Thunderbolt Thinning and Hazardous Fuels Treatment Environmental Assessment

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U.S. Department of Interior
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Roseburg District
Swiftwater Field Office
Roseburg, Oregon

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U.S. Department of the Interior, Bureau of Land Management
Roseburg District Office
777 NW Garden Valley Blvd.
Roseburg, Oregon 97471

This environmental assessment analyzes proposed thinning and hazardous fuels treatment designed in conformance with management direction provided in the 1995 Roseburg Record of Decision and Resource Management Plan (ROD/RMP), as amended.

The BLM is providing a 30-day period for public review and comment on the document and will accept comments until the close of business (4:30 PM, PST) on December 12, 2013.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. Individual respondents may request confidentiality. Such requests will be honored to the extent allowed by the law. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Submissions from organizations, businesses, and individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

In keeping with Bureau of Land Management policy, the Roseburg District posts Environmental Assessments, Environmental Impact Statements, Findings of No Significant Impact, and Decision Records/Documentations on the district web page under Planning & Environmental Analysis, at http://www.blm.gov/or/districts/roseburg/plans/. A copy of these documents is also made available in the public reading room of the Roseburg Public Library. Individuals desiring a paper copy of such documents will be provided one upon request. Individuals with the ability to access these documents on-line are encouraged to do so as this reduces paper consumption and administrative costs associated with copying and mailing.

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Executive Summary

The Thunderbolt Thinning and Hazardous Fuels Treatment project would occur within the Adaptive Management Area (AMA), General Forest Management Area (GFMA), Connectivity/Diversity Blocks (C/D) and Riparian Reserve land use allocations administered by the Swiftwater Field Office, Roseburg District Office BLM. This Environmental Assessment (EA) considers four alternatives (including the No Action) for thinning of approximately 1,583 acres of forest stands, that are 49-95 years old in the proposed Big Thunder, Rolling Thunder and Thundering Herd timber sales. In addition, approximately 102 acres outside of proposed timber sale units are analyzed for treatment of hazardous fuels in stands 19-200 years old.

See *Table i* (*Comparison of the Key Findings and Effects of the Thunderbolt Alternatives*). This table highlights specific examples of the differences among the alternatives. For a complete discussion of the alternatives, see *Chapters 2* and *3*.

The Roseburg District initiated planning and design for this project on April 1, 2010. The project conforms to and is consistent with the Roseburg District's 1995 Record of Decision/Resource Management Plan (1995 ROD/RMP). Analysis of the effects of the proposed actions tiers to the analytical assumptions and conclusions of the 1994 *Final - Roseburg District Proposed Resource Management Plan/Environmental Impact Statement* ((PRMP/EIS) USDI/BLM 1994). Analysis of effects and information from the 2008 *Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management* is incorporated by reference.

Scoping comments gathered during the early stages in the planning process did not provide additional information specific to the proposed Thunderbolt Thinning project. As a consequence, these scoping comments did not prompt the Swiftwater Field Office to alter or include additional analyses beyond those already considered as pertinent by the interdisciplinary team.

Table i: Comparison of the Key Findings and Effects of the Thunderbolt Alternatives.

Key Finding/Effect		No Action Alternative	Proposed Action Alternative 1	Proposed Action Alternative 2	Proposed Action Alternative 3
Proposed Thinning	**Project Size**	0 acres	1,583 acres	1,583 acres	1,583 acres
	General Thinning Prescription	None	Light thinning prescription – upland treatment areas Moderate thinning prescription – riparian treatment areas Unit 31B - Gaps and skips in addition to the above prescription	Light thinning prescription – upland treatment areas Moderate thinning prescription – riparian treatment and shaded fuel break Unit 31B - Gaps and skips in addition to the above prescription	Light thinning prescription – upland treatment areas Moderate thinning prescription – riparian treatment and shaded fuel break Unit 31B - light, moderate, and heavy thinning prescriptions, gaps and skips
	Volume Harvested	0 MMBF	16 MMBF	16 MMBF	16 MMBF
	Proposed Road Maintenance or Renovation	0 miles	68.34 miles	68.34 miles	68.34 miles
	Proposed Road Construction	0 miles	4.79 miles	4.79 miles	4.79 miles
	Proposed Road Decommissioning	0 miles	8.99 miles	8.99 miles	8.99 miles
	Logging Slash Treatment – **Machine Piling and Burning** **Hand Piling and Burning**	0 acres	284 acres 118 acres		
Forest Vegetation	**Post-Harvest Canopy Cover**	No harvest 65-100%	57-76%	57-76%	54-76%
Hazardous Fuels Treatment	**Roadside Treatment – Within Timber Sale Units**	0 acres	118 acres	118 acres	118 acres
	Roadside Treatment – Outside Timber Sale Units	0 acres	0 acres	10 acres	10 acres
	Shaded Fuel Break – Within Timber Sale Units	0 acres	0 acres	101 acres	101 acres
	Shaded Fuel Break – Outside Timber Sale Units	0 acres	0 acres	92 acres	92 acres
Northern Spotted Owls	**Within Nest Patch** (300 meter radius) **Thinning** **Fuels Treatment**	0 acres	41 acres 0 acres	41 acres 0 acres	41 acres 0 acres
	Within Core Area (0.5 mile radius) **Thinning** **Fuels Treatment**	0 acres	403 acres 0 acres	403 acres 36 acres	403 acres 36 acres
	Within Home Range (1.2 mile radius) **Thinning** **Fuels Treatment**	0 acres	1,467 acres 0 acres	1,467 acres 75 acres	1,467 acres 75 acres
	Suitable Habitat	None would be modified	12 acres	76 acres	76 acres

Key Finding/Effect		No Action Alternative	Proposed Action Alternative 1	Proposed Action Alternative 2	Proposed Action Alternative 3
	Dispersal Habitat	None would be modified	1,571 acres	1,582 acres	1,582 acres
	Critical Habitat Modified	0 acres	1,387 acres	1,495 acres	1,495 acres
	Seasonal Restrictions	• **Harvest and fuels treatment activities -** Disruption restrictions would apply within at least 35 yards of to two activity centers within the proposed project area, including the No Bridge (IDNO 3996O) and South Susan (IDNO 4018A) activity centers from March 1 to July 15, both dates inclusive. • **Broadcast burning** - Disruption restrictions would apply to within one-quarter (0.25) mile of known five activity centers within the proposed project area, including: No Bridge (IDNO 3996O), South Susan (IDNO 4018A), Lookout Canyon (IDNO 4015A), Thunder Bob (INDO 0235O), and Shivigny (IDNO 2536O) activity centers from March 1 to July 15, both dates inclusive.. • **Modification of suitable nesting, roosting and foraging (NRF) habitat** within one-quarter (0.25) mile of a known northern spotted owl sites or unsurveyed suitable habitat would be prohibited from March 1 to September 30, both dates inclusive. Due to the modification of suitable habitat within the Big Thunder Unit 30I, disruption restrictions would be required for the Thunder Bob (INDO 0235O) activity center.			
Soils	**Detrimental Compaction** (3-9% of the ground-based yarding area; 2-3% of the cable yarding area)	0 acres	26-45 acres	26-45 acres	26-45 acres
	Roads or spurs that would use existing, compacted trails	0 miles	0.96 miles	0.96 miles	0.96 miles
	Roads or spurs mulched with logging slash to aid soil recovery	0 miles	3.09 miles	3.09 miles	3.09 miles
Hydrology, Aquatic Habitat & Fisheries	**"No-harvest" Stream Buffer Widths**	None	35 feet intermittent streams; 60 feet perennial & fish-bearing streams		
	Net Roaded Area (peak flow response when > 12%)	3.6%	3.5%		
	Stream Temperature	Unchanged	Stream temperature regimes would remain unchanged under all alternatives		
	Sediment Regime	Sources of sediment from roads that would not be fully repaired with road maintenance alone	Sources of sediment from roads would be reduced due to improved drainage.		
	Fish Populations	None	No impacts to fish populations would be anticipated under all alternatives		
Botany	**Bureau Sensitive & Strategic Botanical Species** (6 populations, 2 species discovered in Thunderbolt)	19 populations would persist at current levels and conditions	Six populations would persist at current levels.		
	Survey and Manage (13 populations, 4 species discovered in Thunderbolt)		13 populations would persist at current levels due to protection provided by the "no-harvest" stream buffers.		

Chapter 1. Purpose and Need for Action

A. Purpose & Need

The Bureau of Land Management (BLM), Swiftwater Field Office, proposes thinning of approximately 1,583 acres of forest stands in the Little River and Middle North Umpqua River watersheds. The Thunderbolt Thinning project includes three proposed timber sales: Big Thunder (668 acres), Thundering Herd (430), and Rolling Thunder (485 acres) as shown in Figure 1(Appendix H, Map Packet). In addition, the BLM proposes a hazardous fuels project to coincide with the thinning project which would include 10 acres of roadside brushing and approximately 92 acres of shrub/understory treatment in a shaded fuel break outside of proposed thinning units (Appendix H; Figure 5). It is anticipated that the proposed timber sales would yield approximately 16 million board feet (16 MMBF) of timber volume in support of the local and regional manufacturers and economies.

The stands in the Thunderbolt Thinning project range from 49 to 95 years old and are stocked at levels that are currently at or beyond the appropriate relative density for thinning. The *purpose* of the proposed action is to reduce stand stocking in a cost-efficient manner that produces commercial timber and reduces the threat of wildfire while enhancing habitat for the northern spotted owl and improving the vigor of the residual stand. The *need* for action is to provide substantial timber volume in support of the local economy and provide a potential location to safely fight a wildfire, while protecting northern spotted owl habitat components.

B. Conformance

The Roseburg District initiated planning and design for this project on April 1, 2010 to conform and be consistent with the *Roseburg District's 1995 Record of Decision/Resource Management Plan* (1995 ROD/RMP). Analysis of the effects of the proposed actions tiers to the analytical assumptions and conclusions of the 1994 *Final - Roseburg District Proposed Resource Management Plan/Environmental Impact Statement* ((PRMP/EIS) USDI/BLM 1994). Analysis of effects and information from the 2008 *Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management* is incorporated by reference.

This environmental assessment (EA) analyzes the environmental consequences of the *No Action Alternative* and three *Proposed Action Alternatives* to compare the environmental effects of each in the decision-making process. The need and purpose for action are consistent with the objectives of the 1995 *Roseburg District Record of Decision and Resource Management Plan* (ROD/RMP), which directs BLM to produce a sustainable supply of timber and other forest commodities from the Matrix, while providing habitat for a variety of organisms and providing for ecological functions such as dispersal of organisms (ROD/RMP p.33). The BLM is also tasked with addressing fire/fuels management for all land use allocations as part of project planning including determinations of the role of fire and the risk of large-scale, high intensity wildfires at a landscape level (ROD/RMP p.75). The ROD/RMP (pg. 77) directs management of hazardous fuels to lower the potential of fire ignition and rate of spread while considering safety of firefighting personnel, wildlife habitat features, smoke management and objectives for the land use allocation.

As described briefly above, the *Action Alternatives* all conform to the 1995 ROD/RMP (as amended prior to December 30, 2008), incorporating the standards and guidelines therein. Specifically, the alternatives conform to these 1995 ROD/RMP management actions/directions:

Riparian Reserve

- Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives (1995 ROD/RMP, pg. 25).
- Limit the size of all wildfires (1995 ROD/RMP, pg. 27).

General Forest Management Area

- Provide a sustainable supply of timber and other forest commodities (from the Matrix) (1995 ROD/RMP, pg. 33).
- Provide habitat for a variety of organisms associated with both late-successional and younger forests (1995 ROD/RMP, pg. 33).
- Provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees (1995 ROD/RMP, pg. 33).
- Select logging systems based on the suitability and economic efficiency of each system for the successful implementation of the silvicultural prescription, for the protection of soil and water quality, and for meeting other land use objectives (1995 ROD/RMP, pg. 61). Also, provide a harvest plan flexible enough to facilitate harvesting within a three year timber sale contract.
- Reduce fuels hazards in all land use allocations through methods such as prescribed burning, mechanical or manual manipulation of forest vegetation and debris, removal of forest vegetation and debris while considering the safety of firefighting personnel (1995 ROD/RMP, pg. 77).

Adaptive Management Area

- Contribute substantially to provide for well-distributed late-successional habitat outside reserves, retention of key structural elements of late-successional forests on lands subjected to regeneration harvest, restoration of riparian zones, and a stable timber supply (1995 ROD/RMP, pg. 32).
- Explore and support opportunities to research the role and effects of fire/fuels management on ecosystem functions (1995 ROD/RMP pg. 33).
- Emphasize fire/fuels management cooperation across agency and ownership boundaries (1995 ROD/RMP pg.33).

Connectivity/Diversity Blocks

- Produce a sustainable supply of timber and other forest commodities (1995 ROD/RMP; p. 33) and manage suitable commercial forest land to assure a moderately high level of sustained timber production (1995 ROD/RMP, p. 151).
- Provide connectivity (along with other allocations such as Riparian Reserves) between Late-Successional Reserves (1995 ROD/RMP, p. 33).
- Provide habitat for a variety of organisms associated with both late-successional and younger forests (1995 ROD/RMP, p. 33).

This analysis tiers to the assumptions and analysis of consequences provided by the following NEPA analyses:

- The 1994 *Final Supplemental Environmental Impact Statement* (FSEIS) *on Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl*;

- The 2001 *Final Supplemental Environmental Impact Statement* (FSEIS) for *Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl.*

Survey & Manage

On December 17, 2009, the U.S. District Court for the Western District of Washington (District Court) issued an order in *Conservation Northwest, et al. v. Rey, et al.*, No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007 Record of Decision eliminating the Survey and Manage mitigation measure. Judge Coughenour deferred issuing a remedy in his December 17, 2009 order until further proceedings, and did not enjoin the BLM from proceeding with projects. Plaintiffs and Defendants entered into settlement negotiations that resulted in the 2011 Survey and Manage Settlement Agreement, adopted by the District Court on July 6, 2011.

The Ninth Circuit Court of Appeals issued an opinion on April 25, 2013, that reversed the District Court's approval of the 2011 Survey and Manage Settlement Agreement. The case is now remanded back to the District Court for further proceedings. This means that the December 17, 2009, District Court order which found National Environmental Policy (NEPA) inadequacies in the 2007 analysis and records of decision removing Survey and Manage is still valid.

Previously, in 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation had entered into a stipulation exempting certain categories of activities from the Survey and Manage standard (hereinafter "Pechman exemptions").

Judge Pechman's Order from October 11, 2006 directs: "Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

A. Thinning projects in stands younger than 80 years old (emphasis added):
B. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
C. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and
D. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph A. of this paragraph."

The Thunderbolt project is in conformance with the 2001 ROD (as amended or modified as of March 21, 2004) and applies the Pechman exemptions.

1. The proposed thinning in the Thunderbolt project includes no regeneration harvest and includes thinning only in stands less than 80 years old, thus the part of this project that would occur in stands less than 80 years old meets exemption A of the Pechman exemptions (October 11, 2006 Order).

2. The hazardous fuels treatment in the Thunderbolt project does not involve commercial logging outside of the proposed thinning units, thus this part of the project meets exemption D of the Pechman exemptions (October 11, 2006 Order).
3. The six-acre stand that is approximately 95 years old has been surveyed applying the 2001 species list, thus this part of the Thunderbolt project is consistent with 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*, as incorporated into the Roseburg District Resource Management Plan.

The Thunderbolt project may still proceed even if the District Court sets aside or otherwise enjoins use of the 2007 Survey and Manage Record of Decision because the Pechman exemptions remain valid in such case.

The forest stands in the Thunderbolt thinning units are 49-63 years old (q.v., pg. 35) with the exception of one six acre stand that is 95 years old. Stand boundaries were determined from the Forest Operations Inventory (FOI). Stand ages were derived from stand examination information collected within the FOI boundaries. Breast height ages were sampled on dominant trees. Typically one tree per four acres was sampled. Total age was calculated by ORGANON using the breast height age and adjusting it to calculate how long the tree took to grow to breast height (4.5 feet above the ground) based on site productivity class. A simple average of the sample trees determined the stand age.

Road activities associated with the proposed thinning treatment include spur road construction, maintenance/renovation, and decommissioning as described in *Chapter 2: Description of the Alternatives* (pgs. 12-13, 23-25). Spur road construction within the treated stands, would have right-of-way widths typically less than the tree-spacing following harvest. Road maintenance, renovation, and decommissioning activities would occur on existing roads where habitat for Survey and Manage species is absent and would not be considered habitat disturbing.

C. Decision Factors

Factors to be considered when selecting among alternatives would include:

- The degree to which the objectives previously described would be achieved, including: the retention of existing habitat features and potential for creating future habitat components for listed species, the manner in which thinning would be conducted with respect to cost, and the feasibility of project implementation;
- The nature and intensity of environmental impacts that would result from implementation and the nature and effectiveness of measures to mitigate impacts to resources including, but not limited to, wildlife and wildlife habitat, soil productivity, water quality, and the spread of noxious weeds;
- Compliance with management direction from the 1995 ROD/RMP;
- Compliance with applicable laws including, but not limited to, the Clean Water Act, the Endangered Species Act, O&C Act, and the National Historic Preservation Act; and
- Generating revenue to the government from the sale of timber resources in a cost efficient manner.

Chapter 2. Description of the Alternatives

This chapter describes the features of the *No Action Alternative* and the *Proposed Action Alternatives* that are being analyzed in this EA. The BLM has developed three action alternatives that vary in the intensity of silvicultural treatments and treatment of hazardous fuels. These alternatives are summarized in Table 2. *Thunderbolt Proposed Action Alternatives and Silvicultural Prescriptions.*

A. Terminology & Definitions

There are several terms whose definitions and meanings are integral to a clear understanding and comparison of the alternatives specific to the Thunderbolt Environmental Analysis. These definitions are presented below, prior to the description of the *No Action* and *Proposed Action Alternatives*. In addition, throughout this analysis, acres (or percentages of the proposed units by treatment type) are presented and discussed; these numbers are approximations based on office planning and subsequent field review. These acres (and percentages) may change as additional information and further field review (e.g. global positioning system [GPS] locations) refines earlier approximations. Final acres and percentages, if different from those shown here, would be included in decisions developed from this analysis.

1. Silvicultural Terminology

Relative Density (RD) – Relative Density (RD) is a means of describing the level of competition among trees or the site occupancy in a stand relative to some theoretical maximum based on tree size and species composition. For this project "RD" refers to Curtis relative density (Curtis, 1982).

Light Thinning Prescription – Tree density is reduced to a residual relative density ranging from 27 to 37. For the Thunderbolt project this equates to an average residual tree density of about 115 trees per acre and 120 square feet of basal area.

Moderate Thinning Prescription – Tree density is reduced to a residual relative density ranging from 18 to 25. For the Thunderbolt project this equates to an average residual tree density of about 77 trees per acre and 80 square feet of basal area.

Heavy Thinning Prescription – Tree density is reduced to a residual relative density of 12. For the proposed Thunderbolt Unit 31B this equates to a residual tree density of about 20 trees per acre and 60 square feet of basal area.

Variable Density Thinning (VDT) – A thinning method where at least two densities of retained trees are used to promote stand heterogeneity. Provision of conditions conducive to the initiation and growth of natural shrub and tree regeneration is an objective of VDT to encourage the development of two-storied or multi-layered stands. In addition, VDT may include skips and gaps to provide increased stand diversity.

Gaps – Gaps would be areas where all or nearly all overstory trees are harvested. Gaps are also commonly referred to as "patch cuts" and "group selections" (Helms, 1998). Gaps for the Thunderbolt project are planned for only Unit 31B. They would be between approximately one-quarter and one and one-half acres in size.

Skips – Skips would be areas designated as reserved from harvest, i.e. "no treatment" areas.

Layered structure stand (or two-storied) – A forest stand would be considered a two-storied or layered stand when at least 30 percent of that stand is comprised of layered areas (adapted from Oregon Department of Forestry, 2010). An area would be considered "layered" when at least one of the following are met:

- Sixty percent of the vertical space from the top of the main tree canopy to the forest floor is filled with live tree crowns from *both* overstory and understory trees (i.e. a two-storied condition). Understory trees must be at least 30 feet tall in order to satisfy this criterion.
- Thirty percent of the stand is comprised of gaps containing trees at least 30 feet tall.
- A combination of conditions 1 *and* 2.

Minor conifer – Any conifer tree species other than Douglas-fir (*Pseudotsuga menziesii*).

Passive Recruitment – The reliance on natural mortality processes to produce snags and down wood.

2. Hazardous Fuels Terminology

a) ***Activity Fuels***

Slash and other material created during the timber harvest process. Generally consist of limb wood, tops, and cull material.

b) ***Hazardous Fuels***

Natural or otherwise live or dead vegetation that creates a condition of continuous fuels both horizontally and vertically that would be likely to threaten human life, private property, or natural resources if a wildfire were to begin in the area.

3. Road Terminology

a) ***Road Maintenance/Renovation***

Road maintenance/renovation includes road work to maintain the original design and/or bring an existing road ***back to its original design***. Road maintenance/renovation includes work on any existing designed road that is on the landscape - not just numbered roads currently in the BLM transportation system. Indicators of a designed road include a defined cut and fill, compacted surface, rock surfacing, and/or drainage structures. In some instances, trees and other plant species may have re-vegetated the road but it would still be considered road maintenance/renovation if the planned road work would bring the road back to its original design.

The amount of effort to bring the road back to its original design can vary from road to road. Typical activities that would be associated with road maintenance/renovation include:

- brushing,
- ditch cleaning,
- surface grading,

- replacing drainage structures, and/or
- rock placement where needed, in locations where rock was included in the original design.

Typically, road maintenance/renovation that is performed by BLM staff is called "maintenance" while road maintenance/renovation performed by a timber sale purchaser or other contractor is called "renovation".

b) ***Road Construction***

Road construction includes road work to build a road where a ***designed road did not exist previously***. Road work on a "jeep road" would be considered road construction since no previous design specifications would exist.

Typical activities that would be associated with road construction include:

- building cut/fill slopes,
- compacting the driving surface,
- surfacing with rock (in some instances but not all) and/or
- installation of drainage structures (e.g. culverts, cross-drains).

c) ***Road Decommissioning***

Roads and spurs that are not needed for long-term resource management or require resource protection would be closed to vehicle traffic. Prior to closure, roads would be left in an erosion-resistant condition by applying one or more of the following:

- removal of temporary culverts and/or existing culverts where barriers would prevent culvert maintenance;
- installation of waterbars to effectively drain a rock or native road surface;
- mulching the road surface with logging slash to control erosion and deter use by off-highway vehicles;
- mulching the road surface with seed and straw mulch to control erosion where logging slash is unavailable or where future access would be necessary for noxious weed control or power line maintenance;
- blocking the road with a barrier, such as logs, a gate or a trench to prevent access.

B. No Action Alternative

The *No Action Alternative* provides a baseline for the comparison of the alternatives. This alternative describes the existing condition and continuing trends anticipated in the absence of the proposal but with the implementation of other reasonably foreseeable federal and private projects. If the *No Action Alternative* were selected there would be no thinning of timber or treatment of the stands within the 1,583 acres of the project area at this time, there would be no revenue generated from the sale of the timber and there would be no treatment of hazardous fuels to provide a potential location to stop a wildfire.

Stands would continue to develop under generally dense and overstocked conditions characterized by high levels of canopy cover and live-crown recession. Over time, mortality in the suppressed and intermediate canopy layers would increase and individual tree growth could stagnate unless growth trajectories were altered by a natural disturbance, such as wind or fire. The increased mortality would also increase fire risk and fire behavior should an ignition occur.

There would be no road construction to provide access for yarding and timber hauling. Road renovation designed to reduce erosion, correct drainage deficiencies, improve water quality, and provide for user safety would not be undertaken. Decommissioning of roads surplus to long-term transportation and management needs would not occur. Road work would be conducted as-needed to provide resource protection, accommodate reciprocal users, and protect the federal investment.

Selection of this alternative would not constitute a decision to re-allocate these lands to non-commodity uses. Future harvesting in this area would not be precluded and could be considered again under a subsequent EA.

C. Proposed Action Alternatives

The three *Action Alternatives* propose the offering of three timber sales (i.e. Big Thunder, Rolling Thunder and Thundering Herd) located on Revested Oregon and California Railroad Lands (O&C Lands) in the Little River and Middle North Umpqua Fifth-field Watersheds. The total Riparian Reserve width in these watersheds would be 360 feet (two site potential tree heights on both sides of the stream) for perennial, fish-bearing streams and 180 feet (one site potential tree height on both sides of the stream) for perennial, non-fish bearing streams and intermittent streams.

Thunderbolt would be implemented within the AMA, GFMA, C/D and Riparian Reserve land use allocations and includes 1,692 acres of which approximately 1,583 acres would be thinned (Table 1). The project would treat mid-seral stands in 21 units and provide approximately 16 million board feet of timber (Appendix H, Figure 1). Approximately 18 acres would be cleared for spur right-of-ways or roads to access the thinning units. All planned spur road construction would occur within proposed harvest units.

Table 1. Legal Description, Land Use Allocations and Proposed Yarding Methods of Thunderbolt Units.

Unit	Township-Range-Section	Acres	Land Use Allocation	Yarding Method(s)
Big Thunder				
29A	T26S-R02W-Sec. 20 & 29	38	Riparian Reserves; GFMA; C/D	Cable; Ground-based
29B	T26S-R02W-Sec. 29	295	Riparian Reserves; GFMA; AMA	Cable; Ground-based
30I	T26S-R02W-Sec. 30	12	Riparian Reserves; GFMA	Cable; Ground-based
30J	T26S-R02W-Sec. 30 & 31	9	Riparian Reserves; GFMA	Cable; Ground-based
31A	T26S-R02W-Sec. 30 & 31	20	Riparian Reserves; AMA	Cable; Ground-based
31B	T26S-R02W-Sec. 31	294	Riparian Reserves; GFMA; AMA	Cable; Ground-based
	Big Thunder Total	**668**		
Rolling Thunder				
19C	T26S-R02W-Sec. 19	88	Riparian Reserves; GFMA	Cable; Ground-based
19D	T26S-R02W-Sec. 19	48	Riparian Reserves; GFMA	Cable; Ground-based
20A	T26S-R02W-Sec. 20	25	Riparian Reserves; C/D	Cable; Ground-based
21F	T26S-R02W- Sec. 21	15	GFMA	Cable; Ground-based
21G	T26S-R02W- Sec. 21	46	Riparian Reserves; GFMA	Cable; Ground-based
21H	T26S-R02W- Sec. 21	38	Riparian Reserves; GFMA	Cable; Ground-based
23A	T26S-R02W- Sec. 23	35	Riparian Reserves; GFMA	Cable; Ground-based
23 B	T26S-R02W- Sec. 23	3	Riparian Reserves; GFMA	Ground-based
23 C	T26S-R02W- Sec. 23	47	Riparian Reserves; GFMA	Cable; Ground-based
23 D	T26S-R02W- Sec. 23	37	Riparian Reserves; GFMA	Cable; Ground-based
25 A	T26S-R02W- Sec. 25	53	Riparian Reserves; C/D	Cable
29 C	T26S-R02W- Sec. 29	50	Riparian Reserves; GFMA	Cable; Ground-based
	Rolling Thunder Total	**485**		
Thundering Herd				
25A	T26S-R02W-Sec. 25	234	Riparian Reserves; Connectivity; AMA	Cable; Ground-based
26A	T26S-R02W-Sec. 26	55	Riparian Reserves; GFMA; AMA	Cable; Ground-based
33B	T26S-R02W-Sec. 33	141	Riparian Reserves; GFMA; AMA	Cable; Ground-based
	Thundering Herd Total	**430**		
Thunderbolt Total Acres		**1,583**		

The *Proposed Action Alternatives* differ by: 1) silvicultural treatment of 294 acres in Big Thunder Unit 31B; and 2) treatment of hazardous fuels both within and outside of units as shown in Table 2.

All of the units, with the exception of Big Thunder Unit 31B, would be treated with a variable density thinning prescription that retains two densities of trees and includes skips. Big Thunder Unit 31B would be treated with a variable density thinning prescription retaining two or three densities of trees and would include skips and gaps.

Table 2. Thunderbolt Proposed Action Alternatives and Silvicultural Prescriptions

Action Alternatives	All Thunderbolt Units Except Big Thunder Unit 31B	Big Thunder Unit 31B	Treatment of Hazardous Fuels
1	Light thinning Moderate thinning Skips	Light thinning Moderate thinning Skips Gaps	No
2	Light thinning Moderate thinning Skips	Light thinning Moderate thinning Skips Gaps	Yes
3	Light thinning Moderate thinning Skips	Light thinning Moderate thinning Heavy thinning Skips Gaps	Yes

D. Design Features Common to All Proposed Action Alternatives

This section identifies the project design features of Thunderbolt that would apply to all units of the timber sales proposed under the three *Action Alternatives*.

1. Timber Harvest

a) Treatment Prescription Common to Action Alternatives 1, 2 and 3

A variable density thinning prescription would be used in the Thunderbolt Thinning project. In general, a light thinning prescription would be applied in AMA, GFMA, and C/D lands. Riparian Reserves, in general, would be treated with a moderate thinning prescription. These marking prescriptions are referred to as "upland treatments" and "riparian treatments", respectively, in the remainder of this analysis.

In the thinned areas, merchantable trees in the suppressed and intermediate crown classes would be the primary targets for removal, although some co-dominant and dominant trees would be removed where necessary to meet the residual density objective. Older remnant trees may be present, but are not the numerically predominant stand components and would generally be retained. Minor conifer and hardwood species would be retained to maintain stand diversity.

Skips in the form of aggregate retention are primarily along streams in the "no-harvest" buffers. There may be other locations that would be designated as skips if they are determined to not be economical to harvest or unreachable by conventional harvest methods. These locations would be determined at the time of final layout for all proposed units. The only skip areas analyzed in this EA are within Big Thunder Unit 31B and are displayed in the treatment prescription tables (Tables 5, 6, and 7) and Figures 6a, 6b, and 6c (Appendix H).

Passive Recruitment of Snags & Coarse Woody Debris
In all land use allocations, conifer and hardwood snags would be reserved from cutting unless they are a safety concern. Snags felled for safety reasons would be retained on site as coarse woody debris. Existing coarse woody debris in decay classes 3, 4, and 5 would be retained in GFMA lands, and all coarse woody debris would be retained in the Riparian Reserve.

The residual stands following harvest would provide a pool of candidate trees for future snag and coarse woody debris recruitment. Additional coarse woody debris and snags may be created incidentally through the harvest operations (e.g. damage leading to broken-out tops or individual tree mortality) or through weather damage (e.g. wind and snow break).

b) Stream Buffers and Riparian Reserves

Perennial or Fish-bearing Streams
A "no-harvest" stream buffer extending 60 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line for perennial or fish-bearing streams, would be implemented to maintain the integrity of the stream channel, stream banks, and streamside vegetation.

Intermittent Streams
A "no-harvest" stream buffer extending 35 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line, would be implemented for intermittent and non-fish-bearing streams.

c) Powerline Prescription

A moderate thinning prescription would be applied in Big Thunder and Rolling Thunder units within 100 feet, horizontal distance, of powerline right-of-ways (Figs. 2 and 3). Trees would be selected for retention based on species, structure, and distance from powerlines to reduce the potential for trees to fall on the powerlines from wind throw.

d) Timber Cruising

Timber cruising would include 3P (Probability Proportional to Prediction), variable plot, or 100 percent cruise methods to sample standing trees. The samples would be computed on form class tables for estimating volume in 16-foot lengths. The sample tree volume would be expanded to a total sale volume.

Additional timber would potentially be included as a modification to this project. These additions would be limited to the removal of individual trees or small groups of trees that are blown down, are a safety hazard, or trees needed to facilitate the proposed action. Historically, these additions have been less than ten percent of the estimated sale quantity.

e) Firewood

Firewood cutting and salvaging of logging debris (slash) could occur in cull decks, logging landings, and near roads within the units, after thinning activities are completed.

2. Timber Yarding

Skyline cable yarding and ground-based yarding would be used to remove timber from the proposed units. Up to ten acres of additional, incidental ground-based logging within each of the three proposed Thunderbolt timber sales may be necessary (i.e. removal of guyline anchor trees, isolated portions of units, etc.).

a) ***Cable Yarding***

Cable logging systems that limit ground disturbance would be used to obtain partial or full log suspension (1995 ROD/RMP, pg. 130). Intermediate supports would be used as necessary to obtain partial suspension at slope breaks. Where excessive soil furrowing occurs, yarding corridors would be hand waterbarred and filled with limbs or other organic debris. Where practical, cable yarding would require full suspension over streams.

At least 75 feet of lateral yarding capability would be required of cable equipment, with average spacing of 150 feet between cable corridors, whenever practicable, to reduce the number of yarding corridors and landings to reduce the amount of soil disturbance.

Prior to attaching any logging equipment to a reserve tree, precautions to protect the tree from damage would be taken. Examples of protective measures include tree plates, straps, or synthetic rope, and minimal notching (less than half the tree diameter) where necessary. If it would be necessary to fall a reserve tree for safety reasons then it may be harvested or left as coarse woody debris at the discretion of the government's contract administrator. The smallest possible anchor trees would be selected in all instances, trees with suitable spotted owl nesting structure would be avoided when possible, and anchor trees (i.e. tailhold trees) would be left standing when feasible. Trees felled within Riparian Reserves, LSRs, and Critical Habitat would remain on site.

Additional Restrictions for Downhill Cable Yarding

Downhill cable yarding is planned where topography allows for adequate deflection and one-end suspension of logs during in-haul. In order to obtain adequate deflection, given the topography analyzed in Thunderbolt, downhill cable yarding distances would be less than 750 feet horizontal distance. The authorized officer would suspend yarding operations if damage to the soil resource is excessive.

b) ***Ground-Based Yarding***

Ground-based yarding would *not* be allowed during the bark slip period (i.e. April 15 to July 15) or during the wet season (i.e. typically October 15 to May 15, depending on weather conditions). If soil moisture levels would cause the amount of compaction and soil displacement to exceed ten percent or more of the ground-based area (including landings, log decks, and trails), operations would be suspended during unseasonably wet weather in the dry season. The soil scientist and the contract administrator would monitor soil moisture, compaction and displacement to determine when operations may need to be suspended.

Ground-based yarding equipment would be limited to slopes generally less than 35 percent (2001 Plan Maintenance; 2008 APS, pgs. 65-66). The location of landings (including log deck areas and equipment areas), skid trails, and large slash pile areas would be designed such that less than approximately ten percent of the ground-based harvest area would be affected. Ground-based equipment would be confined to designated skid and forwarder trails and would re-use existing skid trails as much as practical. Skid trails would have an average spacing of at least 150 feet apart. In addition, machines used for ground-based logging would be limited to a track width no greater than 12 feet.

c) ***Restrictions for Harvester/Forwarder Operations***

Cut-to-length harvesters would de-limb the harvested trees in front of the harvester, so that the harvester trails are covered with slash for the machine to walk across, reducing ground pressure, and the potential for compaction. Harvester equipment would be limited to no more than two passes, in and out, over a trail, with spacing of trails at least 50 feet apart to reduce soil compaction. Cut-to-length forwarder trails would be spaced an average of 100 to 150 feet apart depending on topography (every 2nd or 3rd harvester trail). Harvesters would cut trees so that stumps are no higher than 12 inches above the ground to allow subsoiling excavators to pass over the stumps.

Logging slash would be placed around reserve trees that are within five feet of harvester and forwarder trail segments to protect the large roots at or near the surface. If slash from processed trees is not adequate to cover the harvester and forwarder trails, additional slash would be placed as necessary in the trails in front of the equipment to reduce soil displacement and compaction.

d) ***Subsoiling***

Main skid trails and adjacent landings could be subsoiled subject to evaluation of site conditions by the soil scientist. Logging slash would be placed over subsoiled areas, to replace some of the displaced duff and surface soil organic matter. Any main skid trails that are not subsoiled in Thunderbolt would be mapped for later evaluation of subsoiling needs.

3. Fuels Treatment

Activity slash at the landings would be machine-piled and burned. On designated roadways, small diameter (between three and seven inches) activity slash within 50 feet of the road would be hand-piled and burned. There would be approximately 284 acres treated by machine-piling and 118 acres by hand-piling in the Thunderbolt timber sale areas (Table 3). The fine fuels (less than three inches in diameter) generated during the thinning treatments would remain scattered throughout the units.

All prescribed burning (i.e. slash piles) would have an approved "Burn Plan," and be conducted under the requirements of the Oregon Smoke Management Plan and in a manner consistent with the requirements of the Clean Air Act (Oregon Department of Environmental Quality and Oregon Department of Forestry 1992). Slash would be burned during the late-fall to mid-spring season when the soil, duff layer (soil surface layer consisting of fine organic material), and large down log moisture levels are high (1995 ROD/RMP, pg. 140).

Table 3. Treatment of Activity Fuels in Thunderbolt

Unit	Township-Range-Section	Acres	Hand Pile[1]	Machine Pile[2]
Big Thunder				
29A	T26S-R02W-Sec. 20 & 29	38	7	4
29B	T26S-R02W-Sec. 29	295	29	59
30I	T26S-R02W-Sec. 30	12	0	1
30J	T26S-R02W-Sec. 30 & 31	9	0	1
31A	T26S-R02W-Sec. 31	20	2	2
31B	T26S-R02W-Sec. 30 & 31	294	33	59
	Big Thunder Total	**668**	71	126
Rolling Thunder				
19C	T26S-R02W-Sec. 19	88	8	18
19D	T26S-R02W-Sec. 19	48	0	5
20A	T26S-R02W-Sec. 20	25	0	3
21F	T26S-R02W- Sec. 21	15	2	2
21G	T26S-R02W- Sec. 21	46	3	5
21H	T26S-R02W- Sec. 21	38	3	4
23A	T26S-R02W- Sec. 23	35	3	4
23B	T26S-R02W- Sec. 23	3	1	1
23C	T26S-R02W- Sec. 23	47	2	5
23D	T26S-R02W- Sec. 23	37	3	4
25A	T26S-R02W- Sec. 25	53	0	11
29C	T26S-R02W- Sec. 29	50	2	10
	Rolling Thunder Total	485	27	72
Thundering Herd				
25A	T26S-R02W-Sec. 25	234	3	47
26A	T26S-R02W-Sec. 26	55	2	11
33B	T26S-R02W-Sec. 33	141	15	28
	Thundering Herd Total	**430**	**20**	**86**
Thunderbolt Total Acres		**1,583**	**118**	**284**

[1]Hand Piling: acreage was calculated using length of road segment (in feet) x width of treatment (50 feet) = square feet which was then converted to acres.
[2]Machine Piling: units under 50 acres = harvest unit acres x 10%; units over 50 acres = harvest unit acres x 20%.

4. Timber Hauling

Roads with inadequate rock to support wet season or winter haul have been identified in Tables 4a – 4c. Prior to wet season haul on these roads, either the road surfacing would be improved (e.g. additional rock) or sediment reducing measures (e.g., placement of straw bales and/or silt fences and sediment filters) would be placed near stream crossings, if necessary, to prevent sediment from reaching the streams. Timber hauling would be suspended during wet weather if road run-off would deliver sediment at higher concentrations than existing conditions to the receiving stream.

5. Road Activities

The proposed project would include dry season and wet season logging activities and use existing roads to the greatest extent practical. Roads and landings would be located on geologically stable locations; e.g., ridge tops, stable benches or flats, and gentle-to-moderate side-slopes (1995 ROD/RMP, pg. 132. Roads and spurs would be designed no wider than needed for the specific use to minimize soil disturbance (1995 ROD/RMP, pg. 132). Roads would generally be designed with a 14 foot wide road surface and would have an average road clearing width of 40 feet. However, road shoulders, landings, vehicle turnouts, and curve widening could result in road surfaces as wide as 60 feet.

Road construction, renovation, maintenance, overwintering, and decommissioning would be restricted to the dry season (normally May 15 to October 15). The operating season could be adjusted if unseasonable conditions occur (e.g. an extended dry season beyond October 15 or wet season beyond May 15). In-stream work, including culvert replacement and/or installation, would be limited to periods of low or no flow (generally between July 1 and September 15).

There would be approximately 68.34 miles of road maintenance/renovation and 4.79 miles of road construction (Tables 4a, 4b, and 4c). As indicated in these Tables, where surfacing on existing, rocked roads is currently inadequate for winter haul, additional rock would be added to bring the roads up to winter haul standards. Approximately nine miles of roads would be decommissioned after harvest operations are completed (Tables 4a, 4b, and 4c).

Over-wintering

Natural surfaced roads not decommissioned prior to the wet season would be overwintered. Natural surface spur roads would be built, used and winterized prior to the end of the dry season. Over-wintering would include: installation of waterbars, mulching the running surface with weed-free straw, seeding and mulching bare cut and fill surfaces with native species (or a sterile hybrid mix if native seed is unavailable), and blocking.

Sediment Control Plan for Road Activities

To minimize or prevent sediment delivery to waters of the United States in compliance with the Clean Water Act of 1972 and its revisions, the following Best Management Practices (BMPs) would be incorporated into project design and implementation. Implementation of these BMPs and others found in Appendix D of the ROD/RMP (pgs. 131-138), would disconnect road surfaces from drainage ditches to minimize or reduce the conveyance and delivery of sediment to streams. It is not intended that all of the BMPs listed would be selected for any specific management action or project site. Each activity is unique and, based on site-specific conditions, selection of individual or a combination of BMPs would become the design appropriate for the project.

- Disconnect the road runoff to the stream channel by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Minimize ditch flow conveyance to stream through cross drain placement above stream crossing.

- Locate cross drains to prevent or minimize runoff and sediment conveyance to wetlands, riparian management areas, floodplains and waters of the state. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences and check dams to prevent or minimize sediment conveyance.

- Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion.

- Install underdrain structures when roads cross or expose springs, seeps, or wet areas rather than allowing intercepted water to flow down gradient in ditchlines.

- Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips) and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion proofed.

- Locate surface water drainage measures (e.g., cross drain culverts, rolling dips, water bars) where water flow would be released on convex slopes or other stable and non-erosive areas that would absorb road drainage and prevent sediment flows from reaching wetlands, floodplains and waters of the state. Where possible locate surface water drainage structures above road segments with steeper downhill grade.

- Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures and/or energy dissipaters at cross drain outlets or drivable dips where water is discharged onto loose material, erodible soils, fills, or steep slopes.

- Use slotted risers, over-sized culverts or build catch basins where floatable debris or sediments may plug cross drain culverts.

