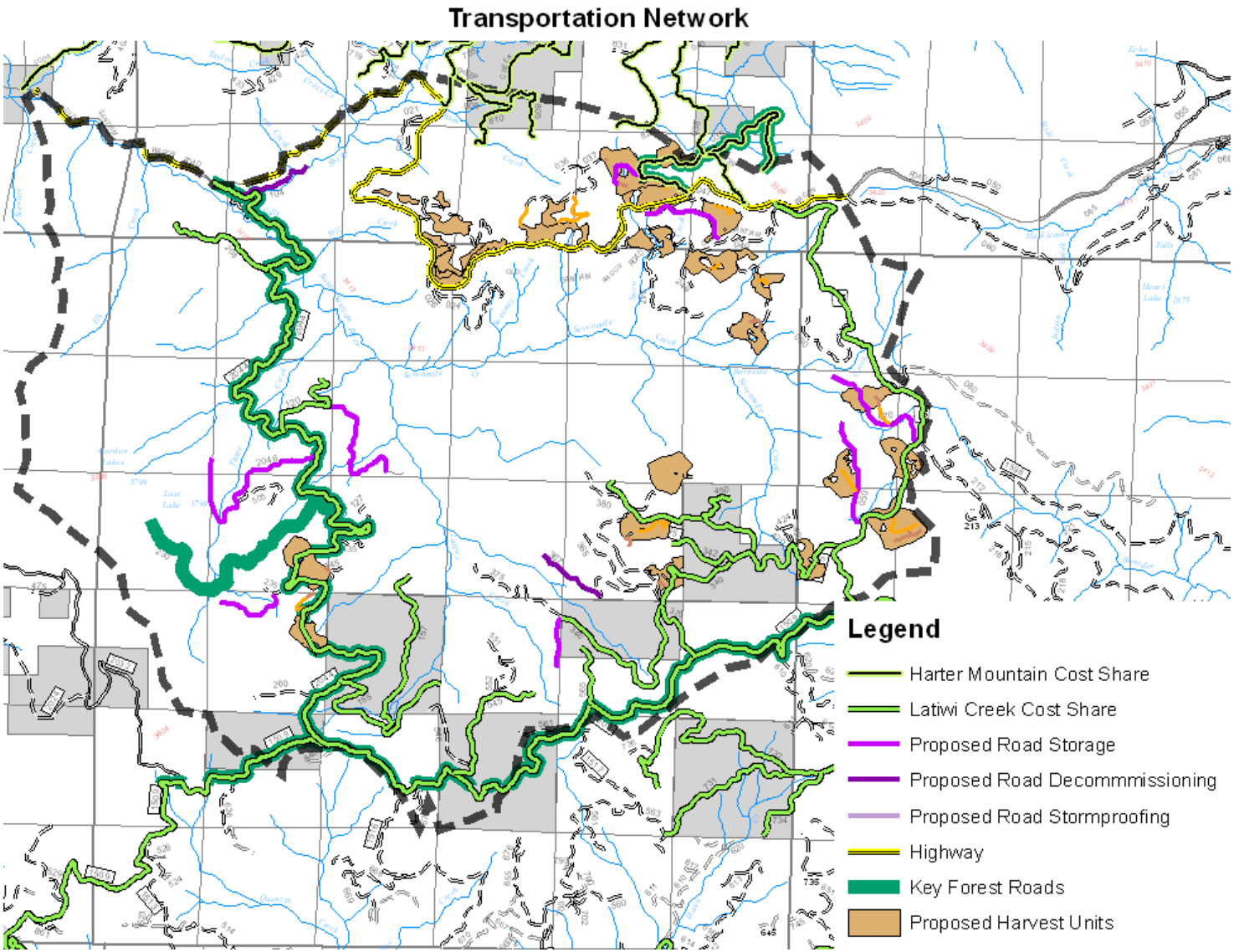

Figure 38: Cost Share, Key Forest Roads, and Proposed Road Storage, Decommissioning, and Stormproofing in Project Area

Terrestrial Wildlife

This section addresses potential effects of the project to proposed, endangered, threatened or sensitive fauna (PETS) that have been documented or have suspected occurrences on the Willamette National Forest. In addition, Management Indicator Species, Migratory Bird Species and Survey & Manage Species are addressed in this document in accordance with current Standard and Guidelines outlined in the Record of Decision and Willamette National Forest Land and Resource Management Plan, as amended. The current condition is described for each species, group of species or habitat. Direct, indirect and cumulative effects of the alternatives are identified in this document. See Wildlife Biological Evaluation for more information. That report is part of the project file and available at the Ranger District.

Introduction and Analysis Methods

Currently, the northern spotted owl is listed as Threatened under the Endangered Species Act and as a Management Indicator Species (MIS) under the Willamette National Forest Plan.

Northern spotted owl habitat and use was analyzed with GIS and VEGIS applications, aerial photography and field visits to the project area. Proposed harvest units were reviewed on-the-ground to verify tree size, canopy cover and existing snag and down wood levels. Nest check surveys on known owl sites and calling station surveys conducted on adjacent timber sales also provided information for this analysis. In addition, nest location data from the HJ Andrews Northern Spotted Owl Monitoring Project were used in this analysis. Data provided by the HJ Andrews surveys updated one owl location (Known Owl Site #0007/2956) in this project area and were used in this analysis.

Northern Spotted Owl – *Strix occidentalis*

***Current Conditions* -** Northern spotted owls have been documented in a variety of forest types, but Douglas-fir dominated stands tend to be preferred habitat. Nest and roost sites are typically found in forests that exhibit complex structure and heterogeneity. These habitats tend to be multi-storied with large diameter trees (20” DBH and greater) and high canopy cover (> 60%). Most spotted owls are territorial and dispersal of young depends on availability of suitable habitat (USDI 2012).

Past management activities, such as timber harvest, have reduced or fragmented northern spotted owl habitat throughout its range. In addition, increased barred owl occupancy on the Sweet Home Ranger District has contributed to the cumulative effects to this species (Courtney et al. 2004, USDI 2004, 2012, 2012a). As a result, overall northern spotted owl population densities have decreased, specifically in areas where habitat reduction is concentrated and where competition with barred owls is present (USDI 2012, 2012a).

There are fifteen known owl sites and no predicted owl sites within the Toll Joe Project Area; those sites within 1.2 miles of proposed activities will be discussed in this analysis. No proposed activities would take place within 300 meters (about 984 feet) of any known owl site.

Suitable Habitat - Suitable habitat in known owl sites in the Core Nest Area and Home Range is shown in Tables 44 and 45. Proposed units in suitable owl habitat are 80-110 years old with stand structural components that provide roosting and foraging opportunities. Nesting habitat occurs in riparian areas and drainages where fire or previous harvest activity is absent. Previous timber harvest and small scale fire disturbance from the Sevenmile Fire have occurred in this area, and as a result, there are low levels of medium and large coarse woody debris (debris larger than 11" DBH) outside of riparian and wetland areas.

Suitable Habitat within Core Nest Area: U.S. Fish and Wildlife Service recommends that spotted owl nest territories should have at least 50% suitable habitat in the core nest areas to avoid substantial impact (USDA 2012, USDI 2012). Currently, 12 of the 15 known owl sites within the project area meet or exceed the 50% threshold with 50-98% of core nest areas in suitable habitat. Three owl sites fall below the threshold with 30-43% of the core nest area in suitable habitat (Table 44).

Table 44: Current Conditions for Northern Spotted Owl Suitable Habitat within Core Nest Area (0.5 mile radius) of Known Owl Sites

Known Owl Sites	Total Acres within 0.5 mile radius of activity center	Required Minimum Acres of Suitable Habitat Needed within 0.5 mile radius of activity center	Actual Acres of Suitable Habitat within 0.5 mile radius of activity center	Percent of Area in Suitable Habitat in activity center
0007 (2956)	503	252	216	43%*
0011	503	252	375	75%
0014	503	252	462	92%
0619	503	252	314	62%
0694	503	252	250	50%
0827	503	252	153	30%*
2460	503	252	443	88%
2846	503	252	308	61%
2962	503	252	491	98%
2968	503	252	448	89%
4095	503	252	250	50%
4196	503	252	471	94%
4397	503	252	488	97%
4405	503	252	408	81%
4488	503	252	215	43%*
15 Sites Total			**Average = 352**	**Average = 70%**

** Sites that currently fall below the minimum threshold for suitable habitat capability requirements.*

Suitable Habitat within Home Range - U.S. Fish and Wildlife Service recommends that spotted owl nest territories should have at least 40% suitable habitat in the nest territory (provincial home range) to avoid substantial impact (USDA 2012, USDI 2012). Currently, 13 of

the 15 known owl sites within the project area meet or exceed the 40% threshold with 43-93% of home range in suitable habitat. Two owl sites fall below the threshold with 36-39% of the home range in suitable habitat (Table 45).

Table 45: Current Conditions for Northern Spotted Owl Suitable Habitat within Home Range Territory (1.2 mile radius) of Known Owl Sites

Known Owl Sites	Total Acres within 1.2 mile radius of activity center	Required Minimum Acres of Suitable Habitat Needed within 1.2 mile radius of activity center	Actual Acres of Suitable Habitat within 1.2 mile radius of activity center	Percent of Area in Suitable Habitat in activity center
0007 (2956)	2895	1158	1,444	50%
0011	2895	1158	1,872	65%
0014	2895	1158	2,383	82%
0619	2895	1158	1,446	50%
0694	2895	1158	1,232	43%
0827	2895	1158	1,117	39%*
2460	2895	1158	2,695	93%
2846	2895	1158	1,738	60%
2962	2895	1158	2,540	88%
2968	2895	1158	2,158	75%
4095	2895	1158	1,366	47%
4196	2895	1158	2,137	74%
4397	2895	1158	2,433	84%
4405	2895	1158	1,655	57%
4488	2895	1158	1,047	36%*
15 Sites Total			**Average = 1818**	**Average = 63%**

** Sites that currently fall below the minimum threshold for suitable habitat capability requirements.*

Dispersal Habitat - All proposed units within dispersal habitat of the Toll Joe Project Area exhibit marginal dispersal habitat conditions regardless of the land use designation and are 40-79 years old with previous harvest activity and small scale fire history. Harvest activities have produced low canopy cover percentages and low levels of coarse woody debris in medium/large size classes. Fire events from the early 1900s have contributed to low levels of medium and large coarse woody debris outside of riparian areas. Owl movement is possible throughout this area and in the proposed units. However, due to the lack of canopy complexity (lack of suitable roosting limbs and limb connectivity) and coarse woody debris, the proposed units provide limited places for foraging and roosting which are needed to support dispersing owls.

Critical Habitat (2012) - The final rule on spotted owl critical habitat was published on December 4, 2012. Critical Habitat Units (CHU) are intended to provide large blocks of suitable

habitat within the landscape that would provide the necessary elements to maintain stable, viable and interconnected owl populations. The physical and biological features of critical habitat essential to species conservation are identified as Primary Constituent Elements (USDI 2012). Primary Constituent Elements (PCEs) are described in the Final CH Rule as the specific elements that comprise the physical or biological characteristics required to sustain the species' life-history processes. Habitat that includes these elements is essential in meeting the home range needs of territorial pairs, and/or the dispersal needs of juvenile and non-territorial spotted owls. Old-growth forest habitat is typically the most suitable habitat to provide such conditions. Other habitats of lesser quality can provide support for home range needs if old-growth habitat is absent.

The Primary Constituent Elements (PCEs) include: 1) specific forest types in early-, mid-, or late-seral stages; 2) specific habitat that provides for nesting and roosting; 3) specific habitat that provides for foraging; and 4) habitat that supports transient and colonization phases of dispersal. PCEs are described for four ecological zones with the Willamette National Forest being in the West Cascades/Coast Range of Oregon/Washington Zone.

Approximately 17,862 acres of Critical Habitat are present in the Toll Joe Project Area (Figure 5) and project activities are proposed in this designation. Currently, 14 of the 15 known owl sites the Toll Joe Project Area are located in Northern Spotted Owl 2012 Critical Habitat.

Recovery Action 32 Designations –Recovery Action 32 in the 2011 Revised Recovery Plan for the Northern Spotted Owls recommends retaining high quality suitable habitat (USDI 2011). This recovery action was specifically developed to address the threat posed by barred owls. Protection of these high-quality habitats would not "further exacerbate competitive interactions between spotted owls and barred owl that would otherwise occur if the amount of shared resources were decreased" (ibid. p.34). Any habitat that was identified as high quality suitable or RA-32 was dropped from proposed activities.

Desired Future Conditions 2012 Critical Habitat and Habitat outside of the Designation: Desired future conditions for the northern spotted owl should strive for a contiguous, well-distributed network of high quality habitat on a landscape scale. High quality habitat should include a multi-story stand structure with old growth quality and canopy cover of at least 60%. Snag and down wood components should also be present in order to provide habitat for nesting, roosting and prey availability. Forest conditions are not static; therefore, future management activities should involve the enhancement of younger stands that exhibit a lack of structural diversity. Management activities should focus on four major structural components of old growth Douglas fir forests, which is the preferred habitat of the northern spotted owl. These four attributes include: live old growth trees, standing dead trees (snags), fallen trees or logs on the forest floor and logs in the streams (USDA 1994). Canopy gaps and patchy understories are important elements in the composition of old growth forests as well.

In addition, management activities should tier to the Revised Recovery Plan for the Northern Spotted Owl and the Final Critical Habitat Ruling. Four special management considerations or

protections were identified for this zone in the Final Critical Habitat Rule and are listed below. These recommendations should be used to evaluate and to manage for desired future conditions.

1. Conserve older stands that contain the conditions to support northern spotted owl occupancy or high-value northern spotted owl habitat as described in Recovery Actions 10 and 32.
2. Management emphasis needs to be placed on meeting northern spotted owl recovery goals and long-term ecosystem restoration and conservation. When there is a conflict between these goals, actions that would disturb or remove the essential physical or biological features of northern spotted owl critical habitat need to be minimized and reconciled with long-term restoration goals.
3. Continue to manage for large, continuous blocks of late-successional forest.
4. In areas that are not currently late-seral forest or high-value habitat and where more traditional forest management might be conducted (e.g. matrix), these activities should consider applying ecological forestry practices.

Direct and Indirect Effects

Proposed activities are in Matrix and Late-Successional Reserve Allocations, with approximately 950 to 1,100 acres proposed for commercial thinning and/or fuels treatment. Both Action Alternatives have proposed units located in stands that are classified as suitable, dispersal and unsuitable northern spotted owl habitat. In addition, most of the proposed units are in Critical Habitat for the northern spotted owl.

Northern spotted owls may be affected if habitat is modified within their median home range (1.2 mile radius around the nest tree) or within the core activity center. Habitat modification may occur in three different ways:

1. *Habitat Maintain* - activities that alter forest stand characteristics and may affect the quality of suitable or dispersal habitat temporarily without altering the functionality of such habitat by maintaining components of spotted owl habitat within the stand.
2. *Habitat Downgrade* - habitat downgrading which alters the functionality of suitable habitat so that it no longer supports nesting, roosting, and foraging.
3. *Habitat Removal* - habitat removal which alters suitable or dispersal habitat to such an extent that the habitat no longer supports nesting, roosting, foraging, or dispersal.

Owl Sites- Tables 46 and 47 summarize all habitat modification from proposed activities within northern spotted owl core and home ranges by alternative.

All suitable habitat would be maintained in Core Areas in both action alternatives (Table 46). Proposed activities would remove or downgrade suitable habitat for eight owl sites in Alternative 2 and no owl sites in Alternative 3 (Table 47).

Table 46: Proposed Activities (in approx. acres) within 0.5 miles (Core Area) of each Owl Site

Known Owl Site #	Treatment	Current NSO Habitat	Alternative 2	Alternative 3
Treatment within 0.5 miles of Activity Centers				
0007 (2956)				
0011	Habitat Maintained	Dispersal	28 Ac.	28 Ac.
0014	Habitat Maintained – Fuel Treatments Only*	Suitable	8 Ac.	8 Ac.
0619				
0694	Habitat Maintained	Dispersal	25 Ac.	25 Ac.
0827	Habitat Maintained	Dispersal	34 Ac.	34 Ac.
2460				
2846				
2962				
2968				
4095	Habitat Maintained	Dispersal	1 Ac.	1 Ac.
4196				
4397				
4405				
4488	Habitat Maintained	Dispersal	4 Ac.	4 Ac.
	Hatch shading indicates No Proposed Activities.			

** Habitat is considered maintained if canopy cover is retained at 60% or above.*

Table 47: Proposed Activities (in approx. acres) within 1.2 miles (Home Range) of Each Owl Site				
Known Owl Site #	**Treatment**	**Current NSO Habitat**	**Alternative 2**	**Alternative 3**
Treatment within 1.2 miles of Activity Centers				
0007 (2956)	Habitat Maintained	Dispersal	173 Ac.	173 Ac.
0011	Habitat Downgraded	Suitable	5 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	13 Ac.	13 Ac.
	Habitat Maintained	Dispersal	186 Ac.	186 Ac.
	Habitat Maintained	Unsuitable	6 Ac.	6 Ac.
0014	Habitat Removed	Suitable	13 Ac.	
	Habitat Downgraded	Suitable	15 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	20 Ac.	20 Ac.
0619	Habitat Maintained	Dispersal	95 Ac.	95 Ac.
0694	Habitat Maintained	Dispersal	138 Ac.	138 Ac.
0827	Habitat Maintained	Dispersal	172 Ac.	172 Ac.
2460	Habitat Removed	Suitable	9 Ac.	
	Habitat Downgraded	Suitable	5 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	30 Ac.	30 Ac.
2846	Habitat Maintained	Dispersal	60 Ac.	60 Ac.
2962	Habitat Removed	Suitable	5 Ac.	
	Habitat Downgraded	Suitable	70 Ac.	
	Habitat Maintained	Suitable	30 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	28 Ac.	28 Ac.
	Habitat Maintained	Unsuitable	1 Ac.	1 Ac.
	Habitat Maintained – Fuels Treatment Only	Unsuitable	2 Ac.	2 Ac.
2968	Habitat Downgraded	Suitable	9 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	5 Ac.	5 Ac.
	Habitat Maintained	Dispersal	264 Ac.	264 Ac.
	Habitat Maintained – Fuels Treatment Only	Dispersal	6 Ac.	6 Ac.
	Habitat Maintained	Unsuitable	11 Ac.	11 Ac.
	Habitat Maintained – Fuels Treatment Only	Unsuitable	2 Ac.	2 Ac.

Table 47: Proposed Activities (in approx. acres) within 1.2 miles (Home Range) of Each Owl Site

Known Owl Site #	Treatment	Current NSO Habitat	Alternative 2	Alternative 3
4095	Habitat Removed	Suitable	6 Ac.	
	Habitat Downgraded	Suitable	52 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	20 Ac.	20 Ac.
	Habitat Maintained	Dispersal	185 Ac.	185Ac.
	Habitat Maintained	Unsuitable	12 Ac.	12 Ac.
4196	Habitat Downgraded	Suitable	22 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	7 Ac.	7 Ac.
	Habitat Maintained	Dispersal	222 Ac.	222 Ac.
	Habitat Maintained – Fuels Treatment Only	Dispersal	6 Ac.	6 Ac.
	Habitat Maintained	Unsuitable	16 Ac.	16 Ac.
4397	Habitat Removed	Suitable	13 Ac.	
	Habitat Downgraded	Suitable	50 Ac.	
	Habitat Maintained	Suitable	31 Ac.	
	Habitat Maintained – Fuels Treatment Only*	Suitable	18 Ac.	18 Ac.
4405	Habitat Maintained	Dispersal	5 Ac.	5 Ac.
4488	Habitat Maintained	Dispersal	94 Ac.	94 Ac.
	Hatch shading indicates No Proposed Activities.			

* Habitat is considered maintained if canopy cover is retained at 60% or above.

Owl Habitat - Table 48 summarizes all habitat modification from proposed activities within and outside of northern spotted owl core and home ranges, along with designations such as 2012 Critical Habitat. Alternative 2 impacts approximately 1, 090 acres and Alternative 3 impacts approximately 945 acres.