- Prior to the wet season, provide effective road surface drainage through practices such as machine cleaning of ditches, surface blading including berm removal, constructing sediment barriers, cleaning inlets and outlets.

- Avoid undercutting of cut-slopes when cleaning ditchlines.

- Retain ground cover in ditchlines, except where sediment deposition or obstructions require maintenance.

- Apply native seed and certified weed free mulch to cut and fill slopes, ditchlines, and waste disposal sites with the potential for sediment delivery to wetlands, riparian management areas, floodplains and waters of the state. Apply upon completion of construction and as early as possible to increase germination and growth. Reseed if necessary to accomplish erosion control. Select seed species that are fast growing, have

adequate germination and provide ample ground cover and soil-binding properties. Apply mulch that would stay in place and at site specific rates to prevent erosion.

- Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the wet season to diminish the likelihood of plugged culverts and the possibility of washouts.

- On active haul roads, during the wet season, use durable rock surfacing and sufficient surface depth to resist rutting or development of sediment on road surfaces that drain directly to wetlands, floodplains and waters of the state.

- Suspend commercial use where the road surface is deeply rutted or covered by a layer of mud or when runoff from the road surface is causing a visible increase in stream turbidity in the receiving stream.

- Do not allow wet season haul on natural surface roads or high sediment producing surfaced roads without practicable and effective mitigation.

Table 4a. Big Thunder Roads and Spurs

Road No.	Construction		Maintenance/ Renovation (miles)	Surfacing		Season of Haul	Decommissioning	
	Length (miles)	Within Riparian Reserve (feet)		Existing	Proposed		Length (miles)	Method
26-2-20.1	0	0	1.00	Native	Native	Dry	1.00	Waterbar, seed & mulch, block with gates.
26-2-21.0	0	0	2.61	Rock	Rock	Wet /Dry	0	None
26-2-22.0	0	0	.50	Rock	Rock	Wet /Dry	0	None
26-2-29.0	0	0	0.10	Rock	Rock	Wet /Dry	0	None
26-2-29.1	0	0	0.10	Rock	Rock	Wet/Dry	0	None
26-2-29.3	0	0	0.12	Rock	Rock	Wet/Dry	0	None
26-2-31.0	0	0	.54	Rock	Rock	Wet/Dry	0	None
26-2-31.1	0	0	0.62	Rock	Rock	Wet/Dry	0	None
26-2-31.2	0	0	1.56	Rock	Rock[1]	Wet/Dry	0	None
26-2-31.3	0	0	0.33	Rock	Rock	Wet/Dry	0	None
26-2-31.5	0	0	0.24	Native	Rock	Wet/Dry	0	None
26-2-31.6	0	0	0.20	Rock	Rock	Wet/Dry	0	None
26-2-32.1	0	0	1.73	Rock	Rock	Wet/Dry	0	None
26-2-32.2	0	0	0.19	Rock	Rock	Wet/Dry	0	None
26-3-1.1	0	0	2.23	Rock	Rock	Wet /Dry	0	None
26-3-13.0	0	0	4.20	Rock	Rock	Wet /Dry[2]	0	None
26-3-15.0	0	0	0.47	Rock	Rock	Wet /Dry	0	None
26-3-34.2	0	0	6.69	Rock	Rock	Wet/ Dry	0	None
Spur BT 2	0.15	15	0	None	Rock	Wet/ Dry	0.15	Waterbar, block
Spur BT 3	0.10	0	0	None	Rock	Wet/Dry	0.10	Waterbar, block

Spur BT 4	0.22	0	0.25	Native	Rock	Wet/Dry	0.47	Waterbar, block
Spur BT 5	0.40	700	0	None	Rock	Wet/Dry	0.40	Waterbar, block
Spur BT 7	0.19	0	0	None	Native	Dry	0.19	Waterbar, seed & mulch, block
Spur BT 10	0.30	0	0	None	Rock	Wet/Dry	0.30	Waterbar, block
Spur BT 12	0.10	0	0	None	Rock	Wet/Dry	0.10	Waterbar, block
Spur BT 15	0.30	0	0	None	Rock	Wet/Dry	0.30	Waterbar, block
Spur BT 16	0	0	0.10	Native	Rock	Wet/Dry	0.10	Waterbar, block
Spur BT 17	0	0	0.10	Native	Native	Dry	0.10	Waterbar, seed & mulch, block
Spur BT 18	0.10	0	0.10	Native	Rock	Wet/ Dry	0.20	Waterbar, block
Spur BT 19	0	0	0.03	Native	Rock	Wet/ Dry	0.03	Waterbar, block
Spur BT 20	0.07	0	0	None	Rock	Wet/ Dry	0.07	Waterbar, block
Spur BT 21	0	0	0.13	Native	Rock	Wet/ Dry	0.13	Waterbar, block
Spur BT 22	0.10	0	0.10	Native	Rock	Wet/ Dry	0.20	Waterbar, block
Spur BT 23	0.11	0	0.13	Native	Rock	Wet/ Dry	0.24	Waterbar, block
Spur BT 24	0	0	0.02	Native	Rock	Wet/ Dry	0.02	Waterbar, block
Spur BT 25	0	0	0.05	Native	Rock	Wet/ Dry	0.05	Waterbar, block
Total	**2.14**	**715**	**24.44**	**-**	**-**	**-**	**4.15**	**-**

[1] Existing rock surfacing is inadequate for winter haul; additional rock may be added to bring road up to winter haul standards.
[2] Existing drainage is inadequate for winter haul; additional cross drains may be added to disconnect ditches from streams for winter haul.

Table 4b. Thundering Herd Roads and Spurs

Road No.	Construction		Maintenance/ Renovation (miles)	Surfacing		Season of Haul	Decommissioning	
	Length (miles)	Within Riparian Reserve (feet)		Existing	Proposed		Length (miles)	Methods
26-2-33.0 Seg A1	0	0	0.45	Rock	Rock	Wet/Dry	0	None
26-2-33.0 Seg A	0	0	0.45	Native	Rock	Wet/Dry	0	None
26-3-34.2 Seg A-G	0	0	7.15	Rock	Rock	Wet/ Dry	0	None
26-3-34.2 Seg H-N	0	0	4.58	Rock	Rock[1]	Wet/Dry	0	None
Spur TH 1	0.80	200	0	None	Rock	Wet/Dry	.80	Waterbar, block
Spur TH 2	0	0	0.15	Native	Rock	Wet/Dry	0.15	Waterbar, block
Spur TH 5	0.18	150	0	None	Rock	Wet/Dry	0.18	Waterbar, block
Spur TH 7	0	0	0.16	Native	Rock	Wet/Dry	0.16	Waterbar, block
Spur TH 8	0.13	0	0	None	Rock	Wet/Dry	0.13	Waterbar, block
Total	**1.11**	**350**	**12.94**	**-**	**-**	**-**	**1.42**	**-**

[1] Existing rock surfacing is inadequate for winter haul; additional rock may be added to bring road up to winter haul standards.
[2] Existing drainage is inadequate for winter haul; additional cross drains may be added to disconnect ditches from streams for winter haul.

Table 4c. Rolling Thunder Roads and Spurs

Road No.	Construction		Maintenance/ Renovation (miles)	Surfacing		Season of Haul	Decommissioning	
	Length (miles)	Within Riparian Reserve (feet)		Existing	Proposed		Length (miles)	Method
26-2-19.0	0	0	0.46	Native	Native	Dry	0.46	Waterbar, mulch with slash, block with trench barrier.
26-2-20.0	0	0	0.43	Rock	Rock	Wet /Dry	0	None
26-2-20.4	0	0	0.60	Native	Native	Dry	0.60	Waterbar, mulch with slash, block
26-2-21.0	0	0	2.61	Rock	Rock	Wet /Dry	0	None
26-2-21.3	0	0	0.71	Native	Native	Dry	0.71	Waterbar, mulch with slash, block
26-2-22.0	0	0	6.62	Rock	Rock	Wet/Dry	0	None
26-2-23.1	0	0	0.40	Rock	Rock[1]	Wet/Dry	0	None
26-2-23.1	0	0	0.30	Native	Rock	Wet/Dry	0	None
26-2-23.2	0	0	0.10	Rock	Rock[1]	Wet/Dry	0	None
26-2-26.0	0	0	0.11	Native	Rock	Wet/Dry	0.11	Waterbar, block
26-2-26.1	0	0	0.20	Native	Rock	Wet/Dry	0	None.
26-2-30.2	0	0	1.56	Rock	Rock	Wet/Dry	0	None
26-2-31.6	0	0	0.80	Rock	Rock	Wet/Dry	0	None
26-2-32.1	0	0	1.73	Rock	Rock	Wet/Dry	0	None
26-3-1.1	0	0	2.23	Rock	Rock	Wet /Dry	0	None
26-3-13.0	0	0	4.20	Rock	Rock	Wet /Dry[2]	0	None
26-3-15.0	0	0	0.47	Rock	Rock	Wet /Dry	0	None
26-3-25.3	0	0	1.24	Rock	Rock	Wet/Dry	0	None
26-3-34.2	0	0	6.19	Rock	Rock	Wet/ Dry	0	None
Spur RT1	0.03	0	0	None	Rock	Wet/Dry	0.03	Waterbar, block
Spur RT2	0.40	1600	0	None	Native	Dry	0.40	Waterbar, mulch with slash, block
Spur RT3	0.10	0	0	None	Native	Dry	0.10	Waterbar, mulch with slash, block
Spur RT4	0.11	0	0	None	Rock	Wet/Dry	0.11	Waterbar, block
Spur RT5	0.23	0	0	None	Native	Dry	0.23	Waterbar, mulch with slash, block
Spur RT6	0.23	120	0	None	Rock	Wet/Dry	0.23	Waterbar, block
Spur RT7	0.04	135	0	None	Rock	Wet/Dry	0.04	Waterbar, block
Spur RT8	0.10	0	0	None	Rock	Wet/ Dry	0.10	Waterbar, block
Spur RT9	0.30	0	0	None	Native	Dry	0.30	Waterbar, mulch with slash, block
Total	**1.54**	**1855**	**30.96**	**-**	**-**	**-**	**3.42**	**-**

[1] Existing rock surfacing is inadequate for winter haul; additional rock may be added to bring road up to winter haul standards.
[2] Existing drainage is inadequate for winter haul; additional cross drains may be added to disconnect ditches from streams for winter haul.

6. Cultural Resources

If any additional objects of cultural value (e.g. historic or prehistoric ruins, graves, fossils, or artifacts) are found during the implementation of the proposed action, operations would be suspended until the site has been evaluated to determine the appropriate mitigation action.

7. Noxious Weeds

Weed populations in this area would be monitored and evaluated for treatment at regular intervals (USDI, BLM 1995). Manual, mechanical, or chemical treatments would be used to manage invasive plant infestations. Existing infestations of Scotch broom and Himalayan blackberry would be treated prior to thinning operations.

Logging and road construction equipment would be required to be cleaned with a pressure washer, and be free of weed seed prior to entering BLM lands (BLM Manual 9015-Integrated Weed Management).

8. Survey and Manage Species (S&M)

To reduce impacts to mollusk species (S&M species, as well as *Bureau Sensitive* mollusk Species) and their micro habitats, avoid placement of burn piles and burning on rock outcrops, large downed-woody debris, and around large hardwoods (particularly bigleaf maple *(Acer macrophyllum*)) within hazardous fuels treatment areas in stands more than 80 years old.

9. Special Status Plants and Animals

Federally listed (Threatened or Endangered), or proposed, plants and animals and their habitats would be managed to achieve their recovery in compliance with the Endangered Species Act, approved recovery plans, and bureau special status species policies (1995 ROD/RMP, pg. 41). Bureau Sensitive species and their habitats would be managed so as not to contribute to the need to list, and to recover the species (1995 ROD/RMP, pg. 41).

If during implementation of the proposed action, any Special Status Species are found that were not discovered during pre-disturbance surveys, operations would be suspended as necessary and appropriate protective measures would be implemented before operations would be resumed.

Northern Spotted Owl (Federally Threatened Species)

Suitable spotted owl (*Strix occidentalis*) habitat is present within 65 yards of all of the Thunderbolt units and fuels treatment areas. The entire project area has received two or more consecutive years of protocol surveys for the spotted owl within 1.2 miles of proposed project boundaries. If two years of protocol surveys do not detect owl presence or activity, restrictions may be waived until March 1 of the following year subject to spot checks prior to or concurrent with operations.

Based on current survey data, two spotted owl activity centers are located within 65 yards of proposed units, the No Bridge (IDNO 3996O) and South Susan (IDNO 4018A) activity centers are located approximately 55 yards north of Rolling Thunder Unit 21G and northwest boundary of Rolling Thunder Unit 23B, respectively. In addition to the No Bridge and South Susan activity centers, Lookout Canyon (IDNO 4015A), Thunder Bob (INDO 0235O), and Shivigny (IDNO 2536O) sites are located within 440 yards (0.25 miles) of a unit boundary.

The following Project Design Features (PDF), for activities near northern spotted owl sites, would be implemented:

1) Operations within applicable disruption threshold distances of known northern spotted owl sites would be prohibited from March 1 to July 15, both dates inclusive. Disruption restrictions would apply to two activity centers within the proposed project area, the No Bridge (IDNO 3996O) and South Susan (IDNO 4018A) activity centers.

2) Broadcast burning within one-quarter (0.25) mile of known northern spotted owl sites or unsurveyed suitable habitat would be prohibited from March 1 to July 15, both dates inclusive. Disruption restrictions would apply to five activity centers within the proposed project area: No Bridge (IDNO 3996O), South Susan (IDNO 4018A), Lookout Canyon (IDNO 4015A), Thunder Bob (INDO 0235O), and Shivigny (IDNO 2536O).

3) Modification of suitable nesting, roosting and foraging habitat within one-quarter (0.25) mile of a known northern spotted owl sites or unsurveyed suitable habitat would be prohibited from March 1 to September 30, both dates inclusive. Modification of suitable habitat within the Big Thunder Unit 30I would require disruption restrictions for the Thunder Bob (INDO 0235O) activity center.

4) With respect to the three preceding seasonal restrictions (above, 1-3), if two years of protocol surveys have been completed, then spot checks are not required if the following four conditions have been met:
    a. No territorial northern spotted owls are detected during protocol survey visits,
    b. No northern spotted owl activity centers are known to occur in the survey area,
    c. No barred owls are detected in the survey area during protocol surveys or are otherwise known to occur in the survey area, and
    d. All northern spotted owl habitat within the survey area has been completely covered during protocol surveys (i.e. there is no habitat that was omitted due to inaccessibility, landowner restrictions, incomplete survey, or other constraints).

    If any of the preceding conditions (above, a-d) are not met, then spot checks are necessary in order to grant early waiver of seasonal restrictions. Projects may be initiated during the breeding season, concurrent with spot checks, if:
    a. No territorial northern spotted owls are detected during protocol surveys and there are no known northern spotted owl sites in the survey area, but barred owls are known to occur in the survey area, or
    b. No territorial northern spotted owls are detected during protocol surveys, but known northern spotted owl sites do occur in the survey area.

    Spot checks would be required prior to initiation of operations occurring after February 1, if:
    a. No territorial northern spotted owls are detected during protocol surveys and no known northern spotted owl sites are known to occur within the survey area, but portions of northern spotted owl habitat within the survey area was unsurveyed during protocol surveys due to inaccessibility, landowner restrictions, incomplete survey, or other constraints and
    b. If territorial northern spotted owls are detected during protocol surveys.

    If future surveys or spot checks locate spotted owls with the project area, operations within applicable disruption threshold distances (e.g. 65 yards for harvest activities and 440 yards

for prescribed burning) would be prohibited from March 1 to July 15, both days inclusive. This restriction could be waived until March 1 of the following year if surveys indicate owls are not nesting or have failed in a nesting attempt.

10. Petroleum Products or Other Hazardous Material

The operator would be required to comply with all applicable State and Federal laws and regulations concerning the storage, use and disposal of industrial chemicals and other hazardous materials. All equipment planned for in-stream work (e.g. culvert replacement) would be inspected beforehand for leaks. Accidental spills or discovery of the dumping of any hazardous materials would be reported to the Authorized Officer and the procedures outlined in the "*Roseburg District Hazardous Materials (HAZMAT) Emergency Response Contingency Plan*" would be followed.

Hazardous materials (particularly petroleum products) would be stored in appropriate and compliant Underwriter's Laboratory (UL) listed containers and located so that any accidental spill would be fully contained and would not escape to ground surfaces or drain into watercourses. Other hazardous materials such as corrosives and/or those incompatible with flammable storage shall be kept in appropriate separated containment. All construction materials and waste would be removed from the project area.

E. Additional Design Features of Proposed Action Alternative 1

1. Timber Harvest

a) ***Treatment Prescription for Action Alternative 1***

In addition to the variable thinning intensities described above for the other Thunderbolt units, gaps and additional skips would be incorporated into the prescription for Big Thunder Unit 31B which is located in the AMA. The skips and gaps identified for this unit would be the same in all three *Action Alternatives.*

Skips in the form of aggregate retention are primarily along streams in the "no-harvest" buffers, some of which have been expanded to protect Survey and Manage known sites and large diameter coarse wood concentrations. These skips would make up at least thirteen percent of the unit. Dispersed retention of individuals and groups of large hardwoods, trees surrounding concentrations of large diameter coarse wood, and trees with wildlife structure are also components of the prescription.

Gaps would be placed around sugar pine trees to remove competing vegetation so this minor species would survive in this stand. Numerous sugar pine trees have been identified in Unit 31B and these would be treated by removal of all trees less than 25 inches DBH within a 25 foot radius of the sugar pine's drip line. Surveys in units other than Unit 31B, have not identified sugar pine in the tree species inventory. If sugar pines are found in other units they would be treated as described.

Gaps currently exist around laminated root rot pockets and would be cleared of tree species that are infected to slow the spread of the disease. Species susceptible to the disease include Douglas-fir, grand fir, and western hemlock (Goheen and Willhite 2006). Potential tree species that would be retained are western red cedar, incense cedar, sugar pine, and hardwoods. The infected area and an additional 50 foot radius around these infected areas would be cleared of susceptible tree species. In areas where the root rot disease pockets and sugar pine treatment areas overlap, the sugar pine treatment would be given highest priority.

Gaps placed around sugar pine trees and root rot disease pockets would make up about nine percent (approximately 27 acres) of the 294 acre unit. Sixty-eight (68) gaps are identified and almost half would occur around sugar pines and the rest are root rot disease pockets. Gaps would be less than one and one half acres (1.5 acres) in size. Three gaps range in size from one to one and one half (1.5) acres where there are multiple sugar pines or larger disease pockets. The remaining sixty-five gaps would be less than one acre in size.

Table 5 presents the treatment prescription proposals for the Thunderbolt project under *Alternative 1*. Big Thunder Unit 31B is separated out from the rest of the Big Thunder units because it involves a more complex prescription than the other units.

Table 5. Proposed Action Alternative 1 – Proposed Treatment Prescriptions for the Thunderbolt Thinning Project.

Sale	Light Thin		Moderate Thin		Heavy Thin		Gaps		Skips	
	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian[1]
Big Thunder (374 acres)	66%	0%	3%	31%	0%	0%	0%	0%	0%	0%
Big Thunder Unit 31B (294 acres)	56%	0%	4%	18%	0%	0%	7%	2%	3%	10%
Rolling Thunder (485 acres)	59%	0%	0%	41%	0%	0%	0%	0%	0%	0%
Thundering Herd (430 acres)	79%	0%	0%	21%	0%	0%	0%	0%	0%	0%

1. Skips in Riparian Reserves would include acres of "no-harvest" buffers when layout is completed. In Unit 31B, the skips include "no-harvest" buffers plus additional acres that have been calculated into a percentage of the proposed unit treatment.

2. Hazardous Fuels Treatment

Under this alternative, hazardous fuels within stands would not be treated to create a shaded fuel break or along roadways outside of the timber sale units. Activity fuels would be treated as described on page 12.

F. Design Features Unique to Proposed Action Alternative 2

This section describes the design features that would apply under *Proposed Action Alternative 2*. In addition to the design features described above for *Proposed Action Alternative 1*, a shaded fuel break would be created by treating hazardous fuels along the ridge dividing the Little River and North Umpqua River watersheds. Roadside hazardous fuels would also be treated along the 26-3-34.2 road, identified as a haul route for the proposed timber sales. These treatments would provide a potential location to stop a wildfire and provide for safe ingress and egress from the area.

1. Hazardous Fuels Treatment

a) ***Shaded Fuel Break***

Harvest units within the proposed Big Thunder and Thundering Herd timber sales contain shaded fuel break treatment areas (Figure 5). Rolling Thunder has no units located along the ridge top and treatment of hazardous fuels would not occur in this sale area. Treatment for the shaded fuel break would be continuous within the BLM lands including areas outside of harvest units.

Description of the Treatment

Outside of the proposed harvest units, approximately 92 acres of BLM lands along the ridgeline would be treated for 200 feet on either side of the ridge. No merchantable timber would be removed from these areas. Understory vegetation, generally consisting of shrubs and immature trees, up to seven inches DBH would be cut. Remaining trees would be limbed up to 15 feet from the ground or half the height of the tree, whichever is less. Multi-stemmed

hardwoods over seven (7) inches DBH would be reduced to one or two dominant stems and limbed up to 15 feet from the ground or half the height of the tree, whichever is less. Young stands, i.e. less than 20 years of age, would be limbed and thinned according to the pre-commercial thinning specifications typically used for silviculture treatments. All cut vegetation would be hand piled, covered, and burned or chipped in place unless a market exists for biomass, then material could be offered for sale in place of burning. If the cut vegetation is chipped, the chips would be spread at a depth of no more than ten inches in any one location. Existing downed wood between three and seven inches diameter would also be gathered into the hand piles for burning. Up to two small piles per acre could be retained as habitat and would not be burned. Existing downed wood greater than seven inches in diameter and standing snags that do not qualify under the District hazard tree definition would remain in place. Areas of vulnerability, as specifically identified by botany or soils specialists, would be avoided for pile placement and/or burning. Should any proposed harvest unit not be harvested, the ridgeline fuel break would still be treated as described.

Within the proposed harvest units, a moderate thinning prescription would be implemented for a width of 200 feet on either side of the ridgeline totaling approximately 101 acres. Any hazardous fuels remaining after harvest within this area would be treated as described above then hand piled and burned with the activity fuels generated from the thinning. Areas of vulnerability, as specifically identified by botany or soils specialists, would be avoided for pile placement and/or burning.

b) ***Roadside Treatment***

Approximately 0.8 miles of the primary haul road, 26-3-34.2, would be treated on BLM lands from the west edge of Section 31 of T26S, R2W to the pump chance, Sugar Pine Camp heli-pond, located in the middle of Section 25, T26S, R2W. Treatment would occur within 50 feet on either side of the road (Figure 5) and would total approximately 10 acres.

Roadside treatment outside of harvest units would involve cutting understory vegetation, consisting of shrubs and immature trees, up to seven inches DBH. Retained vegetation would be limbed up to15 feet from the ground or half the height of the tree, whichever is less. Multi-stemmed hardwoods would be reduced to one or two dominant stems and limbed to the same height. All cut vegetation and existing downed wood between three and seven inches diameter would be hand piled, covered, and burned or chipped in place. If the cut vegetation is chipped, the chips would be spread at a depth of no more than ten inches in any one location. If a market exists for biomass at the time of treatment, cut vegetation could be offered for sale in place of burning or chipping. Areas of vulnerability, as specifically identified by botany or soils specialists, would be avoided for pile placement and/or burning.

Where the 26-3-34.2 road passes through proposed harvest units, no additional treatment of hazardous fuels would occur beyond treatment of activity fuels as described in the *Design Features Common to All Alternatives* section (pg. 19).

2. Timber Harvest

a) ***Treatment Prescription for Action Alternative 2***

A variable density thinning prescription would be used in the proposed Thunderbolt units. In general, AMA and GFMA and C/D lands would have a light thinning prescription identified

as the upland treatment. Riparian Reserves, in general, would have a moderate thinning prescription identified as the riparian treatment.

Under *Action Alternative 2*, a moderate thinning prescription, instead of a light thinning prescription, would be applied on approximately 101 acres in the upland where the shaded fuel break occurs within Big Thunder and Thundering Herd units (Figure 5). In Big Thunder Unit 31B where gaps may overlap the fuel break, non-susceptible laminated root rot tree species would be selected for retention.

For comparison purposes with other proposed *action alternatives*, Table 6 displays the treatment prescriptions for the three proposed Thunderbolt timber sales. Big Thunder Unit 31B is separated from the rest of the Big Thunder units because it involves a more complex prescription than what is proposed for the other units.

Table 6. Proposed Action Alternative 2 – Proposed Treatment Prescriptions for the Thunderbolt Thinning Project.

Sale	Light Thin		Moderate Thin		Heavy Thin		Gaps		Skips	
	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian[1]
Big Thunder (374 acres)	63%	0%	6%	31%	0%	0%	0%	0%	0%	0%
Big Thunder 31B (294 acres)	45%	0%	15%	18%	0%	0%	7%	2%	3%	10%
Rolling Thunder (485 acres)	59%	0%	0%	41%	0%	0%	0%	0%	0%	0%
Thundering Herd (430 acres)	67%	0%	12%	21%	0%	0%	0%	0%	0%	0%

1. Skips in Riparian Reserves would include acres of "no-harvest" buffers when layout is completed. In Unit 31B, the skips include "no-harvest" buffers plus additional acres that have been calculated into a percentage of the proposed unit treatment.

G. Design Features Unique to Proposed Action Alternative 3

This section describes the design features that would apply under *Action Alternative 3*.

1. Timber Harvest

a) ***Treatment Prescription for Action Alternative 3***

In addition to the design features described in *Action Alternative 2*, the variable density thinning prescription in Unit 31B would incorporate heavy, light, and moderate thinning, gaps, and skips. This would add complexity to the variable density thinning prescription. Distribution of the three thinning levels would be adjusted within the unit and would result in the treatment prescriptions as shown in Table 7.

Table 7. Proposed Action Alternative 3 – Proposed Treatment Prescriptions for the Thunderbolt Thinning Project.

Proposed Sale	Light Thin		Moderate Thin		Heavy Thin		Gaps		Skips	
	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian	Upland	Riparian[1]
Big Thunder (374 acres)	63%	0%	6%	31%	0%	0%	0%	0%	0%	0%
Big Thunder 31B (294 acres)	24%	4%	28%	9%	8%	5%	7%	2%	3%	10%
Rolling Thunder (485 acres)	59%	0%	0%	41%	0%	0%	0%	0%	0%	0%
Thundering Herd (430 acres)	67%	0%	12%	21%	0%	0%	0%	0%	0%	0%

1. Skips in Riparian Reserves would include acres of "no-harvest" buffers when layout is completed. In Unit 31B, the skips include "no-harvest" buffers plus additional acres that have been calculated into a percentage of the proposed unit treatment.

2. Hazardous Fuels Treatment

A shaded fuel break and roadside treatment of fuels along the 26-3-34.2 road as described for proposed *Action Alternative 2* (q.v. pg. 30-31) would be implemented to provide a potential location to stop a wildfire and provide for protection of safe ingress and egress from the area.

H. Alternatives Considered but Not Analyzed in Detail

1. Additional Units

An alternative was considered that included one additional unit in Thundering Herd (27A). This 15 acre stand is approximately 58 years old and was dropped due to stand conditions that do not warrant thinning at this time. Consequently, this unit was deferred from further analysis in the Thunderbolt EA.

2. Helicopter Yarding

An alternative was considered by the interdisciplinary team that would use helicopter (aerial) yarding and less road construction in lieu of ground-based and cable yarding. However, typical expenses for helicopter yarding are approximately $400 per 1,000 board feet (1MBF) in contrast to the cost for ground-based yarding systems and cable-yarding systems. In previous analyses done by the Swiftwater Field Office, the monetary expense for ground-based and cable yarding systems was estimated to be $102-$191 per MBF (Johnson Cleghorn Thinning EA, NEPA #: DOI-BLM-OR-R040-2011-011-EA, pg. 91). The logs from the Thunderbolt project would have an estimated pond-value of approximately $575-585 (2rd Quarter 2013 2S-3S Douglas-fir from Oregon Department of Forestry at http://oregon.gov/ODF/STATE_FORESTS/TIMBER_SALES/logpage).

Based on these expenses and values, extensive use of helicopter yarding would not produce an economically viable timber sale and would therefore be unlikely that helicopter yarding of these units would be accomplished without the cost being subsidized by the government. Consequently, the use of helicopter yarding was not analyzed further in the Thunderbolt EA due to economic reasons.

Chapter 3. Affected Environment & Consequences by Resource

This chapter discusses the specific resources potentially affected by the alternatives and the direct, indirect and cumulative environmental effects of the alternatives over time. Cumulative effects are the impacts of an action when considered with past, present, and reasonably foreseeable future actions (40 CFR 1508.7). This discussion is organized by individual resource, and provides the basis for comparison of the effects between alternatives.

The cumulative effects of the BLM timber management program in western Oregon have been described and analyzed in the 1994 *Final - Roseburg District Proposed Resources Management Plan / Environmental Impact Statement* (1994 PRMP/EIS), incorporated herein by reference.

A. Forest Vegetation

1. Affected Environment

The forest stands in the proposed Thunderbolt units range in age from 49 to 63 years old with one stand of approximately six acres that is 95 years old. The stands originated as a result of timber harvest from the 1940's to the early 1970's. Management records for the 95 year-old stand show it was partial-cut harvested in the 1940's, harvesting some of the older trees and leaving the smaller trees to grow. The stands within all of the proposed units are best described as even-aged with a single-story structure (Daniel *et al.* 1979), although some remnants of an older age class may be present.

Stand specific inventories (stand exams) were used to identify current vegetation stand attributes. See *Appendix F* for a description of the assumptions and methodology used to analyze changes in forest vegetation. Proposed units may contain one or more stands as mapped in the District's forest operations inventory (FOI), and may contain a mix of tree species, form, and distribution. The current stand conditions of live trees are summarized by sale for the Thunderbolt project in Table 8.

Table 8. Current Stand Conditions: Live Trees[1] in Thunderbolt.

Sale	Stand Age (years)	Trees Per Acre[1]	Basal Area[1] (square feet)	Quadratic Mean Diameter[1] (inches)	Curtis Relative Density[1]	Canopy Cover[1,2] (%)	Live Crown Ratio[1] (%)
Big Thunder	52-59	78-222	125-205	10-19	36-56	77-96	44-60
Big Thunder Unit 31B	58-95[3]	150-183	190-285	15-17	48-71	87-97	38-50
Rolling Thunder	50-59	117-217	150-210	12-15	39-56	81-95	30-52
Thundering Herd	49-62	124-230	135-245	13-15	36-65	78-95	38-49
RANGE	***49-95***	***78-230***	***125-285***	***10-19***	***36-71***	***77-97***	***30-60***

[1] Data shown are for trees six inches DBH and larger.

[2] *Canopy Cover* is the proportion of the forest floor covered by the vertical projection of tree crowns adjusted for crown overlap.

[3] This unit includes a six acre stand that is approximately 95 years old.

A stand representing the average conditions for each proposed sale was selected to illustrate the existing amount of snags currently estimated in the project area. No data was available for amounts of down woody debris. Table 9 shows the existing average snag amounts.

Table 9. Current Stand Conditions[1]: Dead Trees in Thunderbolt.

Snag Density (Trees Per Acre)			**Down Woody Debris[2]**
Proposed Sale	**<-20" DBH**	**≥ 20" DBH**	**Cubic Feet Per Acre**
Big Thunder	5	0	n/a
Rolling Thunder	8	0	n/a
Thundering Herd	14	0	n/a

[1] One stand reflecting average conditions per proposed sale was selected for estimating the current amount of snags.
[2] Data on down woody debris was not available.

Douglas-fir is the predominant overstory tree species on all units. Other overstory tree species in the stands include western hemlock, grand fir, sugar pine, western red cedar, Incense-cedar, big leaf maple, and red alder. Crown ratios of dominant and co-dominant trees are currently in the 30-60 percent range indicating moderate to high vigor and good potential for a positive response to thinning. Understory vegetation is common, spatially variable, and generally consists of sword fern, salal, vine maple, Oregon grape, and huckleberry.

Surveys indicate that Big Thunder Unit 31B has 67 sugar pine trees over 18 inches in diameter. Mature sugar pine trees in the area have exhibited increasing amounts of mortality caused by the mountain pine beetle (*Dendroctonus ponderosae,* Hopkins).

Prolonged drought, top and branch killing by white pine blister rust, and unfavorable stand conditions are major predisposing factors to beetle infestation. Excessive competition between sugar pines and surrounding trees as a result of overstocking appears to be particularly significant in susceptibility of individual trees to infections and insects (Goheen 1998). Stand exams have not recorded sugar pine in the other proposed harvest units, however, it is expected that scattered sugar pine trees are present.

Laminated root rot (*Phellinus suphurascens*) is the suspected cause of approximately 47 pockets of dead and dying trees within Big Thunder Unit 31B. There are potential root rot areas in the other proposed units but surveys did not locate any. The *Phellinus* fungus spreads among living trees via root contact causing progressive decay, resulting in reduced uptake of water and nutrients and weakening of structural support to the trees. As the roots are progressively killed, a tree eventually dies while standing or loses its structural support and is wind thrown (Thies 1995).

2. Environmental Consequences

a) ***No Action Alternative***

In the absence of a substantial disturbance, it is expected the structure of the forest stands proposed for treatment would continue to be single-storied through the next 100 years. Over time, site conditions would become more conducive to the establishment and growth of shade-tolerant tree species. However, this process would be slow and understory tree

development would be insufficient to cause a shift from a single-storied to a two-storied or layered structure within 100 years (Oliver and Larson 1990; Munger 1940).
In the absence of treatment, canopy cover would remain high, relative density would increase and the crowns of individual trees would continue to recede (Chan *et al.* 2006), resulting in increased suppression mortality and decreasing diameter growth as trees compete for water, nutrients, and sunlight (Oliver and Larson 1990). Merchantable board foot production would be high because of the high density of trees (Curtis and Marshall 1986). Table 10 displays predicted conditions of Thunderbolt stands in in 100 years with the absence of thinning. The prediction is based on modeling one stand per proposed sale that approximates the average initial stand conditions.

High height to diameter ratios (≥ 80-100) can predispose trees to stem bending, windsnap, and windthrow. As trees increase in height, with little increase in diameter, they become unstable and more susceptible to damage (Wonn and O'Hara 2001; Oliver and Larson 1990).

Inter-tree suppression or *regular* mortality would occur primarily in the smaller size classes of trees and would be the main source for passive snag and coarse woody debris recruitment. However, non-suppression *irregular* mortality from insects, disease, windthrow and stem breakage can occur across all crown classes at any age. As the stand ages, regular mortality from inter-tree competition would become less significant and age and irregular mortality factors would become more important (Oliver and Larson 1990).

Sugar pine trees within this project area may be at risk for insect infestation as research has shown pines to be at risk of bark beetle attack when basal areas are greater than 180 square feet per acre on good sites in Southwestern Oregon (Mallams 2008). The basal area of Unit 31B, which has a high number of sugar pines, is currently 190-285 square feet per acre (Table 8). With no treatment, sugar pines have an increased death rate, decreased radial growth, and half the rate of sugar pine regeneration than treated sugar pines (Goheen 2011).

Laminated root rot pockets would progressively increase in size as tree roots pass on the fungus to nearby trees, resulting in additional tree mortality and reducing the future volume potential (Thies 1995).

Mortality is the source of snags and down wood. Since trees would not be removed under the *No Action Alternative*, this alternative would produce the highest amount of dead wood through passive recruitment, compared to other proposed alternatives or treatments.

Shrub density and cover would be expected to remain stable in the short term (Chan *et al.* 2006). In the long-term, shrubs and tolerant tree species (e.g. hemlock) would gradually increase as understory light increases due to receding overstory tree crowns and increased tree mortality (Oliver and Larson 1990).

Table 10. Stand Conditions[1] in 100 Years under the *No Action Alternative*: Live Trees in Thunderbolt.

Proposed Sales	Trees Per Acre	Basal Area (sq. ft./acre)	Quadratic Mean Diameter (inches)	Canopy Cover[2] (%)
Big Thunder (incudes Unit 31B)	113	360	24	90
Rolling Thunder	149	385	22	95
Thundering Herd	143	383	22	95

[1] Data shown are for trees six (6) inches DBH and larger.
[2] *Canopy Cover* is the proportion of the forest floor covered by the vertical projection of tree crowns adjusted for crown overlap.

b) ***Environmental Consequences Common to Action Alternatives 1, 2, and 3***

Thinning would be used to reduce the density of trees in the proposed units and provide intermediate timber volume and revenue (Daniel *et al.* 1979). The changes in relative stand density and canopy closure would reduce competition among the remaining trees for available water, light, and nutrients and result in increased tree diameter growth compared to unthinned controls. A study of commercially thinned 40 to 100 year old stands, found that radial growth rates averaged about 36 percent greater in thinned stands compared to unthinned stands at 10 to 23 years post-thinning (Bailey and Tappeiner 1998). Thinning stabilizes or prevents height to diameter ratios from increasing above thresholds that predispose the stand to stem bending, windsnap, and windthrow (Wonn and O'Hara 2001, Oliver and Larson 1990).

Thinning can increase, maintain, or reduce the rate of recession of live crown ratios (Oliver and Larson 1990, Chan *et al.* 2006, Marshall and Curtis 2002). Maintaining live crown ratios greater than 30 percent prevents a substantial reduction in vigor and diameter growth (Smith 1962). Thinning can also increase crown ratios by stimulating epicormic branching in tree species, such as Douglas-fir, true firs, and big-leaf maple (Tappeiner *et al.* 2007).

Canopy cover gradually increases after a thinning. Canopy closure measured as skylight through the canopy decreases by two percent per year (Chan *et al.* 2006). Shrubs and herbaceous vegetation cover is initially reduced by thinning; however, subsequent cover and plant diversity would increase to levels beyond pre-treatment conditions (Chan *et al.* 2006, Bailey *et al.* 1998).

Natural regeneration of tree species is common after thinning, depending on availability of seed and other factors. Seedling distribution and density are highly variable (Chan *et al.* 2006, Nabel 2008) but generally increase with increasing intensity of thinning (Bailey and Tappeiner 1998, Nabel 2008).

The immediate post-treatment stand conditions are displayed in Table 11. Using the percentage of each treatment type, values were calculated using a weighted average for the stands and the range for each sale is shown. The variability shown for each proposed sale is reflective of the variation between unit stands and does not show a difference in treatment under the three alternatives. Only Unit 31B, where the proposed thinning treatment is more variable, shows differences between the three alternatives in post-treatment stand conditions.

(1) Effects from the Light Thinning Prescription

Stands that are lightly thinned to a relative density of 27-37 would produce moderately-high volume growth rates at the expense of individual tree diameter growth rates (Curtis and Marshall, 1986). A single light thinning offers minimal opportunity to create diverse, multi-storied (i.e. layered structure) stands. Understory conifer and hardwood tree vigor and survival would diminish as the overstory canopy closes (Chan *et al.* 2006; Cole and Newton 2009).

(2) Effects from the Moderate Thinning Prescription

Stands that are moderately thinned to a relative density of 18-25 would produce high rates of diameter growth at the expense of volume production (Curtis and Marshall 1986). It is uncertain whether the overstory in moderately thinned stands would remain open enough without additional thinning treatment to maintain light levels that would provide an environment conducive to the long-term survival and growth of understory vegetation to result in a layered structure (Chan *et al.* 2006; Cole and Newton 2009).

Table 11. Immediate Post-Treatment Stand Conditions under the Proposed Action Alternatives: Live Trees in Thunderbolt.

Sale	Action Alternative	Trees Per Acre[1]	Basal Area[1] (sq. ft./acre)	Quadratic Mean Diameter[1] (inches)	Canopy Cover[1, 2] (%)
Big Thunder	1, 2, 3	48-99	97-110	14-19	57-72
Big Thunder Unit 31B	1	74	125	19	62
	2	70	120	19	60
	3	60	105	20	54
Rolling Thunder	1, 2, 3	75-132	89-120	13-15	59-76
Thundering Herd	1, 2, 3	95-109	100-116	14-15	64-72

[1] Data shown are for trees six (6) inches DBH and larger.
[2] *Canopy Cover* is the proportion of the forest floor covered by the vertical projection of tree crowns, adjusted for crown overlap.

(3) Effects from the Heavy Thinning Prescription – Unit 31B

Heavily thinned stands would produce the highest rates of diameter growth of the proposed thinning intensities at the expense of volume production (Curtis and Marshall 1986). It is anticipated the overstory canopy would remain open enough to maintain light levels conducive to the long-term survival and growth of understory vegetation that would produce a layered structured stand (Chan *et al.* 2006; Newton and Cole 2009). The addition of a heavy thinning treatment to Unit 31B would increase the development of stand structural complexity more than the other alternatives.

(4) Effects from the Gap Prescription – Unit 31B

Gaps around sugar pines have been shown to be the best treatment for reducing sugar pine mortality from beetle kill and stem breakage. Sugar pines have increased their annual radial growth, after such treatments, which is a sign of improved tree vigor. The potential for natural sugar pine regeneration doubled when treated (Goheen 2011).

The gap strategy prescribed for treatment of laminated root rot has been shown to prevent the spread of the fungus into healthy adjacent trees (Thies 1995). Limiting the spread of the disease would ensure future harvest potential for the affected stands.

Canopy gaps with or without retention trees would encourage understory vegetation development contributing to horizontal and vertical structural diversity. Gap size and height growth of the adjacent stand affects the development of vegetation in gaps (Malcolm *et al.* 2001). In stands dominated by Douglas-fir, trees in the thinned matrix adjacent to gaps have shown an increased basal area growth of 11 percent (Roberts and Harrington 2008).

(5) Effects from Skips

Portions of stands where skips are located would develop in the same manner as described previously for stands under the *No Action Alternative.* Stands would remain single-storied with high canopy cover and a stable shrub density. Suppression mortality would result in increased coarse woody debris and snags.

(6) Effects of Variable Density Thinning

Variable-density thinning has been suggested as a method to promote the development of diverse, structurally complex stands through the manipulation of young even-aged stands (Carey 2003). Variable-density thinning in *Alternatives 1, 2,* and *3* would be applied at a gross scale with uplands receiving a light thinning and riparian areas receiving a moderate thinning and skip treatment. Individual treatment types would produce effects described previously for each treatment type.