Table 48: Summary of Habitat Modification from Proposed Activities by Alternative
Note: *Acres calculated for owl habitat do not include subtractions for buffers or gaps.*

		Alt. 1 Acres	Alt. 2 Acres	Alt. 3 Acres
Suitable Habitat				
Habitat Removed Outside of CHU		None	No Acres Affected	No Acres Affected
Habitat Removed in 2012 CHU	CHU – LSR	None	No Acres Affected	No Acres Affected
	CHU – Matrix	None	20	No Acres Affected
Habitat Downgraded Outside of CHU		None	No Acres Affected	No Acres Affected
Habitat Downgraded in 2012 CHU	CHU – LSR	None	8	No Acres Affected
	CHU – Matrix	None	72	No Acres Affected
Habitat Maintained Outside of CHU		All	No Acres Affected	No Acres Affected
Habitat Maintained in 2012 CHU	CHU – LSR	All	5	No Acres Affected
	CHU – Matrix	All	40	No Acres Affected
Habitat Maintained in 2012 CHU – Ground & Ladder Fuel Treatments Only	CHU – LSR	All	30	30
	CHU – Matrix	All	42	42
Sub-Total Suitable Habitat		**All**	**217**	**72**
Dispersal Habitat				
Habitat Removed Outside of CHU		None	No Acres Affected	No Acres Affected
Habitat Removed in 2012 CHU	CHU - LSR	None	No Acres Affected	No Acres Affected
	CHU - Matrix	None	No Acres Affected	No Acres Affected
Habitat Maintained Outside of CHU		All	263	263
Habitat Maintained in 2012 CHU	CHU - LSR	All	358	358
	CHU - Matrix	All	214	214
Habitat Maintained in 2012 CHU – Ground & Ladder Fuel Treatments Only	CHU - LSR	All	1	1
	CHU - Matrix	All	6	6
Sub-Total Dispersal Habitat		**All**	**842**	**842**
Unsuitable Habitat (Non-Habitat)				
Habitat Maintained Outside of CHU		All	3	3
Habitat Maintained in 2012 CHU	CHU - LSR	All	8	8
	CHU - Matrix	All	8	8

Table 48: Summary of Habitat Modification from Proposed Activities by Alternative
Note: *Acres calculated for owl habitat do not include subtractions for buffers or gaps.*

		Alt. 1 Acres	Alt. 2 Acres	Alt. 3 Acres
Habitat Maintained in 2012 CHU – Ground & Ladder Fuel Treatments Only	CHU - LSR	All	1	1
	CHU - Matrix	All	11	11
Sub-Total Unsuitable Habitat		**All**	**31**	**31**
Total Acres (Original Planning		**N/A**	**1,090**	**945**

Commercial Thinning near Known Owl Sites and in Owl Habitat - Studies show that commercial thinning in stands less than 80 years may have negative effects on the abundance of northern spotted owl prey species, particularly northern flying squirrels (Anthony 2013, Carey 2000, Gomez et al. 2005, Manning et al. 2012, Thrailkill 2006, Wilson 2010, Wilson 2013), which can make up almost 50% of the northern spotted owl diet in some cases (Forsman et al. 2004, Hamer et al 2001). Studies have also shown that commercial thinning can negatively impact other northern spotted owl prey species such as red tree voles and arboreal prey species (Wilson 2013). In addition, several studies have suggested that forest thinning can create short term effects (20 years or less) by reducing certain species of fungi that northern flying squirrels and other mammals rely on (Gomez et al. 2005, Luoma et al 2003, Meyer et al. 2005).

Studies also show that commercial thinning may have negative effects to northern spotted owls and site occupancy. Several studies show that owls were displaced by harvest near the activity center (Forsman et al. 1984, Hicks et al. 1999, Meiman et al. 2003). Site abandonment seemed to be tied to the availability of suitable habitat at and around the core nesting area.

Direct/Indirect Effects

Alternative 1 (No Action)

This alternative would not modify any suitable, dispersal or unsuitable owl habitat in core nest areas, home ranges, or other land designations related to northern spotted owls. Under Alternative 1, all conditions within the Toll Joe Project Area would progress naturally. The acceleration of late-successional habitat may be delayed compared to thinning treatments, but the current conditions likely favor northern spotted owls by maintaining their preferred prey species and limiting the potential for site abandonment via habitat degradation (Forsman et al. 1984, Hicks et al. 1999, Meiman et al. 2003).

Alternative 2

- Core Range (0.5 Mile) - Alternative 2 proposes activities in suitable habitat for one owl site; however, activities would maintain all suitable habitat. (Tables 44 & 46).
- Home Range (1.2 Mile) – Alternative 2 proposes activities that would remove or downgrade suitable habitat for eight owl sites and suitable habitat thresholds for these

sites would be reduced by 1-4%. However, those sites affected would remain above threshold acreage (Tables 45 & 47).

- No proposed activities would take place in the nest patch of any owl site.
- No incidental take is anticipated from this Alternative.
- Suitable Habitat: Alternative 2 proposes activities in 217 acres of suitable habitat for commercial harvest and for fuels treatments north of the highway. Proposed commercial harvest activities include the removal of 20 acres of suitable habitat in the form of 5-acre gaps and the downgrade of 80 acres of suitable habitat in Critical Habitat. Proposed commercial harvest activities also include treatments that would maintain 45 acres of suitable habitat in Critical Habitat. Fuel treatments proposed include activities that would maintain 72 acres of suitable habitat located in Critical Habitat. Removal and downgrade of suitable habitat would involve decreasing canopy cover, removing roosting trees/limbs and reducing potential forage opportunities due to effects on preferred prey species for 20-30 years (Anthony 2013). No potential nest trees are expected to be removed (trees > 30" DBH). (Table 48).
- Dispersal Habitat: Alternative 2 proposes activities that would maintain 572 acres of dispersal habitat inside and 263 acres outside of Critical Habitat designations. Proposed activities in dispersal habitat involving commercial harvest and fuels reduction would decrease canopy cover, remove roosting trees/limbs and reduce potential forage opportunities, but would maintain 40% canopy cover at the stand level. Proposed fuels treatments would involve ground and ladder fuel reduction (no canopy treatments) in dispersal habitat. (Table 48).
- Unsuitable (Non-habitat): Alternative 2 proposes commercial harvest activities in 31 acres of unsuitable habitat, located inside and outside of Critical Habitat designations. Fuel treatments proposed include activities in unsuitable habitat located in Critical Habitat. (Table 48).

Alternative 3

- Core Range (0.5 Mile) - Alternative 3 proposes activities in suitable habitat for one owl site; however, activities would maintain suitable habitat conditions. All suitable habitat threshold percentages would remain the same (Tables 44 & 46).
- Home Range (1.2 Mile) – Alternative 3 proposes activities that would maintain suitable habitat for eight owl sites and suitable habitat thresholds percentages would remain the same. (Tables 45 & 47).
- No proposed activities would take place in the nest patch of any owl site.
- No incidental take is anticipated from this Alternative.
- Suitable Habitat: Alternative 3 proposes activities in 72 acres of suitable habitat for fuels treatments north of the highway, all of which are in Critical Habitat. Proposed activities include treating ground and ladder fuels and would maintain suitable habitat. No commercial harvest activities are expected to take place in suitable habitat under this

Alternative. No potential nest trees are expected to be removed (trees > 30" DBH). (Table 48).

- Dispersal Habitat: Alternative 2 proposes activities that would maintain 572 acres of dispersal habitat inside and 263 acres outside of Critical Habitat designations. Proposed activities in dispersal habitat involving commercial harvest and fuels reduction would decrease canopy cover, remove roosting trees/limbs and reduce potential forage opportunities, but would maintain 40% canopy cover at the stand level. Proposed fuels treatments would involve ground and ladder fuel reduction (no canopy treatments) in dispersal habitat. (Table 48).
- Unsuitable (Non-habitat): Alternative 3 proposes commercial harvest activities in 31 acres of unsuitable habitat, located inside and outside of Critical Habitat designations. Fuel treatments proposed include activities in unsuitable habitat located in Critical Habitat. (Table 48).

Effects Determination

Alternative 2 ***may affect and is likely to adversely affect (but would not result in incidental take)*** northern spotted owls and their habitat, due to the removal of suitable habitat in the form of 5-acres gaps and the downgrading of suitable habitat to dispersal habitat in the Home Range of eight existing owl sites (See Table 47). This habitat is also designated as Critical Habitat. Proposed activities in suitable habitat would remove 20 acres and downgrade 80 acres (See Table 48). The 80 acres affected represent less than 0.05% of the total acres of suitable habitat in Critical Habitat Subunit West Cascades South (WCS 3). The proposed activities would reduce canopy cover, forest structure and prey species availability, and as a result, owls would not likely use these acres until they recover into more desirable habitat conditions. In addition, the loss or degradation of habitat has the potential to intensify competition with barred owls by reducing the total amount of resources available to the northern spotted owl (USDI 2012a).

Alternative 3 ***may affect, but is not likely to adversely affect*** northern spotted owls and their habitat, due to temporarily affecting canopy cover, forest structure and preferred spotted owl prey species in dispersal habitat conditions that already exhibit these conditions. This habitat is also designated as Critical Habitat. Vegetative and fuel reduction activities proposed to maintain suitable and dispersal habitat conditions may improve owl habitat in the long term; however, short term effects may affect northern spotted owl habitat use and prey species. Activities may improve current conditions for spotted owls and their prey species in the long term; however, those improvements would not be observed for at least 20 years or more (Wilson 2013). Those activities that involve ladder fuel treatments without disrupting over-story canopy cover may be beneficial to protecting existing suitable habitat from potential fire risk.

All proposed activities in Alternative 2 and 3 are in Subunit 3 of the West Cascades South Critical Habitat Unit. Four primary constituent elements (PCEs) are evaluated for effects to CH.

PCE 1 are the forest types that support northern spotted owls and are used to identify critical habitat affected by the project. Because none of the proposed actions would result in a change in forest type, there was no effect to this PCE.

PCEs 2, 3, and 4 (nesting/roosting, foraging, and dispersal habitat) were specifically considered with respect to the proposed actions to determine if they were removed, reduced, maintained or enhanced at a stand level. The assessment considered both short-term (0-20 years) and long-term (21-100 years) effects with respect to these PCEs. For early seral stands of capable (i.e. PCE 1) habitat that currently do not provide PCEs 2-4, the analysis of effects had both a temporal scale (would the actions delay or accelerate the development of the PCEs in the stand following treatment) and a qualitative scale (would the future habitat be better or worse with respect to the PCEs as a result of the treatment).

The proposed actions of Alternative 2 would downgrade or remove suitable Critical Habitat and temporarily reduce canopy cover in dispersal Critical Habitat, and as a result, the functionality of the habitat at the stand level would be affected for at least 40-80 years. The proposed actions of Alternative 3 would temporarily reduce canopy cover in dispersal Critical Habitat and the functionality of the current habitat at the stand level would be temporarily affected for 20-30 years. No proposed activities would take place in suitable habitat in any owl site's core range and no activities would take place in any habitat designation in any owl site nest patch. Some of the proposed treatments may occur in habitats that provide for nesting, roosting, or high quality foraging, as described in the Final CH rule for this ecological zone (USDI 2012a), so there would be short-term effects to PCEs 2 and 3. Proposed vegetative management activities that intend to increase tree diameter growth and crown development would temporarily decrease canopy cover and foraging opportunities in the short term; however, such activities may accelerate the development of nest and roost structure in the long-term. In stands of dispersal habitat that exhibit limited movement opportunities, those that are commercially thinned may have a short-term reduction in cover used for dispersal habitat; however, canopy cover would remain above 40%. Also the reduction in over-story and mid-story canopy cover would likely cause a short-term reduction in the abundance of owl prey species and foraging opportunities; however, this short-term reduction may be outweighed by improved conditions in the long-term.

Some of these reductions to PCE 4 may affect use of dispersal habitat by owls in the short-term by reducing foraging and roosting opportunities; but thinning may provide greater structural complexity and prey abundance in the long-term.

As a result, the proposed activities of Alternatives 2 and 3 ***would modify*** northern spotted owl critical habitat at the stand level; however, proposed activities ***would not adversely modify*** critical habitat at the subunit scale (WCS 3), or range-wide scale, or cause jeopardy to the species.

Direct and Indirect Effects

Disturbance - The northern spotted owl breeding season generally extends from March 1st to September 30th with March 1st to July 15th considered to be critical from a disturbance perspective (USDA 2012). Activities that generate noise above ambient levels have the potential to disturb nesting spotted owls and may result in the incidental take of young and adult birds. The Biological Assessment and Biological Opinion (USDA 2012, USDI 2012) identify two types of disturbance levels. The unit wildlife biologist may increase these disturbance distances according to the best available scientific information and site-specific conditions.

In the Toll Joe Project Area, six northern spotted owl known nest sites are located within 0.5 miles of proposed activities. All other known owl sites are located > 0.5 miles from proposed activities of the Toll Joe Project Area. Table 49 lists known owl nest sites in relation to proposed activities.

Table 49: Known Owl Sites in Relation to Proposed Activities in Action Alternatives

Known Owl Sites	Sites within 1.0 Miles of Proposed Units	Sites within 0.5 Miles of Proposed Units	Sites within 0.25 Miles of Proposed Units
0007 (2956)	X		
0011	X	X	
0014	X	X	
0619	X		
0694	X	X	
0827	X	X	
2460	X		
2846	X		
2962	X		
2968	X		
4095	X		
4196	X	X	
4397	X		
4405	X		
4488	X	X	
15 Sites Total	**15 Sites Total**	**6 Sites Total**	**0 Sites Total**

Project activities that occur between March 1 and September 30 that are 0.25 miles or greater (1.0 mile or greater for blasting) and are not in a direct helicopter (Type I or Type II) flight path from a known owl site *may affect* but are *not likely to adversely affect* northern spotted owls in regards to disturbance. Disturbance from proposed actions conducted outside of the breeding period (October 1-February 28), including helicopter use and blasting, would have *no effect* on northern spotted owls. No proposed activities would take place within the breeding season (including critical breeding season) that are less than the disturbance/disruption distances, as described in the Biological Assessment (BA) and Biological Opinion (BO) for this project (Appendix I).

For this project, only helicopter and potential blasting would take place within 0.25 miles of an owl site. As a result, these activities would be restricted from either March 1st to July 15th or March 1st to September 30th, based on the activity. See Table 50 for seasonal restriction timelines (refer to BA in Appendix I).

All other activities (chainsaw use, hauling on open roads, use of heavy equipment, pile driving, road brushing/maintenance, rock crushing, tree climbing, and underburning) associated

with this project would occur more than 0.25 miles away from an owl site; and as a result, those activities would not need a seasonal restriction.

Table 50: Seasonal Restrictions for Known and Predicted Owl Sites Based on Proposed Activities

Toll Joe Planning Unit	Activity Restricted	Owl Site Number Affected	Seasonal Restriction*
All Units	Type I Helicopter	0007 (2956), 0011, 0014, 0619, 0694, 0827, 2460, 2846, 2962, 2968, 4095, 4196, 4397, 4405, 4488	March 1st to Sept. 30th
All Units	Type II Helicopter	0007 (2956), 0011, 0014, 0619, 0694, 0827, 2460, 2846, 2962, 2968, 4095, 4196, 4397, 4405, 4488	March 1st to July 15th
Blasting Locations TBD	Blasting within 1.0 mile of a known or predicted owl site	TBD	March 1st to July 15th
Blasting Locations TBD	Blasting within 0.25 mile of a known or predicted owl site	TBD	July 16th to Sept. 30th

Direct/Indirect Effects

Alternative 1 (No Action) - Noise Disturbance

This alternative would not disturb any known owl sites in the Toll Joe Project Area. Under Alternative 1, all conditions of the Toll Joe Project Area would remain the same without any management activities or modifications.

Effects Determination - This alternative would have no effect on northern spotted owls due to disturbance.

Alternatives 2 & 3 – Noise Disturbance

Direct effects associated with project activities that may result in disturbance to spotted owls are considered short-term and are summarized as follows:

- Any activity proposed in the action alternatives resulting in disturbance outside the breeding season, or conducted beyond disturbance distances described in the Biological Assessment (USDA 2012) would have no effect on spotted owls (Appendix I).
- Due to seasonal restrictions of helicopter and potential blasting, no disruption to owls is anticipated.
- During the breeding season, disturbance activities such as use of chainsaws, heavy equipment, hauling, blasting, rock crushing, and prescribed burning *may affect but are not likely to adversely affect* known or predicted owl sites that are >0.25 miles from such activities.
- No known indirect noise disturbance effects would result from any of the proposed activities.

- With the additional seasonal restrictions employed (Table 50), all proposed activities of the Toll Joe Project Area are not likely to adversely affect spotted owl to the extent to disrupt a spotted owl or breeding pair from normal activities. Minimal disturbance is anticipated.

Cumulative Effects – Northern Spotted Owls and Critical Habitat

The effects of vegetative management on habitat and prey species, climate change, regional vegetation patterns, sudden oak death syndrome, West Nile virus and barred owls have been identified as individual and cumulative threats to the northern spotted owl (Anthony et al. 2004, Carey 2000, Courtney et al. 2004, Forsman et al 1984, Gomez et al. 2005, Hicks et al. 1999, Manning et al 2012, Meiman et al. 2003, Wiens 2012, Wilson 2010, Wilson 2013). As a result, the overall northern spotted owl population densities have decreased throughout its range, specifically in areas where these threats are present (USDA 2012, USDI 2012). In addition, the Recovery Plan for the Northern Spotted Owl, US Fish & Wildlife Service identifies habitat loss and competition from barred owls as the two main threats to the spotted owl (2012b)

Habitat Loss - Continued habitat loss or degradation due to timber harvest, especially on Federal lands, has declined relative to expectations in 1990 (Courtney et al. 2004). Nonetheless, past habitat loss is a current threat when compiled with current management activities. Past management activities, such as timber harvest, have reduced or fragmented northern spotted owl habitat throughout its range and has contributed to poor demographic performance (Courtney et al. 2004). As a result, overall population densities have decreased, specifically in areas where habitat reduction is concentrated and other factors are present (Anthony et al. 2004, USDI 2011).

Barred Owls and Competition - The barred owl is an invasive species from the eastern United States and has expanded its range extensively throughout the Pacific Northwest. It is a generalist that can utilize a wide range of habitat types and forest age classes (Herter and Hicks 2000, Livezey 2007, Pearson and Livezey 2003, USDI 2012b). It also has a wide diet range and can survive on many different prey types (Forsman et al 2004, USDI 2011, USDI 2012b, Van Lanen et al. 2011, and Wiens 2012). Competition with barred owls is an important threat to northern spotted owls and was addressed in the project Biological Opinion (FWS Reference Number 01EOFW00-2012-F-0158). This document is part of the project record and available upon request. As discussed previously, Recovery Action 32 recommends protection of the highest quality habitat to reduce interspecific competition between the two owl species and no RA 32 habitat would be affected by this project.

In the recent meta-analysis of spotted owl populations, Forsman et al. (2011:77) wrote:

> *"In view of the continued decline of spotted owls in most study areas, it would be wise to preserve as much high-quality habitat in late successional forests for spotted owls as possible. This recommendation is comparable to (Recovery Action 32) in the final recovery plan for northern spotted owls (USFWS 2011), but we believe a more inclusive definition of high-quality habitat is needed than the rather vague definition provided in the 2011 recovery plan. Much of the habitat occupied by NSOs and their prey does not fit the classical definition of*

> *'old-growth' as defined by Franklin and Spies (1991), and a narrow definition of habitat based on (this) criteria would exclude many areas currently occupied by NSOs. Second, we believe more information on competitive interactions between northern spotted owls and barred owls is needed. A recent study by D. Wiens at Oregon State University …will provide some of this information for western Oregon, but similar information is needed for other parts of the range of spotted owls."*

The Wiens (2012) study found that spotted owls and barred owls both prefer conifer forests >120 years of age with dominant overstory trees > 90 centimeters DBH. Use of such forests was 2-5 times greater than their availability. Loss of these old forests is likely to increase the competition between the two owl species for territorial space with negative effects to spotted owls. Wiens (2012) found a substantial decline in survival of spotted owls as the percent of old conifer forest in the general home range dropped below 35%. He recommended that conifer forests > 120 years of age be protected to avoid further increasing the competition pressure from barred owls. The Toll Joe project does not affect any forests that are older than 120 years of age.