The composite of harvest types and their spatial distribution in these alternatives suggest that long-term (next 100 years), the potential for development of a layered structure is expected to occur in portions of the area receiving the moderate thinning treatments. However, the spatial distribution of this condition would not be variable enough to classify the overall stand structure as layered. As described previously under the effects of moderate thinning, long-term persistence of layering is problematic due to the level of residual stand density or the long-term probability of maintaining fuel breaks with low levels of layered structure.

The proposed prescription for Unit 31B would increase the variability in the stand by retaining sugar pine, a minor species; slowing the progression of root rot and encouraging growth of natural regeneration and shrubs in those gaps; and passive recruitment of snags and coarse woody debris in the skips. However, the addition of gaps would not be of sufficient quantity to classify the overall stand structure as layered. Table 12 displays the stand conditions for live trees under all alternatives for the Thunderbolt proposed timber sales.

(7) *Effects on Potential Dead Wood Production*

A stand representing the average conditions and treatment proportions for each proposed sale by alternative was modeled to estimate the amount of dead wood (tree mortality) produced over a 100 year simulation period. The estimated amounts of total dead wood and snags greater than 20 inches DBH are shown in Table 13. Over a one-hundred year scenario, the *Action Alternatives* would produce approximately 60 to 70 percent of the amount of dead wood predicted under the *No Action Alternative*. Estimated production of snags over 20 inches DBH is in the 40 to 70 percent range when compared to no action.

Table 12. Stand Conditions[1] in 100 Years under the No Action and Action Alternatives: Live Trees in Thunderbolt

Proposed Sale	Proposed Alternative	Trees Per Acre[1]	Basal Area[1] (ft^2./acre)	Quadratic Mean Diameter[1] (inches)	Canopy Cover[1, 2] (%)
Big Thunder	NA	113	360	24	90
	1	60	242	27	80
	2	59	240	27	80
	3	59	240	27	80
Big Thunder Unit 31B	NA	113	360	24	90
	1	81	274	26	85
	2	88	276	25	85
	3	97	273	23	90
Rolling Thunder	NA	149	385	22	95
	1	82	272	25	90
	2	82	272	25	90
	3	82	272	25	90
Thundering Herd	NA	143	383	22	95
	1	101	297	24	90
	2	95	288	24	90
	3	95	288	24	90

[1] Data shown are for trees 6 inches dbh and larger.

[2] *Canopy Cover* is the proportion of the forest floor covered by the vertical projection of tree crowns, adjusted for crown overlap.

Table 13. Cumulative Production of Coarse Dead Wood (Tree Mortality) over a 100 Year Period

Proposed Sale	Proposed Alternative	# of Snags/Acre ≥ 20" DBH	Total Coarse Wood[1] (cubic feet/acre)
Big Thunder	NA	18	5,400
	1	12	3,700
	2	12	3,700
	3	12	3,700
Big Thunder Unit 31B	NA	18	5,400
	1	12	3,700
	2	11	3,600
	3	7	3,300
Rolling Thunder	NA	16	5,500
	1	12	3,500
	2	12	3,500
	3	12	3,500
Thundering Herd	NA	16	5,400
	1	12	3,500
	2	12	3,400
	3	12	3,400

[1] Coarse wood includes all tree mortality volume, rounded to the nearest 100 cubic feet, for trees four inches DBH and greater (including snags and down wood).

B. Fire and Fuels Management

1. Affected Environment

The Thunderbolt project occurs along a ridgeline between two large watersheds at a relatively high elevation in an area known for both lightning and human caused fires. The entire area is considered Wildland Urban Interface (WUI) in the Douglas County North Umpqua Community Wildfire Protection Plan (Douglas County 2010).

Fire modeling was done for an area of approximately 43 square miles that included the Thunderbolt project area, to analyze how the proposed treatments would influence fire behavior at a landscape level. The model used for this analysis was FlamMap with the Landfire 2008 data modified to more accurately depict fuel models present in the project area (Finney 2006). A description of the model, definitions of fire behavior terminology, and the fire behavior prediction fuel models are contained in Appendix G.

Wildfire data collected from Douglas Forest Protective Association and BLM records indicate there were approximately 29 fires in the past 20 years (from 1993-2012) in the area modeled for this analysis. Of those, five were caused by lightning, 11 by arson, and 13 by other accidental human causes. The majority of the fires were less than five acres in size. However, within three miles of this analysis area, several larger fires occurred in the same timeframe, including the 8,000 acre Williams Creek Fire in 2009.

Most fires occurred in the months of August and October but ranged from April to November. Fire weather for this area is captured at several Remote Automated Weather Stations (RAWS), of which, the closest is at the North Bank Habitat Management Area. However, this station was installed in May 2006 and therefore does not have earlier information. For the fire modeling the Silver Butte RAWS near Canyonville, Oregon, which was installed in July 1986, was used. The summary data of average weather for the month of August during the 20 year period from 1993 to 2012 were used for the input to the models (Appendix G, Table 1).

Fire behavior over the model landscape would be highly variable based on current vegetation conditions. Therefore, two representative fire behavior fuel models were selected for use in FlamMap to predict flame length, rate of spread, and crown fire potential (Scott & Burgan 2005). The representative fire behavior fuel models in the area are, predominantly, *moderate load conifer litter* (TL3) or *very high load timber shrub* (TU 5).

Currently, there is understory vegetation directly adjacent to the roadway along much of the main haul route, the 26-3-34.2 road, for the Thunderbolt project. This results in a fuel break of twelve to fifteen feet, which would be crossed by a fast moving fire producing too much heat to allow safe access by fire equipment and personnel.

The Sugar Pine Camp pump chance is located in the center of Section 25 of Township 26, Range 2 on the eastern end of the project area. Currently the pump chance is in a useable condition for both engine and helicopter access.

The BLM ownership in this area is interspersed with private timber company lands, typical of O&C Revested lands. Many of the private landowners have completed roadside fuels treatments along the 26-3-34.2 road, the Thunder Mountain Road, which would complement the proposed treatment for BLM administered lands.

2. Environmental Consequences

a) ***No Action Alternative***

The existing fuel loads in the stands would continue to increase through mortality, self-pruning, and other natural events such as blow-down or disease. As fuel loading increases, potential fire behavior would increase and fires would be more difficult to contain and would be larger. Areas currently represented by fire behavior fuel model *moderate load conifer litter* (TL3) would transition over time into *high load conifer litter* (TL5) roughly doubling the predicted flame length (Table 14). Areas currently considered fire behavior fuel model *very high load timber shrub understory* (TU5) would also have a corresponding increase in fuel loading, however, there is no higher representative fuel model in the timber understory (TU) series.

Flame lengths in the areas of timber litter would still remain below the four feet considered safe for attack with ground resources (Fire Behavior Characteristics Chart, Appendix G). The increase in fuel loading, however, would make navigating the area on foot more difficult and navigating with a fire engine likely impossible. Areas with *timber/shrub understory* (TU5) would, at a minimum, maintain greater than ten foot flame lengths making attack with hand tools impossible.

There would also be an increase in heat per unit area as larger fuels accumulate. The heat per unit area, measured in British Thermal Units per square foot, provides an estimate of severity of the fire on the landscape. Much like a campfire, small diameter wood burns quickly without much heat generation while large diameter wood burns slowly while generating high temperatures. A recent study (Busse *et al.* 2013) showed maximum temperatures for piles of large wood vs. piles of small diameter material were similar at the soil surface. However, five centimeters below the surface, the soil temperatures under the large wood piles were two to three times higher than the soil under the small diameter material. The dramatic difference in soil temperature correlates directly with fire severity and level of damage to soils. The location of this project on the ridgeline makes it vulnerable to erosion following fire-related soil damage.

The existing trees along the ridgeline would render an aerial retardant drop ineffective. In order for aerially applied retardant to work as intended, it must reach the surface of the ground where firefighters can then augment the retardant by creating a fireline.

A young stand, planted in 1994, located along the ridgeline would be pre-commercially thinned regardless of the Thunderbolt project. Slash generated from pre-commercial thinning would remain in the stand and the remaining trees would not be limbed. This would result in the stand changing from a *moderate load dry climate shrub* (SH2) to a *very high load, dry climate shrub* (SH7) fuel model. Potential flame lengths would increase from seven feet to more than twenty feet (Table 14) making direct firefighting impossible and application of aerial retardant ineffective.

b) ***Proposed Action Alternative 1***

Fuel loading within the sale units post-harvest would be represented by high load activity fuel model SB3. Activity fuels along the roadways and at yarding landings would be treated by piling the material and burning the piles. This would reduce the fuel loading along the

roadways. Safe ingress and egress to the area would be improved and the risk of roadside ignition would be reduced.

Timber harvest with treatment of activity fuels would not improve fire suppression capability over the area in the short term and would increase potential fire behavior. The arrangement of the fuels changes from a natural, upright, and mostly live condition to dead downed wood potentially stacked several feet from the ground. This change results in increased flame lengths, resulting in more than double the predicted heat per unit area in areas with *moderate load conifer litter* (TL3) (Table 14). Similar to the *No Action Alternative*, the increase in heat per unit area would increase the likelihood of high severity fire resulting in soil damage and erosion. The primary difference between the *No Action Alternative* and *Action Alternative 1* is the change in fuel composition due to timber harvest that occurs over a single season rather than accumulating over time.

In the event of a wildfire, the decrease in canopy closure from timber harvesting would increase the amount of aerially applied retardant that would reach the understory and logging slash. However, the presence of slash within the stand along the ridgeline would hinder access and make the construction of firelines more difficult.

Treatment of the activity fuels would increase the usefulness of the heli-pond pump chance by reducing understory vegetation resulting in easier access by firefighting resources. Harvesting the timber would not change aerial access to the heli-pond because a flightline currently exists.

c) ***Proposed Action Alternatives 2 and 3***

(1) *Shaded fuel break within the timber sale units*

The additional treatment of fuels (slash) on 101 acres within the proposed sale units along the shaded fuel break would reduce the fuel loading and potential fire behavior (Maxwell & Ward 1976). The reduction in fuel loading would change the representative fuel model from *high load activity fuel* (SB3) post-harvest, as shown for *Alternative 1*, to *low load timber-grass-shrub* (TU1) as shown in Table 14. The change would reduce the expected flame length from approximately 12 feet to less than four feet allowing suppression by firefighters with hand tools (Finney 2006). It is estimated that fires with flame lengths greater than four feet would require the use of heavy equipment or aerial retardant (Rothermel 1983). The proposed treatment would also improve access for firefighting personnel to any fires near the fuel break by improving footing and reducing hiking time.

The average slope along most of the shaded fuel break, both inside and outside the harvest units, is approximately 44 percent with an average tree height of 93 feet in the harvest units. As fire burns upslope, the flames contact the uphill vegetation more quickly, resulting in fire moving faster through a stand. In order to create an effective fuel break, this slope effect must be taken into account along with tree height. Generally, safe firefighting refuge is considered to be at least twice the height of the vegetation and would increase in size as other factors, like slope, are incorporated. Treatment of vegetation 200 feet from the ridgeline would provide a substantial break in the continuity of fuels for a crown fire to transition into a surface fire allowing firefighters an opportunity to safely suppress the fire. This distance would also allow for convective heat generated from the fire to dissipate prior to impacting firefighters.

The moderate thinning prescription planned for the shaded fuel break area would increase the usefulness of aerial retardant as a firefighting tool. After thinning, the trees would have wider spacing with less canopy closure allowing more retardant to reach the ground. Slash treatment within the proposed fuel break would remove surface fuels increasing the effectiveness of retardant application and facilitate in the building of firelines.

(2) *Shaded fuel break outside the timber sale units*

The representative fuel model for most of the stands near the proposed timber sales is either *very high load timber-shrub* (TU 5) or *moderate load conifer litter* (TL 3) (Table 14). By cutting understory brush and trees less than seven inches diameter and limbing the overstory trees up to 15 feet from the ground, the fuel model becomes *low load timber-grass-shrub* (TU 1). The result is the estimated flame lengths decrease to four feet or less, which would allow for suppression by firefighters with hand tools.

The 1994 stand located along the ridgeline would be treated with a modified pre-commercial thinning (PCT) prescription. Typical PCT would not involve treatment of slash and the stand would be represented by fuel model SH7, *very high load, dry climate shrub*. The modified PCT prescription would remove slash from the stand along the proposed fuel break and the remaining trees would be limbed thus changing the fuel model to *low load shrub*, SH1. With this treatment, the estimated flame lengths would be reduced from approximately twenty-one feet to less than four feet.

(3) *Roadside treatment within the timber sale units*

This treatment is part of *Proposed Action Alternative 1* therefore the effect would be the same as described in the *Proposed Action Alternative 1* section.

(4) *Roadside treatment outside of the timber sale units*

Treatment of approximately 10 acres of the existing fuels along the 26-3-34.2 road outside of proposed sale units would widen the potential fuel break provided by the roadway. This would improve safe ingress and egress to the area for firefighting personnel and the public.

Treatment of roadside vegetation in the project area would also reduce the likelihood of a wildfire event resulting from roadside ignition caused by human activity.

Table 14. Comparison of Fuels Characteristics for All Proposed Alternatives

	Area	Alternatives	Initial Fuel Model[3]	Post-Treatment Fuel Model[3]	Fuel Loading (tons/ac)			Flame Length (ft)[1]	Heat per Unit Area (Btu/ft²)[1]
					1-hr	10-hr	100-hr		
Within Timber Harvest Units	Entirety of Unit	Current Condition	TL3		0.50	2.20	2.80	1.2	212
			TU5		4.00	4.00	3.00	10.6	2862
		No Action	TL3	TL5	1.15	2.50	4.40	2.5	382
			TU5	TU5	4.00	4.00	3.00	10.6	2862
		Action Alternative 1	TL3/TU5	SB3	5.50	2.75	3.00	12.5	1506
	Within Shaded Fuel Break	Action Alternatives 2 & 3	TL3/TU5	TU1	0.20	0.90	1.50	2.5	434
	Outside Shaded Fuel Break	Action Alternatives 2 & 3	TL3/TU5	SB3	5.50	2.75	3.00	12.5	1506
Shaded Fuel Break Outside Timber Sale Units	Stands Younger Than 20 Years Old	Current Condition	SH2		1.35	2.40	0.75	7.1	1404
		No Action[2]; Alternative 1[2]	SH2	SH7	3.50	5.30	2.20	20.9	2386
		Action Alternatives 2 & 3	SH2	SH1	0.25	0.25	0.00	3.4	271
	Stands Older Than 20 Years Old	Current Condition	TL3		0.50	2.20	2.80	1.2	212
			TU5		4.00	4.00	3.00	10.6	2862
		No Action; Alternative 1	TL3	TL5	1.15	2.50	4.40	2.5	382
			TU5	TU5	4.00	4.00	3.00	10.6	2862
		Action Alternatives 2 & 3	TL3/TU5	TU1	0.20	0.90	1.50	2.5	434

1 – Flame Length and Heat per Unit Area derived from fire model BehavePlus 5.0 (Heinsch & Andrews, 2010).
2 –Treatment would consist of a PCT prescription with no treatment of the resulting slash.
3 – Scott & Burgan, 2005

C. Wildlife

1. Northern Spotted Owl (*Federally Threatened*)

The northern spotted owl (spotted owl) is present throughout the Roseburg District, inhabiting forests more than 80 years old that provide habitat for nesting, roosting and foraging, commonly referred to as *suitable habitat or NRF*. Spotted owl habitat is categorized into three types: 1) suitable (NRF), 2) roosting and foraging, and 3) dispersal. As defined by Thomas *et al*. (1990), structural components that distinguish superior suitable spotted owl habitat from less suitable habitat include:

- a multi-layered, multi-species canopy dominated by large (greater than 30 inches in diameter at breast height) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods;
- a moderate to high (60 to 80 percent) canopy closure;
- substantial decadence in the form of large, live coniferous trees with deformities, such as cavities, broken tops, and dwarf mistletoe infections;
- numerous large snags;
- ground-cover characterized by large accumulations of logs and other woody debris;
- canopy that is open enough to allow spotted owls to fly within and beneath it.

Roosting and foraging habitat contains (USDI USFWS 2008b):

- moderate to high canopy closure (60 to 80 percent);
- a multi-layered and multi-species canopy;
- large accumulations of fallen trees and other woody debris on the ground;
- open space below the canopy for spotted owls to fly;
- but lacks nesting structure.

Forest types described as dispersal habitat are essential to the dispersal of juvenile and non-territorial (e.g. single birds) northern spotted owls. *Dispersal habitat* can occur in intervening areas between or within blocks of nesting, foraging, and roosting habitat. Although NRF habitat also functions as dispersal habitat, these terms are used separately.

Thomas *et al*. (1990) defines dispersal habitat as conifer-dominated forest stands with canopy closures of 40 percent or more and an average diameter at breast height of 11 inches or larger. Younger, conifer-dominated forest stands, 40 to79-years old provide dispersal habitat. Dispersal habitat may contain snags, coarse woody debris, and prey sources that allow owls to move and forage between blocks of NRF habitat (USDI USFWS 2009). Dispersal habitat is essential to the movement of juvenile and non-territorial (e.g. single birds) northern spotted owls enabling territorial vacancies to be filled, and to providing adequate gene flow across the range of the species (USDI USFWS 2008b). A canopy cover of 60-80 percent would provide roosting habitat conditions to provide for thermoregulation, shelter and cover to reduce predation risks while resting or foraging.

Habitat use by spotted owls is influenced by prey availability (Ward 1990; Zabel *et al.* 1995). The composition of the spotted owl's diet varies geographically and by forest type, but is primarily comprised of small mammals. Flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga*

heterophylla) forests (Forsman *et al*. 1984), while woodrats *(Neotomas pp.*) are a major part of the diet in the Oregon Klamath province (Forsman *et al*. 1984; Forsman *et al*. 2004; Ward *et al.* 1998).

Both flying squirrels and woodrats are present and likely are the key prey species for spotted owls in the analysis area. Flying squirrels are associated with several habitat components within forests, including: high canopy cover; large trees, snags and abundant coarse woody debris; understory cover; patch-level changes in vegetation composition; and availability of fungi (Wilson 2008). Woodrats, as well other prey species (i.e. brush rabbits and other rodents) are primarily associated with early-and mid-seral forest habitat (Maser *et al*. 1981, Sakai and Noon 1993, Carey *et al*. 1999).

a) ***Affected Environment***

The extent of the Analysis Area for the northern spotted owl is defined by a composite of a 1.2-mile polygon around proposed timber sale units and provincial home range radius circles around activity centers affected by the proposed action. The Analysis Area covers approximately 24,610 total acres, of which 14,486 acres (59 percent) are on Federal lands. Approximately 11,750 acres (81 percent) of the Federal lands within the analysis area are Critical Habitat as designated for the northern spotted owl in 2012 (USDI USFWS 2012). There are 8,503 acres (59 percent) of spotted owl NRF habitat and 3,203 acres (22 percent) of dispersal-only habitat on Federal lands within the analysis area (Table 15, Appendix H - Figure 7).

Within the analysis area, historical annual surveys for spotted owls were completed from the mid 1980's thru the late 1990's. There was a survey gap at most sites from 2000 through 2006. The most recent surveys were conducted from 2007 to 2013. Based on historical and current survey data, there are 16 known spotted owl sites within 1.2 miles of the proposed units, which includes 22 activity centers (Appendix H - Figure 7). For the analysis of effects to owls and their habitat in the Thunderbolt project area, only the most recently occupied activity center within a site and its corresponding home range circle were considered to determine habitat impacts. Five of the spotted owl sites have not been occupied within the last five years (since 2008) and will not be considered further in this analysis. Ten of the 11 remaining sites have been occupied by spotted owls for at least one year from 2008 through 2013. Nesting was confirmed at three of the occupied sites since 2008. Because four consecutive years of surveys have been completed at the final (11^{th}) site, it is assumed to be occupied until the fifth consecutive year of survey has been completed (planned for 2014). Table 16 summarizes the status of the 11 occupied spotted owl sites within the action area including habitat conditions, survey history, occupancy status, and nesting/ reproduction status. Of the 11 occupied spotted owl sites, nesting was confirmed at three sites, two sites fledged young one year and one site fledged young two of the past five years (Table 16).

Barred owls have been present within all of the occupied spotted owl sites identified in this analysis within the last five years. The presence of barred owls either causes effects to detectability rates during surveys or causes social instability among spotted owl pairs, thus affecting occupancy, reproduction, and survival (Olson *et al.* 2005; Pearson and Livezey 2003).

Table 15. Northern Spotted Owl Habitats and Critical Habitat within the Analysis Area Affected by the Thunderbolt Project.

Habitat Type	Total Habitat in Analysis Area	Treatment Type (acres)		Total Habitat Treated In Analysis Area	
		Thinning	Fuels	Acres	Percent
Suitable (NRF) Habitat	8,503	12	64	76	0.1
Dispersal Habitat	3,203	1,571	11	1,582	49
TOTALS	***11,706***	***1,583***	***75***	***1,658***	***14***
Critical Habitat	11,753[1]	1,387	108	1,495	13

1. Total Critical Habitat acres, in addition to suitable and dispersal habitats, include acres of noncapable habitat (incapable of developing into spotted owl habitat) and capable habitat (capable of developing into habitat in the future).

Table 16. Environmental Baseline of Known Northern Spotted Owl Sites Affected by the Thunderbolt Project within the Action Area.

IDNO	SITE NAME	LUA[1]	NEST PATCH			CORE AREA			HOME RANGE				NSO STATUS SUMMARY			
			FED ACRES	NRF ACRES[2] (%)	DISPERSAL ACRES	FED ACRES	NRF ACRES[2] (%)	DISPERSAL ACRES	PROVINCIAL. HOME RANGE[3]	FED ACRES	NRF ACRES[2] (%)	DISPERSAL ACRES	LAST YEAR OF KNOWN PAIR STATUS	LAST YEAR OF KNOWN NESTING/ REPROD.	SUMMARY OF SITE STATUS[4] 2008-2013	OCCUPANCY STATUS OF INDO FOR THIS ANALYSIS[5]
0235O	**THUNDER BOB**	Matrix	65	51 (72)	0	340	248 (49)	22	WC	2126	1194 (40)	689	2013	2013	Pair – Nesting	Occupied
0384O	**BARE FOX**	Matrix	67	64 (91)	3	368	257 (51)	79	WC	2204	1235 (42)	595	2012	None	Unknown (2013) Pair - Nesting (2012)	Occupied
0426O	**ITTY BITTY EMILE**	Private[M]	30	25 (36)	5	87	38 (8)	31	WC	887	637 (22)	145	None	None	Single male (2013) Pair Status Unknown (2012)	Occupied
0509A	**EMILE CREEK**	Private[M]	70	59 (84)	10	332	254 (47)	23	WC	2407	1648 (56)	283	2013	2010	Pair (2013-2010) Single Res. (2009) Unknown (2008)	Occupied
1523O	**THUNDER**	Matrix	70	35 (50)	3	502	276 (55)	117	WC	2730	1702 (58)	532	2013	None	Pair – Nesting Status Unknown	Occupied
2104O	**ENGLES CREEK**	Matrix	64	64 (91)	0	284	265 (53)	15	WC	1506	919 (31)	408	1995	1994	Unoccupied (2013, 2011-2009) Single Res. (2012) Pair Status Unknown (2008)	Occupied
2532O	**GREENMAN CREEK**	Matrix	44	42 (60)	0	352	157 (31)	0	WC	1322	458 (15)	205	2009	1999	Unoccupied (2013-2010) Pair (2009-2008)	Occupied
2536O	**SHIVIGNY**	Matrix	69	58 (84)	11	404	243 (48)	153	WC	1709	1018 (34)	442	2011	1994	Single Res. (2013-2012) Pair (2011) Floater (2010-2008)	Occupied
3996O	**NO BRIDGE**	Matrix	70	46 (66)	18	321	165 (33)	117	WC	1166	685 (23)	403	1996	1995	Unoccupied (2013-2010) Unknown (2009-2008)	Occupied
4015A	**LOOKOUT CANYON**	Matrix	68	61 (88)	2	330	213 (42)	47	WC	1158	662 (22)	192	2012	1995	Single Res. (2013) Pair (2012-2011) Unknown (2010-2008)	Occupied
4018A	**SOUTH SUSAN**	Matrix	46	19 (27)	12	246	108 (22)	101	WC	1433	943 (32)	367	2013	2011	Pair (2013-2011; *2010 [O])* Unknown (2009-2008)	Occupied

[1] **Land Use Allocation** – **Matrix** = lands within BLM Adaptive Management Area (AMA), BLM Connectivity/Diversity Block (C/D), BLM General Forest Management Area (GFMA), BLM Northern General Forest Management Area (NGFMA), USFS AMA, or USFS Matrix land use allocations. **Private =** non- federal lands. M = Matrix and R= Reserved, indicating the primary LUA of Federal lands in surrounding sections of the IDNO activity center.

[2] **NRF Percent (%)** = NEST PATCH NRF acres per 70 acres = percent of Nest Patch that contains NRF habitat; CORE AREA NRF acres per 502 acres= percent of Core Area that contains NRF habitat; HOME RANGE NRF acres per 2955 acres = percent of Home Range that contains NRF habitat.

[3] **Provincial Home Range:** WC = Western Cascades (2,955 acres).

[4] Spotted Owl **Site Status** Definitions are defined in the survey protocol (USFWS 2011b). Unknown = no surveys completed or surveys were not completed to protocol during the year indicated and therefore, occupancy status is "unknown". *Italicized text* indicates that occupancy was located at a different alternate within the Master Site for the year(s) indicated. For example: Pair (2012; *2011 [B])* indicates that there was a Pair in 2012 at the IDNO being analyzed for this analysis; however, there was a pair at Alt B in 2011.

[5] **Occupancy Status of IDNO for this Analysis** was determined "Occupied" if 1) a "pair" was present at the IDNO during any year(s) since 2008 or 2) if the site status was "Unknown" because surveys have not been completed.

DISTURBANCE/DISRUPTION

Noise, human intrusion, and mechanical movement associated with an action are likely to cause some form of disruption or disturbance to the normal behavioral patterns of nesting northern spotted owls. "Disruption" occurs closest to the nest and may cause a measurable change in nesting behavior (i.e. flushing from a nest or cause a feeding attempt to fail). Thus, the disruption threshold is the distance within which activities occurring during the critical breeding period could significantly disrupt the normal behavior pattern of individual animals or breeding pairs and could create a likelihood of injury (USDI 2004b:51). "Disturbance" occurs further from the nest site and the disturbance threshold is the distance within which the effects to northern spotted owl nesting behavior from noise, human intrusion, and mechanical movement associated with an action would be expected to be "discountable" or "insubstantial."

There are two spotted owl activity centers currently located within the 65 yard disruption distance for chainsaw use. The No Bridge (IDNO 3996O) and South Susan (IDNO 4018A) activity centers are located approximately 55 yards north of Rolling Thunder Unit 21G and 50 yards northwest of Rolling Thunder Unit 23B, respectively (Appendix H – Figure 7). Surveys have determined the No Bridge spotted owl site to be unoccupied since 2010. However, the site was not surveyed in 2008 and 2009 therefore the status is unknown for those two years. To determine status for five consecutive years, surveys would continue at the site through 2014. If the No Bridge site becomes occupied, harvest operations would be restricted during the critical breeding season (March 1-July 15, both days inclusive) to avoid disruption of nesting owls unless current year surveys determine non-nesting status. The occupied South Susan activity center would require seasonal restrictions, unless current year surveys determine non-nesting status.

The other nine activity centers are located approximately 180 to 1,640 yards (0.1- 0.9 miles) from proposed project boundaries. Because the proposed harvest units are located outside of the disruption distance thresholds (e.g. 65 yards), there would be no seasonal restriction requirements for harvest operations occurring during the spotted owl critical breeding season.

In addition to the No Bridge and South Susan sites, Lookout Canyon (IDNO 4015A), Thunder Bob (IDNO 0235O), and Shivigny (IDNO 2536O) sites are located within 440 yards (0.25 mile) of a unit boundary. These five sites would require seasonal restriction requirements for prescribed burning activities occurring within the 440 yard (0.25 mile) disruption buffer during the critical breeding season (March 1-July 15, both days inclusive).

KNOWN OWL ACTIVITY CENTERS (KOAC)

Known Owl Activity Centers have been designated to minimize impacts and protect nest sites found before 1994 (USDI BLM 1995; ROD/RMP; pg. 48). There are nine KOACs located within the proposed project area but not within any units. No treatment would occur within these KOACs.

SPOTTED OWL HABITATS

Effects of thinning and fuel treatments are discussed for suitable habitat, dispersal habitat and designated Critical Habitat for the spotted owl.

Suitable Habitat – Stands with birthdates of 1933 or earlier were considered NRF habitat for this analysis. Roads are not considered NRF habitat. An average width of 20 feet was used for all roads included in the transportation database, and these acres were subtracted from the stand acres.

No NRF habitat would be removed, however, up to 76 acres of NRF habitat are proposed to be modified under the proposed *Action Alternatives*, including 12 acres of thinning and 64 acres of fuels treatment (Table 15).

There are six acres proposed in the Big Thunder unit 31B that are 95 years old, which would be considered NRF habitat for the spotted owl. However, three acres of the 95-year old stand are considered dispersal-only because this portion lacks NRF habitat components associated with nesting, roosting, and foraging habitat for the spotted owl. The remaining three acres contain NRF habitat components, but would be maintained within a "skip" and therefore, are not included in the treatment acres for the owl analysis.

There are 12 acres proposed in the Big Thunder Unit 30I that are 63 years old (birthdate = 1950). However, this stand contains structural components that enable this stand to function as NRF habitat for the spotted owl. Based on the habitat assessment and to minimize impacts to the spotted owl from modification of NRF habitat, it is recommended this unit be dropped from all proposed *Action Alternatives*.

Approximately 64 acres of NRF habitat are proposed for fuels treatment, outside of thinning units.

Dispersal Habitat – Conifer stands 40-79 years old were considered dispersal habitat for this analysis. The proposed thinning units are considered dispersal habitat when the stands contain relatively small tree sizes (quadratic mean diameter (QMD) 10 to 19 inches) (*Forest Vegetation*, Table 8, pg. 35), high stand densities, and lack NRF habitat components (i.e. large snags, large remnant trees, and multiple canopy layers). Under the proposed *Action Alternatives*, approximately 1571 acres of dispersal habitat would be treated with thinning and 11 acres of dispersal habitat outside of thinning units would be treated for hazardous fuels.

Northern spotted owls and their prey base benefit from larger snags and coarse woody debris (Thomas *et al*. 1990). In addition, the majority of wildlife species (including flying squirrels) use larger snags (> 18 inches diameter at breast height) (Mellen *et al.* 2009), providing for multiple life cycle needs. Small diameter snags are used primarily as foraging habitat by wildlife (Hagar 2008, Mellan *et al.* 2009), including spotted owl prey species. Cary *et al.* (1999a) concluded that at least 10 percent cover of coarse woody debris is needed to ensure high prey populations for mustelids and owls in Douglas-fir forests in southwestern Oregon (Carey and Harrington 2001). Large down wood is present within some of the units, however the amounts within the units has not been quantified.

Designated Critical Habitat – Critical Habitat is a specific geographical area designated by the USFWS as containing habitat essential for the conservation of a threatened or endangered species. Critical Habitat for the northern spotted owl was re-designated in 2012 (USDI USFWS 2008b). There are approximately 11,750 acres of Critical Habitat within the Analysis Area for the spotted owl (Table 15). With the exception of Thundering Herd Units 26A and 33B and the fuels treatment within Sections 26, 27 and 33 (totaling 291 acres), the remaining Thunderbolt units (1,387 acres) and fuels treatment areas (108 acres outside of timber sale units) are located within designated Critical Habitat (West Cascades South - Subunit WCS 6) for the spotted owl.

SPOTTED OWL ANALYSIS AREAS

Effects of thinning and fuels treatment on spotted owl habitat are discussed at three spatial scales based on the most recently occupied activity center (i.e. nest site): within a nest patch (300-meter radius), within a core area (0.5-mile radius), and within the home range (1.2-mile radius). Of the 1,666 acres (1,583 acres of thinning and 81 acres of fuels treatment outside of thinning units) of habitat treated, approximately 142 acres (eight (8) percent of the Thunderbolt project acres) are not located within a spotted owl home range.

The current amount and character of habitat provided by Federal lands within the identified spotted owl home ranges are presented in Table 16. Potential contributions from private lands were not considered, as they are not expected to provide any more than dispersal habitat in the long term.

Home Range – The home range for spotted owls in the Cascade Range Province is a 1.2 mile radius circle surrounding an activity center (i.e. nest site) and is used by spotted owls to obtain cover, food, mates, and to care for their young. The home ranges of several owl pairs may overlap and the habitat within them is commonly shared between adjacent owl pairs and by other dispersing owls. These areas are important for the survival and productivity of spotted owls because owls are non-migratory birds that remain in their home ranges year-round.

There are 11 spotted owl sites within 1.2 miles of the proposed action area. Ten sites have been occupied by spotted owls for one or more years within the past five years (Table 16 and Table 17). An additional spotted owl site (No Bridge; INDO 3996O) is also within 1.2 miles of the proposed Analysis Area; however, surveys are in progress to determine occupancy status for five consecutive years. For this analysis, the site is assumed to be occupied.

Of these 11 sites, seven sites are considered "habitat limited" because the amount of NRF habitat is below the 40 percent threshold within the home range (Table 16 and Table 18). The remaining four sites, including Thunder Bob (IDNO 0235O), Bare Fox (IDNO 0384O), Emile Creek (IDNO 0509A), and Thunder (IDNO 1523O), are at or above the NRF habitat threshold (Table 16).

All or a portion of the 20 timber sale units and all eight proposed fuel treatment areas (outside of timber sale unit boundaries) are located within one or more spotted owl home range and would consist of 76 acres of NRF habitat and 1,466 acres of dispersal habitat (Table 17).

Suitable Habitat – Twelve acres of NRF habitat are proposed for thinning within the home range of the Thunder Bob (IDNO 0235O) site. The 64 acres of NRF habitat proposed for fuels treatment outside of timber sale units occurs within the home ranges of eight spotted owl sites (Table 18), including six (6) acres of NRF habitat proposed for thinning within the Thunder Bob home range.

Dispersal Habitat - Thinning of 1,568 acres and fuels treatment of 11 acres of dispersal habitat would occur within the home ranges of 11 spotted owl sites (Table 18).

Core Area – Within the home range, the core area for spotted owls is a 0.5-mile radius circle around the spotted owl activity center used to describe the area most heavily utilized during the nesting season (USDI USFWS *et al*. 2008c). Core areas represent areas defended by territorial spotted owls and generally do not overlap the core areas of other spotted owl pairs.

Of these 11 sites, eight sites are considered "habitat limited" because the amount of NRF habitat is below the 50 percent threshold within the core area (Table 16 and Table 18). Three spotted owl sites, Bare Fox (IDNO 0384O), Thunder (IDNO 1523O), and Engles Creek (IDNO 2104O), are at or above the NRF habitat threshold (Table 16).

Eleven proposed units and three fuel treatment areas fall within the core areas of six spotted owl activity centers, affecting 44 acres of NRF habitat and 407 acres of dispersal habitat (Table 17; Appendix F- Figure 7).

Suitable Habitat – Twelve (12) acres of NRF habitat are proposed for thinning within the core area of the Thunder Bob (IDNO 0235O) site. The 32 acres of NRF habitat proposed for fuels treatment outside of timber sale units occurs within the core area of three spotted owl sites, the Itty Bitty Emile (IDNO 0426O), Shivigny (IDNO 2536O), and Lookout Canyon (IDNO 4015A) sites (Table 18).

Dispersal Habitat - Thinning of 403 acres and fuels treatment of four (4) acres of dispersal habitat would occur within the home ranges of six spotted owl sites (Table 18).

Nest Patch – Within the core area, the nest patch is defined as a 300-meter radius circle around a known spotted owl activity center (USDI USFWS *et al*. 2008c). The two key elements of spotted owl habitat within a nest patch are: (1) canopy cover of dominant, co-dominant, and intermediate trees (conifers and hardwoods) and (2) the amount of down wood (USDI USFWS *et al*. 2008c; pg. 13). Any activity within this high-use area is likely to affect the reproductive success of nesting spotted owls and is used in determination of incidental take.

Suitable Habitat – No NRF habitat would be removed or modified and no fuels treatment would occur within a nest patch.

Dispersal Habitat - Seven proposed thinning units fall within the nest patch of four spotted owl activity centers, affecting 41 acres of dispersal habitat. The four owl sites affected are Shivigny (IDNO 2536O), No Bridge (IDNO 3996O), Lookout Canyon (IDNO 4015A), and South Susan (IDNO 4018A) (Table 18).

The entire Rolling Thunder 23B unit (12 acres) and eight acres of Unit 23A are located within the South Susan (IDNO 4018A) nest patch; approximately two acres and 15 acres of Rolling Thunder Units 21F and 21G, respectively, are located within the No Bridge (IDNO 3996O) nest patch; approximately 2 acres of the Thundering Herd Unit 33B is located within the Lookout Canyon (IDNO 4015A) nest patch; and ten acres of the Thundering Herd Unit 25A is located within the Shivigny (IDNO 2536O) nest patch (Table 17 and Table 18; Appendix F- Figure *7*).

Table 17. Northern Spotted Owl Habitat within Thunderbolt Proposed Units.

Sale	Unit	Unit Acres	Unit Acres within…						
			Nest Patch		Core Area		Home Range		
			NRF Habitat	Dispersal-only Habitat	NRF Habitat	Dispersal-only Habitat	NRF Habitat	Dispersal-only Habitat	Total Unit Acres Treated
BIG THUNDER	29A	38	0	0	0	0	0	38	38
	29B	295	0	0	0	0	0	214	214
	30I	12	0	0	12	0	12	0	12
	30J	9	0	0	0	0	0	9	9
	31A	20	0	0	0	0	0	15	15
	31B	294	0	0	0	0.5	0	294	294
Timber Sale Sub-Total		**668**	**0**	**0**	**12**	**0.5**	**12**	**570**	**582**
ROLLING THUNDER	19C	88	0	0	0	0	0	81	81
	19D	48	0	0	0	6	0	48	48
	20A	25	0	0	0	0	0	2	2
	21F	15	0	2.2	0	14	0	15	15
	21G	46	0	15	0	45	0	46	46
	21H	38	0	0	0	27	0	38	38
	23A	35	0	8	0	34	0	35	35
	23B	3	0	2.8	0	3	0	3	3
	23C	47	0	0.7	0	45	0	47	47
	23D	37	0	0	0	11	0	37	37
	25B	53	0	0	0	0	0	53	53
	29C	50	0	0	0	0	0	50	50
Timber Sale Sub-Total		**485**	**0**	**28.7**	**0**	**185**	**0**	**455**	**455**
THUNDERING HERD	25A	234	0	10	0	151	0	234	234
	26A	55	0	0	0	26	0	55	55
	33B	141	0	2.4	0	40	0	141	141
Timber Sale Sub-Total		**430**	**0**	**12.4**	**0**	**217**	**0**	**430**	**430**
TOTAL THINNING		***1,583***	***0***	***41***	***12***	***403***	***12***	***1,455***	***1,467***
THUNDER MTN HAZARDOUS FUELS TREATMENT	203 ac	**Fuels Treatments Outside of Timber Sale Units…**							
		102	0	0	32	4	64	11	75
TOTAL PROPOSED PROJECT TREATMENT ACRES		***1,685***	***0***	***41***	***44***	***407***	***76***	***1,466***	***1,542***

b) ***Environmental Consequences***

(i) No Action Alternative

The quality and availability of northern spotted owl habitat would be unaffected under the *No Action Alternative*. Approximately 76 acres of NRF habitat and 1,583 acres of dispersal habitat included in the proposed Thunderbolt project area would continue to function in its current capacity as NRF and dispersal habitat, respectively. At the unit-scale, habitat conditions would remain generally unchanged in the short-term unless a major disturbance such as fire, wind, ice, insects, or disease occurred. Otherwise, the primary influence on long-term habitat development would be the growth and mortality of overstory trees. Spotted owl nest patches, core areas, and home ranges within the proposed action area would continue to function at current levels because habitat would not be modified.

In the long term, stand conditions within all of the proposed thinning units would be most affected by competition among overstory trees. Overstocked conditions in young stands would result in relatively slow growth rates that would delay crown differentiation. Without silvicultural treatment or natural disturbance, canopies would remain closed and individual tree growth would slow even as stand growth continues. Stand diversity would decrease over time as hardwoods and shrubs (where they currently exist), important components of owl habitat, die from suppression as previously mentioned in the *Forest Vegetation: No Action Alternative.* Stands would be slower to develop structural complexity to provide for nesting, or gaps large enough to provide growth of diverse grass, forbs, shrubs, and hardwoods that would support abundant prey populations. The development of multiple canopy layers and structural diversity would continue but at a slower rate than with the proposed thinning treatment, thus delaying the development of NRF habitat characteristics in proximity to or within northern spotted owl home ranges, core areas and nest patches for more than 100 years (Forest Vegetation, pg. 35).

Since trees would not be removed under the *No Action Alternative*, this alternative would produce the highest amount of dead wood through passive recruitment, compared to the proposed *Action Alternatives*. Suppression mortality would occur primarily in the smaller size classes of trees and would be the main source for snag and coarse woody debris recruitment. Dead trees would stand for a relatively short time and ultimately fall, but would not create openings as in late-seral stands because of the small size of the snags. There would be recruitment of a large number of small snags and coarse woody debris that would provide foraging habitat, but these would not be large enough to provide opportunities for nesting or denning for spotted owl prey species. The remaining dominant trees would expand their crowns into the newly-available growing space, limiting development of understory vegetation. Multiple waves of such competition mortality would need to occur before dominant tree density would be low enough to allow understory re-initiation. A continuous closed canopy would limit the opportunity for increasing the horizontal and vertical heterogeneity in vegetation structure and species diversity in vascular plant composition, which would provide habitat complexity important for small mammals (Carey and Harrington 2001).

Proposed hazardous fuels treatments would also not occur under the *No Action Alternative*. Higher fuel loads within the fire prone area (as described in the *Fire and Fuels Management* section) would create conditions that would foster larger and hotter

fires. Suitable and dispersal habitats would be more vulnerable to a stand replacement event because of the higher fuel loading and greater potential of fire starts within the area.

(ii) Proposed Action Alternatives

Consequences Common to Action Alternatives 1, 2 and 3:

DISRUPTION/DISTURBANCE

For all harvest activities associated with this proposed action, there would be no disruption concerns for spotted owls. Effects associated with noise arising from thinning activities would be discountable because all activities would either be conducted outside of the minimum disruption thresholds established by the U.S. Fish and Wildlife Service (e.g. chainsaw use is 65 yards, heavy equipment use is 35 yards, and prescribed burning is 440 yards), from any known spotted owl site or unsurveyed NRF habitat, or would be subject to seasonal restrictions from March 1 to July 15, both days inclusive. This would ensure that noise disruption would not cause spotted owls to abandon nests or fledge prematurely.

Cable yarding uses trees for tailholds and guyline anchors. For the proposed *Action Alternatives*, these tailholds and guyline anchor trees may be located within NRF habitat outside of the unit boundaries. To the extent possible, trees with NRF nesting structure would be avoided. To ensure that tree removal does not directly affect spotted owls, seasonal restrictions would be implemented unless clearance surveys have been conducted and it has been determined by a BLM biologist that there are no active spotted owl activity centers within the disruption threshold.

SPOTTED OWL HABITAT

THINNING TREATMENTS

Thinning treatments would be conducted on 1,583 acres, including 12 acres of NRF habitat and 1,571 acres of dispersal habitat (Table 17). Thinning would modify habitat features important to spotted owl dispersal, including horizontal and vertical structure, canopy cover, and hardwoods.

The quality of habitat within the proposed units would be temporarily reduced by the thinning however the treated stands are expected to maintain their function because 60 percent and 40 percent minimum canopy cover, in NRF and dispersal habitat, respectively, would be maintained post-harvest. In addition, many habitat features necessary for the future development of late-seral characteristics would be maintained or enhanced.

Vertical and horizontal cover would be reduced within the proposed units through the reduction in overstory canopy cover with varying levels of residual tree density. Under the proposed *Action Alternatives*, the post-treatment average canopy cover would be maintained between 54 and 76 percent and the quadratic mean diameter would be between 13 and 20 inches (q.v. Forest Vegetation; Table 7, pg. 36). Large remnant trees and dominant and co-dominant hardwoods would be reserved. Existing snags and coarse woody debris would be protected to the extent practicable. Thinning may initially reduce

the cover of shrubs and herbaceous vegetation due to disturbance caused by harvesting activities. However, cover and plant diversity would be expected to increase following thinning activities to levels above pre-treatment conditions (Chan *et al.* 2006; Bailey et al. 1998).

Although general effects of thinning on the physical parameters of habitat can be quantified, actual effects on spotted owl behavior and use of habitat in nest patches and core areas are not fully known. Thinning opens the forest canopy, may change environmental conditions such as temperature and humidity, and may increase risk of predation.

Scientific opinions on the actual effects of thinning on the spotted owl are varied. Meiman *et al*. (2003) suggested that heavy thinning reduces stand use by spotted owls. Spotted owls are likely to increase the size of their home ranges to utilize untreated stands in preference to newly treated stands both during and after harvest (Meiman *et al*. 2003). Factors that reduce the quality of habitat within a home range or cause increased movement by owls in order to meet prey requirements may decrease the survival and reproductive fitness of owls at that site (Meiman *et al*. 2003).

In contrast, work by Forsman *et al*. (1984) in older late-successional forests and by Lee and Irwin (2005) in younger forests indicates that lightly thinned stands receive moderate to high use by spotted owls. More recent, preliminary research in southwest Oregon and northern California has indicated that spotted owls did not vacate their home ranges and generally foraged within thinned forest stands as applied on BLM timberlands (unpublished draft, NCASI, 2008). Generally, research data supports the notion that spotted owls would continue using thinned stands for foraging when overall canopy cover remains above 50 percent (Forsman 1984, Hanson *et al*. 1993).

Although much of this work refers to treatments inside stands with nesting, roosting and foraging components, they illustrate the variability of responses by owls to treatments. Where canopy cover exceeds 50 percent it is expected that those thinning units would continue to provide foraging and dispersal opportunities. Within those stands where post-harvest canopy cover is between 40 and 50 percent (*Forest Vegetation*, Table 7, pg. 33), owls may avoid portions of stands until canopy cover conditions recover to at least 50 percent. A conservative assumption based on the ORGANON model output is that crown cover would recover about one percent per year following treatment. However, closure as measured by percent skylight should recover faster, up to two percent per year (q.v. *Forest Vegetation*, pg. 38).

Variable density thinning, in contrast to even-spaced thinning, may accelerate development of NRF habitat and denser prey populations (Carey and Peeler1995, Carey 2000), particularly when components like snags, cavity trees, and coarse woody debris are taken into account. It enhances tree growth, understory development, and understory flower and fruit production for prey species, while maintaining more canopy connectivity, woody plant diversity, and spatial variability (Carey in Courtney *et al.* 2004; Carey 2000).

Spotted owl prey species would also be affected by the proposed thinning treatments. Species such as brush rabbits, woodrats, and other rodents are primarily associated with early- and mid-seral forest habitat (stands < 80 years of age) (Maser *et al.* 1981; Sakai and Noon 1993; Carey *et al.* 1999), and could benefit from increased understory and

shrub development (Carey 2001; Carey and Wilson 2001; Haveri and Carey 2000). This could indirectly benefit spotted owls by providing more prey available for capture.

Variably density thinning can have rapid, positive effects for many forest-floor prey species (e.g., mice, voles, chipmunks) especially from increased understory development (Carey 2001, Carey and Wilson 2001, Haveri and Carey 2000). However, variable density thinning may keep flying squirrel populations suppressed and may do so for several decades until long-term ecological processes provide sufficient structural complexity in the mid-story and overstory favorable to squirrels (Wilson 2010). Wilson (2010) suggested reducing short-term effects to flying squirrels while trying to create more forest complexity would benefit them in the long-term. Each *Action Alternative* incorporates some of those considerations, including:

- retention of existing large decadent trees and snags;
- retention of no-treatment areas (e.g. "no-harvest" buffers in Riparian Reserves) to provide travel corridors from adjacent late seral habitats and across the landscape;
- retention of a range of tree size classes throughout the stand;
- improvement of foraging opportunities by promoting the development of understory and shade-tolerant tree species throughout the stand; and
- maintenance of canopy cover within the stands (e.g., lightly and moderately thinned areas) which would provide protective cover from predators, as well as provide a tree density that allows squirrels to adequately glide between trees and move through a stand in order to access foraging areas.

Existing pockets of large down wood would be retained. After the harvest, residual stands would provide a pool of candidate trees for future snag and coarse woody debris recruitment. Additional coarse woody debris and snags would be created incidentally through the harvest operations (e.g. damage leading to broken-out tops or individual tree mortality) or through weather damage (e.g. wind and snow break). Although fewer snags would develop over time when compared to the *No Action Alternative*, they would be larger snags with more resiliency and limb structure (Reukema 1987) than snags that develop under a more competitive stand condition (Nietro 1985). In the meantime, the *Action Alternatives* would provide other ecological benefits by allowing trees to grow larger faster, and to develop other NRF wildlife habitat characteristics, such as large limbs and crowns. These trees would become a future source for large snags and downed wood.

Snags and coarse woody debris would also be acquired through passive recruitment through suppression mortality. Passive recruitment of snags and down wood would be expected to be less in areas treated with a higher intensity of thinning. Skips, including "no-harvest" buffers, and areas of lower treatment intensities would continue to provide a source of snags and down wood within the stands providing habitat that would serve as refugia and travel corridors for flying squirrels.

Within Big Thunder Unit 31B, gaps would be created around 67 sugar pines to reduce the risk of infestation by bark beetles. In addition, the gap strategy is proposed to treat 47 areas with dead and dying trees within Unit 31B to prevent the spread of laminated root rot into healthy trees. In the long term, treatment around the sugar pines and reducing the spread of laminated root rot would maintain diversity and the large live tree component within the stand. However, reducing the risk of tree mortality from laminated root rot,

bark beetles, and stem breakage, would reduce the number of snags and downed wood created by passive recruitment.

Approximately 4.8 miles (17 acres) of road would be constructed under all three *Action Alternatives* and would be decommissioned post-harvest. The new roads would not cause edge effects or habitat fragmentation for the northern spotted owl, nor would they create a barrier to dispersing small mammals. In addition, approximately 4.2 miles (15 acres) of existing roads would be decommissioned post-harvest within the project area. The decommissioned roads are expected to provide habitat, with the re-establishment of understory vegetation and seedlings.

Variable density thinning treatments would cause an indirect beneficial effect in the long term by improving dispersal habitat conditions as canopy cover increases and multi-canopy and multi-species layers develop, creating more favorable roosting and foraging habitat conditions. The proposed silvicultural treatments are expected to enhance future NRF habitat, improve habitat connectivity in the action area and reduce the risk of loss of habitat from stand-replacing wildfires. Reducing tree densities by the creation of gaps would also create growing conditions that would foster development of additional forbs and shrubs, thus creating additional niche habitat and forage for prey species. In addition, fostering the development and growth of the sugar pine trees would provide a future source of large trees or snags for nesting and contribute to the diversity of the stand. Consequently, the proposed treatments would have an indirect beneficial effect to the spotted owl and its habitat in the long-term by accelerating the development of late-successional features used by owls and their prey, such as large diameter trees and snags, multiple canopy layers, large CWD, and hunting perches.

HAZARDOUS FUELS TREATMENT

Fuels treatments (shaded fuel breaks and roadside treatment) would modify habitat features important to spotted owl dispersal, including horizontal and vertical structure, and understory hardwood components. Understory vegetation up to seven inches in diameter at breast height would be cut, hand piled, covered, and burned.

Treated stands are expected to maintain their function because 60 percent and 40 percent canopy cover, in NRF and dispersal habitat, respectively, would be maintained. In addition, many habitat features necessary for the future development of late-seral characteristics would be maintained or enhanced. Though the quality of habitat within the proposed units would be temporarily reduced by the fuels treatments, the capability of the habitat to providing for nesting, roosting, foraging, or dispersal would be maintained.

Vertical and horizontal cover would be reduced within the proposed treatment units through the reduction in understory vegetation. Overstory trees, including large remnant trees, and dominant and co-dominant hardwoods would be reserved. Snags and coarse wood would be protected to the extent practicable. The proposed fuel treatments would affect relatively narrow, linear portions of stands and would not affect the development of understory vegetation in the remainder of the treated stands.

Overall, fuel treatments may have an indirect benefit to northern spotted owls by creating a situation in which wildfire could be better controlled if one were to occur thereby reducing the likelihood of catastrophic loss of habitat from a wildfire.

SPOTTED OWL ANALYSIS AREAS

The U.S. Fish and Wildlife Service determined viability thresholds of 50 percent NRF habitat in the core area and 40 percent NRF habitat in the home range, respectively. Suitable habitat levels below these thresholds may compromise the reproductive success of spotted owls (USDI USFWS *et al.* 2008c). Table 18 summarizes the effects of thinning and hazardous fuels treatment on occupied spotted owl sites within the Analysis Area.

Home Range –Suitable and dispersal habitat would be modified by thinning and fuels treatments within the home ranges of 11 known spotted owl sites (Table 16).

Suitable Habitat – No NRF habitat would be removed under the *Proposed Action Alternatives* (Table 18). Seventeen (17) acres of NRF habitat would be modified by a combination of thinning activities (12 acres) and hazardous fuels treatments (five acres) within the Thunder Bob (IDNO 0235O) spotted owl site, affecting approximately one percent of the NRF habitat within its home range (Table 16 and Table 18). Thinning would occur from below, removing the less dominant trees within the stand, thereby modifying the canopy cover from 79 to 60 percent post-harvest.

Fuels treatment is proposed for 69 acres of NRF habitat within the home range of 11 known spotted owl sites, including the Thunder Bob site. Fuels treatment activities would remove small down wood up to seven inches in diameter. Existing down wood larger than seven inches would be retained and would continue to provide habitat components important for spotted owl prey. Other NRF habitat structural components, including multi-canopy layers, large down wood, and large snags would not be removed.

Because NRF structural components would remain, including canopy cover at or above 60 percent, suitable habitat for the spotted owl would continue to function for nesting, roosting, and foraging activities.

Dispersal Habitat – These home ranges are expected to continue to support spotted owls at their current level because there would be no loss of dispersal habitat. Although dispersal habitat would be modified, its function would be maintained because canopy cover would remain greater than 50 percent post-harvest (Table 10).

Core Area – Where thinning is conducted in a core area containing less than 50 percent (less than 250 acres is considered to be habitat limited) NRF habitat, a temporary reduction in the quality of dispersal habitat would be expected to cause a decline in productivity or use by spotted owls in the near term (USDI USFWS 2008c). However, because post-harvest canopy cover would remain above 50 percent under all *Action Alternatives* (Table 10), the decline of core area use or productivity would not be expected because treatments would not limit spotted owl movement through these stands. Therefore, within the seven core areas that contain less than 50 percent NRF habitat, thinning is not expected to cause a decline in productivity or use of the core areas by spotted owls in the near term.

Nest Patch – Research indicates that dispersal habitat within 300 meters (a 70 acre patch) of a spotted owl site is particularly important (Meiman, *et al*. 2003, Glenn *et al*. 2004). Within this high-use area, any modification of habitat may downgrade its suitability as a spotted owl activity center. Under the proposed thinning, a total of 41 acres of dispersal-only habitat are proposed to be treated within nest patches associated with four (4) separate spotted owl sites, Shivigny (IDNO 2536O), No Bridge (IDNO 3996O), Lookout Canyon (IDNO 4015A), and South Susan (IDNO 4018A) (Table 12).

A total of 11 acres in the nest patch (16 percent) are proposed for thinning treatment within the South Susan (IDNO 4018A) owl site, including Rolling Thunder units 23B (3 acres) and 23A (8 acres). Thinning treatment would modify the entirety of dispersal-only habitat on BLM administered land within the nest patch. Approximately, 27 percent (19 acres) of the nest patch contains NRF habitat and the remaining 54 percent (34 acres) of the nest patch is located on private lands and is dispersal habitat. The activity center was last determined occupied by a pair in 2013 and reproduction most recently occurred in 2011. Because proposed thinning within the nest patch is expected to cause a decline in productivity or use by spotted owls in the near term, it is recommended the portion of these units within the nest patch not be thinned.

Approximately 10 acres of the Thundering Herd Unit 25A are located within the nest patch associated with the Shivigny (IDNO 2536O) owl site, proposing treatment of fourteen percent of the nest patch. Treatment would modify the entirety of dispersal-only habitat within the nest patch however the proposed unit is located on the opposite side of the ridge from the activity center. Approximately, 84 percent of the nest patch contains NRF habitat. In addition, there is more than 100 acres of NRF habitat contiguous with the nest patch in the same drainage as the activity center. Therefore, treatment of dispersal habitat is not expected to cause a decline of use by spotted owls in the near term because there are additional acres of NRF habitat contiguous to the nest patch. The activity center was last occupied by a pair of spotted owls in 2011 and reproduction last occurred in 1994 (Table 10). Because surveys were not conducted from 1996 through 2007, it is unknown if reproduction occurred during that time. In 2012 a single resident was documented and from 2008 to 2010 a "floater" was documented each year. Therefore, nesting has not occurred at this site within at least the last five years. Because there are more than 600 acres of NRF habitat contiguous with the nest patch and the canopy cover after treatment of the dispersal habitat within the nest patch is expected to be at least 64 percent, the proposed thinning within the nest patch is not expected to cause a decline in productivity by spotted owls in the near term.

Approximately two acres of Thundering Herd Unit 33B are located within the Lookout Canyon (IDNO 4015A) spotted owl activity center, treating approximately three percent of the nest patch. Treatment would modify the entirety of dispersal-only habitat within the nest patch. Approximately, 88 percent (61 acres) of the nest patch contains NRF habitat. In addition, 350 acres of NRF habitat is contiguous with the nest patch in the same drainage as the activity center. Site status is not available for the most recent five years because the site was not surveyed from 2008 to 2010. Based on historical survey data, reproduction is last known to have occurred in 1995 at this site. Because surveys were not conducted from 1997 to 2010, it is unknown when reproduction last occurred. Based on recent survey data, the activity center was last occupied by a pair of spotted owls in 2011 and 2012, but reproduction did not occur during those two years. A single resident male was detected in 2013. Surveys are planned to continue at the site through at least 2015.

A total of 17 acres, including approximately two acres and 15 acres of Rolling Thunder Units 21F and 21G, respectively, are located within the No Bridge (IDNO 3996O) activity center, treating approximately 24 percent of the nest patch. Treatment would modify all but one acre of dispersal-only habitat within the nest patch. Approximately, 66 percent (46 acres) of the nest patch contains NRF habitat. In addition, there are more than 200 acres of NRF habitat contiguous with the nest patch. The activity center was last occupied by a pair in 1996 and reproduction was last known to occur in 1995. Because the site was not surveyed from 1999 to 2009, it is unknown when reproduction last occurred in years 1999 through 2009. Site status is not available for the most recent five years because the site was not surveyed in 2008 and 2009. Spotted owls were not detected during surveys in 2010 through 2013. Surveys are planned to continue at the site in 2014 and 2015. If the site remains unoccupied, the thinning treatment within the historic nest patch would be implemented as proposed. If surveys determine the site is occupied by an owl pair at the original activity center or in a new nest location that could be impacted by the proposed action, thinning within the nest patch would be reevaluated.

Table 18. Habitat Effects From Thinning and Fuels Treatment within the Analysis Areas of Individual Occupied Spotted Owl Sites.

IDNO	NEST PATCH (Acres)					CORE AREA (Acres)						HOME RANGE (Acres)					
	NRF		DISPERSAL			NRF		DISPERSAL				NRF		DISPERSAL			
	Removed	Modified	Removed	Modified	Percent of Nest Patch Effected	Removed	Modified	Removed	Modified	Percent of Core Area Effected	Habitat Limited?	Removed	Modified	Removed	Modified	Percent of Home Range Effected	Habitat Limited?
0235O	0	0	0	0	0	0	12[3]	0	5	3	Yes	0	19	0	662	23	No
0384O	0	0	0	0	0	0	0	0	0	0	No	0	0	0	180	6	No
0426O	0	0	0	0	0	0	13[4]	0	26	8	Yes	0	29	0	151	6	Yes
0509A	0	0	0	0	0	0	0	0	0	0	Yes	0	13	0	87	3	No
1523O	0	0	0	0	0	0	0	0	0	0	No	0	8	0	50	2	No
2104O	0	0	0	0	0	0	0	0	0	0	No	0	6	0	116	4	Yes
2532O	0	0	0	0	0	0	0	0	0	0	Yes	0	0	0	73	3	Yes
2536O	0	0	0	10	14	0	7[4]	0	151	31	Yes	0	16	0	386[2]	14	Yes
3996O[1]	0	0	0	17	24	0	0	0	86	17	Yes	0	0	0	263	9	Yes
4015A	0	0	0	2	3	0	13[4]	0	40	8	Yes	0	49	0	188	8	Yes
4018A	0	0	0	11	16	0	0	0	93	21	Yes	0	26	0	346	13	Yes

1. *This owl IDNO 3996O has been unoccupied since 2010. However, the site was not surveyed in 2009 and 2008 and therefore, status is unknown for those two years (Table 16 and Table 21). Surveys are continuing at the site for at least the next two years. If the site remains unoccupied, the Thinning within the nest patch would be implemented as proposed. If surveys determine owls are present within the site, the proposed action within the nest patch would be reevaluated with the Level 1 Team.*

2. Less acres if surveys in 2013 and/or 2014 determine the site is occupied by an owl pair as described above and the proposed action within the nest patch is dropped.

3. Thinning treatment only.

4. Fuels treatment only.

Designated Critical Habitat – Thinning and hazardous fuels treatment would modify approximately 1,495 acres of Designated Critical Habitat. Two percent of Critical Habitat West Cascades South Subunit WCS 6 (99,516 acres in total size) would be treated under the proposed *Action Alternatives*. Thinning would be of variable intensity resulting in a post-harvest stand average canopy cover ranging from 54 to 76 percent (Table 11), removing structures contributing to canopy cover. However, stand-level canopy cover would not fall below 40 percent in dispersal habitat or 60 percent in NRF habitat, values widely used as a threshold to maintain function (Thomas *et al.* 1990). For those stands where canopy cover is reduced below 60 percent, canopy cover is expected to recover within 5-10 years. A canopy cover of 60-80 percent would improve roosting habitat conditions, and provide thermoregulation, shelter, and cover to reduce predation risks.

Large remnant trees would be reserved, and snags and coarse woody debris would be protected to the extent practicable. Treatment of the stands would improve roosting and foraging habitat characteristics contributing to Primary Constituent Elements. Thinning treatments would cause an indirect beneficial effect in the long term by accelerating or enhancing the development of late-successional features used by northern spotted owls,

such as large diameter trees and snags, multiple canopy layers, large coarse woody debris, and hunting perches. Treated stands are expected to maintain their function because sufficient canopy cover and other structural elements important for northern spotted owls would be retained at the stand level.

Approximately 4.2 miles (20.4 acres) of road would be constructed within Critical Habitat for the spotted owl under the three *Action Alternatives*. The 4.2 miles of roads constructed would be decommissioned post-harvest. The new roads would not cause significant edge effects or habitat fragmentation for the spotted owl, nor would they create a barrier to dispersing small mammals. An additional 3.9 miles (18.9 acres) of existing roads would be decommissioned post-harvest within the Critical Habitat Subunit. The decommissioned roads would provide habitat, with the re-establishment of understory vegetation and seedlings.

Consequences Unique to Action Alternatives 2 and 3:

Of the 102 acres of hazardous fuels treatment proposed outside of timber sale units, approximately 75 acres would occur within habitat for the spotted owl, 64 acres of NRF habitat and 11 acres dispersal habitat. A portion of the fuels treatments would occur within each of the 11 spotted owl home ranges within the Analysis Area (Table 17). A total of 32 acres of NRF habitat and four (4) acres of dispersal habitat to be treated would occur within two of the spotted owl core areas (Itty Bitty Emile (IDNO 0426O) and Shivigny (IDNO 2536O)) (Table 17). No fuels treatment would occur within a nest patch (Table 17).

Treated stands are expected to maintain their function because 60 percent canopy cover in NRF and 40 percent canopy cover in dispersal habitat would be maintained. In addition, many habitat features necessary for the development of late-seral characteristics would be maintained or enhanced. Although the quality of habitat within the proposed fuels treatment units would be temporarily reduced by treating understory vegetation, the capability of the habitat to continue providing nesting, roosting, foraging, or dispersal functions would be maintained. Overall, hazardous fuels treatments may have an indirect benefit to spotted owls by creating a situation where a wildfire could be controlled, thereby reducing the catastrophic loss of habitat.

Consequences Unique to Action Alternative 3:

Under *Action Alternative 3*, 13 percent (38 acres) of Big Thunder Unit 31B is proposed to be treated with a heavy thinning prescription (Table 7Heavy thinning, in combination with light and moderate thinning treatments, skips, and gaps, would create more variability within the stand than proposed under *Alternative 1* and *Alternative 2*. The variable density thinning treatment under this alternative would result in increased stand differentiation, developing more structural components and diversity within the stand, which are characteristics of NRF habitat.

Heavy thinning would occur within the home range of three (3) spotted owl sites, 10 acres within Greenman Creek (IDNO 2532O), 15 acres within Engles Creek (IDNO 2104O), and 43 acres within Thunder Bob (INDO 0235O). Heavy thinning would not occur within a core area or nest patch of any spotted owl site.

Dispersal Habitat – The treatment of 38 acres with heavy thinning, in in addition to light and moderate thinning, skips, and gaps, would result in a post-harvest stand average canopy cover of approximately 54 percent. Canopy cover would recover to 60 percent or more in 5 to 10 years. As a result of greater thinning intensity within this unit, the stand would develop a more variable multi-layered canopy with the establishment of understory shrubs, grasses, and forbs. Larger trees with more complex crown and limb structure would also develop as a result of reduced competition within the heavier thinned portion of the stand.

Existing pockets of large down wood would be retained within the units. Snags and down woody debris would be acquired through passive recruitment from suppression mortality. Passive recruitment of snags and down wood would be less in areas treated with heavy thinning. However, skips and light thinning areas would provide a source of snags and down wood within the stand. These areas would also provide habitat, which would serve as refugia and travel corridors for spotted owl prey species.

CUMULATIVE EFFECTS TO NORTHERN SPOTTED OWLS

Approximately 77 percent (1,367 of 1,784 acres) of the proposed Thunderbolt project would occur within the Middle North Umpqua Fifth-field Watershed. Of the approximately, 145,100 acres (Federal and private) within the Middle North Umpqua Fifth-field Watershed, there are approximately 88,200 acres (61 percent) of NRF habitat and 25,110 acres (17 percent) of dispersal-only habitat on Federal lands. Within the past ten years, approximately 430 acres of thinning has occurred and approximately 1,382 acres of thinning is planned within the next ten years on Federal lands (Forest Service and BLM), collectively affecting 0.01 percent of the NRF habitat and 31 percent of the dispersal-only habitat within the watershed. The *Proposed Action Alternatives* would modify approximately 35 acres (0.07 percent) and 1,312 acres (5 percent) of NRF and dispersal habitat, respectively, within the watershed. Including this proposed action, approximately 5,100 acres (20 percent) of dispersal habitat and 35 acres of NRF habitat (0.03 percent) would be modified within the watershed spanning a 15 year period (including past 10 years and next five years). Approximately, 73 percent of the project acres within this watershed are on Forest Service.

The remaining 23 percent of the Thunderbolt project acres (417 of 1,784 acres) occur within the Little River Fifth-field Watershed. Of the 131,950 acres (Federal and private) within the Little River Fifth-field Watershed, there are approximately 48,710 acres (37 percent) of NRF habitat and 24,598 acres (19 percent) of dispersal-only habitat on Federal lands. Within the past ten years, approximately 2,200 acres of thinning has occurred and approximately 520 acres of thinning is planned (including this proposed action) within dispersal habitat within the next five years on Federal lands (primarily on BLM), collectively affecting six (6) percent of the dispersal-only habitat within the watershed spanning 15 years.

Adverse effects to spotted owls would likely continue within the action area. To date, the Oregon Forest Practices Act requires protection of a 70-acre area around occupied nest sites, and does not provide any protection or conservation of other surrounding habitat. Removal of NRF and dispersal habitat on private lands may also increase the risk to the persistence of the species in the action area.

Although the proposed action may temporarily reduce the quality of dispersal habitat within the project area, it would still continue to function for the dispersal of spotted owls. Therefore, the proposed project would not preclude or appreciably reduce spotted owl movement within the watershed, between Critical Habitat Units, or within the Physiographic Province.

2. Marbled Murrelet (*Federally Threatened*)

The proposed Thunderbolt project is located outside of the distribution range (within 50 miles of the Oregon coast) of the marbled murrelet *(Brachyramphus marmoratus)*. Therefore, this project would have no effect to the marbled murrelet or its designated Critical Habitat.

3. Survey & Manage (S&M) Species

a) *Affected Environment*

Within the proposed Analysis Area, there are six terrestrial *Survey & Manage Species* associated with conifer forest habitats, including the Great Gray Owl (*Strix nebulosa*), Red Tree Vole (*Arborimus longicaudus)*, Siskiyou Sideband *(Monadenia chaceana)*, Crater Lake Tightcoil (*Pristiloma arcticum crateris)*, Oregon Megomphix *(Megomphix hemphilli)*, and Oregon Shoulderband *(Helminthoglypta hertleini*), all of which are associated with mature and late-successional forests. Appendix A: *Survey & Manage Species* contains a summary of survey requirements (Table A-1) and general habitat requirements, status of species within the project area, and impacts of the proposed action on the species (Table A-2).

- **Great Gray Owl -** The habitat characteristics of suitable habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (*Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*, January 12, 2004). The stands in the project do not have proximity to natural-openings $\geq$ 10 acres (Elizabeth Gayner, staff review, 2013) and pre-disturbance surveys are not required (pg. 14, *Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*, January 12, 2004).
- **Red Tree Vole** –Suitable habitat is almost exclusively in forests having Douglas-fir trees in the stand, and associated primarily with late-successional (older, structurally complex) forests. Because of their exclusive diet of conifer needles, red tree voles are restricted to conifer forests. Although they use a variety of tree species, they principally feed on Douglas-fir needles and nest in Douglas-fir trees (Huff *et al.* 2012).

  Under Pechman Exemption A for *Survey and Manage Species* (q.v. pg. 8), surveys for red tree voles are not required in stands less than 80 years old and proposed for thinning only. The six acre stand within Unit 31B that is 95 years old does not meet Pechman Exemption A because it is more than 80 years old. However, surveys were completed in this unit in 1998 and 1999 associated with a previously planned timber sale and one confirmed red tree vole nest was located. In addition, the stand has a QMD of 16.9 inches, which does not meet the minimum QMD of 18 inches to be considered suitable habitat for the red tree vole (pg. 9, *Survey Protocol for Survey Protocol for the Red Tree Vole, Version 3.0, 2012*).

Pre-disturbance surveys for the red tree vole are not required for the hazardous fuels treatment because it meets Pechman Exemption D (q.v. pg. 9-10). In addition, the fuels treatment outside of thinning units would not remove or modify the conifer canopy structure or individual conifer crowns.

- **Siskiyou Sideband -** Suitable habitat for the Siskiyou Sideband may be found within 98 feet (30 meters) of rocky areas, talus deposits and in associated riparian areas in the Klamath physiographic province and adjacent portions of the southwestern Oregon Cascades physiographic province. Areas of herbaceous vegetation in rocky landscapes adjacent to forested habitats are preferred. Areas that contain moist, shaded rock surfaces are preferred for daily refuges. In more mesic, forested habitats, especially in the Oregon Cascades, the species is associated with large woody debris and the typical rocky habitat is not required. Forest habitats without either rock features or large woody debris are not currently considered to be suitable habitat for this species (pg. 42, *Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003*).
- **Crater Lake Tightcoil -** Suitable habitat for the Crater Lake Tightcoil is "perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 meters of open water in wetlands, springs, seeps and riparian areas…" (pg. 43, *Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003*). Field review of the proposed project units have not identified suitable habitat for this species.
- **Oregon Megomphix-** Suitable habitat for the Oregon Megomphix is mature or late-seral, moist conifer/hardwood forests, usually in hardwood leaf litter and decaying non-coniferous plant matter under bigleaf maple trees. The species may be present even without bigleaf maple being present, especially at moist sites where deciduous shrubs, coarse woody debris, rotten logs, stumps, and large sword ferns provide abundant cover (pg. 42, *Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003*). Mature or late-seral forests are considered to be stands at least 80 years old, depending on site conditions and stand history (2001 ROD, Standards and Guidelines, pg. 78).
- **Oregon Shoulderband –** The Oregon Shoulderband is known from rocky areas, including talus deposits and outcrops, which contain stable interstitial spaces large enough for snails to enter. Within rocky habitat, the species is associated with herbaceous vegetation and deciduous leaf litter, generally within 98 ft. (30 m.) of stable talus deposits or other rocky areas in shrublands or rocky inclusions in forest habitat, often adjacent to areas with substantial grass or seasonal herbaceous vegetation. Woody debris is often used as refugia in moist situations (*Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003,* pg. 41).

Pre-project clearance mollusk surveys were conducted within Unit 31B of Big Thunder in 1998 and 1999 associated with a previously planned timber sale. Three of the four mollusk species were not observed during the surveys. Two Oregon Megomphix sites were located within the unit and two are located within riparian "no-harvest" buffers. Because the four Megomphix were located prior to 9/30/1999, these sites would be protected with a site-tree (180 feet) buffer (pgs. 49 & 41, USDA and USDI 2001).

b) ***Environmental Consequences***

(1) *No Action Alternative*

Under the *No Action Alternative*, no forest habitat features would be affected. *Survey & Manage Species* within the project area would be expected to persist at their current levels. It is expected that the forest habitat currently present within the proposed units would continue to function in its current capacity. The development of suitable habitat characteristics such as multi-layered canopy with large overstory Douglas-fir trees that would benefit the red tree vole, large snags for the great gray owl, and large coarse woody debris and a well-developed understory for mollusk species, would occur more slowly than compared to the proposed *Action Alternatives*.

Without treatment or a natural disturbance, a multi-layered and multi-species canopy would not be well-developed within 50 years because of the closed canopy conditions. The development of large Douglas-fir trees with large limbs and deep crowns for the red tree vole would be slow to develop without disturbance and a reduction in the high tree density and closed canopy within the stands. Although a large number of small snags and coarse woody debris recruited passively, would provide foraging opportunities, they would not be as beneficial as large snags and coarse woody debris. The lack of these structural attributes would limit the amount of diversity and micro habitats used by mollusk species, as well as small mammal prey species for the great gray owl.

(2) *Proposed Action Alternatives*

Project design criteria would be implemented with the fuels treatments to avoid disturbance to micro habitats associated with the mollusk species by avoiding placement of burn piles on rock outcrops, or near large down woody debris and large hardwoods (particularly big-leafed maple) in stands more than 80 years old. Therefore, pre-disturbance surveys for mollusks are not required since the fuels treatment project is not considered to be habitat-disturbing and would not affect suitable habitat elements associated with the species.

The *Survey & Manage Species* associated with structurally complex forests would benefit from treatment under the proposed *Action Alternatives*. However, the development of suitable habitat components within a stand is dependent on the intensity of the treatments. Under conditions of high tree densities (low and moderate thinning treatments) in the uplands under *Action Alternatives 1 and 2*, post-harvest conditions would limit the ability to create diverse, multi-storied stands because canopy cover would recover to pre-harvest conditions in 10 to 20 years.

The most stand heterogeneity would develop from a combination of treatment intensities. Under all *Action Alternatives*, Big Thunder Unit 31B is expected to develop into a stand with more diversity because of the gaps, skips and heavy thinning in the treatment prescription. In the long term, the red tree vole would benefit most from treatments including heavy thinning and gap creation under *Alternative 3* in Big Thunder Unit 31B which would create conditions fostering the development of larger trees with large, deep crowns and large limbs providing suitable nesting and foraging habitat As structural components developed, such as multiple canopy layers with a diverse understory of forbs and shrubs, large diameter trees, and large snags and coarse woody debris, the amount of diverse micro habitats would increase for mollusk species and small mammal prey species for the great gray owl.

The Thunderbolt project is not expected to cause cumulative effects to *Survey & Manage Species*. The proposed thinning treatments are expected to create structural diversity and complexity within stands that are currently lacking these components. An increase of characteristics associated with older forests would increase the amount of habitat available to the species.

4. Special Status Wildlife Species

a) *Affected Environment*

For each Special Status Species, *Appendix B: Bureau Sensitive & Bureau Strategic Species* summarizes general habitat requirements, status of species within the project area, and impacts of the proposed action to the species. Other *Bureau Sensitive* and *Bureau Strategic* species suspected to occur on the Roseburg District BLM but not in the project area are also listed in *Appendix B*. Within the proposed project area, there are seven *Bureau Sensitive* terrestrial species associated with conifer forest habitats, of which four are associated with late-successional forests.

Three of the *Survey & Manage* mollusk species, including the Siskiyou Sideband, Oregon Megomphix, and Oregon Shoulderband are also *Bureau Sensitive Species* and have been addressed in *the Survey & Manage Species* section.

Even though these species are associated with conifer forest habitats, they are not a concern for the following reasons:

- **American Peregrine Falcon** *(Falco peregrinus anatum)* – Primarily associated with cliffs, rock outcrops with open habitats for hunting birds. A known site is located in T. 27 S., R 2 W., Section 06, approximately 0.9 miles south of the Big Thunder Unit 31B. Although a portion of the unit falls within the one (1.0) mile protection buffer, no seasonal restriction would be required because the unit lies on the outer periphery of the protection buffer and topographical features (i.e. a ridge) would provide an adequate buffer to noise during the breeding season. Although peregrine falcons likely forage within the proposed project area, the proposed action is not expected to cause measurable effects to foraging habitat. The proposed project would have no affect to nesting habitat.
- **Purple Martin** *(Progne subis)* – There is a lack of suitable nesting habitat (snags in forest openings) within the project area. Although, the species is expected to forage above the forest habitat, the proposed action is not expected to cause measurable effects to foraging habitat.
- **Foothill Yellow-legged Frog** *(Rana boylii)* – Primarily associated with low gradient streams and rivers with rocky, gravelly, or sandy substrates and sunny banks. This species has been documented in the North Umpqua River approximately 0.5 miles from some of the proposed units in the project. Habitat for the species does not exist within the project area because all streams in the project area are identified as high gradient cascade and step-pool stream types (*Hydrology, Aquatic Habitat and Fisheries*, pg. 90).

The following species are primarily associated with late-successional conifer forest habitat and would be expected to occur within adjacent suitable habitat.

- **Bald Eagle** *(Haliaeetus leucocephalus)* – The bald eagle is associated with late-successional forests with multi-canopies, generally within two miles of a major water source. There are no known bald eagle nest sites within two miles of the proposed

project area. However, based on numerous observations of bald eagles and the presence of suitable habitat, it is suspected (but not confirmed) there are other bald eagle nest sites located within the project area, specifically north of the project area along the North Umpqua River. For unknown nesting eagles within one mile of a harvest unit, noise or visual (line-of-sight) disturbance caused by harvest operations could occur during the bald eagle's breeding season (January 1 through August 31). The proposed action would not affect suitable nesting or roosting habitat (late-seral habitat or large trees within one mile of a major water source) or known nest sites.

- **Fisher** *(Martes pennanti)* – The Fisher would be expected to use the forest habitat within the proposed units for dispersal. However, the fisher has not been documented within the watershed in recent years and the closest documented sighting in1978 was approximately 21 miles north of the proposed project area. No effects to suitable denning and foraging habitat within late-successional conifer and mixed conifer hardwood forests are anticipated. Fisher would be expected to use the forest habitat within the proposed units for dispersal.
- **Fringed Myotis** *(Myotis thysanodes)* and **Pallid Bat** (*Antrozous pallidus)*– Potential habitats, including caves, mines, or rock outcrops, do not occur within the proposed units. These bat species would be expected to forage within the units; however, there would be no measurable effects to foraging habitat.
- **Townsend's Big-eared Bat** *(Corynorhinus townsendii)* – This species would be expected to forage within the proposed project area; however, there would be no measurable effects to foraging habitat.

b) *Environmental Consequences*

(1) No Action Alternative

Under the *No Action Alternative*, no forest habitat features would be affected. *Special Status Species* within the project area would be expected to persist at their current levels. It is expected that the forest habitat currently present within the proposed units would continue to function in its current capacity. The development of suitable habitat characteristics that would benefit the bald eagle, fisher, Townsend's big-eared bat and fringed myotis, such as multi-layered and multi-species canopy with large overstory trees, large snags, coarse woody debris, and a well-developed understory, would occur more slowly when compared to the proposed *Action Alternatives.*

Without treatment or natural disturbances, a multi-layered and multi-species canopy would not be well-developed within 50 years because of the closed canopy conditions. Although a large number of small snags and coarse woody debris recruited passively, would provide foraging opportunities, they would not be as beneficial as large snags and coarse woody debris. The lack of these structural attributes would limit the amount of diversity and micro habitats used for foraging, denning, or roosting.

(2) Proposed Action Alternatives

Special Status Species that are associated with structurally complex forests would benefit from thinning under the proposed *Action Alternatives*. However, the development of suitable habitat components within a stand is dependent on the intensity of the treatments. Under conditions of high tree densities (low and moderate thinning treatments) in the uplands under *Action Alternatives 1 and 2*, post-harvest conditions would limit the

development of diverse, multi-storied stands because canopy cover would recover to pre-harvest conditions in 10 to 20 years.

The most heterogeneity would develop from a combination of treatment intensities. Under all *Action Alternatives*, Big Thunder Unit 31B is expected to develop into a stand with more structural and vegetative diversity because of the addition of the gaps, skips, and heavy thinning in the treatment prescription. These species would benefit most from treatments of heavy thinning and gap creation under *Alternative 3* in the Big Thunder Unit 31B, which would create conditions fostering the development of suitable nesting, denning, foraging, or roosting habitat.

Large trees or snags containing large limbs or structural characteristics would not develop or develop at a slower rate in areas of higher post-harvest tree density and tree competition (i.e. light and moderate thinning intensities). In the Riparian Reserves, more structural components would be expected to develop because those areas would be treated with greater intensity and variability.

In the long term, as structural components continue to develop, such as multiple canopy layers with a diverse understory of forbs and shrubs, large diameter trees and eventually large snags and coarse woody debris, the amount of diverse micro habitats would increase for these species associated with late-successional forest habitat. In addition, the amount of interior habitat would increase as suitable habitat structure develops adjacent to existing suitable habitat. Larger blocks of forested habitat support larger numbers of wildlife, including the fisher, and provide a larger diversity of micro habitats, increasing species diversity and richness.

The Thunderbolt project is not expected to cause cumulative effects to *Special Status Species*. The proposed thinning treatments are expected to create structural diversity and complexity within stands that are currently lacking these components. An increase of characteristics associated with older forests would increase the amount of habitat available to the species.

5. Landbirds

a) *Affected Environment*

Guidance for meeting agency responsibilities under the Migratory Bird Treaty Act and Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" is provided by Instruction Memorandum OR-2008-050 (USDI BLM 2008c). The guidance identifies lists of "Game Birds Below Desired Condition", "Birds of Conservation Concern", and "Bald and Golden Eagle Protection Act" to be addressed during environmental analysis of agency actions and plans. Appendix C addresses impacts to 20 species of land birds expected within the project area.

Of the 20 species of land birds addressed in Appendix C, nine of these species are associated with mature and old-growth stands. The remaining 11 species are found in forested stands less than 80 years old.

b) ***Environmental Consequences***

(1) *No Action Alternative*

Under the *No Action Alternative*, no forest habitat features would be affected. Species that use young (40-50 year old) stands with closed canopy conditions would continue to persist. Until suppression mortality creates gaps within the overstory canopy, these stands would continue to be unsuitable for species dependent on an abundance of flowering plants and shrubs because of the lack of understory development.

For the species that rely on older, more structurally complex forest habitat, these stands would remain unsuitable because they would continue to lack characteristics typically found in mature or old-growth forests that are at least 80 years old. These stands would continue to develop over the next 100 years as homogeneous and even-aged stands that are primarily single-storied in nature and dominated by Douglas-fir (Forest Vegetation, pg. 35). Formation of canopy gaps and stratification of the canopy into multiple layers would generally not occur. The amount of sunlight reaching the forest floor would be insufficient to support establishment and survival of shrubs, forbs, grasses, and herbaceous plants, components important for nesting and foraging of species that occur in the understory. Suppression mortality would occur primarily in the smaller size classes of trees and would be the main source for snag and coarse woody debris recruitment, which would provide a source of foraging habitat for some avian species.