Other Factors **-** Connected issues such as climate change effects on regional vegetation patterns, sudden oak death syndrome and West Nile virus have also added to cumulative threats of the species (Courtney et al. 2004). With the onset of climate change, new problems may arise with potential effects to vegetation patterns. In addition, sudden oak death presents a possible future threat to northern spotted owl habitat because of its potential impact on forest tree dynamics and alteration of key habitat components, most specifically in the southern portion of its known range (Courtney et al. 2004). West Nile virus has also become an issue of concern as it has spread quite rapidly though the United States in recent years. The virus is now within the range of the northern spotted owl, although no known cases of infection are documented at this time (Courtney et al. 2004, ODHS 2013).

Fire, wind and volcanic activity have also been issues of concern and serve as potential sources of habitat loss. With the buildup of fuels in some areas of the Cascades, there is a potential for stand-replacing fire events. Fire events such as the 2003 Biscuit Fire in southwest Oregon produced a 2.3% of northern spotted owl habitat loss (Courtney et al. 2004). Wind throw and volcanic activity were considered issues by the 5-year review species status review; however, such issues were insignificant in comparison to threats of wildland fires (Courtney et al. 2004).

Summary of Cumulative Effects **-** The area analyzed for cumulative effects was the Toll Joe Project Area, proposed harvest units and past land management activities on the Sweet Home Ranger District. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects. Timber harvest and road building have reduced the amount of snags and down wood habitat within the project area while natural disturbances typically have increased snag and down wood levels. Proposed thinning activities may improve the area on a landscape level; however, these improvements to the landscape would not benefit northern spotted owls in the short term and it is expected that the area would not be suitable

habitat for at least 20 years. In the reasonable foreseeable future, there are no additional habitat-altering projects identified at this time within the project area.

Sensitive Species

Current Conditions - Terrestrial wildlife species listed for the Willamette National Forest under the 2011 Regional Forester's Special Status Species Program (USDA 2011) were evaluated to determine if individuals, populations or habitat would be impacted by Toll Joe Project Area activities and are shown on Table 51. Analysis methods included evaluating proposed stands for potential habitat and reviewing historic data.

Table 51: Sensitive Terrestrial Wildlife Species on the Willamette National Forest

Species	Habitat Present	Species Documented in the Project Area	Conflict	Analysis of Effect
Amphibians				
Foothill Yellow-legged Frog	No			
Oregon Spotted Frog	No			
Birds				
American Peregrine Falcon	Yes	Yes	Potential Conflict	MIIH, NLCT*
Bald Eagle	No			
Black Swift	No			
Bufflehead Duck	No			
Harlequin Duck	Yes	Yes	Potential Conflict	MIIH, NLCT*
Lewis's Woodpecker	No			
Northern Waterthrush	No			
Purple Martin	No			
White-headed Woodpecker	No			
Yellow Rail	No			
Insects				
California Shield-backed Bug	Yes	No	No Conflict	No Impact
Johnson's Hairstreak	Yes	No	Potential Conflict	MIIH, NLCT*
Mardon Skipper	Yes	No	No Conflict	No Impact
Western Bumblebee	Yes	No	No Conflict	No Impact
Mammals				
North American Wolverine	No			
Fisher	Yes	Yes	Potential Conflict	MIIH, NLCT*
Fringed Myotis	Yes	No	Potential Conflict	MIIH, NLCT*
Pallid Bat	No			

Table 51: Sensitive Terrestrial Wildlife Species on the Willamette National Forest				
Townsend's Big-eared Bat	Yes	No	Potential Conflict	MIIH, NLCT*
Mollusks				
Crater Lake Tightcoil	Yes	No	Potential Conflict	MIIH, NLCT*
Cascade Axetail Slug	Yes	Yes	Potential Conflict	MIIH, NLCT*
Reptiles				
Northwestern Pond Turtle	No			

*MIIH, NLCT = May Impact Individuals or their Habitat, but the action would Not Likely Contribute to a Trend towards Federal Listing or loss of viability to the population or species.

Foothill Yellow-legged Frog, Oregon Spotted Frog, Bald Eagle, Black Swift, Bufflehead Duck, Lewis's Woodpecker, Northern Waterthrush, Purple Martin, White-headed Woodpecker, Yellow Rail, North American Wolverine, Pallid Bat and Northwestern Pond Turtle - No suitable habitat exists in the Toll Joe Project Area for these species; and therefore, will not be discussed further in this document.

Desired Future Conditions: Desired future conditions for those species that have habitat affected by proposed activities should strive for developing and maintaining mature to late-successional conditions and providing a well-distributed network of high quality habitat on a landscape scale. High quality habitat should include a multi-story stand structure, vegetative complexity and canopy cover of at least 60%. Coarse woody debris components, primarily large down wood 20" and greater, should be present to provide adequate habitat conditions for the fisher and Cascade axetail slug. Along with down wood components, vine maple should be retained to provide adequate habitat for the Cascade axetail slug.

In addition, large snags 20" and greater should also be present to provide habitat for the Townsend's big-eared bat and fringed myotis. Riparian corridors should provide down wood and riparian vegetation to meet harlequin duck and Crater Lake tightcoil needs. American peregrine falcon habitat should include the protection of cliff areas and enhance forage opportunities in existing early seral habitat that would promote prey species. Forest conditions are not static; therefore, future management activities should involve the enhancement of younger stands that exhibit a lack of structural diversity and incorporate a coarse woody debris component.

Environmental Effects

Direct/Indirect Effects

Alternative 1 (No Action)

California Shield-backed Bug, Mardon Skipper and Western Bumblebee - No proposed activities would take place in suitable habitat for these species; and therefore, no impact to these species or their habitat is expected to occur.

American Peregrine Falcon, Harlequin Duck, Johnson's Hairstreak, Fisher, Fringed Myotis, Townsend's Big-eared Bat, Crater Lake Tightcoil and Cascade Axetail Slug - This alternative would not modify associated habitat within the proposed units. Under Alternative 1, all conditions within the Toll Joe Project Area would progress naturally through time.

Alternatives 2 & 3

California Shield-backed Bug, Mardon Skipper and Western Bumblebee - No proposed activities would take place in suitable habitat for these species; and therefore, no impact to these species or their habitat is expected to occur. Suitable habitat would receive a 100-foot buffer.

American Peregrine Falcon and Harlequin Duck – Both Alternatives 2 and 3 propose helicopter use in the Toll Joe Project Area. Helicopter use during the breeding season may impact these species. As a result, seasonal restrictions would be placed on helicopter activities for both action alternatives. Proposed helicopter activities in both Alternative 2 and 3 that take place outside of the nesting season, may impact individuals temporarily, but the actions would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Crater Lake Tightcoil – No proposed activities would take place in suitable habitat for this species; and therefore, no impact to these species or their habitat is expected to occur. Suitable habitat would receive a 10 meter buffer.

Johnson's Hairstreak – Approximately 45% of the stands in this project area are in the western hemlock plant series, with dwarf mistletoe present. Proposed activities of either Action Alternative may impact this sensitive species where dwarf mistletoe occurs on western hemlock and is selected for harvest. However, the activities of either Alternative are anticipated to affect less than 1% of the habitat in the watershed. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Fisher - Fishers are unlikely to occur in the project area and the scale of the alternatives, which would affect less than 1% of a hypothetical female home range, would not preclude them from reestablishing in the watershed.

Fringed Myotis and Townsend's Big-eared Bat – All proposed stands of Alternative 2 or 3 have potential foraging and roosting habitat for these species. The probability that an occupied roost or natal site would be fallen during logging operations is low. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Cascade Axetail Slug – Past survey efforts indicate that this endemic species is relatively abundant within its restricted range. Proposed activities of either Action Alternative would impact only a small portion of the known and likely occupied sites in the watershed and on the Forest. All known sites would receive a 2 acre protection buffer. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Survey and Manage Species

Current Conditions - The Toll Joe project applies the 2001 Survey and Manage species list and meets the provisions of 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 2001). It also complies with the Northwest Forest Plan and interim direction in response to the agreement on transition language in the Conservation Northwest, et al v. Harris Sherman, et al and D.R. Johnson Company, Case NO C08-1067-JCC (August 9, 2013.). Based on the Parties' Joint Status Report (August 16, 2013) certain categories of projects may proceed with reliance on the 2011 Consent Decree. This project considers suitable habitat for survey and manage species and applies appropriate mitigations providing for a reasonable assurance of species' persistence.

Table 52 shows current Survey and Manage species whose known or suspected range includes the Willamette National Forest, specifically the Sweet Home Ranger District. Pre-disturbance surveys and management of known sites required by protocol standards were either completed or not required.

Table 52: Survey and Manage Species Associated with Sweet Home Ranger District

	Within the Range of the Species?	Project Activities Occur in Suitable Habitat?	Sites Known or Found?	Surveys Conducted ?	Survey Date	Project Affects?
Great Grey Owl	Yes	No	No	N/A[2]	N/A	No
Red Tree Vole	Yes	Yes	Yes	Yes[1]	2011-2012	MIIH, NLCT*
Oregon Megomphix	Yes	No	No	N/A[2]	N/A	No
Crater Lake Tightcoil	See the Sensitive Species section of this document for analysis.					

**MIIH, NLCT = May Impact Individuals or their Habitat, but the action would Not Likely Contribute to a Trend towards Federal Listing or loss of viability to the population or species as a result of implementing no harvest buffers on active nests.*

[1] *Surveys are not required in stands less than 80 years old. Stands 80 years and older were surveyed using the Red Tree Vole 2.1 and 3.0 Protocols (USDA 2002, 2012). Ground transect line, individual tree search, tree climbing and 100 meter nest search surveys were conducted. All active red tree vole nests would be protected with 10 acre buffers.*

[2] *Proposed activities of either Action Alternative do not occur in suitable habitat, therefore, surveys are not required.*

Red Tree Vole - *Arborimus longicaudus*

The red tree vole is endemic to moist coniferous forests of Western Oregon and extreme Northwest California and is an important prey species to the northern spotted owl. Current research suggests that this species is a habitat specialist, primarily associated with mature and old-growth forest conditions where Douglas fir is the dominate tree species (Dunk et al. 2009). In addition, red tree voles tend to have limited dispersal abilities based on biological requirements

and life history traits (Dunk et al 2009). The Toll Joe Project Area is within the Northern Mesic Zone where habitat disturbing activities require surveys if the stand or a portion of the stand has a QMD (Quadratic Mean Diameter) of 16" DBH and greater or is suitable red tree vole habitat older than 80 years that has mature to old-growth conifer forest conditions, multi-layered canopies and large branches capable of supporting nests and providing travel routes for red tree voles (Huff 2012). Proposed units in the Toll Joe Project Area that had QMD levels of 16" DBH and greater or were > 80 years old were analyzed for potential red tree vole habitat. Units that were considered suitable red tree vole habitat were surveyed using ground searches, individual tree examination surveys and tree climbing methods with 100 meter searches.