(2) *Proposed Action Alternatives*

Disturbance– Nests, eggs, and/or nestlings could be destroyed if nest sites are present and units are thinned during the breeding season (April – July). There may be noise disturbance impacts associated with timber harvest activities within 0.25 mile of suitable habitat (stands at least 80 years old) for the bald eagle, golden eagle or northern goshawk during the nesting season (January through August). It is unknown if these species are present within the late-successional stands adjacent to the units.

Habitat–Potential loss of nesting and foraging habitat for some species would occur. The thinning treatments would modify habitat for species that use young (40-50 year old) forests with closed canopy conditions. Retention of remnant trees, snags, and down wood and no-harvest stream buffers (skips) would benefit some species that rely on these features, regardless of stand age.

Species that flourish in more open forest stands with a well-developed understory would benefit from a higher intensity thinning treatments (i.e. moderate and heavy thinning) and gaps under the *Action Alternatives* in the short-term (10-20 years). However, those species dependent on more closed stand conditions would see a temporary reduction in habitat suitability post-harvest, until the canopy cover closes in 10 to 20 years.

Conditions of high tree densities, such as those currently in the proposed thinning units and expected post-harvest in the light thinning portions of the units, would limit the development of diverse, multi-storied stands because canopy cover would recover to pre-harvest conditions in 10 to 20 years. Large trees or snags containing large limbs or structural characteristics would not develop or develop at a slower rate due to a higher post-harvest tree density and tree competition.

The most heterogeneity would develop from a combination of treatment intensities. Under all *Action Alternatives*, Big Thunder Unit 31B is expected to develop a stand with more diversity because of the addition of gaps in the treatment prescription. The heavy thinning treatment proposed under *Action Alternative 3* on 38 acres within Unit 31B would increase the amount of diversity. Species associated with complex forest habitat structure would benefit most from heavy thinning and gap creation under *Alternative 3* in the Big Thunder Unit 31B. A combination of treatment prescriptions within a stand would create conditions fostering the development of suitable micro-site habitats for a greater suite of bird species. As structural components develop, such as multiple canopy layers with a diverse understory of forbs and shrubs, large diameter trees, large snags, and coarse woody debris, the amount of diverse micro habitats would increase for species associated with late-successional forest habitat.

The proposed project is not expected to cause significant cumulative effects to land birds. The proposed project is expected to create more diversity and structure within stands that are currently homogenous Douglas-fir stands. More stand diversity would increase micro site habitat conditions, which would increase species diversity and richness within the stands. Although there would be ground-disturbing activities and the potential for disturbance to nesting birds, potential adverse impacts to populations of these species are not expected.

D. Soils

1. Affected Environment

About 50 percent of the unit acres are located on stable broad ridges and foot slopes, and gentle to moderately sloping convex to concave sideslopes, with slopes of 30 percent or less. The soils in these areas contain low to moderate amounts of clays in the subsoil, with loam, clay loam, and clay textures. These soils are moderately susceptible to compaction and displacement by heavy equipment because of the clay content and the low to moderate amount of gravels (Johnson *et al*. 2004, Williamson and Neilsen 2000).

Based on 1959 and 1964 aerial photo interpretation, previous ground-based yarding occurred on about 40 percent of the project area, primarily on the gentle to moderate slopes. Soil compaction is still present to varying degrees in skid trails and landings where ground-based yarding occurred during past timber harvesting operations. The major skid trails have heavy compaction with dense and massive to platy soil structure of exposed subsoil in the top five to six inches or more over the running surface, where the topsoil has been displaced. The major skid trails are predominantly vegetated with forbs, moss, and shrubs with little erosion occurring. Soil productivity is recovering very slowly where the topsoil was displaced and the subsoil was exposed.

About 35 percent of the unit acres are located on moderate slopes of 30 to 60 percent, with convex and concave topography. The soils in these areas are moderately deep, 20-40 inches, to deep, more than 60 inches. The soil textures are clays and clay loams, with moderate to high amounts of gravels and stones. Slopes in these areas are stable to moderately stable but would be moderately susceptible to displacement, based on slope steepness. The potential for erosion would also be greater than on the gentler terrain.

The remaining 15 percent of the unit acres are located on steep to very steep side slopes of 60 to 90 percent or more, with moderately deep to shallow soils, less than 20 inches deep. These areas include rock outcrops surrounded by shallow extremely gravelly soils, on very steep slopes greater than 90 percent. The soils are not well developed, with moderate to very high amounts of gravels and cobbles. Soil textures generally range from extremely gravelly loams to very gravelly clay loams. The soils on the steep to very steep slopes are classified as fragile due to the steep to very steep slope gradients. These sites are subject to soil and organic matter losses from surface erosion or mass soil movements, such as shallow, rapid soil failures, as a result of forest management activities, unless measures such as project design features and best management practices are used to protect the soils/growing site (USDI/BLM, 1986). Rolling Thunder units 19C, 23A and 23D and Thundering Herd units 25A and 26A, contain several headwall areas or unstable areas just above stream inception points or adjacent to stream courses.

The majority of the project area is currently stable. The areas affected by slides in the Thunderbolt project area are not currently experiencing erosion except for one area along the 26-2-22.0 road where several failures have occurred recently.

Analysis of the Thunderbolt project area, using aerial photos taken from 1964 through 1989, indicated that the majority of slope failures in the past were small debris avalanches (less than 1/10 acre in size). Most of the identified landslides occurred over 40 years ago under clear-cut or early-seral conditions. About half of the historic slides were from road fill failures and road construction. There was one very large landslide that initiated during the 10-year post harvest period of vulnerability in Rolling Thunder Unit 23D. This slide was about four acres and was due

to both road construction and harvest. There are several active failures along the 26-2-22.0 road in Rolling Thunder 23A. In Rolling Thunder 19C, a very large debris flow and in Thundering Herd 26A a large earthflow occurred after canopy closure.

Consistent with this analysis of landslides in the Thunderbolt project area, aerial photo inventories within the Swiftwater Resource Area have shown a declining number of landslides during the past 25 years. The declining number of landslides corresponds with improved management practices. The rate of road-related landslide occurrence has declined the most. Fluctuations in landslides occur because of variations in weather and levels of management activity. Because of improvements in land management practices, the distribution of landslides in time and space, and their effects, more closely resemble those within relatively unmanaged forests (Skaugset and Reeves 1998).

2. Environmental Consequences

a) ***No Action Alternative***

Without timber harvesting or road construction, no additional soil compaction or displacement would occur beyond the current level. In-unit erosion would remain low. Areas already compacted or disturbed by the initial entries (especially at depths less than six inches), would recover slowly as processes of freezing and thawing, the penetration of plant roots, and burrowing of small animals gradually break up compaction and incorporate organic matter into the soils (Amaranthus *et al.* 1996; Powers *et al.* 2005). These soil building processes would continue to return soil to near pre-harvest conditions over many decades (Amaranthus *et al.* 1996). The duff layer would increase with the accumulation of needles, twigs, and small branches, along with decomposing larger woody material, absent a wildfire of sufficient intensity to consume the material.

Oregon Department of Forestry (ODF) found that landslide densities and erosion rates were lowest in mid-and old-seral stands (31 to 100 years old) following the intense 1996 storms (ODF Forest Practices Technical Report No. 4, 1999, pg. 64). The stands within the project area are 40-60 years old and within the lower risk age class. There would be no change in the stability of the soils, since there would be no soil disturbance. There could be occasional shallow, rapid slope failures during storm events. The slopes in Thunderbolt are moderately stable. There are several failures that occurred along the 26-2-22.0 road, one each in Rolling Thunder units 23A and 19C, and one in Thundering Herd 26A that occurred after canopy closure. All other failures occurred post-timber harvest, a period of higher vulnerability for landslides (aerial photo landslide inventory; field observations, Barner 2009; ODF 1999, pg. 64). One very large landslide initiated during the 10-year post-harvest period of vulnerability in Rolling Thunder unit 23D. Many of the sites that were most vulnerable to failure probably failed after the units were clearcut in the early 1960s and were then subjected to an intense rain-on-snow event, such as occurred during the winter of 1964.

b) ***Proposed Action Alternative 1***

(1) *Soil Displacement and Compaction*

Severe soil compaction can reduce soil productivity, resulting in reduced height and volume growth of conifer species (Wert and Thomas 1981). Extensive displacement of the mineral surface soil and gouging can result in degradation of site quality by exposing

unfavorable subsoil material, which is generally denser, and lower in nutrients and organic matter. Extensive soil displacement can also alter slope hydrology, increasing the potential for surface soil erosion (Page-Dumroese *et al.* 2009).

Ground-based Yarding

Monitoring of timber sales using ground-based harvest systems from fiscal years 2000 through 2012 has shown that with application of the proposed project design features and Best Management Practices described in this assessment (q.v. pg. 18-19), the extent of soil detrimentally affected by ground-based machinery ranges from 3-9 percent of the ground-based harvest area (USDI/BLM 2004, 2006, 2007, and 2009). This is below the 10 percent threshold analyzed in the 1994 PRMP/EIS (Chapter 4, pgs. 12-16). Effects include soil compaction deeper than four (4) inches and/or soil displacement deeper than the organic enriched surface soil layer. The effects of ground-based yarding varies by the type of equipment used, number of equipment passes over the trails, terrain, access routes, weather, soil conditions, and operator skill.

The project design features would limit the total surface area potentially displaced and compacted in ground-based yarding areas to range from 3-9 percent or affecting approximately 26-45 acres (depending on the equipment used and number of landings and large pile areas). Limiting ground-based yarding to designated trails and on slopes less than 35 percent would reduce soil displacement and the extent of area affected.

Harvester forwarder systems tend to be the least impacting, affecting from 3 to 6 percent of the ground-based harvest area (pers. obs., W.Fong, 2008-2009/ pers. obs.; Barner, 2009/2010). Hand falling and using a cat skidder or shovel yarder typically leads to 5-8 percent detrimental impacts (pers. obs.; Barner, 2009/2012). Feller-buncher systems are not commonly used on the Roseburg District but one operation that was monitored resulted in 7-9 percent of the ground-based area being detrimentally compacted.

Cable Yarding

Cable-yarding corridors would create soil disturbance on about three percent of the cable-yarding area's surface (USDI/BLM 2008a, Chapter 4, pg. 838). Cable yarding, either uphill or downhill, would produce localized areas of soil disturbance, such as duff removal and/or displacement of the top 1-6 inches of soil, along the yarding corridors. Downhill cable-yarding areas that do not have favorable corridor deflection or downhill cable yarding on moderate to very steep slopes (i.e. greater than 40 percent) would have detrimental soil displacement or compaction greater than the 2-3 percent expected when uphill yarding. Downhill cable yarding generally would produce more soil disturbance than uphill yarding on equivalent slopes because there would be less control of the logs on the ground surface. In addition, disturbed soil, gravel, and slash material would be more easily moved downward by gravity with the downward movement of the logs. Increased soil disturbance increases the potential for surface soil erosion on the steeper slopes.

Soil disturbance from cable yarding would vary by topography (e.g. convex vs. concave slope, slope steepness, and the presence or absence of pronounced slope breaks) and by the volume of logs yarded. Light compaction would be confined to the topsoil and would recover without mitigation.

The project design feature to obtain partial or full log suspension (i.e. a minimum of one-end suspension) would reduce the degree of soil displacement and furrowing in the yarding corridors. Excessive furrowing created by cable yarding would be hand waterbarred and filled with limbs or other organic debris to prevent erosion, sedimentation, and the channeling of water. This would also help reduce the potential for shallow, rapid slope failures by minimizing the surface soil disturbance. The most soil disturbance would be within 100 to 150 feet of landings due to the increased volume of logs. Light to moderate soil compaction would occur in the center of the corridors at depths of 3-4 inches. Heavy soil compaction up to six (6) inches deep would occur in small pockets due to logs moving through the corridor.

Soil Productivity

The proposed spur construction would create approximately 3.5 acres of new soil displacement and compaction where soil impacts due to past management are currently light or non-existent. Widening partially existing trails into proposed spurs would re-disturb approximately one acre where there is currently moderate to heavy residual soil compaction and varying degrees of re-vegetation. New road cut and fill slopes would be mulched with weed-free straw (or its equivalent) and seeded to prevent surface soil erosion from new road construction. The project design features described in Chapter 2, would limit soil erosion to localized areas, and any reduction of soil productivity due to erosion would be minor. The effects to soils would be consistent with those identified and considered in the 1994 PRMP/EIS (Chapter 4, pgs. 12-16).

The creation and use of skid trails would displace and compact soil, especially in areas with high amounts of clay, thereby decreasing soil productivity. Main skid trails and associated landings would be subsoiled. Subsoiling would help prevent runoff and erosion by reducing the amount of soil compaction and increasing water infiltration into the soil. Subsoiling would provide approximately 80 percent soil fracturing. Although subsoiling does not produce total recovery from soil compaction or restore detrimental soil displacement, it would be an important step in the recovery process (Luce 1997).

(2) Slope Stability

The overall effect on slope stability from the proposed harvest activities would be low for various reasons including retention of residual canopy elements and current road practices. The stands in Thunderbolt are 49-95 years old and would have a low risk for slope failure or landslides due to canopy inception of precipitation and root strength. With regard to shallow, rapid slope failures, the Oregon Department of Forestry studied stands 0-100 years of age and older that were previously clearcut or replaced by fire (Robison *et al.* 1999). After the extreme storms of 1996, forested areas 31-100 years old were found to have the lowest landslide densities and erosion (Robison *et al.* 1999).

The thinning proposed in Thunderbolt would retain residual trees to intercept rainfall and transpire water through the tree canopy, along with live roots to retain soil strength (USDI/ BLM 2008d; pg. 348). Thinning would accelerate the growth of the residual trees which would increase canopy coverage into the areas previously occupied by the removed trees. The residual trees with their live roots would also help retain soil strength and slope stability. The gradual loss of soil holding strength from decaying roots of the cut trees would be compensated, over time, by the increased root coverage of the residual trees.

In addition to residual canopy and root elements, areas of concern would be avoided, which would reduce the overall effect of thinning. The 2008 FEIS reported that the relative landslide density is expected to decrease over time, towards a more natural rate (those occurring in the absence of management activities) on managed lands (USDI/BLM 2008a, Chapter-4, pg. 770). This is expected because current management practices have improved and projects are designed to avoid areas of instability. Shallow, rapid slope failures occur on a small percentage of forest lands, over a variety of forest types, whether managed or unmanaged, however, the highest risk for shallow, rapid slope failures was found on slopes over 70 percent, depending on landform and geology (USDI/BLM 2008a). On landslide-prone portions of the landscape, timber harvest can increase the probability of landslide, but only if a damaging storm occurs during the vegetation re-growth period, which may last up to 10 years following timber harvesting (USDI 2008, pg. 769). Landslide-prone areas most commonly occur within the steep inner-gorge of some streams. However, these areas have been buffered with "no-harvest" areas based on the stream periodicity, whether the stream is perennial or intermittent (*Hydrology, Aquatic Habitat, & Fisheries*, pg. 87). If a slope failure were to occur on the steep to very steep slopes, then the travel distance of the material would depend on a variety of factors, including the initial failure size (amount of material), the initial and down slope steepness, proximity to stream channels, the downstream channel junction angles, stream channel gradients, and the riparian condition along the resulting debris flow path (Robison *et al.* 1999; Benda and Cundy 1990).

The spur renovation and construction would be located on stable positions that are: (1) ridge tops and gently to moderately sloping locations (near level to 40 percent) and (2) show no apparent signs of potential instability through the presence of highly curved or pistol-butted conifer boles or tension cracks, scarps, or jack-strawed trees that indicate active slope movement.

c) ***Proposed Action Alternative 2***

(1) Effect of Shaded Fuel Break

Much of the nitrogen, as well as other nutrients in forest ecosystems, come from decomposition and recycling of organic matter including decayed leaves or needles, branches, fallen trees, coarse woody debris, and roots. Organic matter helps improves water retention in soils, maintains good soil structure, aids in water filtration into the soil, stores carbon, and promotes the growth of soil organisms (Rapp *et al.* 2005).

The degree of change in the levels of organic matter and nitrogen is directly related to the magnitude of soil heating and the severity of the fire. When organic matter is burned, the stored nutrients are either volatilized or are changed into highly available forms that can be taken up readily by microbial organisms and vegetation (Neary *et al.* 2005). Carbon and nitrogen are the key nutrients affected by burning. Large amounts are lost through direct volatilization in moderate to high-severity fires. Other nutrients, such as cationic calcium, magnesium, sodium and potassium are not as easily volatilized and usually remain on the site in a highly available form.

Burning of landings and piles would create high temperatures that can cause adverse effect to soils through loss of soil carbon, nitrogen and other nutrients (Korb *et al.* 2004). Landings and piles would be burned in late autumn or winter after periods of extended

precipitation so that soil and duff moistures would be high, moderating the effects to soils.

d) ***Proposed Action Alternative 3***

(1) Effects of heavy thinning

Trees transpire water and intercept moisture in their canopies, and live roots increase soil strength, both of which increase slope stability (USDI/BLM 2008d; pg. 348). Thinning proposed in Thunderbolt would retain residual trees to intercept rainfall and transpire water through the tree canopy, along with live roots to retain soil strength. Under the heavy thinning treatment, there would be minimum average 40 percent canopy cover in the residual trees to intercept rainfall and the canopy cover for Unit 31B would be 54 percent (q.v. *Forest Vegetation*, pg. 39). The thinning treatments would accelerate the growth of the residual trees, with increased canopy and root coverage. The gradual loss of soil holding strength from decaying roots of the cut trees would be compensated over time by the increased root coverage of the residual trees. The residual stand would continue to intercept rainfall and transpire water through the tree canopies, and live roots would maintain soil strength and stability.

The proposed thinning and the gap openings in *Alternative 3* would decrease the current tree canopy and the live root mass helping to hold the soil in place for a short period, until the remaining roots of the residual trees expanded into the thinned and cleared areas. In cleared areas or openings, root strength drops to a low point in seven to ten years and then improves rapidly. After 10 years, the landslide susceptibility drops substantially (USDI 2008; pg. 348; Robison *et al.* 1999). In the gap areas, the residual trees along the border would grow into the open areas, as well as understory vegetation, such as shrubs, forbs and grasses, that would also take up any increased soil moisture and help in stabilizing the soil.

E. Hydrology, Aquatic Habitat and Fisheries

1. Affected Environment

The Thunderbolt project area lies within the Hill Creek, Bob Creek, Hogback Creek, Cole Creek, and Fox Creek 14 digit Hydrologic Unit Code (HUC) Drainage Areas (7th field watershed) of the Susan Creek and Thunder Creek 12 digit HUC Subwatersheds (6th field watershed) of the Middle North Umpqua River 10 digit HUC Watershed (5th field watershed).

The project is also within the Bond Creek, Greenman Creek, and Shivigny Creek 14 digit HUC Drainage Areas of the Middle Little River 12 digit HUC Subwatersheds of the Little River 10 digit HUC Watershed.

Within the three Subwatersheds containing the project area there are approximately 364 miles of streams, of which approximately 13 miles are within proposed thinning units. Of these 13 miles, 79 percent are 1st and 2nd order headwater streams and 21percent are 3rd order or higher streams. Approximately 30 percent of this stream length is classified as perennial (i.e. surface water flows year-round with the channels passing some volume of water throughout the year) and 70 percent is classified as intermittent (i.e. they stop flowing in the dry season and surface water is no longer transported downstream).

a) *Water Quality & Water Quantity*

No streams within the project area have been placed on the Oregon 303(d) list. Segments of the North Umpqua River and Little River adjacent to the project area had previously been placed on the Oregon 303(d) list as being water quality limited. Both streams have been listed due to excessive temperature, sedimentation, dissolved oxygen and a number of other reasons that are unrelated to forestry operations. These streams are now covered by the Oregon Department of Environmental Quality's 2006 Umpqua Basin Total Maximum Daily Load and Water Quality Management Plan, which was approved by the U.S. Environmental Protection Agency on April 12, 2007.

The potentially affected beneficial uses of water within the project area are: resident fish and aquatic life, salmonid spawning and rearing, and public domestic water supply. Beneficial uses of water immediately downstream of the project area include: private domestic water supply, fish and aquatic life, and irrigation. Within one mile downstream of the project area there are nine surface water rights for irrigation or domestic water supply. Most of the Thunderbolt project area lies within the municipal drinking water source area for the community of Glide, Oregon. The drinking water intake for Glide is located approximately 4 miles downstream from the closest Thunderbolt unit. Portions of the project are also within the Wolf Creek Job Corps drinking water source area approximately 3 miles downstream, and the City of Roseburg source water area approximately 30 miles downstream.

Average annual precipitation in the Thunderbolt project area ranges from 52 to 60 inches, occurring primarily between October and April. Elevations in the Thunderbolt project area range from 1100 to 3,400 feet. Approximately 20 percent of the project area lies within the rain dominated hydroregion where snow accumulation is uncommon (i.e. below 2,100 feet elevation). The remaining 80 percent of the project area lies within the rain-on-snow hydroregion (i.e. 2,100-4,000 feet in elevation) where some snow accumulation occurs transiently throughout the wet season.

Stream flows are dependent upon the capture, storage, and runoff of precipitation. Timber harvest can alter the amount and timing of peak flows by changing site-level hydrologic processes. These hydrologic processes include changes in evapotranspiration, snowmelt, forest canopy interception of rain and snow, road interception of surface and subsurface flow and changes in soil infiltration rates and soil structure (2008 Final EIS; pg. 352). Based on a compilation of watershed studies in the Northwest, completed in small catchments, a peak flow response is detected when at least 29 percent of the drainage area is harvested (Grant *et al.* 2008). No experimental study shows a peak flow increase when less than 29 percent of a drainage area in the rain dominated hydroregion has been harvested (2008 Final EIS, pg. 353). In the rain-on-snow hydroregion, variations in climate conditions would have more effect on susceptibility to peak flow increases than timber harvest (2008 Final EIS; pp 757). None of the subwatersheds in the Thunderbolt project area are susceptible to increases in peak flow stemming from unrecovered canopy openings (2008 Final EIS; pg. 755 & 757). Research by Poggi *et al.* (2004) suggests that forest thinning treatments maintain normal patterns of snow accumulation and have little effect on snowmelt rates during rain-on-snow events (2008 Final EIS, pg. 355).

Increases in peak flow can also occur when roads and other impermeable areas occupy more than 12 percent of the drainage in rain-on-snow hydroregions (2008 Final EIS, pg. 355). Roads total approximately 163 miles in the eight drainages encompassing the project area. The average road density in the project area is 4.7 road miles per square mile. Assuming a 40-foot average width, roads cover approximately 790 acres and represent between 2.5 and 4 percent of the drainages that comprise the project area. The average area covered by roads is approximately 3.6 percent for all the drainages within the project area and do not pose a risk of increased peak flows.

b) *Aquatic Habitat*

From an aquatic habitat perspective, there are two major components of woody material – small functional wood (< 20 inches diameter), and large wood (≥ 20 inches diameter and ≥ 50 feet long; also called key pieces). Large wood is more important in fish bearing streams to trap and store smaller pieces of wood. Because decay rates and displacement probability are functions of size, large wood has more influence on habitat and physical processes than small functional wood (Dolloff and Warren 2003).

(1) *Small Functional Wood*

Nearly all wood that falls into stream channels has the capacity to influence habitat and aquatic communities (Dolloff and Warren 2003). Small functional wood material that enters stream channels is important to overall channel function because it can store sediment and organic material, contribute nutrients, and provide temporary pool habitat and slow-water refugia. Pools formed by smaller wood generally are not as deep or complex as those formed by large wood. In addition, small functional wood does not persist for long periods of time because it deteriorates quickly and is more likely to be flushed from the system (Naiman *et al.* 2002, Keim *et al.* 2002).

Small functional wood is generally lacking in the larger, channels throughout the project area. Based on professional judgment, this is likely due to the lack of stable large wood available to trap and store this material, not a lack of available small functional wood for recruitment. Where there are pockets of large wood, the amount of small functional wood is relatively high compared to other streams without large wood.

In smaller streams adjacent to previously harvested stands, field surveys indicated relatively large amounts of existing (in-stream) and potential (standing) small functional wood are present (McEnroe 2011). Field surveys also indicate that the majority of the down wood in these areas originated from within 50 feet of the stream channel. This is consistent with findings by Minor (1997), who found that in second-growth coniferous riparian forests in the Oregon Coast Range, 70-84 percent of the total in-stream wood was recruited from within 49 feet (15 meters) of the channel. McDade *et al.* (1990) and Welty *et al.* (2002) also found 80 percent and 90 percent, respectively, of the wood loading occurred within 66 feet (20 meters) of the stream channel in coniferous forests.

Current stand densities in the proposed units range from 78 to 230 trees per acre (TPA) (q.v. Forest Vegetation, Table 8). Based on studies in the Oregon Coast Range by Tappeiner *et al.* (1997), conifer stands that initiated and grew at relatively low densities with little self-thinning were reported to have stand densities ranging from 40 to 50 TPA. This suggests that the available source of small functional wood was naturally lower in these areas and the current average stand density is two to four times higher than what was likely found when the previous stands in the Thunderbolt project area were similar ages.

(2) Large wood

Based on field surveys within the Thunderbolt project area (McEnroe 2011), large wood levels are low in all channel sizes and in all areas adjacent to previously harvested stands. Small pockets of in-stream large wood present in the project area are associated with mature or old growth riparian areas that have not been harvested and do not have roads in close proximity to the stream. Areas with large wood in the stream are dominated by gravel and cobble substrates, deep scour pools, point bars, and an abundance of habitat diversity where fish and other organisms can find suitable cover throughout the year. Aquatic habitat conditions are substantially different in areas without large wood.

c) *Fish Populations*

There are no fish populations within the Thunderbolt project area. There nearest fish-bearing stream to the project area is the North Umpqua River which is 0.5 miles downstream. There are no haul routes adjacent to fish bearing streams within the project area. Consequently, impacts to fish populations will not be discussed further.

2. Environmental Consequences

a) *No Action Alternative*

(1) Riparian Vegetation Conditions

Under the *No Action Alternative*, riparian areas would continue to be dominated by dense, even-aged, Douglas-fir stands. Individual tree growth rates would continue to decline and suppression mortality would increase. Over time, these areas would diversify naturally as individual trees or small groups of trees die and natural processes leading to structural and vegetative diversity occur. This slow development would result in a smaller size of potential wood for long-term recruitment to streams and slower canopy development to provide shade. In addition, there would be a higher risk of mass tree mortality from a natural disturbance, such as a windstorm or fire.

(2) Small Functional Wood

The *No Action Alternative* would maintain existing stand densities. This alternative would not affect the amount of small functional wood available to enter stream channels.

(3) Large Wood

Based on the trend of increasing suppression mortality and decreasing diameter growth rates in these stands, the *No Action Alternative* would result in an increase in the time needed for average stand diameters to reach 20 inches DBH, when compared to disturbances such as thinning that decrease stand density and increase tree growth rates, making large wood available sooner for recruitment into the streams.

(4) Sedimentation from roads

Road renovation, beyond routine maintenance, would not repair existing sediment sources (e.g. some road segments that are in poor condition and experiencing surface erosion). Some road stream crossings and drainage features are in poor condition and have an increasing likelihood of failure over time, with the potential to introduce sediment into streams. The amount of sediment would vary depending on the condition of the road and the size of the storm event.

(5) Landslide potential

As discussed previously (*Soils: No Action Alternative*, pg. 77), there is a low probability of landslides occurring but there is the potential for in-unit landslides to directly impact segments of first, second, and third order streams. The likelihood of a landslide reaching a stream segment in a given year is low, and would produce a short-term increase in sedimentation until the material is dispersed downstream. Effects of sediment in the stream bed from small landslides would have a low probability of being detected more than a few hundred feet downstream from the landslide (during normal flow conditions) since small 1st and 2nd order streams have a low capacity for carrying sediment due to their small size and low flows.

Landslides are a natural disturbance mechanism which can provide important ecological functions when they occur at natural rates. As discussed previously (*Soils: Slope Stability*, pg. 79), landslide rates have been declining over the last 25 years to where they now occur at near natural rates on BLM managed lands.

(6) Road Impacts on Peak Flow Susceptiblility

Existing roads and landings may modify storm peaks by reducing infiltration, which would allow more rapid surface runoff (Ziemer 1981, pg. 915). Existing roads may also intercept subsurface flow and surface runoff and channel it more directly into streams (Ziemer 1981, pg. 915). However, peak flows have been shown to have a statistically significant increase due to effects from roads only when roads occupy at least 12 percent of the watershed (Harr *et al.* 1975). Currently roads occupy an average of approximately 3.6 percent of the total acres within each drainage within the project area. Therefore, no statistically significant increase in peak flows would be expected to occur due to road effects. Also, with no change in the vegetative cover there would be no change in runoff, infiltration and transpiration from the project areas sub-watersheds.

In summary, there would be no impact to water quality, beneficial uses of water, or hydrologic processes under the *No Action Alternative*.

b) ***Proposed Action Alternative 1***

(1) *Stream Temperature*

Flow on intermittent streams ceases for some portion of the year, which makes them less susceptible to propagating temperature impacts downstream during the warm dry season. Many of these intermittent streams are also interrupted (the defined stream channel disappears in some locations as it extends downstream due to water going subsurface) which further minimizes the mechanism for delivering impacts further downstream. Water going subsurface tends to be cooled by the subsurface environment such that it has a lower temperature when it re-appears downstream (Story *et al*. 2003). In contrast, perennial streams flow year-round, which makes them more susceptible to temperature impacts and downstream effects.

Vegetation that provides primary shading for perennial streams would be protected by a 60 foot "no-harvest" buffer and by maintaining a canopy closure equal to or greater than 50 percent in the Riparian Reserves (Table 11, pg. 39). Consequently, effective shade for these streams would not be affected by thinning due to retention of sufficient shade and any measurable increase in water temperature from solar heating during the summer months would be avoided (2008 Final EIS, pgs. 759-760).

(2) *Sedimentation from Harvesting/Yarding Operations*

Thinning near streams can cause localized soil disturbance and the short-term potential for erosion, primarily associated with yarding operations. However, "no-harvest" buffers (a minimum of 60 feet on perennial streams and 35 feet on intermittent streams) would be established for all streams adjacent to and within the proposed units and full suspension would be required when yarding across streams (*Timber Yarding: Cable Yarding*, pg. 18). These "no-harvest" buffers would prevent disturbance to stream channels and stream banks as well as intercept and filter any surface run-off from reaching the streams. In the instance when trees from within the no harvest buffer need to be cut for cable yarding corridors they would be felled toward the stream and left in the stream channel. Leaving the trees in the stream would armor stream banks, provide a source of small and large woody debris used to capture sediment and other organic debris and provide a source for nutrient pulses within the aquatic system.

(3) *Sedimentation from Roads*

According to Reid (1981) and Reid and Dunne (1984), forest roads can be a major contributor of fine sediment to streams, through down cutting of ditch lines and erosion of unprotected road surfaces by overland flow. Under the proposed *Action Alternative 1*, there would be four temporary stream crossings that would require entry into the "no harvest" buffer. All of these entries would be on old existing road beds and few trees would be cut to facilitate road construction. Spurs BT5, BT10, TH2, and RT2, would be constructed for temporary use during the dry season and decommissioned after use. All of these crossings would occur on intermittent streams. There would also be a low water crossing used for haul on the 26-2-20.1 road. This crossing is on Bob Creek, a perennial, non-fish bearing stream. The road is a natural surface road with a concrete pad at the stream crossing. This would only be used during the dry season and would be decommissioned and gated after use for the project.

Except for the stream crossings discussed above, the proposed new spur roads would not be connected to the drainage network. Since road segments must be connected directly to

channels in order to deliver sediment-laden water, nearly all 4.79 miles of new road construction would not be connected to the streams through ditchline drainage and therefore would have no effect on stream sediment. All 4.79 miles of new road construction plus an additional 4.2 miles of road would be decommissioned at the end of the project, resulting in a net decrease of 4.2 miles of road. These roads would be decommissioned to a condition that is resistant to erosion and sedimentation. Road construction and log hauling on these spurs would be limited to the dry season and would not deliver road-derived sediment to live stream channels because without precipitation there would be no mechanism for the transport of fine sediment into streams. The stream crossings would also be rocked further limiting the amount and potential for contributing sediment. In order to reduce any chance of sediment delivery for the 26-2-20.1 road stream crossing, the approaches to the concrete pad would be rocked. This crossing would only be used for summer haul.

Road maintenance and renovation associated with this project would improve road drainage and add additional cross drains along the haul route to disconnect the roads from the stream system (q.v., *Sediment Control Plan*, pgs. 21-23). This would reduce the amount of sediment currently entering streams in the project area. Road renovation and maintenance would occur on existing roads during the dry season (q.v. *Road Activities*, pgs. 21). Timber hauling could occur in both the dry and wet seasons, although wet season hauling would be limited to surfaced roads. Following the first seasonal rains, erosion rates would stabilize and sediment delivery would be indistinguishable from background levels resulting in no measureable change to water quality.

(4) *Landslide Potential*

The risk of landslides impacting streams would be slightly higher than under the *No Action Alternative* for a given year. If these landslides occur, they would still be occurring at near natural rates and impacts would be similar to the *No Action Alternative*. Some stream reaches would still have low risks and others would have low to moderate risks. "No-harvest" buffers paired with areas of higher basal area retention on steep slopes would exclude or reduce timber harvest on the steepest, inner gorge slopes where there are higher risks for failure, and where the greatest potential for initiating stream impacting landslides exists. The period of increased vulnerability would be about ten years as the roots and canopies of the residual trees expand.

(5) *Riparian Vegetation Conditions*

Thinning treatments implemented under the *Proposed Action Alternatives* would improve riparian vegetation conditions and structural diversity in comparison to the existing conditions. Thinning riparian areas would produce stands more resilient to disturbance from wind, flood, and fire.

(6) *Small Functional Wood*

The proposed action in *Alternative 1* would retain "no-harvest" buffers along stream channels, and thin the rest of the Riparian Reserves to varying densities. The "no-harvest" buffers would maintain existing stand densities and the source of small functional wood near streams. Small functional wood is needed to maintain aquatic complexity. Thinning outside of the "no-harvest" buffers in the Riparian Reserves would

reduce the amount of standing small functional wood that could fall and enter stream channels, however, the majority of instream wood entry is triggered by disturbance events, such as windstorms, fire, floods, and landslides, not suppression mortality and random tree fall (May and Gresswell 2003). Based on the findings of Tappeiner *et al.* (1997), the post-thinning stand densities ranging from 48-132 TPA (Table 11, pg. 39) would still be in the high range of stand densities occurring in the previous stands before they were harvested. As a result, these thinned areas would be able to contribute small functional wood to the aquatic system at higher levels than historically seen in similar aged stands.

(7) *Large Wood*

Based on a retrospective study of treatments in the Riparian Reserves similar to those under the proposed *Action Alternative 1*, average growth rates of residual conifers in the thinned areas increased by 36 percent when compared to unthinned stands at 10 to 23 years post-thinning (Marshall *et al.* 1992). This increased growth would enable the residual trees to attain larger diameters sooner than in the absence of thinning. Thus, trees in the project area would become large trees (greater than 20 inches DBH) and be available for recruitment as large wood in a shorter amount of time.

(8) *Canopy Opening Impacts on Peak Flow Susceptiblility*

The projects planned for Thunderbolt are proposed forest thinning treatments. It is presumed that hydrologic impacts, such as peak flow increases, decrease with the intensity of treatment, (i.e. regeneration harvest having the greatest impact and thinning treatments having the least impact) although past experimental studies in the Pacific Northwest did not fully examine the differences (Grant *et al.* 2008; 2008 Final EIS, pg. 353). Unit 31B in Big Thunder includes 68 gaps less than 1.5 acres in size scattered across the unit. This would most closely approximate a patch cut treatment, although patch cuts studied in the past created much larger gaps. In terms of impact, a patch cut would be less than a regeneration harvest, but more than a thinning treatment. Under the proposed treatment, a majority of the gaps would be placed in areas with existing root rot disease, some of which have advanced regeneration in understory growth, or they would be created around a large sugar pine, so a complete opening in the canopy would not necessarily be created with the gap.

For this analysis, since it is difficult to predict which gaps would create a new opening and which would not, it was assumed that all gaps would create a new opening. For this reason, the amount of Equivalent Clearcut Area (ECA) was delineated from aerial photography of the Greenman Creek Drainage Area. Existing ECA in Greenman Creek is approximately 21 percent. The assumed gap creation under Alternative 1 would increase this to approximately 22 percent. Since this would likely be an overestimate of the true effect, a less than one (1) percent increase would therefore not result in a detectable change in peak flows from the existing condition.

The 2008 Final EIS (pgs.753-759) analyzed peak flow effects from forest management at sixth field subwatersheds across western Oregon. Although some subwatersheds would be susceptible to increases in peak flows, this does not automatically imply adverse effects on stream form. Stream flow runoff normally fluctuates with climate, and over time channels have developed under a wide range of stream flows including infrequent

peak flows. These stream flows have the potential to affect the frequency of sediment transport and the depth of scour. However, the potential for peak flow effects would vary for different stream types (Grant *et al*. 2008). Within the high gradient cascade and step-pool stream types there is little potential to affect sediment transport and peak flow enhancement. All of the streams within the Thunderbolt project area are high gradient cascade and step-pool stream types of streams. The proposed project takes place in the Susan Creek-North Umpqua River, Middle Little River, and Thunder Creek-North Umpqua River 6th Field Sub-Watersheds. According to the 2008 Final EIS (pgs. 753-759), these Sub-Watersheds were found to be "not susceptible" to peak flow effects.

(9) *Road Impacts on Peak Flow Susceptiblity*

There would be no effective increase in road density within the project areas sub-watersheds because 4.79 miles of road would be constructed and then decommissioned after use along with an additional 4.2 miles of road that would be decommissioned. Therefore the net amount of roads within the project area would decrease and remain well below the 12 percent threshold where measurable increases in peak flows would be expected (Harr, *et al*. 1975). Road decommissioning would result in water-barring, mulching with logging slash where available (or with straw if logging slash is not available), and blocking with trench barriers. Rock surface roads and spurs would be decommissioned by water-barring and blocking with trench barriers. By decommissioning roads the potential for peak flow effects and sediment routing would be diminished due to the disconnection from the stream network and stabilizing nature of these actions.

In summary, the silvicultural treatment within the project area is not expected to have any effects on stream flow due to the following reasons:

- Most of the project consists of thinning which has the least hydrologic effect of active forest management and would subsequently not pose any risk to peak flow enhancement.
- Gap creation in Big Thunder unit 31B would only increase the amount of Equivalent Clearcut Area by less than one percent from the existing condition.
- The stream types encountered within the project area are cascade and step-pool streams, which have little potential to be affected by peak stream flows.
- The Sub-Watersheds within the project area have been analyzed and were found to be "not susceptible to peak flow enhancement".
- Decommissioning would decrease the road density, or total roaded area, within the project area as decommissioned roads become overgrown and stabilize.

c) ***Proposed Action Alternative 2***

The additional acres of moderate thinning in the shaded fuel break proposed in alternative 2 would not produce any additional impacts to Hydrology or Aquatic Habitat. Impacts from alternative 2 would be the same as discussed for alternative 1. Creating the proposed shaded fuel break would make it less likely for a large wildfire to cross over the watershed divide. This would limit the extent of future large wildfires which would reduce the amount of watershed area impacted if a wildfire occurred in this area.

d) ***Proposed Action Alternative 3***

Alternative 3 includes additional acres of moderate and heavy thinning in Unit 31B in Big Thunder**.** For this reason, the amount of Equivalent Clearcut Area (ECA) was delineated from aerial photography of the Greenman Creek Drainage Area. Existing ECA in Greenman Creek is approximately 21 percent. The gap creation combined with the additional acres of heavy thinning would increase this to approximately 25 percent. This increase would not result in a detectable change in peak flows from the existing condition for the same reasons given in *Alternative 1*. Creating the shaded fuel break would have the same impact as was discussed in *Alternative 2*.

e) ***Cumulative Impacts***

In Summary, "no-harvest" buffers and the project design features referenced above would prevent disturbance to stream channel and stream banks. These measures would also intercept surface runoff and prevent sedimentation of streams, such that there would be no cumulative degradation to water quality in the project area or to the beneficial uses of water and municipal drinking water sources within or downstream of the project area.

Under the proposed *Action Alternatives*, the time required for trees to attain large wood size (greater than 20 inches DBH) is expected to decrease. In addition, riparian vegetative diversity is expected to increase. The cumulative increase in the availability of large wood to enter streams, coupled with increasing vegetative diversity in Riparian Reserves would contribute to the trend of gradually improving aquatic habitat in the Middle North Umpqua and Little River Watersheds. When compared to the *No Action Alternative* that does not include riparian thinning, this alternative would hasten the attainment of healthy aquatic habitat capable of supporting the aquatic species mix and population variability typical of healthy western Oregon ecosystems. These changes would rarely be measurable at the site scale and are therefore best considered at the cumulative scale across a watershed.

f) ***Aquatic Conservation Strategy***

Based on the information presented in Appendix B: *Aquatic Conservation Strategy Assessment*, the *Proposed Action Alternatives* would meet ACS objectives at the site and watershed scale. In addition, based upon the restorative nature of the action, this project would not retard or prevent attainment of ACS objectives; it would actually speed attainment of these objectives. Therefore, this action is consistent with the ACS and its objectives at both the site and watershed scales.

F. Botany

1. Affected Environment

The proposed project units are forest stands between the ages of 50 to 95 years-old. Douglas-fir is the predominant overstory tree species on all units. Understory vegetation is common, spatially variable, and generally consists of sword fern, salal, vine maple, Oregon grape, and huckleberry.

2. Environmental Consequences

Each Special Status Botanical resource was evaluated based on the range of the species, and habitat requirements were evaluated against the above description of the project area. During the spring and summer of 2011, botanical surveys were conducted for those species expected to occur in the Thunderbolt project area.

a) ***Federally Listed Species***

(1) Kincaid's Lupine

Kincaid's Lupine (*Lupinus sulphureus* ssp. kincaidii), is a Federally Listed Threatened species of vascular plant. Habitat for Kincaid's Lupine in Douglas County is likely to be shaded with canopy cover as high as 50 to 80 percent. Tree and shrub species that dominate known sites of Kincaid's lupine include Douglas-fir (*Pseudotsuga menziesii*), California black oak (*Quercus kelloggii*), Pacific madrone (*Arbutus menziesii*), ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), hairy manzanita (*Arctostaphylos columbiana*), and poison oak (*Toxicodendron diversilobum*).