Red tree voles were documented in the Toll Joe Project Area and 10 acre no-harvest buffers were placed on active red tree vole sites and inactive nest sites within 100 meter of an active site.

Desired Future Conditions - Desired conditions should strive for a contiguous, well-distributed network of high quality habitat on a landscape scale. High quality habitat should include a multi-story stand structure with old growth quality and canopy cover of at least 60%. Douglas fir trees larger than 16" DBH should be retained to provide adequate red tree vole habitat. Forest conditions are not static; therefore, future management activities should involve the enhancement of younger stands that exhibit a lack of structural diversity.

Direct/Indirect Effects

Alternative 1 (No Action)

This alternative would not modify associated habitat within the proposed units. Under Alternative 1, all conditions of the Toll Joe Project Area would progress naturally throughout time.

Alternatives 2 & 3

Proposed fuel treatments and commercial thinning activities in Alternatives 2 and 3 either meet the required Quadratic Mean Diameter (QMD) or do exhibit stand complexity associated with suitable red tree vole habitat. Surveys found red tree vole activity in stands with suitable red tree vole habitat. Active nest sites would be protected with 10 acre buffers and inactive nests within 100 meters of an active site would be protected with a 10 acre buffer as well. Proposed activities are expected to occur outside of known red tree vole active sites and such proposed activities may impact individuals of the population by reducing dispersal potential, canopy cover, connectivity and canopy complexity. In the active red tree vole areas, dispersal may be difficult and suitable habitat may be restricted to riparian and suitable habitat corridors until the area recovers to mature stand conditions. In addition, thinning in stands may impact dispersal capabilities temporarily by reducing canopy connectivity. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Management Indicator Species

Current Conditions - The Willamette National Forest Plan has identified a number of terrestrial wildlife species with habitat needs that are representative of other wildlife species with similar habitat requirements for survival and reproduction. These species have been chosen due to specific habitat requirements that may be substantially influenced by management practices, and therefore, can facilitate in providing guidance towards maintaining viable populations of other species in similar habitat (Table 53). These Management Indicator Species (MIS) include the northern spotted owl, bald eagle, American peregrine falcon, cavity excavators, pileated woodpecker, American marten and big game (black-tailed deer and elk). These species occur in or near the Toll Joe Project Area. The northern spotted owl, bald eagle and American peregrine falcon are addressed in the Threatened and Sensitive Species sections and will not be discussed further in this section.

Table 53: Management Indicator Species Associated with Sweet Home Ranger District

Indicator Species	Habitat Features	Selection Criteria
Northern Spotted Owl	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat - Federal Register of Threatened & Endangered Species - See T & E Section
Bald Eagle	Old-growth conifers near large bodies of water	- Represent limited habitat - Sensitive Species listing due to de-listing in Aug. 2007 - See Sensitive Species Section
American Peregrine Falcon	Cliff nesting habitat near abundant prey.	- Ecological Indicator - Represents limited habitat - See Sensitive Species Section
Cavity Nesters	Dead and decaying trees	- Ecological Indicator - Represents limited habitat
Pileated Woodpecker	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat
American Marten	Old-growth and mature conifer	- Ecological Indicator - Represents limited habitat
Big Game (Deer and Elk)	Summer Range	- Commonly hunted

***Desired Future Conditions*:** Desired future conditions for the pileated woodpeckers, cavity excavators and American marten should strive for maintaining a contiguous, well distributed network of high quality habitat on a landscape scale, especially in Late-Successional Reserves. High quality habitat should include a multi-story stand structure with old growth quality and canopy cover of at least 60%. Medium and large snag and down wood components should also be present to provide habitat for nesting, roosting and prey availability. Desired future conditions for big game should maintain habitat that would provide a harvestable population. Future management activities should focus on maintaining all cover and foraging types outside of Late-Successional Reserves, with natural meadow openings managed as a priority in High

Emphasis Areas. This would involve decreasing open road mileage and shifting dominant cover types, such as hiding and thermal, to more optimal cover type conditions. In addition, management activities would involve maintaining existing meadow forage by managing for tree encroachment and sapling invasion as a priority outside of Late-Successional Reserves. Proposed units that are 40 years and less which occur outside of Late-Successional Reserves and Critical Habitat for the Northern Spotted Owl should be managed for forage potential in summer range areas until those stands have an opportunity to develop.

Direct/Indirect Effects

Alternative 1 (No Action)

Cavity Excavators, Pileated Woodpeckers and American Marten - This alternative would not modify or disturb any habitat associated with these species, including snag or down wood levels within the proposed units. Under Alternative 1, all conditions of the Toll Joe Project Area would progress naturally.

Big Game – Roosevelt Elk and Black-tailed Deer - The quality of forage and thermal cover in proposed units would gradually increase under Alternative 1 as natural mortality thins the dense stocking levels, releases dominant trees and allows a shrub/herbaceous layer to develop in small openings.

Road densities would remain the same as they are currently, but some local roads may close over time through vegetative growth and lack of maintenance. This alternative would also result in a slower transition to optimal habitat than the action alternatives due to the length of time needed to reach late mature forest conditions without the aid of thinning activities. Forage may also decrease as regeneration stands and stands heavily thinned start to recover and develop.

Alternatives 2 & 3

Cavity Excavators, Pileated Woodpeckers and American Marten – Proposed activities for either Action Alternative may impact these species less than 1% at the watershed scale, however, Alternative 2 would pose a greater impact to those species where proposed activities are associated with the older stands (> 80 years) that may have larger diameter trees, more complex canopy structure, vegetative diversity and more coarse woody debris in a wider range of size classes. Such proposed activities, especially those in stands > 80 years old, could also disrupt natural processes and reduce or delay coarse woody debris development. Retaining remnant old-growth trees (trees > 30” DBH, if present), retaining current coarse woody debris and creating additional features where needed would improve habitat for these species over time. Indirect effects associated with habitat modification activities may be beneficial to such species if silvicultural prescriptions intend to accelerate the transition from simplified to complex stand structure by thinning and increase forest health in stands that lack such attributes. It is estimated that in about 10-20 years, tree growth as a result of thinning could increase tree diameter, height and canopy cover in younger stands that lack such attributes. This could result in improved habitat and microclimate conditions in the long term; however, short term actions may impact individuals. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but

the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Big Game – Roosevelt Elk and Black-tailed Deer - All action alternatives would improve habitat conditions by opening up the understory to allow for forage species to persist; however, due to the close proximity to Highway 20 and well used Forest Service roads, caution should be used in managing for big game in this project area. Any big game enhancement opportunities should draw big game away from the highway and into forest corridors. Gap placement of $^{1}/_{10}^{th}$ to 5 acres in size would provide potential foraging habitat until such openings close over time. Current forage species are of low or marginal nutritional value, thus, future planting of native species may not provide adequate nutritional value in this area. Planting in gaps should occur away from the highway and well used Forest Service roads. Reducing the canopy cover also allows more sunlight to reach the forest floor to promote shrub and herbaceous vegetation growth. The development rate of complexity may be greater in Action Alternatives than would occur naturally under Alternative 1 barring any major natural disturbance. Post-sale projects would involve browse cutback to stimulate forage growth and planting forage species, especially in summer range areas, in units 40 years and less.

The decommissioning of temporary roads would further improve the overall habitat quality for elk and is encouraged. If post-sale funding becomes available, one gate would be replaced in the project area that provides wildlife refugia to big game and other species, and would close approximately 1.25 miles of system roads. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Migratory Birds

Current Conditions - The Pacific Northwest supports the highest abundance of birds in any coniferous forest system in North America (Altman 1999). Neo-tropical migrants comprise the largest portion of the bird community and have been absent from resource management plans (Altman 1999). Past management activities have created poor habitat conditions across the landscape and, as a result, neo-tropical migrant populations have been on the decline. In addition, fire suppression has added to the decrease in habitat variability. Species such as the olive-sided flycatcher, western wood pewee, brown creeper and varied thrush have exhibited substantial population decline as a result of habitat loss and fragmentation (Altman 1999).

Forests that exhibit a complex, structurally diverse composition tend to attract a wider diversity of land bird species (Altman 1999). In addition, the importance of habitat associated with hardwood trees and shrubs has been widely documented in published literature as one of the leading factors influencing bird community composition in conifer-dominated landscapes that typify the Toll Joe Project Area (Csuti et al. 1997, Marshall et al. 2003, O'Neil et al. 2001). Hardwood habitat in this project area is limited or located in Riparian Reserves.

Northern flickers, dark-eyed juncos, hermit warblers, varied thrushes, gray jays, winter wrens and yellow-rumped warblers were among some of the species observed in the Toll Joe Project Area.

Desired Future Conditions: Desired future conditions for migratory birds would involve management practices that ensure long-term viability of healthy populations. Identifying areas that express extreme homogeneity and employing management activities that would introduce variability across the landscape would be the first step in maintaining viable populations. Efforts should focus on creating a multi-story, complex canopy structure with habitat components such as, down wood, snags and small openings. Maintaining meadows, hardwood stands and riparian areas should be a primary focus as well. A strategy should be implemented that takes into consideration the recommendations from the Partners in Flight Conservation Strategy which has identified at least 20 focal species.

Direct/Indirect Effects

Alternative 1 (No Action)

This alternative would not modify or disturb any habitat associated with migratory birds, including snag or down wood levels within the proposed units. Under Alternative 1, all conditions of the Toll Joe Project Area would progress naturally throughout time.

Alternatives 2 & 3

Proposed activities from either Action Alternative are generally considered neutral or beneficial to migratory birds and disturbance is anticipated to be minimal to such species. Thinning and gap placement may also provide an understory shrub layer for further migratory bird biodiversity. Therefore, Alternative 2 or 3 may impact individuals or their habitat temporarily, but the action would not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Cumulative Effects- Sensitive Species, Survey & Manage Species, Management Indicator Species and Migratory Bird Species

The area analyzed for cumulative effects was the Toll Joe Project Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities as well as natural disturbances have all impacted the wildlife habitat within the project area. These actions have affected the overall diversity of forested habitat largely by reducing the amount of late seral habitat and maintaining the amount of early to mid-seral habitat and proposed actions of Toll Joe would continue this trend, along with the possibility of future harvest entries. There are no foreseeable actions that would negatively affect stands older than 120 years (late seral).

Coarse Woody Debris

Introduction

Coarse woody debris in the form of snags and down wood are important habitat features for a variety of wildlife species and has become an issue to consider when land management activities may affect current levels on the landscape. 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 (Mellen et al. 2012). At the landscape

level, DecAID recommends providing dead wood at levels within the range of historic variability. The 5th field South Santiam River watershed was used to evaluate deadwood at the landscape level for this project. The median historic condition for this watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages and an estimate of the normal distribution of seral stages derived from the assumed fire return interval. 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 substantially variability in weather conditions and fire severity from century to century (Wimberley et al. 2000). Therefore, levels of dead wood have fluctuated considerably over time and plus or minus 50% of the estimate median value was used to approximate the historic range of variability.

DecAID evaluates deadwood levels by wildlife habitat type. All of the proposed activities of Toll Joe are in the Westside Lowland Conifer-Hardwood Forest habitat (WLCH_OCA). An analysis of deadwood information for the South Santiam River watershed for this forest type suggests that current levels of logs, both large and small, are within historic levels. The median reference condition for total downed log (5” diameter or larger) cover is 4.6% compared to the current estimated condition of 3.9%. The median reference condition for large (20” or greater diameter) log cover is 1.6% compared to the current estimated condition of 2.0%.

The DecAID analysis suggests that, for WLCH_OCA habitat, snags are below historic levels in the South Santiam River watershed. The median reference condition for total snags 10” DBH (diameter breast high) or larger is about 12/acre compared to the current estimated condition of 7/acre. The median reference condition for large snags 20” DBH or larger is about 5/acre compared to the current estimated condition of 3/acre. Currently, within the South Santiam River watershed, about 26.6% of the WLCH_OCA habitat is estimated to have no large snags compared to an estimate of 12.5% for the median historic condition. For snags 10” DBH or larger, about 21% of the habitat is estimated to have no snags compared to an estimate of 5% for the median historic condition. The current lower density of snags and greater percentage of areas lacking snags compared to historic conditions is mainly due to past clearcut harvesting that removed existing snags as well as the trees that could provide future snags. Fire suppression activities have also helped reduce deadwood abundance in the watershed.

Current Conditions At the South Santiam River Watershed Scale - The South Santiam Watershed totals about 101,800 acres including non-federal lands, with approximately 61,600 acres in Westside Lowland Conifer/Hardwood (WLCH) Forest-Oregon Cascades habitat and 37,100 acres in Montane Mixed Conifer Forest habitat. Proposed activities fall primarily within the Western Lowland Conifer/Hardwood category. Snag levels at a watershed scale are low overall in the larger diameter classes. Information for down wood material at the watershed scale was not available at the time of analysis. See Figure 39.

The reference line shows the estimated median historic percent of the watershed in a given snag density class. Snag densities are expressed as numbers of large snags/acre

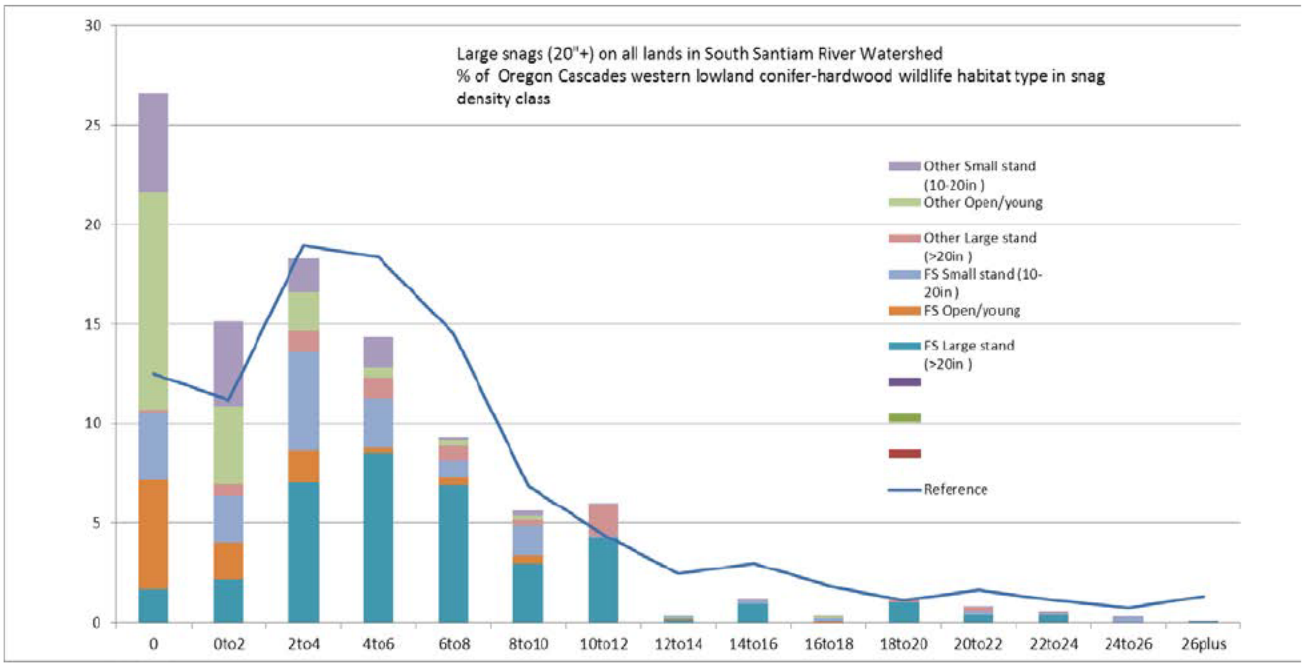

Figure 39: Snag Levels at the Watershed Scale for the South Santiam Watershed for WLCH Habitat

Current Conditions - At the Toll Joe Project Scale - Snag levels in stands less than 80 years are currently below the historic condition, while snags in stands > 80 years are close to the historic condition (Table 54).

Table 54: Current Snag Conditions in Proposed Stands Relative to DecAID Tolerances in Unmanaged Stands (assuming historic conditions)*

Stand Age	Snag Size	Current Snags/Acre	DecAID – WLCH_OCA Tolerance Level
30-79 Yrs.	≥ 10" DBH	~ 5 Snags/Acre*	< 30% Tolerance Level
	≥ 20" DBH	~ 1 Snag/Acre*	< 30%Tolerance Level
80-110 Yrs.	≥ 10" DBH	~ 20 Snags/Acre*	60% Tolerance Level
	≥ 20" DBH	~ 4 Snag/Acre*	40%Tolerance Level

**Field Recon and Stand Exam data used to determine Snags/Acre average.*

Down wood levels in stands less than 80 years are currently below the historic condition, while down wood in stands > 80 years close to the historic condition (Table 55).

Table 55: Current Down Wood Conditions in Proposed Stands Relative to DecAID Tolerances in Unmanaged Stands (assuming historic conditions)*

Stand Age	Down Wood Size	DecAID – WLCH_OCA	
		Current Percent Cover	Tolerance Level
30-79 Years	≥ 6" DBH	Approx. 2.0-4.6%**	< 30%Tolerance Level
80-110 Years	≥ 6" DBH	Approx. 1.8-5.5%**	~30%-40%Tolerance Level

***Percent Cover for the current condition is slightly under estimated because its relies on size classes 6" DBH and greater and stands varied, whereas DecAID tolerance levels are based on 4" DBH and greater.*

**Field Recon and Stand Exam data used to determine percent cover.*

Desired Future Conditions: Desired future conditions for this area should strive to meet Forest Standard and Guidelines for coarse woody debris at a minimum. Further effort may be taken with the consideration of the best available science and recommendations from DecAID. As forest conditions become more complex and diversified, so would wildlife species composition. Creating and retaining decayed wood elements along with the thinning of overstocked stands, in the long term, may provide a more diversified landscape for wildlife species. This, however, may require multiple entries over time since larger age classes are not present in the levels needed to contribute to stand conditions.

Overall, the goal in this area should reflect a change in vegetative management that produces a more heterogeneous forest structure. Proposed Action Alternatives do not appear to increase snag and down wood levels as readily when compared to the No Action Alternative. As a result, developing silvicultural prescriptions that consider snag and down wood components is crucial.

Retaining remnant old-growth trees (trees > 30" DBH, if present), retaining current coarse woody debris and creating additional features (skips in silvicultural prescriptions) where needed would improve habitat for coarse woody dependent species over time.

Direct/Indirect Effects

Alternative 1 (No Action)

This alternative would not modify or disturb snag or down wood levels within the proposed units. Natural processes over time would eventually increase both snag densities more so than the Action Alternatives (Figures 40-44). Down wood cover information was not available for the No Action Alternative; however, it is expected that natural processes over time would eventually increase down wood densities as well. Under Alternative 1, all conditions in the Toll Joe Project Area would progress naturally throughout time.