The proposed units in Thunderbolt EA contain habitat matching this description for Kincaid's lupine sites within Douglas County. Kincaid's lupine was not found during surveys of the project area, therefore the species would not be affected by any of the proposed actions.

(2) Rough Popcorn Flower

Rough popcorn flower (*Plagiobothrys hirtus*) is a Federally Listed Endangered species of vascular plant. The rough popcorn flower is found only in the Umpqua River drainage in Douglas County at sites ranging from 328 to 755 feet in elevation. The northern most site is near Yoncalla, Oregon and the southernmost at Wilbur, Oregon. The species range extends about 10 miles east and 5 miles west of Sutherlin.

The Thunderbolt timber sale units are outside of the described range and suspected habitat for the rough popcorn flower. Therefore, rough popcorn flower would not be affected by any of the proposed actions.

b) ***Bureau Sensitive Species***

(1) Thompson's mistmaiden (Romanzoffia thompsonii)

Botanical surveys conducted in spring and summer found 6 sites of Thompson's mistmaiden in rocky meadows in the hazardous fuels treatment areas. Thompson's mistmaiden occurs in seasonally wet, open, sunny, cliffs and gravelly slopes.

No Action Alternative
Under the *No Action Alternative*, the Thompson's mistmaiden populations in the rocky meadows would persist at their current levels.
Proposed Action Alternatives
There would be no thinning or hazardous fuel treatment in the meadows where Thompson's mistmaiden populations have been identified therefore the proposed actions would not have an effect on this species.

c) ***Bureau Strategic Species***

No Bureau Strategic species were found during surveys of proposed units, along proposed haul routes, or in the proposed hazardous fuels treatment areas.

d) ***Survey and Manage Species***

(1) *Otidea onotica, Otidea leporina, and Buxbaumia viridis (Protection buffer species)*

No Action Alternative
With no disturbance these species would persist at current levels.

All Action Alternatives
All known sites of *Otidea onotica, Otidea leporine* and *Buxbaumia viridis* occur in Big Thunder Unit 31B. These sites would be included in no-touch retention areas of large diameter coarse woody debris to protect these species under all *Action Alternatives*.

(2) *Chaenotheca ferruginia*

This species is a pin lichen that grows on conifers in semi-open forests.

No Action Alternative
With no disturbance, this species would persist at current levels.

All Action Alternatives
Chaenotheca ferruginia occurs in the riparian area of Big Thunder Unit 31B. All known sites would be protected by skips that include the no harvest stream buffers under all of the *Action Alternatives.*

G. Noxious Weeds

1. Affected Environment

Plant surveys for noxious weeds in the proposed Thunderbolt units and along proposed haul routes located: Canada thistle (*Cirsium arvense*), Scotch broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus aremeniacus*), and tansy ragwort (*Senecio jacobaea*). Biocontrols, primarily insects, are widespread and present on most populations of Scotch broom, Canada thistle and tansy ragwort.

All of the noxious weed populations occur along current or historic roads or old skid trails. Table 13 (below) shows the approximate acres of noxious weed infestations associated with each proposed thinning.

Table 13. Noxious Weed Infestations within Thunderbolt.

Sale Name	Noxious Weed Species (acres)			
	Canada Thistle	Scotch Broom	Himalayan Blackberry	Tansy Ragwort
Thundering Herd	0.1	18.0	0.1	11.0
Rolling Thunder	0.3	1.9	1.0	1.5
Big Thunder	1.2	4.2	0.8	6.1
TOTAL	***1.6***	***24.1***	***1.9***	***18.6***

Canada thistle was found along road sides or old spurs. New infestations can be spread from seeds, but are more often caused by redistribution of roots caused by soil disturbance. The populations are small and most of the plants were pulled during the botany surveys. Four species of insects are being used as biocontrols on Canada thistle. Roseburg BLM has no other plans to control Canada thistle in the project area.

Scotch broom is a pioneer species known to displace native plant species. Seeds are long lived (50 years plus) and mature plants are prolific seed producers, establishing persistent seed banks requiring long-term management (ODA Noxious Weed Profiles). Scotch broom was treated previously along the roads with trace amounts of seedling plants currently found during surveys. This area is being monitored and treated as part of the Roseburg District Noxious Weed program.

Himalayan blackberry was found along existing roads or old spurs. In most places it aggressively displaces native plant species and dominates riparian habitats, and has a significant economic impact on right-of-way maintenance, and forest production. Long term control strategies are required to control this species (ODA Noxious Weed Profiles). Himalayan blackberry is a wide spread Noxious Weed problem in Douglas County. Himalayan blackberry is targeted for herbicide treatment as part of the Roseburg District Weed Program.

Tansy ragwort was found in trace amounts along existing roads or old spurs. Tansy ragwort is very effectively controlled using three insect species that attack different parts of the plants. Roseburg BLM has no other plans to control Tansy ragwort in the project area.

2. Environmental Consequences

a) ***No Action Alternative***

Noxious weeds within the project area are managed under the Roseburg District's Noxious Weed Program. Weed populations in this area would be monitored and evaluated for treatment at regular intervals (USDI, BLM 1995). Control of weed populations within the district is contingent on funding and workload priorities. Priority would be given to weed species with long lived seeds and those tolerant of shade. They have the greatest potential to persist in a stand with a dense canopy.

Noxious weed populations would decline as the stand matured. Greater shading and longer period of time between disturbances would favor native vegetation.

b) ***Common to all Proposed Action Alternatives***

Noxious Weed species treatment is evaluated based on the impacts of the specie to the area considering the level of disturbance to implement the project. In addition, Project Design Features (q.v., pg. 26) require washing of equipment prior to entering BLM-administered lands. Washing logging and construction equipment removes weed seed and other plant propagules that can be transported onto new sites by way of the dirt and vegetation that can cling to various parts of the equipment. Following the timber sale action the noxious weed populations would be monitored, evaluated, and treated under the Roseburg District's Noxious Weed Program.

Soil disturbance associated with thinning operations (e.g. ground-based yarding, cable-yarding corridors, spur construction, and slash pile burning) would create areas of exposed mineral soil, which would provide excellent conditions for seed germination and seedling establishment for noxious weeds. New weed infestations on exposed mineral soil would be expected as long as openings in the canopy and available seed sources are present. Some of the noxious weeds would decrease in abundance as the conifer canopy closes and native understory species eventually overtop and out-compete weeds for sunlight, soil moisture, and soil nutrients. The weed infestations currently present would take advantage of the soil exposed from the proposed action some would be short-lived due to competition from the residual forest stand with others would require long term management which would include monitoring, evaluation, and treatment under the Roseburg District's Noxious Weed Program.

Himalayan blackberry, and Scotch broom directly compete with shrubs and young trees, because of their competitive ability these populations are given priority for treatment in forest habitat. Himalayan blackberry and Scotch broom are treated with a combination of herbicide and or mechanical treatment along roadsides prior to project initiation to reduce the opportunity for seed and plant propagule introduction. Successfully eliminating these species from the project area would require continued monitoring and treatment under the Roseburg Districts Noxious Weed Program.

Canada thistle and tansy ragwort are not generally competitive in forested environments. In addition Canada thistle and tansy ragwort host several biological control agents (tansy ragwort 3, Canada thistle 4) that reduce the impact of the species on the environment. For these species the biological control would be the primary source for the management of the species. Only where populations are at a high risk for invading special status plant areas or nearby openings would these species be considered for treatment with other control methods.

H. Carbon Storage

The BLM did not analyze carbon storage or emissions specifically for this project because there is sufficient information from analysis of four recent commercial thinning projects[1] in the Swiftwater Field Office for the Decision Maker to make an informed decision between alternatives. Therefore, analyzing quantitative carbon storage and emissions for the Thunderbolt project would not provide any additional information needed for a reasoned choice among alternatives for this project.

The following is a summary of information from the four recent analyses[2].

- Range of treated acres analyzed in the projects: 244 to 1504 acres.
- Range analyzed for carbon storage in harvested wood: 47,448 to 113,827 tonnes. (Current condition, standing live trees)
- Range analyzed for total carbon emissions in the 50 year period following harvest: 2,479 to 6,079 tonnes.
- Range of carbon storage in the untreated project areas at 50 years: 171,696 to 528,760 tonnes.
- Range of carbon storage in treated project areas plus carbon in landfills and wood products at 50 years: 148,902 – 408,834 tonnes.

The analysis of each of these four projects shows that:

- The carbon emissions attributable to the projects, both individually and cumulatively, are of such small magnitude that it is unlikely to be detectable at any scale (global, continental or regional) and thus would not affect the results of any models now being used to predict climate change.
- Total carbon storage for the *No Action Alternative* of each project is higher than the total carbon storage for all *action alternatives* throughout the 50 year analysis period which is consistent with modeling by Clark *et al.* (2011, pg. 50).
- The thinning projects analyzed in the Thunderbolt EA fall within the range covered by the projects analyzed in all particulars and would be expected to have similar results.

[1.] Little River MMX EA, Elk Wings EA, Mud Den EA and Johnson Cleghorn EA.

[2.] For each of the four projects, carbon analysis was based on more area than was actually treated and more wood volume than was actually harvested. Harvested wood volume is reported here as tonnes of carbon. Carbon emitted is the sum of carbon in harvested wood that would be released in the 50 year analysis period, plus the carbon in diesel fuel used for harvest operations and carbon released by burning piles of logging slash and debris.

I. Resources Considered but not Analyzed in Detail

1. Resources Not in the Project Area

The following resources or concerns are not present and would not be affected by either of the alternatives: Areas of Critical Environmental Concern (ACECs), Research Natural Areas (RNAs), prime or unique farm lands, floodplains/wetlands, solid or hazardous waste, wilderness, and lands with Wilderness Characteristics.

The proposed action is consistent with Executive Order 12898 which addresses Environmental Justice in minority and low-income populations. The BLM has not identified any potential impacts to low-income or minority populations, either internally or through the public involvement process. No Native American religious concerns were identified by the team or through correspondence with local tribal governments.

2. Cultural Resources

Inventories within the proposed units and in the locations of proposed road construction for Thunderbolt are complete (CRS Nos. SW9805, SW1111, SW1112, and SW1113). Five previously identified sites (35DO397, 35DO398, 35DO785, 35DO786, and 35DO787) and five newly identified sites (OR-10-300, OR-10-302, OR-10-303, OR-10-304, and OR-10-305) are located within the project area. The sites 35DO398, 35DO785, and 35DO786 have been previously evaluated and determined to be ineligible for listing on the National Register of Historic Places. As a result, any ground disturbing activities would have "No Effect" on the three sites. The site 35DO397 has been previously evaluated as well and determined to be eligible for listing. Site 35DO787 is unevaluated and considered to be eligible for the purposes of this project. The five newly identified sites have not been evaluated and are also considered to be eligible for the purposes of this project. The eligible sites have been excluded from the proposed units by modification of unit boundaries. One additional site (OR-10-301) is located near the project area and would be avoided as well. Therefore, there would be no effect to any potentially eligible cultural resources or National Register properties in the project area. In accordance with BLM policy and legal requirements, the locations of these sites are not disclosed in public documents in order to diminish the potential for violations of the Archaeological Resources Protection Act.

3. Recreation and Visual Resource Management

Visual Resource Management

All proposed units in Big Thunder, Rolling Thunder and Thundering Herd are located on Visual Resource Management (VRM) Class IV lands where no specific visual management constraints apply. Management activities would be visible, but would not dominate the view. All thinning activities would present a disturbance; however, every attempt should be made to minimize the effect of the activities through careful location, minimal disturbance and repetition of the basic elements of form, line, color and texture as referenced by the RMP, pg. 53).

One proposed unit, Rolling Thunder 21F, borders approximately 200 feet of the North Umpqua Trail, a designated National Recreation Trail, requiring implementation of a fifty-foot "no-harvest" buffer in that portion of the unit "no-harvest" to maintain the visual integrity of the area for trail users.

Recreation
Recreational use of the area primarily includes hunting, forest product gathering, target shooting, and hiking, biking and equestrian use along the North Umpqua Trail (Unit 21F). There is also an opportunity for back country driving. While logging activities are occurring, access along these forest roads may be temporarily blocked, denying opportunities to drive, hunt, target shoot and collect forest products. The access road to the North Umpqua Trail and the North Umpqua Trail itself would not be used for any logging activities or staging areas.

Approximately 168 acres of Units 20A and 21F were removed from the initial thinning proposal due to the fact that portions of the units were within the North Umpqua Wild and Scenic River Corridor. The *North Umpqua Wild and Scenic River Management Plan*, dated July 1992, states that 'no timber harvest would be scheduled within the Wild and Scenic River Corridor' (pg. 31).

4. Off-Highway Vehicle Management

Specialists have not identified Off-Highway Vehicle use during initial development of the Thunderbolt project. BLM does not foresee extensive illegal use of roads or skid trails in the general area.

5. Energy Transmission or Transport Facilities

A high-voltage transmission line is within Big Thunder units 29A, 29B, 30J, 31B and Rolling Thunder units 21F and 29C (Appendix H - Figure 2 and Figure 3). No adverse effect on energy resources would be anticipated because no commercially usable energy sources are known to exist in the proposed units, trees would be felled away from the transmission lines, and ground-based equipment would not be allowed to operate within the transmission line corridor, except on designated skid trails and roads.

Chapter 4. Contacts, Consultations, and Preparers

A. Agencies, Organizations, and Persons Consulted

The Agency is required by law to consult with certain federal and state agencies (40 CFR 1502.25).

1. Threatened and Endangered (T&E) Species Section 7 Consultation

The Endangered Species Act of 1973 (ESA) requires consultation to ensure that any action that an Agency authorizes, funds or carries out is not likely to jeopardize the existence of any listed species or destroy or adversely modify critical habitat.

a) ***U.S. Fish & Wildlife Service***

Consultation with the U.S. Fish & Wildlife Service (USFWS) for the Thunderbolt Thinning project (including the individual sales Big Thunder, Rolling Thunder and Thundering Herd) has been completed. The *Biological Opinion on the Roseburg District of the Bureau of Land Management's Fiscal Years 2014-2015 Program of Activities, which may affect spotted owls, marbled murrelets and spotted owl and marbled murrelet critical habitat* (FWS 01EOFW00-2013-F-0200) was received from the USFWS, dated September 30, 2013. The Biological Opinion (BO) concluded that this project:

- is ***not likely to adversely affect*** the ability of designated critical habitat units to provide for reproducing northern spotted owls (BO, pg. 118);
- ***may affect, likely to adversely affect*** spotted owls due to modification of dispersal and NRF habitat in habitat-limited owl activity centers (BO, pgs. 149-153).

Previous consultation with the USFWS for the Thunderbolt project was completed with receipt of the *Biological Opinion Regarding the effects of the Roseburg District Bureau of Land Management's proposed fiscal year 2011-2013 timber sale program and associated activities on the Northern Spotted Owl, the Marbled Murrelet and their designated critical habitats* (FWS Ref. No. 13420-2011-F-0012), dated December 28, 2010.

b) ***NOAA Fisheries Service***

The Swiftwater fisheries staff has determined that any impacts to water temperature, substrate/sediment quality, large wood, pool quality, or habitat access within the project area would be non-existent or immeasurable above background levels. Aquatic habitat in the Thunderbolt project area would be unaffected, except for short-term reductions in the amount of large and small functional wood available to the stream. Further, there are no Oregon Coast coho populations present within the Thunderbolt project area. The nearest coho presence is 0.5 miles downstream in the North Umpqua River. Therefore, the proposed project ***would not have an effect*** on Oregon Coast coho salmon or its critical habitat and further consultation with the NOAA Fisheries Service is not required.

2. Cultural Resources Section 106 Compliance

The BLM is in compliance with Section 106 of the National Historic Preservation Act under the guidance of the 2012 National Programmatic Agreement and the 1998 Oregon Protocol. It was determined that there would be no effect to any significant cultural or historical resources since none would be included within the proposed Thunderbolt units or in the locations of proposed road construction.

B. Public Notification

1. Notification of Landowners

Prior to publication of this EA, a letter was sent on January 30, 2013 to **adjacent landowners**, **landowners along the proposed haul route**, **registered water-rights users**, and **tribal governments** (Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz, and Cow Creek Band of Umpqua Tribe of Indians).

2. Roseburg District Planning Updates

The **general public** was notified of the Thunderbolt Thinning project in the quarterly *Roseburg District Planning Updates* since May 27, 2010 (i.e. publication of the Summer 2010 planning update). These planning updates were published, and are still available, on the Roseburg District BLM Internet website. Electronic notification of the availability of the Roseburg District Planning was sent to approximately 40 addressees. These addressees consist of members of the public that have expressed interest in Roseburg District BLM projects.

3. Scoping

Scoping for the Thunderbolt Thinning project ensued with the publication of the Roseburg District's Summer 2010 Quarterly Planning Update on May 27, 2010. One set of scoping comments was received specific to Thunderbolt. Key topics raised in the scoping process were reflected in the development of project design features analyzed in this EA. For how specific topics were incorporated into the alternatives, please refer to the *Executive Summary*.

4. State, County, and Local Government Agencies

This EA, and its associated documents, would be provided, through electronic notification of on-line availability, to certain **State, County and local government** offices including: U.S. Fish & Wildlife Service, NOAA Fisheries Service, Oregon Department of Environmental Quality, and the Oregon Department of Fish and Wildlife. If the decision is made to implement this project, the Decision Documents and FONSI would be sent to the aforementioned State, County, and local government offices.

5. Public Comment Period

The BLM is providing a 30-day period for public review and comment on this document, and will accept comments until the close of business (4:30 PM, PST) on December 12, 2013. If the decision is made to implement this project, a notice will be published in *The News-Review* and notification sent to all parties who request it.

In keeping with Bureau of Land Management policy, the Roseburg District posts Environmental Assessments, Environmental Impact Statements, Findings of No Significant Impacts, and Decision Records/Documentations on the district web page under Plans & Projects at *www.blm.gov/or/districts/roseburg*, on the same day on which an electronic notice of availability is transmitted to those individuals and organizations on the District's NEPA mailing list who have expressed an interest in project planning and analysis. Individuals desiring a paper copy of such documents will be provided one upon request. Individuals with the ability to access these documents on-line are encouraged to do so. Internet use reduces paper consumption and administrative costs associated with copying and mailing. A copy of these documents is also made available in the public reading room of the Roseburg Public Library.

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Appendix A. Survey & Manage Wildlife Species

S&M List Date: *2001 Record of Decision and Standards and Guidelines for Amendments of the Survey and Manage, Protection Buffer, and other Mitigation Measures Stands and Guidelines (2001 ROD).*

The Roseburg District compiled the species listed below from the 2001 ROD and includes those vertebrate and invertebrate species with pre-disturbance survey requirements (Category A, B, or C species), whose known or suspected range includes the Roseburg District according to:

- *Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*, January 12, 2004; (refer to IM-OR-2011-063, Attachment 1-26, July 21, 2011).
- *Survey Protocol for the Red Tree Vole: Arborimus longicaudus (= Phenacomys longicaudus) in the Record of Decision of the Northwest Forest Plan)*, Version 3.0, Revision November 2012 (refer to IM-OR-2003-003, October 23, 2002 and Memorandum from the Regional Interagency Executive Committee, November 21, 2012).
- *Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan*, Version 3.0, 2003 (refer to IM-OR-2003-044, February 21, 2003).

This list also includes any Category D, E, or F species with known sites located within the Thunderbolt Thinning and Fuels Treatment units. Applicable management recommendations include:

- Interim management recommendations for the Great Gray Owl were put forth in the 2011 Survey and Manage Settlement Agreement Species List (refer to IM-OR-2011-063, Attachment 1-26, July 21, 2011).
- *Management Recommendations for the Oregon Red Tree Vole: Arborimus longicaudus, Version 3.0* (refer to IM-OR-2000-086, September 27, 2000).
- *Management Recommendations for Survey and Manage Terrestrial Mollusks*, Version 2.0, October 1999 (refer to IM-OR-2000-003, October 15, 1999 and to IM-OR-2000-015, November 23, 1999).

Table A-1. Survey & Manage Wildlife Species – Thunderbolt Thinning and Fuels Treatment

Species	S&M Category	Survey Triggers			Survey Results			Site Management
		Within Range of the Species?	Contains Suitable habitat?	Habitat Disturbing*?	Surveys Required?	Survey Date	Sites Known or Found?	
VERTEBRATES								
Great Gray Owl *Strix nebulosa*	C	Yes	No[1]	No	No[1]	N/A	0	N/A
Red Tree Vole *Arborimus longicaudus*	C	Yes	Yes	Yes Thinning in Big Thunder Unit 30I[2]	Yes[2a]	May-June 2000	1	None Required[2b]
MOLLUSKS								
Siskiyou Sideband *Monadenia chaceana*	B[3]	Yes	Yes[4]	No[5]	No[6]	Fall 1998 Spring 1999	0	N/A

Species	S&M Category	Survey Triggers			Survey Results			Site Management
		Within Range of the Species?	Contains Suitable habitat?	Habitat Disturbing*?	Surveys Required?	Survey Date	Sites Known or Found?	
Crater Lake Tightcoil *Pristiloma arcticum crateris*	A	Yes	Yes[7]	No[5]	No[6]	Fall 1998 Spring 1999	0	N/A
Oregon Megomphix *Megomphix hemphilli*	F[8]	Yes	Yes[9]	No[5]	No[6]	Fall 1998 Spring 1999[9]	4	Site-tree Buffer[9]

*"Habitat disturbing" and thereby a trigger for surveys as defined in the 2001 ROD S&Gs (pg. 22).
N/A = Not Applicable

[1] Pre-disturbance surveys for the great gray owl are not required since there is no suitable nesting habitat within the project area or within proximity of the project area that would be impacted by disturbance. The required habitat characteristics of suitable habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (*Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*, January 12, 2004; and mitigation language in the 2011 Settlement Agreement Species List). The stands in the Thunderbolt project area do not have proximity to natural-openings $\geq$ 10 acres (Elizabeth Gayner, staff review, 2012) and pre-disturbance surveys are not suggested in suitable nesting habitat adjacent to man-made openings at this time (pg. 14, *Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*, January 12, 2004).

[2a] Although the stand would be exempt (Pechman Exemptions), based on stand age (<80 years of age) from pre-disturbance surveys for the red tree vole, the stand's QMD is greater than 18 inches and is considered suitable habitat for the red tree vole. In addition, the stand is also considered suitable habitat for the spotted owl and therefore, given the nature of this stand pre-disturbance surveys for the red tree vole are recommended since the Thunderbolt project would remove or modify the conifer canopy structure of the stand or individual conifer crowns.

[2b] The one active red tree vole nest site location during the May-June 2000 survey effort is located within a Riparian Reserve and would therefore, not be removed or modified during harvest activities within the Big Thunder Unit 31B.

[3] Equivalent-effort pre-disturbance surveys are required for this species.

[4] Suitable habitat for the Siskiyou Sideband may be found within 30 meters (98 feet) of rocky areas, talus deposits and in associated riparian areas in the Klamath physiographic province and adjacent portions of the south-western Oregon Cascades. Areas of herbaceous vegetation in these rocky landscapes adjacent to forested habitats are preferred. Areas that contain moist, shaded rock surfaces are preferred for daily refuges. In more mesic, forested habitats, especially in the Oregon Cascades, the species is associated with large woody debris and the typical rocky habitat is not required. Forest habitats without either rock features or large woody debris are not currently considered to be suitable habitat for this species (*Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003*, pg. 42)

[5] Except for Big Thunder unit 31B, the thinning units within stands younger than 80 years of age are exempt from pre-disturbance surveys under the Pechman Exemptions. Mollusk surveys within the 12

acre stand in Big Thunder unit 31B was included in the equivalent effort surveys completed in 1998-1999,

The Fuels Treatment in stands greater than 80 years project is not considered habitat-disturbing for these mollusk species because project design criteria would be implemented to avoid disturbance to micro habitats associated with each species, including avoidance of placement of debris piles and burning on rock outcrops, large downed-woody debris, and around large hardwoods (particularly big-leafed maple) within hazardous fuels treatment areas in stands greater than 80 years.

[6] With the exception of 12 acres in Big Thunder Unit 31B, the Thunderbolt Thinning portion of the project includes no regeneration harvest and includes thinning in stands less than 80 years old, and therefore this portion of the project meets Exemption A of the Pechman Exemptions (October 11, 2006 Order). Thus, pre-disturbance surveys for mollusks are not required. However, equivalent-effort surveys for mollusks were completed for another timber sale project in 1998-1999 within Section 31, including the project area; no Siskiyou Sideband or Crater Lake Tightcoil sites were discovered within project area. Four Oregon Megomphix sites were discovered in Section 31, within Big Thunder Unit 31B

[7] Suitable habitat for the Crater Lake Tightcoil is "perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 meters of open water in wetlands, springs, seeps and riparian areas…" (*Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003,* pg. 43). Within the project, suitable habitat is confined to the stream-side areas that are contained within Riparian Reserves.

[8] Management of known sites is NOT required for Category F because species are uncommon, not rare, and species within this category would be assigned to other categories or removed from Survey and Manage as soon as new information indicates the correct placement. Until that time, inadvertent loss of some sites is not likely to change the level of rarity. In addition, pre-disturbance surveys are not required for Category F species (2001 ROD, Standards and Guidelines, pgs. 7, 13-14).

[9] Suitable habitat for the Oregon Megomphix is mature or late-seral, moist conifer/hardwood forests, usually in hardwood leaf litter and decaying non-coniferous plant matter under bigleaf maple trees. The species may also be present in the absence of bigleaf maple, especially at moist sites where deciduous shrubs, coarse woody debris, rotten logs or stumps and large sword ferns provide abundant cover (pg. 42, *Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan, Version 3.0, 2003*). In this habitat description, "mature or late-seral" forests include stands typically at least 80 years old, depending on site conditions and stand history (2001 ROD, Standards and Guidelines, pg. 78). However, surveys were completed within the Big Thunder Unit 31B, which includes the 95-year old stand) in fall 1998 and spring 1999 and four Oregon Megomphix sites were located. Because these sites were located prior to 9/30/1999 (2001 ROD, Standards and Guidelines, Table 1-1; pgs. 49 & 51), these sites would be maintained with a full-site tree buffer.

Table A-2. Effects of Proposed Action on Survey & Manage Wildlife Species.

SPECIES	GENERAL HABITAT REQUIREMENTS	PRESENT IN PROJECT AREA?	IMPACTS TO SPECIES	
			NO ACTION	PROPOSED ACTION ALTERNATIVES
VERTEBRATES				
Great Gray Owl *Strix nebulosa*	Habitat characteristics of suitable habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (*Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0*). Though no natural meadows, clear cuts are present in proximity to suitable forest habitat adjacent to units, therefore great gray owls could be present within the project area. However, great gray owls have not been detected during spotted owl surveys.	Suspected	Stands would remain unsuitable until late successional characteristics develop, including open, multi-layered canopy and the presence of large trees and eventually large hollow snags.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags (nesting structure). Forest gaps would increase understory growth, contributing to increased prey production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created would increase foraging opportunities until canopy cover recovers.
Red Tree Vole *Arborimus longicaudus*	Suitable habitat is almost exclusively in forests having Douglas-fir in the canopy, and associated primarily with late-successional (older, structurally complex) forests. (Huff *et al.* 2012).	Documented	High density of trees would limit the stand's ability to create diverse, multi-storied stands, including large trees with deep crowns. However, if present, the species would persist in the stand.	Short term impacts of thinning would reduce tree densities, increasing the space between tree crowns which would limit the ability of tree voles to move through the tree canopy. Variable density thinning would create more diverse stand conditions and accelerates growth of larger Douglas-fir trees with deeper crowns.
MOLLUSKS				
Siskiyou Sideband *Monadenia chaceana*	Rocky, talus habitats in the Klamath Province and southwards and LDWD habitat in Western Cascade Province, rock does not need to be present. Habitat is present in the fuel treatment areas outside of timber sale unit boundaries in stands with a birthdate of DK=1840; rocky areas and large DWD are present within these stands. *Also listed as a Bureau Sensitive Species on the SSS list (Appendix B).*	Suspected	Continuous canopy within the stands would preclude the development of large trees of which would become large DWD in the future.	To reduce impacts to the species burn slash piles away from rocky habitats and around large DWD. These areas used as refugia during dry periods by mollusk species.
Crater Lake Tightcoil *Pristiloma arcticum crateris*	Perennially wet areas in late-seral forests above 2,000 feet elevation and east of Interstate-5; seeps, springs, riparian areas. Suitable habitat was not surveyed. *Also listed as a Bureau Sensitive Species on the SSS list (Appendix B).*	Suspected	No Effect	No measurable effects to habitat due to 60-foot buffer along perennial streams within Riparian Reserve.
Oregon Megomphix *Megomphix hemphilli*	Late-seral or mature conifer/ hardwood forests usually in hardwood leaf litter (i.e. big leafed maple trees) and/or under decaying non-coniferous plant matter. Habitat is present in the fuel treatment areas outside of timber sale unit boundaries in stands with a birthdate of DK=1840; rocky areas and large DWD are present within these stands. Mollusk surveys were completed in suitable habitat in1998-1999 in Unit 26-2-31B; the Oregon Megomphix was not detected. Because	Documented	Continuous canopy within the stands would preclude the development of large trees of which would become large DWD in the future, as well as the development of understory deciduous hardwoods, including bigleaf maple.	The four sites in Unit 31B would be protected with site-tree buffers. No measurable effects to habitat due to PDF avoiding debris piles and burning under large (>19 inches) hardwoods.

SPECIES	GENERAL HABITAT REQUIREMENTS	PRESENT IN PROJECT AREA?	IMPACTS TO SPECIES	
			NO ACTION	PROPOSED ACTION ALTERNATIVES
	surveys were not completed in the fuels treatment areas, it is suspected this species may be present where micro habitat conditions exist.			
Oregon Shoulderband *Helminthoglypta hertleini*	Talus and rocky substrates, grasslands or other open areas with low-lying vegetation. Suitable habitat located in all Fuel Treatment areas, outside of timber sale unit boundaries, in stands that have a birthdate of DK = 1840. Mollusk surveys were completed on Unit 26-2-31B in 1998-1999; the Oregon Shoulderband was not detected. *Also listed as a Bureau Sensitive Species on the SSS list (Appendix B).*	Suspected	No Effect	PDF would minimize impact to the species by burning slash piles away from rocky or open areas; the species use these areas for refuge during dry periods.

Appendix B. Bureau Sensitive & Bureau Strategic Wildlife Species

SSSP List Date: December 1, 2011 (IM-OR-2012-018)

The following table includes those species which are documented or suspected to occur within the Roseburg District BLM. Those *Bureau Sensitive* or *Bureau Strategic terrestrial wildlife species* which are suspected or documented to occur within the project area are detailed below.

Bureau Sensitive Species

BLM districts are responsible to assess and review the effects of a proposed action on *Bureau Sensitive* species. To comply with Bureau policy, Districts may use one or more of the following techniques:

a. Evaluation of species-habitat associations and presence of potential habitat.
b. Application of conservation strategies, plans, and other formalized conservation mechanisms.
c. Review of existing survey records, inventories, and spatial data.
d. Utilization of professional research and literature and other technology transfer methods.
e. Use of expertise, both internal and external, that is based on documented, substantiated professional rationale.
f. Complete pre-project survey, monitoring, and inventory for species that are based on technically sound and logistically feasible methods while considering staffing and funding constraints.

When Districts determine that additional conservation measures are necessary, options for conservation include, but are not limited to: modifying a project (e.g. timing, placement, and intensity), using buffers to protect sites, or implementing habitat restoration activities (IM-OR-2003-054).

Bureau Strategic Species

If sites are located, collect occurrence data and record in corporate database.

Table B-1. Effects of Thunderbolt Thinning and Fuels Project on Bureau Sensitive & Strategic Terrestrial Wildlife Species.

SPECIES	GENERAL HABITAT REQUIREMENTS	PRESENT IN PROJECT AREA?	IMPACTS TO SPECIES	
			NO ACTION	PROPOSED ACTION ALTERNATIVES
BUREAU SENSITIVE				
American Peregrine Falcon *Falco peregrines anatum*	Cliffs, rock outcrops; open habitats for hunting birds. Known sites in T27S-R02W-Section 06, approximately 0.9 miles south of Big Thunder Unit 31A. Although a portion of the unit falls within the one (1.0) mile protection buffer, no seasonal restriction would be required because the unit lies on the outer periphery of the protection buffer and topographical features present (i.e. a ridge) would provide an adequate buffer to noise during the breeding season. Peregrine falcons likely forage within the proposed project area.	Documented	No Effect	No effects to nesting habitat. Improve forest habitat conditions for avian species, thus increasing foraging opportunities and prey species diversity.
Bald Eagle *Haleaeetus leucocephalus*	Late-successional forests with multi-canopies, generally within two miles of a major water source; incidental observations of bald eagles have been documented within the project area. However, it is unknown if bald eagles are nesting within or within two miles of the project area.	Documented	High density of trees would limit the stand's ability to create diverse, multi-storied stands. Large trees or snags containing large limbs or structural	No effects to nesting habitat within two miles of a major water source.

SPECIES	GENERAL HABITAT REQUIREMENTS	PRESENT IN PROJECT AREA?	IMPACTS TO SPECIES	
			NO ACTION	PROPOSED ACTION ALTERNATIVES
			characteristics to support a nest would be slow to develop.	
California Shield-backed Bug *Vanduzeeina borealis California*	A tall grass prairie specialist, this subspecies inhabits high elevation (e.g. 900 meters) natural balds and meadows (Applegarth 1995). *(Xerces Society)*	No Habitat	No Effects	
Columbian White Tailed Deer *Odocoileus virginianus leucurus*	Bottomlands, oak/hardwood forests; cover for fawning.	Out of Range	No Effects	
Crater Lake Tightcoil *Pristiloma arcticum crateris*	Also a *Survey & Manage Species*; refer to Table A-1 in Appendix A for habitat requirements and impacts.			
Fisher *Martes pennanti*	Natal and foraging habitat consists of structurally complex forests; mature open forests with large live trees, snags, and down wood.	Suspected	Stands would remain unsuitable until late successional characteristics develop, including open, multi-layered canopy and the presence of large, hollow snags.	No effects to suitable natal and foraging habitat.
Foothill Yellow-legged Frog *Rana boylii*	Low gradient streams/ponds; gravel/cobble, bedrock pools.	No habitat	No Effect	
Franklin's Bumblebee *Bombus franklini*	Known only from southern Oregon and northern California between the Coast and Sierra-Cascade Ranges. Requires habitat in proximity to water with a sufficient supply of floral resources to provide continuous blooming throughout the colony season. Additionally, probably requires abandoned rodent borrows or clumps of grass for nesting, population sites may be limited by the abundance of rodents and the presence of undisturbed grassland. Closest known documentation of species is in Roseburg and just west of Sutherlin at Ford's Pond. *(Xerces Society)*	No Habitat	No Effect	
Fringed Myotis *Myotis thysanodes*	Late-successional forest features (e.g. snags or trees with deeply furrowed bark, loose bark, cavities), caves, mines, bridges, rock crevices. Suitable habitat is located adjacent to units. Expected to forage in or above units.	Suspected	Stands would remain unsuitable until late successional characteristics develop, including open, multi-layered canopy and the presence of large, hollow snags.	PDF would retain existing snags $\geq$ 10 inches dbh and $\geq$ 16 feet tall.
Green Sideband *Monadenia fidelis beryllica*	Coast Range, riparian forests at low elevations; deciduous trees & shrubs in wet, undisturbed forest.	Out of Range	No Effect	
Harlequin Duck *Histrionicus histrionicus*	Mountain Streams in forested areas on west slope of the Cascade Mountains in swift, rocky, large streams or rivers. Nest under rock overhangs, vegetation or streamside debris. Late spring migrant or summer visitor. The North Umpqua River contains suitable nesting and brooding habitat. Adults with broods have been documented on the North Umpqua River.	Suspected	No Effect	No effects to suitable nesting habitat along the North Umpqua and Little River.

SPECIES	GENERAL HABITAT REQUIREMENTS	PRESENT IN PROJECT AREA?	IMPACTS TO SPECIES	
			NO ACTION	PROPOSED ACTION ALTERNATIVES
Lewis' Woodpecker *Melanerpes lewis*	Open woodland habitat near water; open woodland canopy and large diameter dead/dying trees, snag cavities.	No Habitat	No Effect	
Oregon Shoulderband *Helminthoglypta hertleini*	Also a *Survey & Manage Species*; refer to Table A-1 in Appendix A for habitat requirements and impacts.			
Oregon Vesper Sparrow *Pooecetes gramineus affinis*	Open habitats such as grasslands, meadows, farmlands.	No Habitat	No Effect	
Pacific Pond Turtle *Actinemys marmorata*	Ponds, low gradient rivers; upland over-wintering habitat, CWD. One pond is located in Section 2 within the Rolling Thunder 23 C Unit.	Suspected	No Effect	Ponds buffered to the extent of riparian vegetation.
Pallid Bat *Antrozous pallidus*	Usually rocky outcroppings near dry open areas; occasionally near evergreen forests; cliffs within the project area, but not within units.	Suspected	No Effect	No effect to potential roost sites in cliff area.
Purple Martin *Progne subis*	Snags cavities in open habitats (e.g. grasslands, brushlands, open woodlands); foraging habitat in units.	Suspected	No Effect	No measurable effect to foraging habitat.
Rotund Lanx *Lanx subrotundata*	Major rivers and large tributaries with cold, well-aerated water and rocky substrate.	Out of Range	No Effects	
Siskiyou Sideband *Monadenia chaceana*	Also a *Survey & Manage Species*; refer to Table A-1 in Appendix A for habitat requirements and impacts.			
Townsend's Big-eared Bat *Corynorhinus townsendii*	Late-successional forest features (e.g. snags or trees with deeply furrowed bark, loose bark, cavities), caves, mines, buildings, bridges, tunnels. Suitable habitat is located adjacent to units. Expected to forage in or above units.	Suspected	Stands would remain unsuitable until late successional characteristics develop, including open, multi-layered canopy and the presence of large, hollow snags.	Snags retained in units, to the extent possible.
Western Bumblebee *Bombus occidentalis*	Sufficient supply of floral resources to provide continuous blooming throughout the colony season.	Unknown	Stands would continue to be unsuitable because of the lack of understory development until suppression mortality created gaps and edge habitat allowing for the development of forage habitat – flowering plants and shrubs.	Tree removal would create openings where flowering vegetation important for foraging would persist until the canopy cover increases and closes in 10 to 20 years.
Western Ridgemussel *Gonidea angulata*	Creeks, rivers, coarse substrates; Umpqua R. and possibly major tributaries.	Unknown	No Effect	No measurable effects to habitat due to 60-foot buffer along perennial streams within Riparian Reserve.
White-Tailed Kite *Elanus leucurus*	Open grasslands, meadows, emergent wetlands, farmlands, lightly, wooded areas; wooded riparian habitats close to open hunting; tall trees and shrubs.	No Habitat	No Effects	
BUREAU STRATEGIC				
Broadwhorl Tightcoil *Pristiloma johnsoni*	Moist forest sites, typically with deciduous component; Coast/Cascades in WA, Coast Range	Out of Range	No Effects	

Species	General Habitat Requirements	Present in Project Area?	Impacts to Species	
			No Action	Proposed Action Alternatives
	in OR, as far south as Lane County.			
Klamath Tail-Dropper *Prophysaon sp. nov.*	Moist, open areas along streams or springs in Ponderosa Pine forests; as far North as Crater Lake.	Out of Range	No Effects	
Merlin *Falco columbarius*	Coniferous forests adjacent to open habitats, along forest edges; units within winter range.	No Habitat	No Effect	
Oregon Giant Earthworm *Driloleirus macelfreshi*	Deep, moist, undisturbed soils of riparian forests.	Out of Range	No Effect	

Appendix C. Landbirds

Game Birds

"*Game Birds Below Desired Condition*" identifies six species documented or suspected on the Roseburg District. Three of the six game bird species are suspected or known to occur within the Thunderbolt project area. The band-tailed pigeon is also identified as a focal species.

Birds of Conservation Concern

The most recent "*Birds of Conservation Concern"* list (USDI USFWS 2008d) identifies thirty-two species of concern in Region 5 (North Pacific Rainforest), an area that includes the Roseburg District BLM. Of those thirty-two species, 11 species are suspected or known to occur within the project area. Four of these species, including the bald eagle, peregrine falcon, and marbled murrelet are also *Special Status Species* and addressed previously.

Focal Avian Species

Partners In Flight is an international coalition of government agencies, conservation groups, academic institutions, private organizations, and citizens dedicated to long-term maintenance of healthy populations of native landbirds. Their *Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington* (Altman 1999) provides information on habitat used by species native to the Pacific Northwest, and is one additional plan that may be used as a guideline by the BLM. Fourteen species were identified as focal species to consider during forest management actions. The rufous hummingbird is also identified as a species of conservation concern and is addressed in the relevant section.

Bald Eagle and Golden Eagle

The bald eagle and the golden eagle are protected by the *Migratory Bird Treaty Act* and the *Bald Eagle and Protection Act*. The bald eagle is also listed as a Bureau Sensitive Species and is addressed previously in the *Special Status Species* section.

Table C-1. Effects of the Thunderbolt Thinning and Fuels Project on Landbirds.