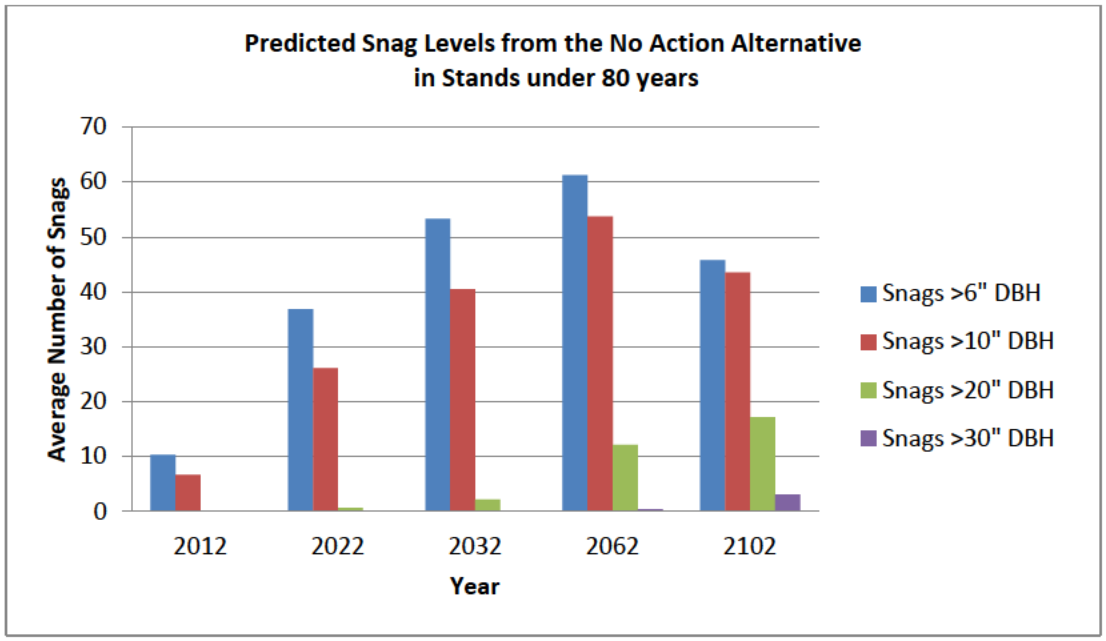

Figure 40: Predicted Snag Level in No Action Alternative in Stands < 80 Years Old

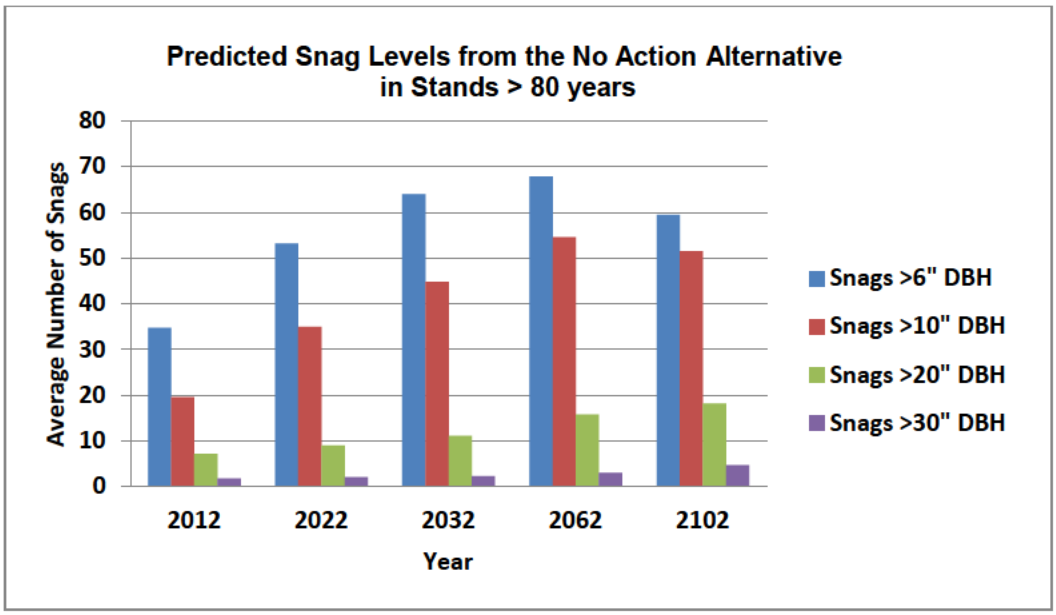

Figure 41: Predicted Snag Level in No Action Alternative in Stands > 80 Years Old

Alternatives 2 & 3

Activities that involve fuels treatment and commercial thinning may degrade habitat by reducing or delaying the potential recruitment for medium and large snags and down wood. Proposed activities in either Action Alternative may impact species dependent on snags and down wood; however, Alternative 2 would pose a greater impact to those species where proposed activities are associated with the older stands (> 80 years) that may have larger diameter trees, more complex canopy structure, vegetative diversity and more coarse woody debris in a wider range of size classes. Such proposed activities, especially those in stands > 80 years old, could

also disrupt natural processes and reduce or delay coarse woody debris development. Retaining remnant old-growth trees (trees > 30" DBH, if present), retaining current coarse woody debris and creating additional features where needed would improve habitat for these species over time. Indirect effects associated with habitat modification activities may be beneficial in the long term since silvicultural prescriptions intend to accelerate stand structure by thinning, however, predicted snag levels show that only smaller snags are increased over time, whereas recruitment for larger snags remains the same among the no action and action alternatives (Figures 40-44). Fuels treatments, especially those on the ground may impact these species, especially in the short term (20 years or less). It is estimated that in about 20 years, thinning may begin to increase tree diameter, height and canopy cover, but not necessarily increase medium and large snag recruitment. Although predicted data for down woody debris was not available at the time of this analysis, it can be expected that the same trend would occur as in predicted snags numbers (Figures 40-44).

Those species that utilize large snags and down wood, such as pileated woodpeckers and American marten may be affected by proposed actions from either Alternative, but those actions are not thought to create a loss of individuals or populations in the watershed. On a watershed scale, those species could utilize other areas until harvested units recover.

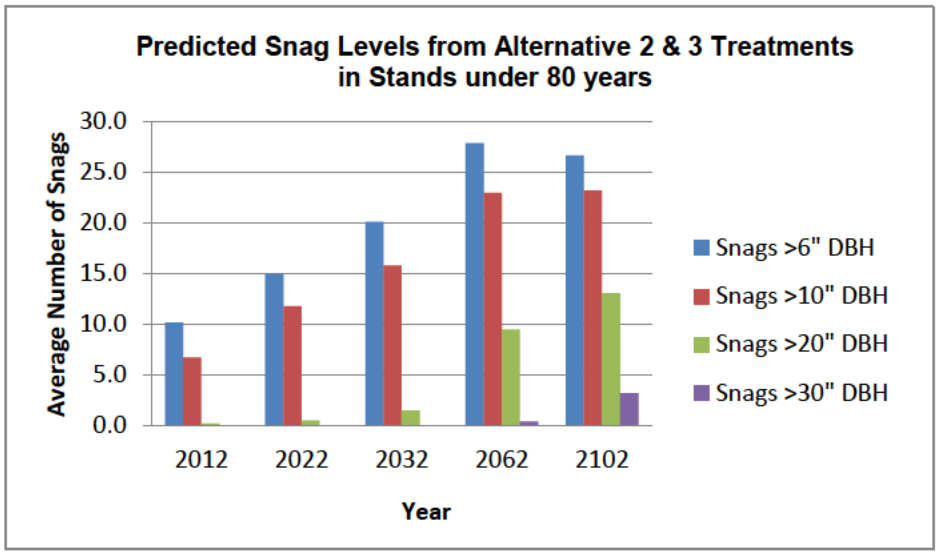

Figure 42: Predicted Snag Levels from Alternative 2 and 3 Treatments in Stands < 80 Years Old

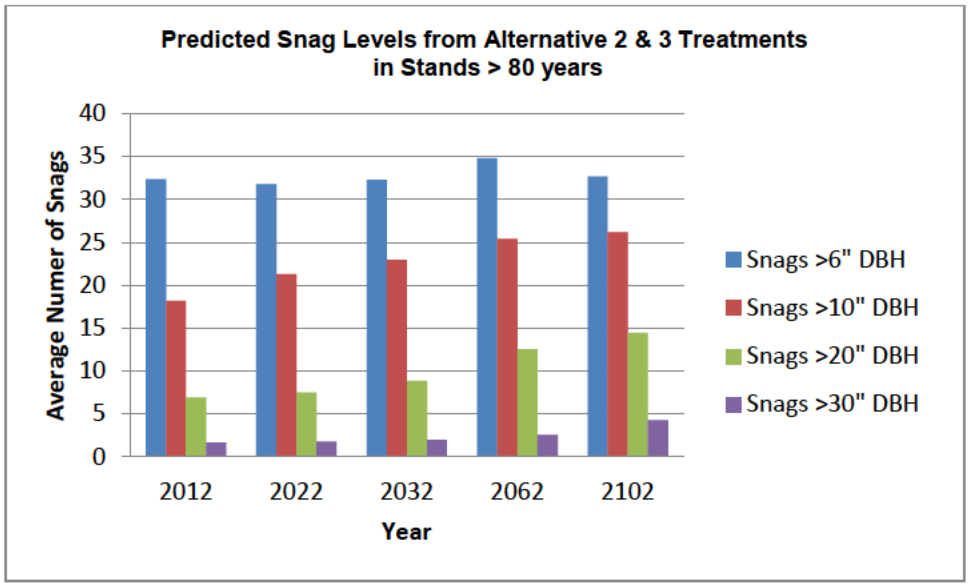

Figure 43: Predicted Snag Levels from Alternative 2 Treatments in Stands > 80 Years Old

Cumulative Effects

The area analyzed for cumulative effects was the Toll Joe Project Area and proposed harvest units. Past timber harvest, road construction, fire suppression and road maintenance activities have contributed to cumulative effects of this area. Timber harvest, road building and natural disturbances have all impacted the amount of snags and down wood habitat within the Toll Joe Project Area. Currently, the proposed units in the Toll Joe Project Area show moderate down wood and snag levels in diameter classes less than 12" and low down wood and snag levels at larger size classes. Past timber harvest and road building typically reduce snag and down wood habitat while natural disturbances tend to increase snag and down wood levels. Snag and down wood levels are expected to continue to increase in the project area, but at a slower rate than the No Action Alternative. In the reasonable foreseeable future, there are no additional habitat altering projects identified at this time within the Toll Joe Project Area.

Appendices

- Appendix A: Integrated Prescriptions
- Appendix B: Monitoring Requirements
- Appendix C: Post Sale Activities
- Appendix D: Economic Analysis
- Appendix E: Compliance with Aquatic Conservation Strategy Objectives
- Appendix F: Compliance with Requirements, Laws and Regulations
- Appendix G: References
- Appendix H: Silvicultural Prescription
- Appendix I: Biological Assessment, Biological Opinion