Species	General Habitat Requirements	Impacts to Species	
		No Action Alternative	Proposed Action Alternatives
GAME BIRDS			
Band-tailed Pigeon *Columba fasciata*	Nest primarily in closed Douglas-fir stands with canopy cover above 70 percent. Key food sources are red elder and cascara species. Mineral springs.	Continuous canopy within the stands would preclude the development of forage species.	Increase of forage species due to decreased canopy cover in more heavily thinned areas (e.g. Riparian Reserve) may allow establishment of shrubs such as red elder and cascara.
Mourning Dove *Zeneida macroura*	Inhabit forest, desert, shrub/scrub, suburban areas and agricultural lands. Forage in areas with little ground cover and nest in edge-habitats between forest/shrubs and open areas.	Continuous canopy would preclude nesting within the stands, except along habitat edges (e.g. roads)	Creation of gaps due to roads and landings may create edge habitat suitable for nesting.
Wood Duck *Aix sponsa*	Nest in tree cavities in the vicinity of wooded swamps, flooded forest, marsh, rivers, or ponds. Expected to occur along Little River and Cavit Creek.	No Effect	Project design criteria for streams and riparian areas would protect habitat.
BIRDS OF CONSERVATION CONCERN			
Olive-sided Flycatcher *Contopus cooperi*	Associated with natural or man-made openings with tall trees or snags available for perching and singing. In the Oregon Coast Range, closely associated with edges of older stands with tall trees and snags greater than 21 inches diameter breast height and broken canopy. Conditions are	Suitable habitat condition would continue to be absent until suppression mortality created gaps and edge habitat.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance

SPECIES	GENERAL HABITAT REQUIREMENTS	IMPACTS TO SPECIES	
		NO ACTION ALTERNATIVE	PROPOSED ACTION ALTERNATIVES
	generally absent within the proposed thinning units but often present in adjacent or nearby older stands.		foraging opportunities. Gaps created by thinning corridors and landings may allow foraging until the canopy eventually closes again and these opportunities are lost.
Purple Finch *Carpodacus purpureus*	Prefer open areas or edges of low to mid-elevation mixed coniferous-deciduous forests, frequently breeding in mixed conifer-deciduous forest, on edges of bogs, in riparian corridors, deciduous forests, orchards, and other areas with scattered conifers and shrubs.	A continuous overstory and lack of deciduous tree and plant species would preclude the species from using these stands.	Long term benefits by treatment proposed would create additional nesting habitat as canopy layers and hardwoods develop in the areas with lower residual tree densities (e.g. Riparian Reserve).
Rufous Hummingbird *Selasphorus rufus*	Primarily associated with forest edges and openings with a diversity of flowering plants for feeding and open space Frequently occurs in open habitats that are shrub-dominated, and late-successional forest with a highly developed and diverse understory of herbaceous plants and shrubs, particularly within large openings. Need flowering plants and shrubs.	Stands would continue to be unsuitable because of the lack of understory development until suppression mortality created gaps and edge habitat allowing for the development of forage habitat.	Tree removal would create openings where flowering vegetation important for foraging would persist until the canopy cover increases and closes in 10 to 20 years.
FOCAL AVIAN SPECIES			
Brown Creeper *Certhia americana*	Optimal habitat appears to be mature and old-growth unmanaged forests where large treesand snags for foraging and nesting are relatively abundant due to natural processes.	Stands would remain unsuitable. May forage away from adjacent suitable habitat in managed stands where large remnant Douglas-fir trees and snags are present.	Benefits most from long-term effects of thinning treatments resulting in lower tree densities, which would best create conditions fostering the development of suitable habitat, including large conifers with deep furrowed bark Also would benefit from retention of large remnant trees and snags.
Hermit Warbler *Dendroica occidentalis*	Conifer forests with a high level of canopy cover. It is not associated with a particular forest age class, and is common in stands greater than 30 years in age and dominated by Douglas-fir where dense canopy provides foraging and nesting habitat.	Continue to use the dense young forests for nesting.	Thinning would modify and partially remove stand overstory, reducing foraging and nesting opportunities over the short term, until forest canopy closes in 10 to 20 years.
Hutton's Vireo *Vireo huttoni*	Strongly associated (i.e., preferentially selected) with pole forest conditions among younger and older forested stands in all elevations of managed forests of the central Oregon Coast Range.	Where present, would continue to persist in stands where a deciduous component is present.	Would benefit from variable thinning under, which would allow understory development of deciduous shrubs and trees.
Pacific-sloped Flycatcher *Empidonax difficilis*	Optimal habitat appears to be low elevation (<3,000 ft) riparian forest in late-successional coniferous forest with a deciduous component and/or wet site coniferous trees such as western hemlock and western red cedar. Also can be found throughout coniferous forests with some open space beneath or in the canopy.	Where present, would continue to persist in portions of stands where open space with a deciduous component is available.	Would benefit from thinning treatments, which would create stand conditions that would create open space for foraging and promote understory development.
Pileated Woodpecker *Dryocopus pileatus*	Strongly associated with mature and old-growth stands (stands ≥ 80 years) with a multi-layered canopy. Nests in large snags and decadent live trees in mature and old-growth forests. Younger forests can be used for foraging if snags and/or down logs are present. Dependent on snags and down wood.	Stands would remain unsuitable for nesting and most foraging activities. May forage away from adjacent suitable habitat where large snags and down wood are present in managed stands.	Benefits most from long-term effects of thinning treatments resulting in lower tree densities which would best create conditions fostering the development of suitable habitat, including large trees, and eventually large snags and down wood. Also would benefit from retention of remnant trees and snags.
Red Crossbill *Loxia curvirostra*	Optimal habitat is late-successional forest with high productivity of conifer cone-producing trees.	Stands would remain unsuitable until stand differentiation and late-successional characteristics developed (large conifers).	Benefits most from long-term effects of thinning treatments resulting in lower tree densities (e.g. Riparian Reserve) which would best create conditions fostering the development of suitable habitat, including large trees with deep crowns.

SPECIES	GENERAL HABITAT REQUIREMENTS	IMPACTS TO SPECIES	
		NO ACTION ALTERNATIVE	PROPOSED ACTION ALTERNATIVES
Swainson's Thrush *Catharus ustulatus*	Primarily associated with a deciduous subcanopy and understory in young closed-canopy forests.	Where present, would continue to persist in portions of stands where open space with a deciduous component is available.	Thinning would be beneficial because canopy cover would be reduced to enhance growth of understory vegetation.
Varied Thrush *Ixoreus naevius*	Mature forests with high canopy closure, high-stem density, multiple tree layers, a deciduous tree component, and a relatively open low understory and forest floor with much debris in patches. Fruit bearing shrub and tree species, and wet sites with deciduous vegetation	Stands would remain unsuitable until multiple tree layers and deciduous tree component develop.	Light, variable spaced thinning in the uplands may enhance development of tree layers, but moderate thinning would reduce too much canopy, and likely enhance development of understory shrubs more than mid-story trees. Because of need for high canopy closure, stem density, and tree layering, and indications that it may be area sensitive, this species may respond negatively to any type of timber harvest.
Vaux's Swift *Chaetura vauxi*	Associated with late-successional forests and large, hollow snags used as nest and roost trees. Availability of suitable large hollow snags and trees is a major limiting factor.	Stands would remain unsuitable until late successional characteristics develop, including open, multi-layered canopy and the presence of large, hollow snags.	Benefits most from long-term effects from thinning treatments resulting in lower tree densities (e.g. Riparian Reserves) which would best create conditions fostering the development of suitable habitat, including large trees, and eventually large snags, as well as a multi-layered canopy.
Wilson's Warbler *Wilsonia pusilla*	Deciduous shrub and sub-canopy layers in a wide range of forest age classes.	Would not likely occupy stands with high canopy cover which would preclude growth of herbs and forbs, shrubs, and trees in the understory.	Nesting opportunities would be reduced by partial overstory removal. Secondary canopy layers and shrubs could be damaged and/or removed, decreasing foraging opportunities. Hagar *et al*. (2004) noted that thinning was relatively neutral in impact to the Wilson's warbler. Additional habitat would become available for nesting as understory vegetation develops in treated areas.
Winter Wren *Troglodytes troglodytes*	Most commonly found in older and more in structurally complex areas in the forest. Requires forest floor complexity -shrubs, rootwads, down logs, ferns, and herbaceous vegetation. May persist in units with newly recruited or remnant down woody material and shrub habitat.	Where present, would continue to persist in portions of stands where newly recruited or remnant down woody material and shrub habitat is present. Where stands are lacking large down wood and an understory component, habitat would continue to be unsuitable for wrens until such components develop within the stand.	Species would benefit from thinning in areas where there is existing large down wood and where canopies are reduced which would facilitate the development of an understory of herbs and forbs, shrubs, and trees.
EAGLE PROTECTION ACT			
Golden Eagle *Aquila chrysaetos*	Associated with open and semi-open habitats. Nest on cliffs, in the upper one-third of deciduous and coniferous trees, or on artificial structures (e.g. artificial nesting platforms, electricity transmission towers, windmills).On the Roseburg District, primarily documented to nest in large conifer trees within late-seral forests near open habitats (e.g. meadows, valleys, and clearcuts)	High density of trees would limit the stand's ability to create diverse, multi-storied stands. Large trees or snags containing large limbs or structural characteristics to support a nest would be slow to develop.	With the exception of the stand of suitable habitat (Unit 30I) and Big Thunder Unit 31B, post-harvest conditions (high canopy cover) would limit the stand's ability to create diverse, multi-storied stands. Large trees or snags containing large limbs or structural characteristics to support a nest would not develop. Unit 31 B, under *Action Alternative 3* would create a stand with the highest amount of heterogeneity and would be expected to develop from a combination of no treatment areas, light to heavy thinning treatments, and gap creation within the stands. Thus, these species would benefit most from treatments of heavy thinning and gap creation under *Alternative 3* which would best create conditions fostering the development of suitable nesting, foraging, or roosting habitat.

Appendix D. Botany Summary

SSSP List Date: December 1, 2011 (IM-OR-2012-018)

Those Bureau Sensitive or Bureau Strategic species which are suspected or documented to occur within the Roseburg District BLM area are detailed below.

Bureau Sensitive Species. BLM Districts are responsible to assess and review the effects of a proposed action on *Bureau Sensitive* species. To comply with Bureau policy, Districts may use the following techniques:

a. Evaluation of species-habitat associations and presence of potential habitat.
b. Application of conservation strategies, plans, and other formalized conservation mechanisms.
c. Review of existing survey records, inventories, and spatial data.
d. Utilization of professional research and literature and other technology transfer methods.
e. Use of expertise, both internal and external, that is based on documented, substantiated professional rationale.
f. Complete pre-project survey, monitoring, and inventory for species that are based on technically sound and logistically feasible methods while considering staffing and funding constraints.

When Districts determine that additional conservation measures are necessary, options for conservation include, but are not limited to: modifying a project (e.g. timing, placement, and intensity), using buffers to protect sites, or implementing habitat restoration activities (IM-OR-2003-054).

Strategic Species. If sites are located, collect occurrence data and record in the corporate database.

Table D-1. Federally Listed & Bureau Sensitive Botanical Species.

Species	Within species range?	Habitat Present?	Species Present?	Reason for concern or no concern	Surveys Completed	Mitigation Measures
Threatened & Endangered Species						
Lupinus sulphureus var. *kincaidii* Kincaid's lupine (T)	**Yes**	**Yes**	No	Surveys performed, not detected.	July 2011	N/A
Plagiobothrys hirtus Rough popcorn flower (E)	**No**	No	No	No habitat present.	N/A	N/A
Sensitive Species						
Bryum calobryoides Beautiful bryum	**Yes**	Yes	No	Surveys performed, not detected	July 2011	N/A
Campylopus schmidii Golden sand moss	**Yes**	No	No	No habitat present.	N/A	N/A
Cephaloziella spinigera Spiny threadwort	**Yes**	No	No	No habitat present	N/A	N/A
Codriophorus depressus Racomitrium moss	**Yes**	No	No	No habitat present.	N/A	N/A
Entosthodon fascicularis Banded cord -moss	**Yes**	Yes	No	Surveys performed, not detected.	July 2011	N/A
Gymnomitrion concinnatum Braided frostwort	**Yes**	No	No	No habitat present.	N/A	N/A
Helodium blandowii Wetland plume moss	**Yes**	No	No	No habitat present	N/A	N/A
Meesia uliginosa Meesia moss	**Yes**	No	No	No habitat present	N/A	N/A

Species	Within species range?	Habitat Present?	Species Present?	Reason for concern or no concern	Surveys Completed	Mitigation Measures
Phymatoceros phymatodes Tuberous hornwort	**Yes**	No	No	No habitat present.	N/A	N/A
Porella bolanderi Bolanders's scalemoss	**Yes**	Yes	Yes	Surveys performed, not detected.	July 2011	N/A
Schistostega pennata Moss	**Yes**	No	No	No habitat present	N/A	N/A
Tetraphis geniculata Moss	**Yes**	No	No	No habitat present	N/A	N/A
Tomentypnum nitens Tomentypnum moss	**Yes**	No	No	No habitat present	N/A	N/A
Tortula mucronifolia Mucronleaf tortula moss	**Yes**	No	No	No habitat present	N/A	N/A
Trematodon asanoi Moss	**Yes**	No	No	No habitat present.	N/A	N/A
Bridgeoporus nobilissimus Giant polypore fungus	**Yes**	No	No	No habitat present.	N/A	N/A
Dermocybe humboldtensis Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Helvella crassitunicata Fungus	**Yes**	**No**	N/A	Surveys Not Practical. [1]	N/A	N/A
Phaeocollybia californica Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Phaeocollybia gregaria Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Phaeocollybia oregonensis Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Pseudorhizina californica Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Ramaria amyloidea Fungus	**Yes**	**No**	N/A	Surveys Not Practical. [1]	N/A	N/A
Ramaria rubella var. blanda Fungus	**Yes**	**No**	N/A	Surveys Not Practical. [1]	N/A	N/A
Ramaria spinulosa var. *diminutiva* Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Rhizopogon chamalelotinus Fungus	**Yes**	**Yes**	N/A	Surveys Not Practical. [1]	N/A	N/A
Rhizopogon exiguus Fungus	**Yes**	**No**	N/A	Surveys Not Practical. [1]	N/A	N/A
Bryoria subcana Lichen	**Yes**	No	No	No habitat present.	N/A	N/A
Calicium adspersum Lichen	**Yes**	No	No	No habitat present	N/A	N/A
Lobaria linita Lichen	**Yes**	No	No	No habitat present.	N/A	N/A
Pilophorus nigricaulis Lichen	**Yes**	No	No	No habitat present.	N/A	N/A
Stereocaulon spathuliferum Lichen	**Yes**	No	No	No habitat present.	N/A	N/A

Species	Within species range?	Habitat Present?	Species Present?	Reason for concern or no concern	Surveys Completed	Mitigation Measures
Adiantum jordanii California maiden-hair	**Yes**	No	No	No habitat present.	N/A	N/A
Arabis koehleri var. *koehleri* Koehler's rockcress	**Yes**	No	No	No habitat present.	N/A	N/A
Arctostaphylos hispidula *Hairy manzanita*	**Yes**	No	No	No habitat present.	N/A	N/A
Asplenium septentrionale Grass-fern	**Yes**	No	No	No habitat present.	N/A	N/A
Bensoniella oregana Bensonia	**Yes**	No	No	No habitat present.	N/A	N/A
Calochortus coxii Crinite mariposa-lily	**Yes**	No	No	No habitat present.	N/A	N/A
Calochortus umpquaensis Umpqua mariposa-lily	**Yes**	No	No	No habitat present.	N/A	N/A
Camassia howellii Howell’s camas	**Yes**	No	No	No habitat present.	N/A	N/A
Carex brevicaulis Bristly sedge	**Yes**	No	No	No habitat present.	N/A	N/A
Carex comosa Bristly sedge	**Yes**	No	No	No habitat present.	N/A	N/A
Cicendia quadrangularis Timwort	**Yes**	No	No	No habitat present	N/A	N/A
Cypripedium fasciculatum Clustered lady slipper	**Yes**	No	No	No habitat present.	N/A	N/A
Delphinium nudicaule Red larkspur	**Yes**	No	No	No habitat present.	N/A	N/A
Epilobium oreganum Oregon willow-herb	**Yes**	No	No	No habitat present	N/A	N/A
Eschscholzia caespitosa Gold poppy	**Yes**	No	No	No habitat present.	N/A	N/A
Eucephalus vialis Wayside aster	**Yes**	No	No	No habitat present	N/A	N/A
Frasera umpquaensis *Umpqua swertia*	**Yes**	No	No	No habitat present.	N/A	N/A
Horkelia congesta ssp. *congesta* Shaggy horkelia	**Yes**	No	No	No habitat present	N/A	N/A
Horkelia tridentata ssp. *tridentate* Three-toothed horkelia	**Yes**	No	No	No habitat present	N/A	N/A
Iliamna latibracteata California globe-mallow	**Yes**	No	No	No habitat present.	N/A	N/A
Kalmiopsis fragrans Fragrant kalmiopsis	**Yes**	No	No	No habitat present.	N/A	N/A
Lathyrus holochlorus Thin-leaved peavine	**Yes**	No	No	No habitat present.	N/A	N/A
Lewisia leeana Lee’s lewisia	**Yes**	No	No	No habitat present.	N/A	N/A
Limnanthes gracilis var. *gracilis* Slender meadow-foam	**Yes**	No	No	No habitat present.	N/A	N/A

Species	Within species range?	Habitat Present?	Species Present?	Reason for concern or no concern	Surveys Completed	Mitigation Measures
Lotus stipularis Stipuled trefoil	**Yes**	No	No	No habitat present.	N/A	N/A
Meconella oregana *White fairypoppy*	**Yes**	No	No	No habitat present.	N/A	N/A
Pellaea andromedifolia Coffee fern	**Yes**	**Yes**	No	Surveys performed, not detected.	July 2011	N/A
Perideridia erythrorhiza Red-rooted yampah	**Yes**	No	No	No habitat present.	N/A	N/A
Polystichum californicum California sword-fern	**Yes**	No	No	No habitat present.	N/A	N/A
Romanzoffia thompsonii *Thompson's mistmaiden*	**Yes**	Yes	Yes	Species present.	July 2011	Avoid population sites.
Schoenoplectus subterminalis Water clubrush	**Yes**	No	No	No habitat present.	N/A	N/A
Scirpus pendulus *Drooping rush*	**Yes**	No	No	No habitat present.	N/A	N/A
Sisyrinchium hitchcockii Hitchcock's blue-eyed grass	**Yes**	No	No	No habitat present.	N/A	N/A
Utricularia gibba Humped bladderwort	**Yes**	No	No	No habitat present	N/A	N/A
Utricularia minor Lesser bladderwort	**Yes**	No	No	No habitat present.	N/A	N/A
Wolffia borealis Dotted water-meal	**Yes**	No	No	No habitat present.	N/A	N/A
Wolffia columbiana Columbia water-meal	**Yes**	No	No	No habitat present.	N/A	N/A

[1] Surveys are considered not practical for these species based on the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guideline (Standards and Guidelines, pg. 9).

Table D-2. Bureau Strategic Botanical Species.

Scientific Name	Roseburg Occurrence?	Occurrence in the Project Area?
Bryophytes		
Campylopus subulatus	Documented	None Observed
Diplophyllum plicatum	Suspected	None Observed
Grimmia anomala	Suspected	None Observed
Orthotrichum bolanderi	Suspected	None Observed
Scouleria marginata	Documented	None Observed
Fungi		
Cazia flexiascus	Suspected	Surveys Not Practical. [1]
Choiromyces alveolatus	Suspected	Surveys Not Practical. [1]
Clavariadelphus subfastigiatus	Documented	Surveys Not Practical. [1]
Endogone oregonensis	Documented	Surveys Not Practical. [1]
Glomus pubescens	Suspected	Surveys Not Practical. [1]
Gomphus kauffmanii	Documented	Surveys Not Practical [1]
Gymnomyces monosporus	Documented	Surveys Not Practical. [1]
Hygrophorus albicarneus	Suspected	Surveys Not Practical. [1]
Mycena quinaultensis	Suspected	Surveys Not Practical. [1]
Nolanea verna var. *isodiametrica*	Suspected	Surveys Not Practical. [1]
Otidea smithii	Documented	Surveys Not Practical. [1]
Phaeocollybia dissiliens	Suspected	Surveys Not Practical. [1]
Phaeocollybia pseudofestiva	Suspected	Surveys Not Practical. [1]
Psathyrella quercicola	Suspected	Surveys Not Practical. [1]
Ramaria abietina	Documented	Surveys Not Practical. [1]
Ramaria botrytis var. aurantiiramosa	Suspected	Surveys Not Practical. [1]
Ramaria concolor f. tsugina	Suspected	Surveys Not Practical. [1]
Ramaria conjunctipes var. sparsiramosa	Documented	Surveys Not Practical. [1]
Ramaria coulterae	Suspected	Surveys Not Practical. [1]
Ramaria gelatiniaurantia	Suspected	Surveys Not Practical. [1]
Ramaria largentii	Documented	Surveys Not Practical. [1]
Ramaria rubribrunnescens	Suspected	Surveys Not Practical. [1]
Ramaria suecica	Documented	Surveys Not Practical. [1]

Scientific Name	Roseburg Occurrence?	Occurrence in the Project Area?
Ramaria thiersii	Suspected	Surveys Not Practical. [1]
Rhizopogon brunneiniger	Suspected	Surveys Not Practical. [1]
Rhizopogon clavitisporus	Suspected	Surveys Not Practical. [1]
Rhizopogon flavofibrillosus	Documented	Surveys Not Practical. [1]
Rhizopogon semireticulatus	Documented	Surveys Not Practical. [1]
Rhizopogon variabilisporus	Suspected	Surveys Not Practical. [1]
Sarcodon fuscoindicus	Documented	Surveys Not Practical. [1]
Lichens		
Buellia oidalea	Suspected	None Observed
Calicium quercinum	Suspected	None Observed
Chaenotheca subroscida	Documented	None Observed
Collema undulatum var. granulosum	Suspected	None Observed
Hypogymnia duplicata	Suspected	None Observed
Lecanora pringlei	Suspected	None Observed
Schaereria dolodes (Lecidea dolodes)	Documented	None Observed
Leptogium platynum	Documented	None Observed
Leptogium teretiusculum	Documented	None Observed
Peltula euploca	Suspected	None Observed
Schaereria dolodes	Documented	None Observed
Sclerophora peronella	Documented	None Observed
Umbilicaria hirsute	Suspected	None Observed
Vezdaea stipitata	Documented	None Observed

[1] Surveys are considered not practical for these species based on the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guideline (Standards and Guidelines, pg. 9).

Appendix E. Aquatic Conservation Strategy Assessment

Project: **Thunderbolt Thinning and Hazardous Fuels Treatment**
Prepared By: Dan Dammann and Jeffrey McEnroe
Date: July 23, 2013

The Aquatic Conservation Strategy (ACS) was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The ACS must strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitats. This approach seeks to prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds. (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, page B-9).

ACS Components:

a. *Riparian Reserves (ACS Component #1)*

Riparian Reserves were established in the 1995 ROD/RMP (pg. 23) and specifies Riparian Reserve widths equal to the height of two site potential trees on each side of intermittent and perennial fish-bearing streams as measured from the ordinary high water line; and one site-potential tree height on each side of a stream channel for intermittent and perennial non-fish-bearing streams. Riparian Management Areas surrounding natural lakes and ponds greater than .25 acres receive one site-potential tree height from water's edge. The height of a site-potential tree for the Middle North Umpqua and Little River Watersheds has been determined to be 180 feet. Some of the objectives of this project are to accelerate the development of late seral characteristics and increase the diversity of habitat in the Riparian Reserves (pgs. 35-36 of EA).

b. *Key Watersheds (ACS Component #2)*

Key Watersheds were established "as refugia . . . for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species [ROD/RMP, pg. 20]." There are no Key Watersheds within the Thunderbolt project area.

c. *Watershed Analysis (ACS Component #3) and other pertinent information:*

In developing the project, the Middle North Umpqua Watershed Analysis (2001) and Little River Watershed Analysis (1995) was used to evaluate existing conditions, establish desired future conditions, and assist in the formulation of appropriate alternatives. Both Watershed Analyses are available for public review at the Roseburg District office or can be viewed under "Plans & Projects" on the Roseburg District website at: http://www.blm.gov/or/districts/roseburg/plans/inventas.php.

Existing watershed conditions are described in the *Hydrology* and *Aquatic Habitat & Fisheries* sections of the EA and also in the both Watershed Analyses. The short and long term effects to aquatic resources are also described in these sections of the EA.

d. *Watershed Restoration (ACS Component #4)*

One of the purposes of this project is to accelerate tree growth and the attainment of late successional characteristics and diversity of Riparian habitat. Therefore, the proposed action is considered to be a watershed restoration project.

Additionally, since 1994, numerous stream enhancement projects have been implemented in the Little River and Middle North Umpqua Watersheds. This includes placing instream structures

(e.g. logs, boulders, root wads, etc…) to improve aquatic habitat in streams, replacing culverts identified as barriers to fish passage to open up access to additional habitat, or improving or decommissioning roads to reduce road sediment impacts to aquatic systems. This work has been done in a collaborative effort with private timber companies, the Partnership for the Umpqua Rivers, the United States Forest Service and the Oregon Department of Fish and Wildlife. Future work would be implemented as budgets allow.

Range of Natural Variability within the Watershed:

Based on the dynamic, disturbance-based nature of aquatic systems in the Pacific Northwest, the range of natural variability at the site scale would range from 0-100 percent of potential for any given aquatic habitat parameter over time. Therefore, a more meaningful measure of natural variability is assessed at scales equal to or greater than the fifth-field watershed scale. At this scale, spatial and temporal trends in aquatic habitat condition can be observed and evaluated over larger areas, and important cause/effect relationships can be more accurately determined.

Natural disturbance events to aquatic systems in the Pacific Northwest include wildfires, floods, and landslides. Average fire return intervals at the drainage scale for the both watersheds were calculated between 20 and 100 years (prior to the advent of fire suppression).

Most of the Middle North Umpqua Watershed is dominated by undifferentiated basalt and andesite lava flows as well as undifferentiated volcaniclastic deposits. Most of the Little River Watershed is dominated by the Little Butte Volcanic formation and the Colestin formation. The granitic terrain found in the Little Butte Volcanic Formation has historically had a landslide density of 12.1 landslides per square mile while the Colestin formation has had a history of 7.9 landslides per square mile (Little River Watershed Analysis)

Timber harvesting and road construction over the past 50 years have substantially increased the frequency and distribution of landslides above natural levels in the project area. However, there is a downward trend in landslide incidence over the last 50 years that is associated with improved management practices. On BLM land, future landslides, mostly during large storm events, are expected to deliver large wood and rock fragments to lower-gradient streams because of BLM Riparian Reserves. These events would more closely resemble landslides within relatively unmanaged forests. These disturbance events are the major natural sources of sediment and wood to a stream system and are very episodic in nature.

Due to the dynamic nature of these disturbance events, stream channel conditions vary based on the time since the last disturbance event. This results in a wide range of aquatic habitat conditions at the site level. Site level habitat conditions can be summarized by Oregon Department of Fish and Wildlife (ODFW) habitat surveys. Surveys have been conducted throughout the Little River Watershed, mostly in the third through sixth-order streams. Approximately 21 stream reference reaches in the Little River Sub-Basin of the Umpqua Basin were used to compare against all surveyed streams. These relatively unmanaged reaches represent the variability of conditions within natural stream systems as well as characteristics desirable for a variety of fish species (including salmonid habitat). When compared to these “reference streams”, aquatic habitat survey data from the Little River Watershed indicates that most of the tributaries are lacking large woody debris. While this condition is considered typical at any given site scale, it is considered atypical for most streams to be devoid of wood at the larger fifth-field scale. Therefore, at this larger scale, aquatic habitat conditions are considered to be outside the range of natural variability.

Because of its dynamic nature, sediment effects to streams can only be described in general terms. It is important to remember that ODFW instream habitat data is a snapshot in time. When compared to reference reaches, sediment conditions in most of the tributaries of Little River Watershed appear to

be similar to the reference reaches in that they fall in the low to low-moderate erosion risk class (Little River Watershed Analysis).

Stream temperatures vary naturally in these watersheds as a result of variation in geographic location, elevation, climate, precipitation, and distance from the source water. Stream temperatures also naturally vary as a response to the natural disturbance events mentioned in the previous paragraphs, as well as current practices on private forest, agricultural, and residential properties. Due to the large amount of riparian clearing that has occurred over the last 150 years (converting forest into farmland), coupled with management-induced channel widening, irrigation withdrawals, and loss of gravels, it is likely that stream temperature increases have been greater over larger spatial and temporal scales than observed naturally. One of BLM's objectives for managing Riparian Reserves is to maintain and enhance shade providing vegetation along streams.

Changes in stream flow can result from consumptive withdrawals and effects of land use activities on storm water runoff, infiltration, storage and delivery. Agricultural and domestic withdrawals are common along Little River, the North Umpqua River and their tributaries. Many tributaries within both watersheds have also been cleaned (had large wood removed) or salvage logged. BLM Forest management in the project area would be designed to reduce or prevent watershed impacts.

Table E-1. Individual Aquatic Conservation Strategy Objective Assessment.

ACS Objective	Site/Project Scale Assessment	Fifth-Field Watershed Scale Assessment
	Scale Description: Units identified in this project are located in 8 separate seventh-field drainages (detailed below*) distributed throughout the watersheds totaling roughly 21,974 acres in size. The BLM manages approximately 10,065 acres in these drainages (46%). Units proposed for treatment represent 7% of the total drainage area, and 16% of the BLM-managed lands in the drainage.	Scale Description: This project is located in the Little River and Middle North Umpqua fifth-field watersheds. These watersheds total roughly 276,794 acres in size (Little River = 131,845, Middle North Umpqua = 144,949). The BLM manages approximately 31,634 acres in these watersheds (11%). Units proposed for treatment represent 0.58% of the total watershed area, and 5% of the BLM-managed lands in the watersheds.
1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Within the drainages, the proposed action would result in approximately 461-487acres of thinned riparian stands and up to 6 acres of gap creation. Trees within these treated stands would attain larger heights and diameters in a shorter amount of time than if left untreated. PDF's such as variable width "no-harvest" buffers established along streams would retain shading and therefore maintain water temperature. Gaps would only be created in the outer edges of the Riparian Reserve. "no-harvest" buffers established on streams in or adjacent to proposed units would prevent disturbance to stream channels and stream banks and intercept surface run-off allowing sediment transported by overland flow to be filtered out before reaching active waterways (EA, pg. 86) and would prevent impacts to aquatic resources. This treatment would speed attainment of this objective.	This treatment would also speed attainment of this objective at the watershed scale.
2. Maintain and restore spatial and temporal connectivity within and between watersheds	Within the project drainages, the proposed project would have no influence on aquatic connectivity. Therefore this treatment would maintain the existing connectivity condition at the site scale.	Within the watershed, the proposed project would have no influence on aquatic connectivity. Therefore this treatment would maintain the existing connectivity condition at the watershed scale.
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations	Treatments would not reduce canopy closure to an extent that could potentially influence in-stream flows (EA, pg. 86). In addition, "no-harvest" buffers established on all streams in or adjacent to proposed units would prevent disturbance to stream channels and stream banks (EA, pg. 86). Therefore, these treatments would maintain the physical integrity of the aquatic system at the site scale.	This treatment would also maintain the physical integrity of the aquatic system at the watershed scale.
4. Maintain and restore	Project design features (PDF) would ensure	Based on the information discussed at the

ACS Objective	Site/Project Scale Assessment	Fifth-Field Watershed Scale Assessment
water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	that water quality would not be adversely impacted by the proposed action. PDF's such as variable width "no-harvest" buffers established along streams would retain shading and hence maintain water temperature. "no-harvest" buffers established on streams in or adjacent to proposed units would prevent disturbance to stream channels and stream banks and intercept surface run-off allowing sediment transported by overland flow to be filtered out before reaching active waterways (EA, pg. 86). Therefore, this treatment would maintain the existing water quality at the site scale.	site scale, this project would also maintain water quality at the watershed scale.
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved.	As mentioned above, "no-harvest" buffers established on streams in or adjacent to proposed units would prevent disturbance to stream channels and stream banks and intercept surface run-off allowing any management related sediment transported by overland flow to settle out before reaching active waterways (EA, pg. 86). Therefore, this project would maintain the existing sediment regime.	This project would maintain the existing sediment regime at the watershed scale as well.
6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.	Treatments would not reduce canopy closure to an extent that could potentially influence in-stream flows (EA, pg. 86). In addition, new road construction would not extend the drainage network, or contribute to a potential increase in peak flow because the new roads would be located on ridge tops or stable side slopes with adequate cross drain structures. There are 5 proposed stream crossings; it is believed that any sediment contributions from these crossings would be negligible when compared to the amount of sediment contributed along the entire length of the stream from all natural sources. Following first seasonal rains, and they would be indistinguishable from background levels resulting in no measureable change to water quality. (EA pg. 87). Therefore, this treatment would maintain stream flows within the range of natural variability at the site scale.	As discussed at the site scale, thinning treatments would not reduce canopy closure to an extent that could potentially influence in-stream flows. Therefore, at the larger watershed scale, this treatment would also maintain stream flows within the range of natural variability.
7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table	As discussed in #6 above, this project would maintain stream flows within the range of natural variability at the site scale. Therefore, it would also maintain stream	At the watershed scale, this project would also maintain stream interactions with the floodplain and respective water tables within the range of natural variability.

ACS Objective	Site/Project Scale Assessment	Fifth-Field Watershed Scale Assessment
elevation in meadows and woodlands.	interactions with the floodplain and respective water tables at the site scale.	
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	The proposed treatment is designed to return riparian stands to a more natural density and growth trajectory. Therefore this treatment would serve to restore plant species composition and structural diversity at the site scale.	The proposed treatment is designed to return riparian stands to a more natural density and growth trajectory. Therefore this treatment would serve to restore plant species composition and structural diversity at the larger watershed scale as well.
9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	As mentioned previously, one of the objectives of this project is to restore riparian stand conditions in the proposed treatment areas. Implementation of riparian restoration projects would help restore adequate habitat to support riparian-dependent species at the site and watershed scales.	As mentioned previously, the intent of this project is to restore riparian stand conditions in the proposed treatment areas. Implementation of riparian restoration projects would help restore adequate habitat to support riparian-dependent species at the site and watershed scales.

*Detailed scale description of the 8 seventh-field drainages: Hill Creek, Bob Creek, Hogback Creek, Cole Creek, Fox Creek, Bond Creek, Greenman Creek, and Shivigny Creek.

1) The **Hill Creek** drainage is roughly 6,074 acres in size. The BLM manages approximately 2,885 acres in this drainage (47%). Units proposed for treatment represent 3% of the total drainage area, and 6% of the BLM-managed lands in the drainage.
2) The **Bob Creek** drainage is roughly 2,177acres in size. The BLM manages approximately 1,549 acres in this drainage (71%). Units proposed for treatment represent 25% of the total drainage area, and 34% of the BLM-managed lands in the drainage.
3) The **Hogback Creek** drainage is roughly 4,235 acres in size. The BLM manages approximately 1,483acres in this drainage (35%). Units proposed for treatment represent 5% of the total drainage area, and 14% of the BLM-managed lands in the drainage.
4) The **Cole Creek** drainage is roughly 2,853 acres in size. The BLM manages approximately 1,766 acres in this drainage (62%). Units proposed for treatment represent 11% of the total drainage area, and 17% of the BLM-managed lands in the drainage.
5) The **Fox Creek** drainage is roughly 1,359 acres in size. The BLM manages approximately 181acres in this drainage (13%). Units proposed for treatment represent 5% of the total drainage area, and 13% of the BLM-managed lands in the drainage.
6) The **Bond Creek** drainage is roughly 987 acres in size. The BLM manages approximately 197 acres in this drainage (20%). Units proposed for treatment represent 3% of the total drainage area, and 14% of the BLM-managed lands in the drainage.
7) The **Greenman Creek** drainage is roughly 1,858 acres in size. The BLM manages approximately 1,000 acres in this drainage (54%). Units proposed for treatment represent 13% of the total drainage area, and 24% of the BLM-managed lands in the drainage.
8) The **Shivigny Creek** drainage is roughly 2,431 acres in size. The BLM manages approximately 1,004 acres in this drainage (41%). Units proposed for treatment represent 3% of the total drainage area, and 7% of the BLM-managed lands in the drainage.

Appendix F. Effects on Live Vegetation Development Analytical Methodology

Analytical Question:

How will treatments alter stand dynamics and what effects will they have on the stand structure and composition of selected live vegetation components, i.e. trees and shrubs?

Analytical Assumptions:

The BLM must make some analytical assumptions to complete its analysis. Key assumptions made are:

- Stand exam data adequately represents the current unit conditions or can be updated by simulation to current conditions.
- Computer simulations beyond the range of the base data on which the Organon model was built are considered adequate for characterizing differences between alternatives.
- Simulations for 100 years into the future are adequate to distinguish between action and no-action alternative outcomes.
- Stand development outcomes are based on a single harvest entry.

Analytical Methodology:

The BLM analyzes impacts to live vegetation by examining site specific data, scientific literature and the outputs from computer simulations.

The methodology used data from site specific stand inventories and the Organon growth simulator model to depict current stand conditions (e.g. trees per acre, diameters, volumes, species, and canopy cover).

- Stand Age:
  Stand boundaries were determined from the Forest Operation Inventory (FOI). Stand ages were derived from stand exam information collected within the FOI boundaries. Breast height ages were sampled on dominant trees. Typically one tree per four acres was sampled. Total age was calculated by ORGANON using the breast height age and adjusting it to calculate how long that tree took to get to breast height (4.5 feet from the ground) based on site productivity class. A simple average of the sample trees determined the stand age.

  Older remnant trees may be present but are not the numerically predominant stand components and would generally be targeted for retention. Since thinning would focus on removal of intermediate and suppressed canopy layers, it is possible that suppressed trees designated for cutting may be older than the prevailing stand age.

- Organon Model Description:
  Organon is an individual-tree, distance-independent model developed by Oregon State University from data collected in western Oregon forest stands (Hann 2009). The architecture of the model makes it applicable for simulations of traditional and non-traditional silviculture (Hann 1998).

  The southwest Oregon variant (SWO-Organon) was selected as the most appropriate for modeling the Thunderbolt stand types, based on the stands' geographic location, species composition, and site productivity.

Simulations of stand growth extend beyond the Organon model's range of data but are within the range considered reasonable for evaluation of stand development trajectories (Tappeiner *et al.* 1997, Andrews *et al.* 2005). The timing of harvests and other silvicultural treatments occur well within the range of the model's validated growth projection capabilities.

Organon can adequately simulate *regular* tree mortality caused by inter-tree competition. However, it underestimates tree mortality from causes other than inter-tree competition, such as insects, disease, windthrow, and stem breakage (Tappeiner *et al.* 1997). This type of mortality is *irregular*, or episodic in nature, and it is inherently difficult to predict the exact time period it will occur (Franklin *et al.* 1987). The Organon mortality equations predict that the risk of dying is very low for trees larger than 20 inches in diameter or with crown ratios greater than 70 percent (Hann and Wang 1990). For mature stands, mortality from inter-tree competition becomes less significant as stands age and mortality from other factors becomes more substantial (Franklin *et al.* 2002).

To account for irregular mortality, the same adjustment factor used for the Roseburg BLM effects analysis of the Northwest Forest Plan was used for Johnson-Cleghorn simulations via the thinning function in the Organon model. The factor is applied only to trees greater than 20" diameter breast height beginning at stand age 100-years-old, to simulate irregular mortality of larger trees. The factor was developed from a review of ecological literature and local inventory data (Lewis and Pierle1991).

Treatment Modeling Assumptions:

- Aggregate the simulation outcomes based on the proportion of a specific treatment at the unit and/or project level to reflect overall effects.

- The Organon model as currently structured is not capable of simulating the level of stand heterogeneity present in the proposed alternatives as a single integrated outcome (Andrews *et al.* 2005). The most feasible option for stands partitioned with substantially different treatments is to model the various treatments as individual discrete units. The simulated growth responses of each treatment can then be aggregated based on the proportion of each treatment type within a stand.
- The aggregation approach has the drawback that it does not take into account the effect of "edge" on mature border trees between treatments or seedling growth in gaps.
- Based on the current literature, no adjustment was made for edge effect on overstory trees located at the boundaries of different treatment types. Roberts and Harrington (2008) showed no significant difference between border tree growth at the edge of thinned and unthinned stands. Roberts and Harrington (2005) and York and Battles (2008) evaluated the potential effects on growth for overstory trees along gap edges. Based on their analysis the percent of growth change and given the amount and size of gaps proposed in *Alternatives 2 and 3*, growth effects would be less than two percent.
- Tree growth within gaps is substantially affected by initial gap size and the subsequent height growth of the adjacent stand (Malcolm *et al.* 2001).

- Natural regeneration is expected to occur following harvest (Bailey 1996; Maas-Hebner *et al.* 2005). The general predominance of Douglas-fir in the overstory of Thunderbolt stands would

likely result in dominance of that species in the understory, with other species occurring in proportion to their representation in the stands.

Snags and Down Wood Analytical Methodology

Analytical Question:

How will treatments alter stand dynamics and what effects will that have on the production of dead wood, i.e. snags and down wood?

Analytical Assumptions:

The BLM must make some analytical assumptions to complete its analysis. Key assumptions made are:

- Stand exam data adequately represents the current unit conditions or can be updated by simulation to current conditions.
- Computer growth model simulations beyond the range of the base data on which the model was built are considered adequate for characterizing differences between alternatives.
- Simulations for 100 years into the future are adequate to distinguish between alternative outcomes.

Analytical Methodology:

The BLM analyzes impacts dead wood by examining data depicting current conditions, literature and the outputs from computer simulations.

The methodology used includes:

Site specific data is used to depict stand conditions at the time of the inventory, e.g. existing snags and down wood. This data is not used for further analysis because this amount is assumed not to vary between alternatives.

Simulate the alternative prescriptions for a period of 100 years into the future using a representative stand closely matching the average condition.

Cumulative dead wood outputs from the Organon growth simulations are summarized for the 100 years of simulation for each proposed sale by alternative. Dead wood components include the trees killed by both regular and irregular mortality processes described previously.

Appendix G. Fire and Fuels Management

Project: Thunderbolt Thinning and Hazardous Fuels Treatment
Prepared By: Erin Banwell and Krisann Kosel
Date: 7/1/2013

1. **Definitions**

a. Fuel model: A set of fuelbed inputs needed by a particular fire behavior or fire effects model. The 40 standard fire behavior fuel models were used (Scott and Burgan, 2005).

Specific fuel models used in this analysis:

- Shrub fuel type models (SH)
    - Low load dry climate shrub (SH1): The primary carrier of fire in SH1 is woody shrubs and shrub litter.
    - Moderate load dry climate shrub (SH2): The primary carrier of fire in SH2 is woody shrubs and shrub litter.
    - Very high load, dry climate shrub (SH7): The primary carrier of the fire in SH7 is woody shrubs and shrub litter.
- Timber-understory fuel type models (TU)
    - Low load dry climate timber-grass-shrub (TU1): The primary carrier of fire in TU1 is low load of grass and/or shrub with litter.
    - Very high load, dry climate timber-shrub (TU5): The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory.
- Timber litter fuel type models (TL)
    - Moderate load conifer litter (TL3): The primary carrier of fire in TL3 is moderate load conifer litter, light load of coarse fuels.
    - High load conifer litter (TL5): The primary carrier of the fire in TL5 is high load conifer litter; light slash or mortality fuel.
- Slash-blowdown fuel type models (SB)
    - High load activity fuel or moderate load blowdown (SB3): The primary carrier of fire in SB3 is heavy dead and down activity fuel or moderate blowdown.

b. Crown fire: Fire that advances from top to top of trees or shrubs more or less independent of a surface fire.

c. Surface fire: Fire that burns loose debris on the surface which includes dead branches, leaves, and low vegetation.

d. Heat per unit area: Total amount of heat released per unit area as the flaming front of the fire passes, expressed as Btu/square foot, a measure of the total amount of heat released in flames.

e. Flame length: The distance from the ground at the leading edge of the flame to the average flame tip (Figure 1).

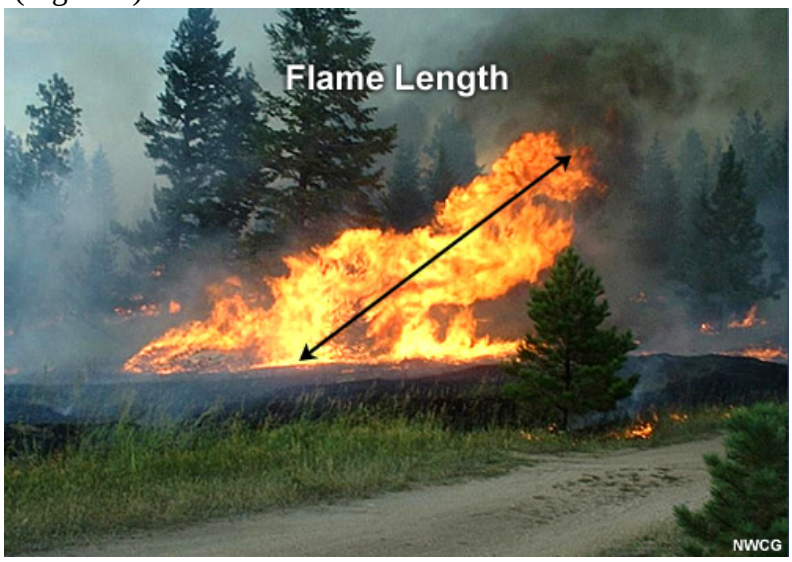


Figure 1. Measurement of flame length (National Wildfire Coordinating Group, 2013).

f. Rate of spread: The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains per hour for a specific period in the fire's history.

g. Crown fire potential: Whether environmental conditions are such that a fire can maintain itself as either a passive or active crown fire.

2. Weather Parameters

Table 1. Summary weather data from Silver Butte RAWS for the month of August, used as input parameters in FlamMap.

Parameter	Factor	Value
20 foot Wind Speed	Average high wind speed for the month from 1993-2012 measured 20 feet above the vegetation	14 miles/ hour
Wind Direction	Average direction from which the wind is blowing, specified in degrees increasing clockwise from north (which is zero degrees) for the month from 1993-2012	243 degrees
1 hour Dead Fuel Moisture	Average low percentage of moisture contained in dead material less than ¼ inch in diameter for the month from 1993-2012	4 %
10 hour Dead Fuel Moisture	Average low percentage of moisture contained in dead material ¼ inch to 1 inch in diameter for the month from 1993-2012	6 %
100 hour Dead Fuel Moisture	Average low percentage of moisture contained in dead material 1 inch to 3 inches in diameter for the month from 1993-2012	10 %
Live Woody Fuel Moisture	Percentage of moisture contained within live woody fuels when annual growth complete and plants begin to enter dormancy	60 %
Live Herbaceous Fuel Moisture	Percentage of moisture contained within grasses and forbs when annual growth is complete but plants are not yet fully cured or dead	40 %

Note: these weather parameters and the resulting outputs from the model do not account for long term drought or climate changes.

3. **Historic Fire Data (1993-2012 within the modeling area only)**
    - Total of 29 fires
    - 13 human accidental
    - 11 arson
    - 5 lightning

4. **Fire Behavior Models and Vegetation Data**
    a. **LANDFIRE 2008 (version 1.10):** The Landscape Fire and Resource Management Planning Tools (LANDFIRE) is an interagency vegetation, fire, and fuel characteristics mapping program sponsored by the United States Department of the Interior (DOI) and the United States Department of Agriculture (USDA). LANDFIRE landscape files are geospatial map layers that represent topography, vegetation, and canopy characteristics at a 30-meter grid resolution.
    b. **FlamMap:** A fire behavior mapping and analysis software application that computes potential fire behavior characteristics such as rate of spread, flame length, and fireline intensity over an entire landscape under constant weather and fuel moisture conditions.
    c. **BehavePlus:** A fire modeling system containing a collection of mathematical models that describe fire and the fire environment. BehavePlus can be used for a multitude of fire management applications, including projecting the behavior of an ongoing fire, planning prescribed fires, and training.

5. Fire Behavior Characteristics Chart (Haul Chart)

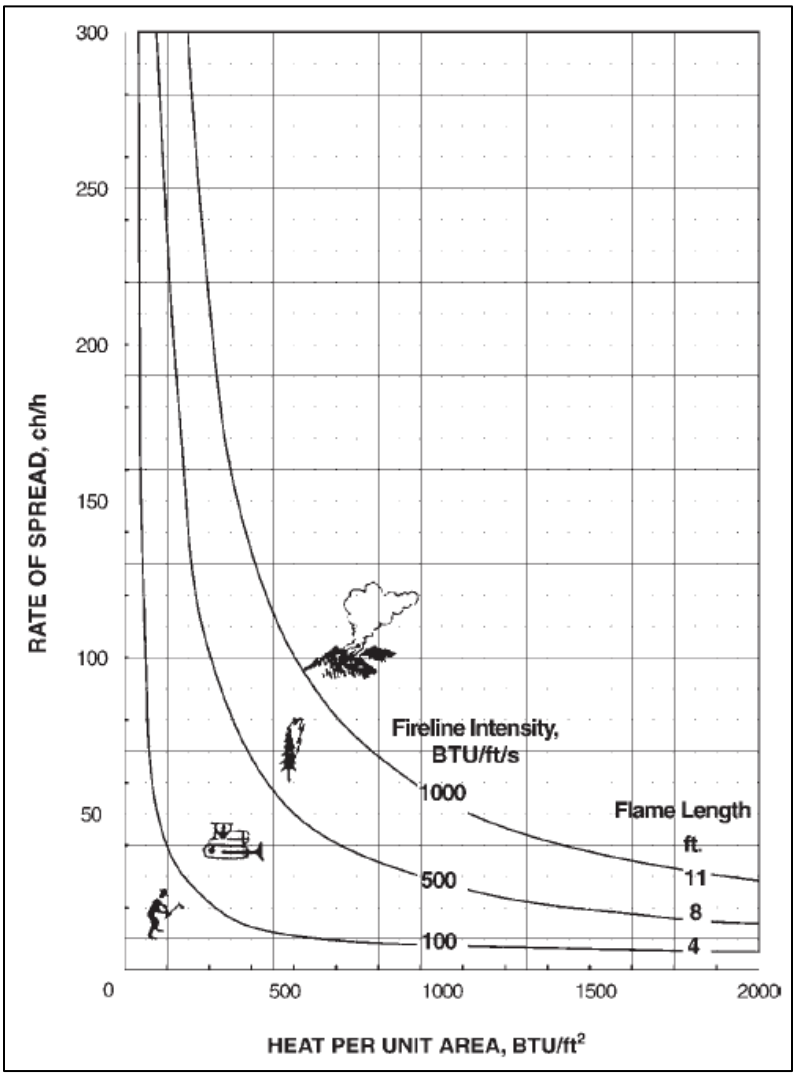


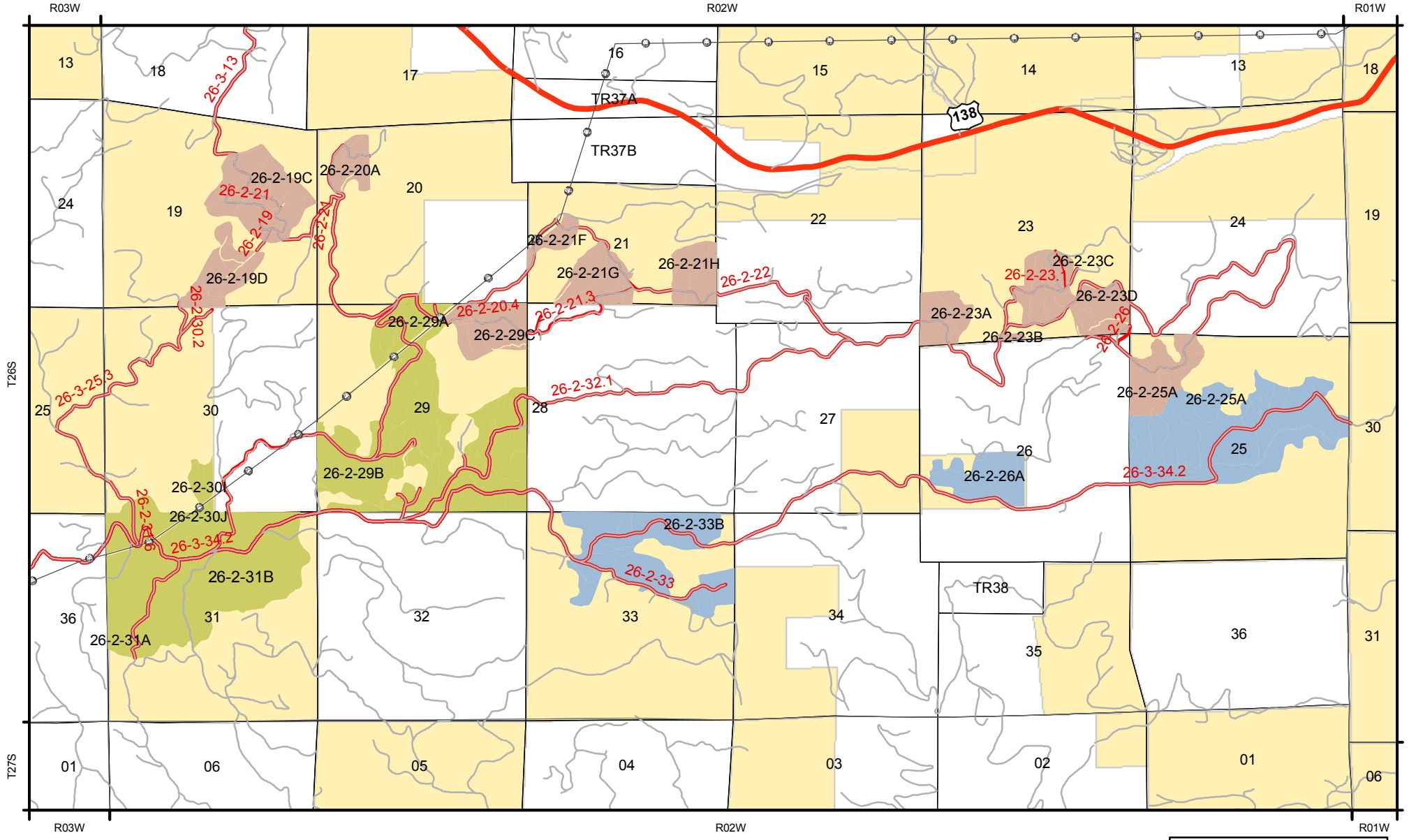
Figure 2. Fire behavior characteristics chart (National Wildfire Coordinating Group, 2006).

Table 2. Interpretation of how flame lengths affect fire suppression actions (National Wildfire Coordinating Group, 2004).

Flame Length	Fire Suppression Interpretations
< 4 feet	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold.
4 to 8 feet	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold the fire. Dozers, engines, and retardant drops can be effective.
8 to 11 feet	Fires may present serious control problems: torching, crowning, and spotting. Control efforts at the head would probably be ineffective.
> 11 feet	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective.

Appendix H. Map Packet Table of Contents

Figure 1. Thunderbolt EA - Proposed Units and Haul Routes



Legend

- Big Thunder Units
- Rolling Thunder Units
- Thundering Herd Units
- BLM ownership
- Haul Route
- Roads
- Highway 138
- Power Transmission Line

Creation Date: 9/4/2013

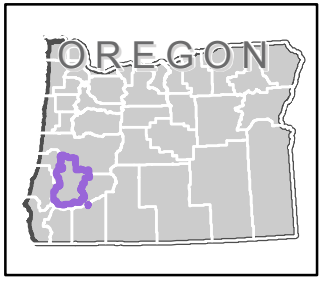
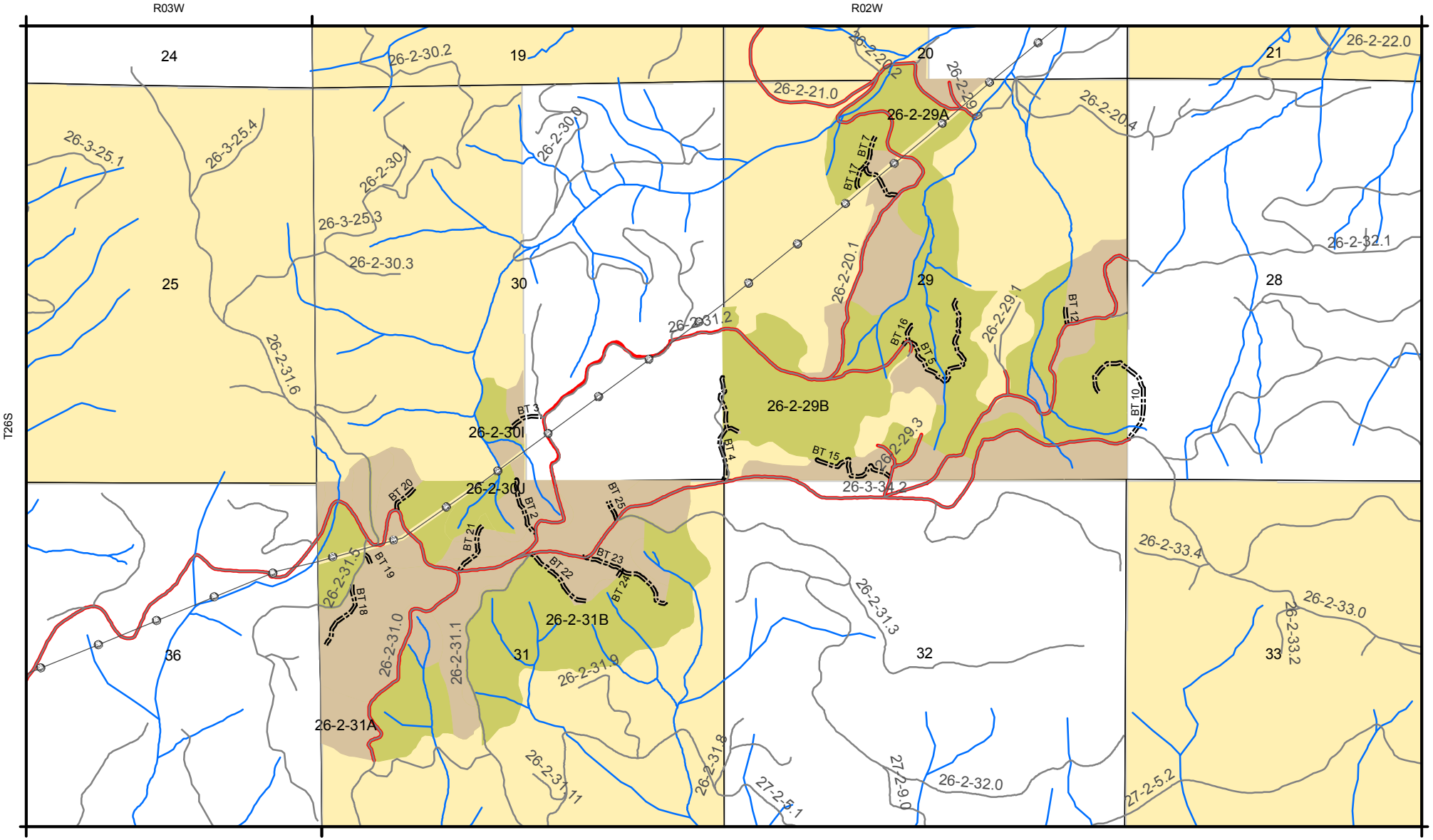


Figure 2. Big Thunder - Proposed Units and Roads



Legend

Big Thunder Units

- CABLE
- GROUND
- Big Thunder Spurs
- Haul Route
- Roads
- Streams
- Power Transmission Line
- BLM ownership

0 0.25 0.5 1

Miles

N W E S

Creation Date: 9/3/2013

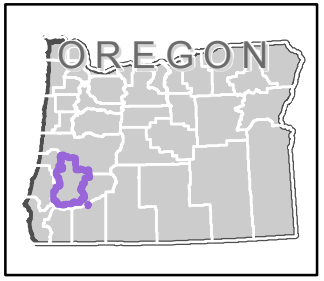
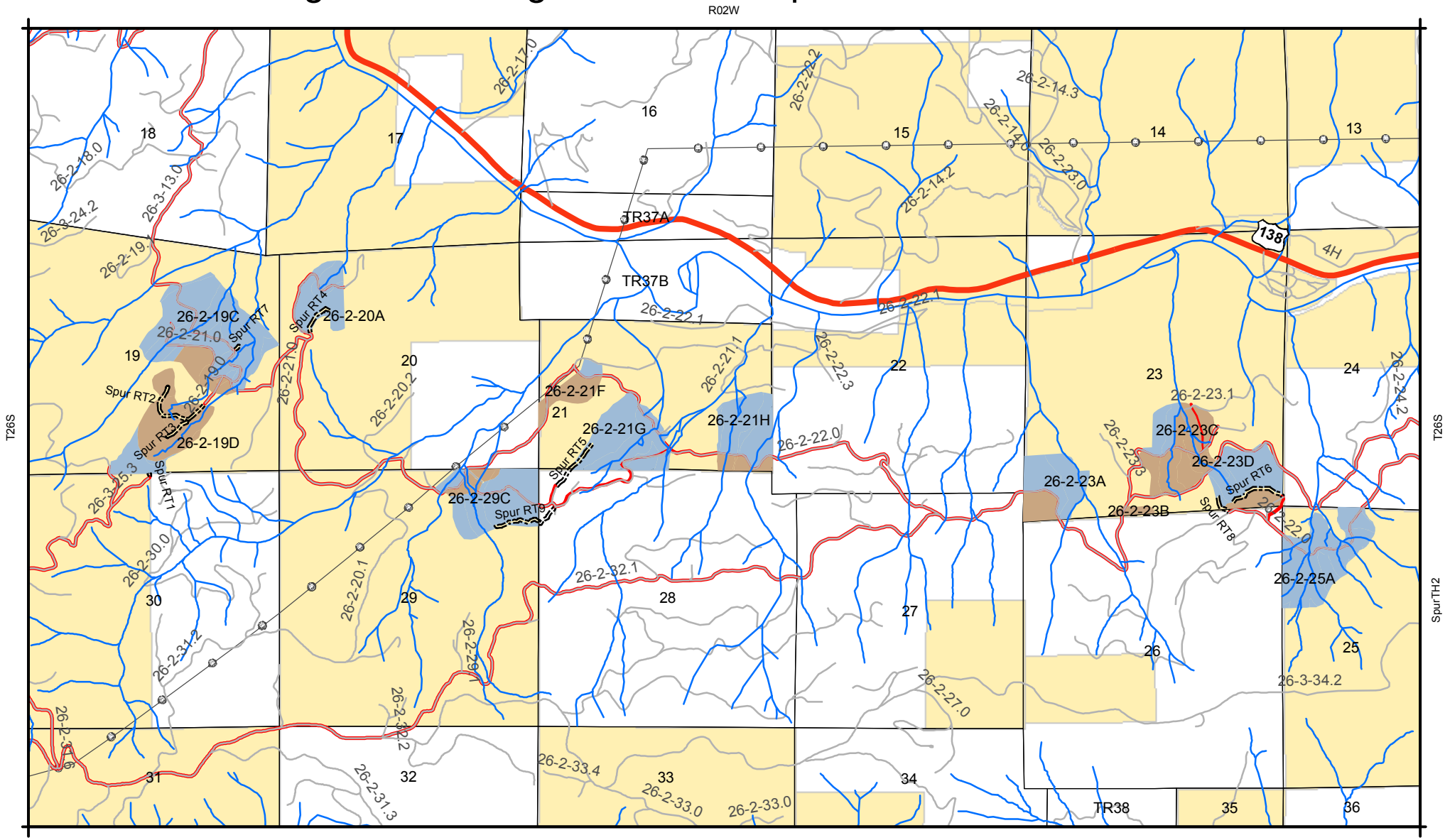


Figure 3. Rolling Thunder - Proposed Units and Roads



Legend

Rolling Thunder Units

- Cable yarding
- Ground-based Yarding
- Rolling Thunder Spurs
- Haul Route
- Streams
- Roads
- Highway 138
- Power Transmission Line
- BLM ownership

N
W E
S

0 0.25 0.5 1

Miles

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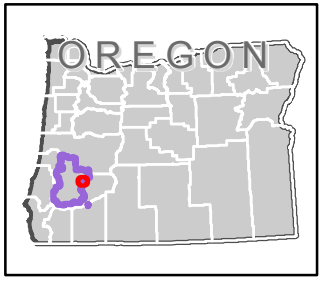
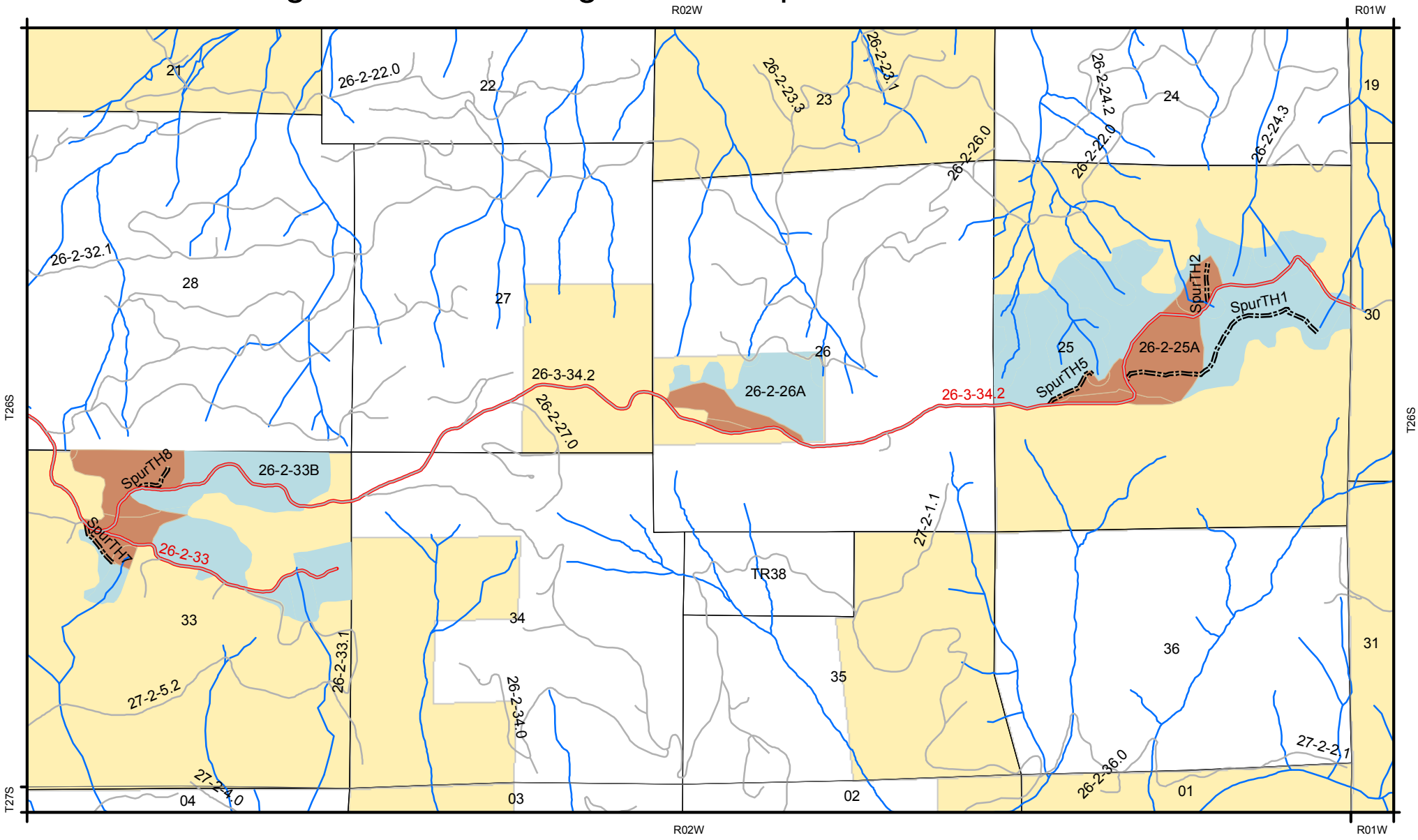


Figure 4. Thundering Herd - Proposed Units and Roads



Legend

Thundering Herd Units

- Cable Yarding
- Ground-based Yarding
- Thundering Herd Spurs
- Haul Route
- Roads
- Streams
- BLM ownership

N
W E
S

0 0.25 0.5 1

Miles

Creation Date: 9/4/2013

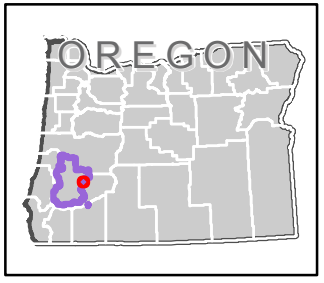


Figure 5. Thunderbolt EA - Proposed Hazardous Fuels Treatment

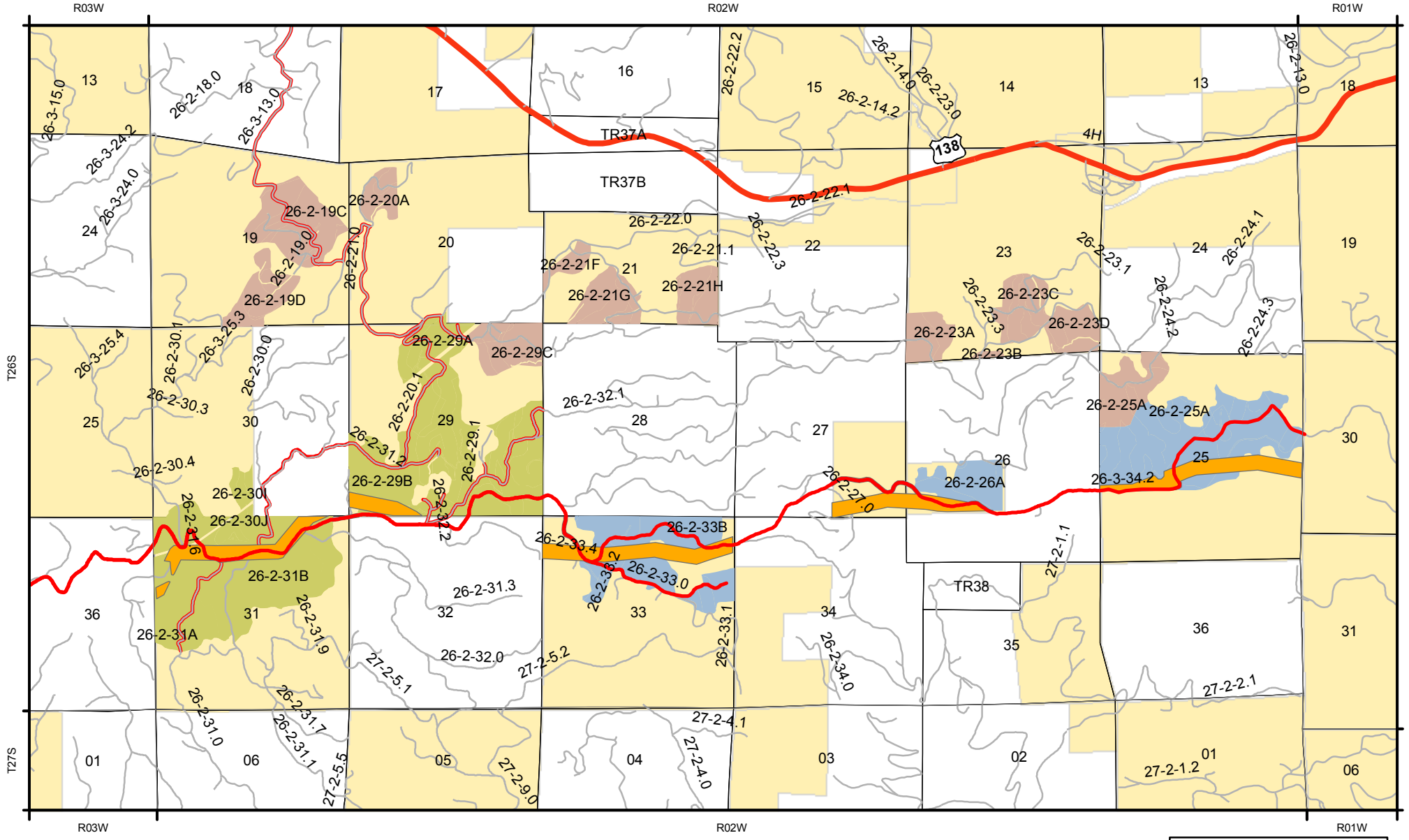
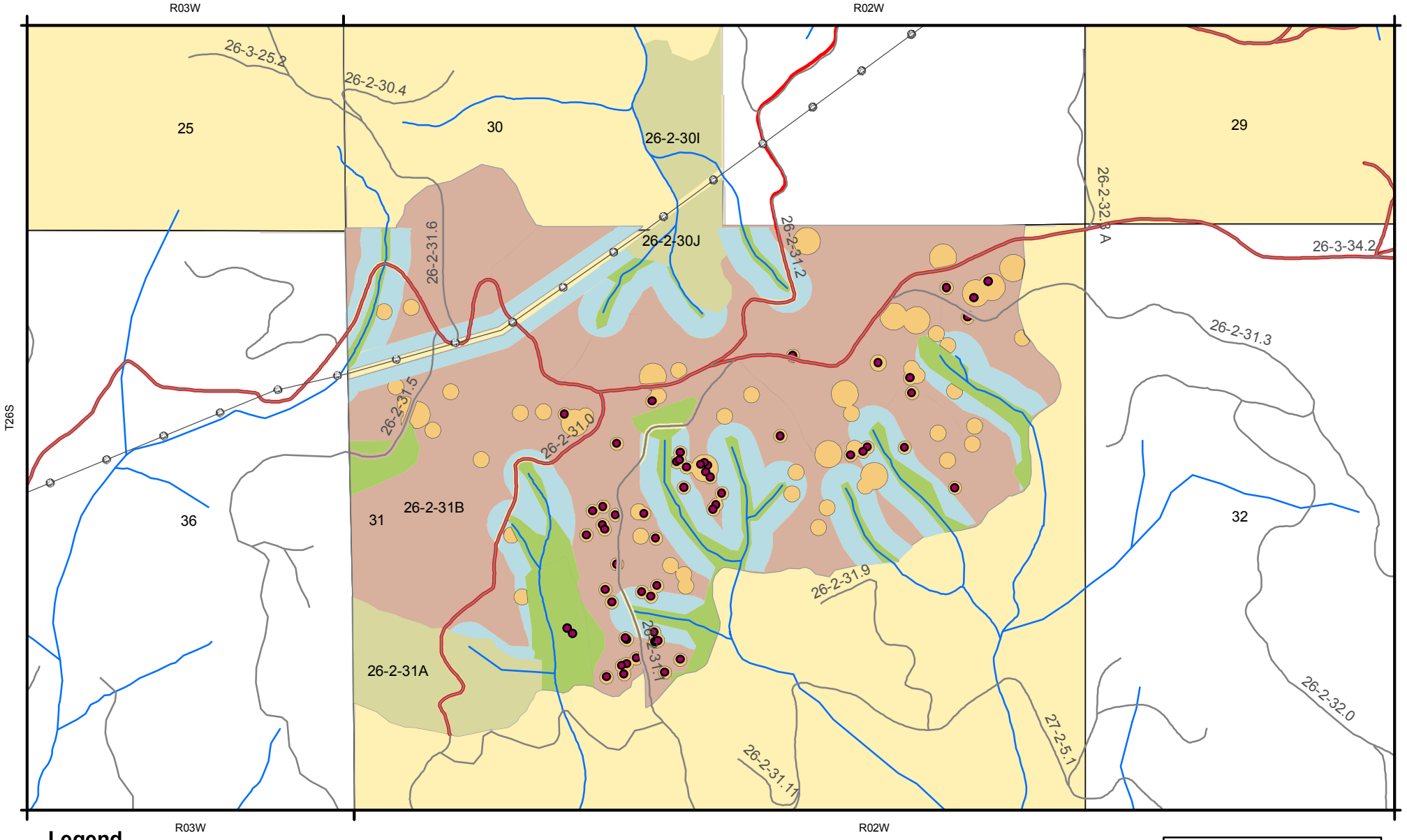


Figure 6a. Big Thunder Unit 31B - Silvicultural Prescription, Alternative 1



Legend

- Light thinning
- Moderate thinning
- Sugar Pine
- Skips
- Gaps
- Haul Route
- Roads
- Streams
- Power Transmission Line
- Adjacent Big Thunder Units
- BLM ownership

0 0.125 0.25 0.5

Miles

N W E S

Creation Date: 9/5/2013

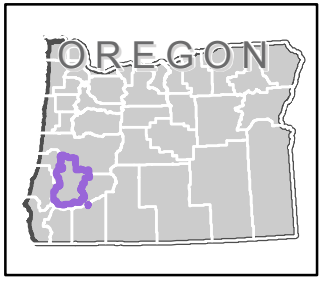
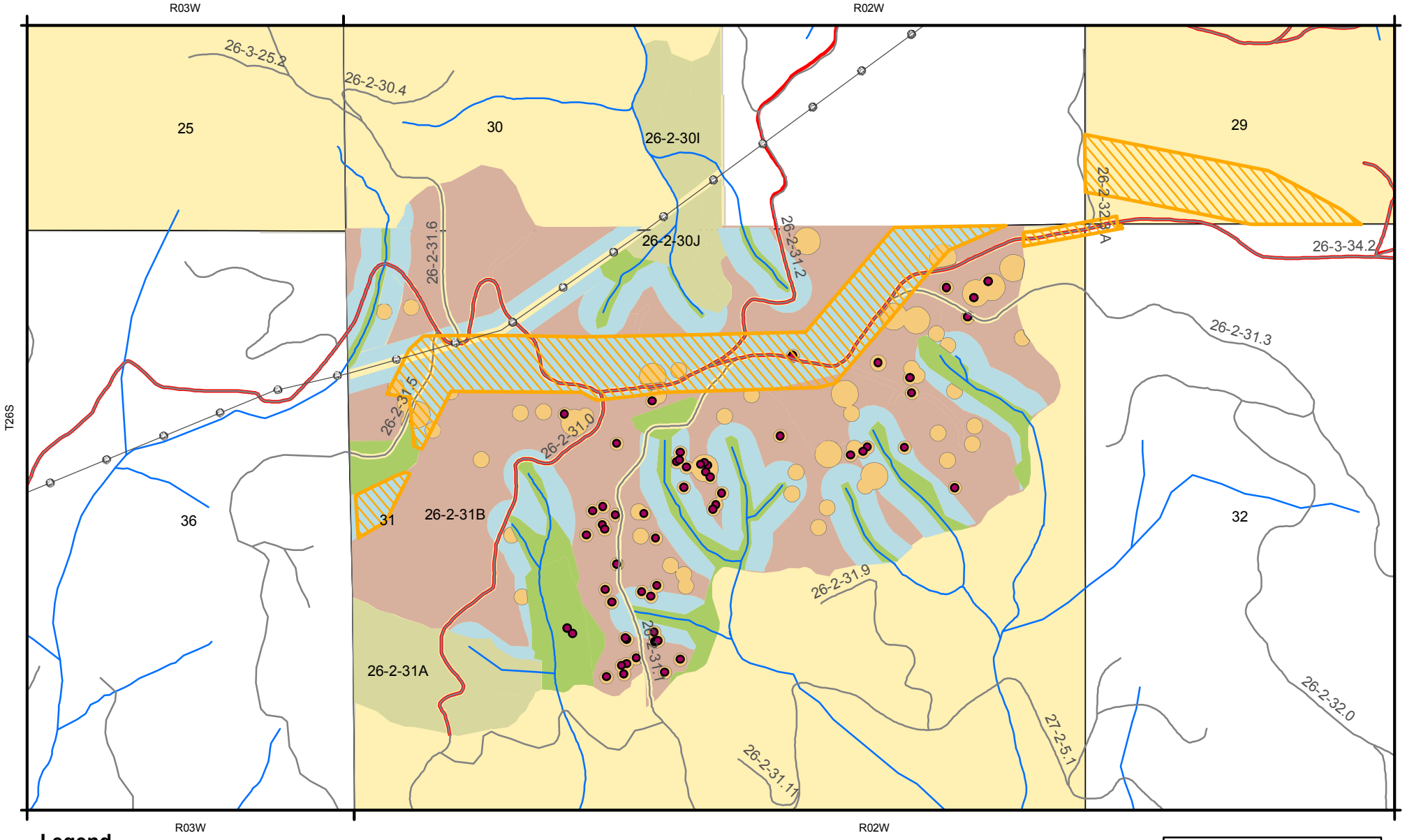


Figure 6b. Big Thunder Unit 31B - Silvicultural Prescription, Alternative 2



Legend

- Light thinning
- Moderate thinnning
- Sugar Pine
- Skips
- Gaps
- Haul Route
- Hazardous Fuels Treatment
- Roads
- Streams
- Power Transmission Line
- Adjacent Big Thunder Units
- BLM ownership

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Miles

N W E S

Creation Date: 9/5/2013

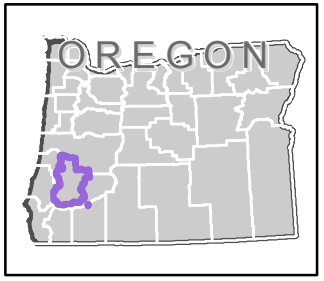
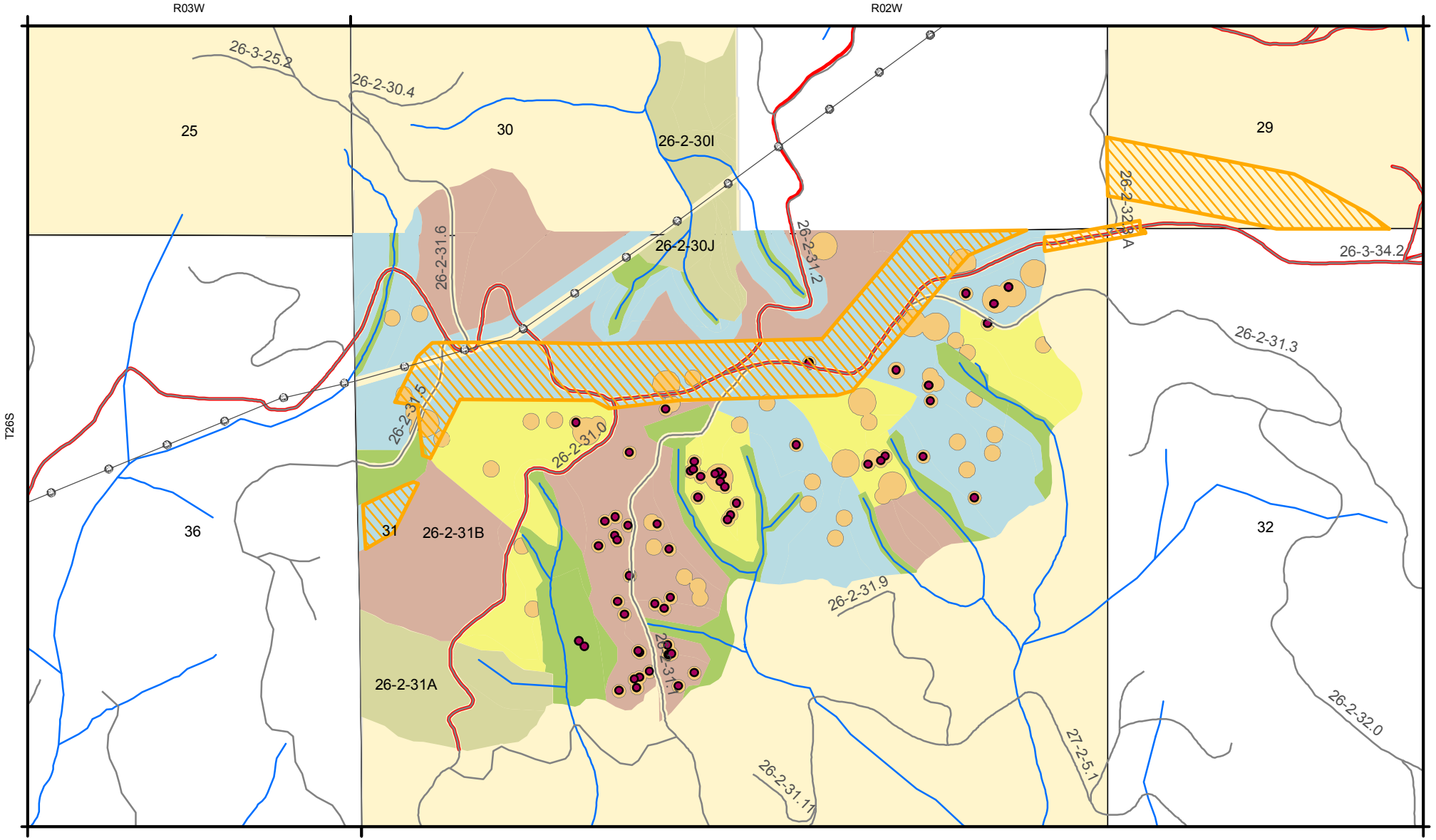


Figure 6c. Big Thunder Unit 31B - Silvicultural Prescription, Alternative 3



Legend

- Light thinning
- Moderate thinning
- Heavy thinning
- Sugar Pine
- Skips
- Gaps
- BLM ownership
- Hazardous Fuels Treatment
- Haul Route
- Roads
- Streams
- Power Transmission Line
- Adjacent Big Thunder Units

0 0.125 0.25 0.5

Miles

N W E S

Creation Date: 9/5/2013

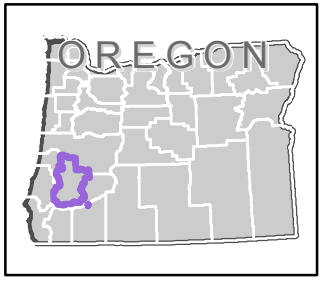
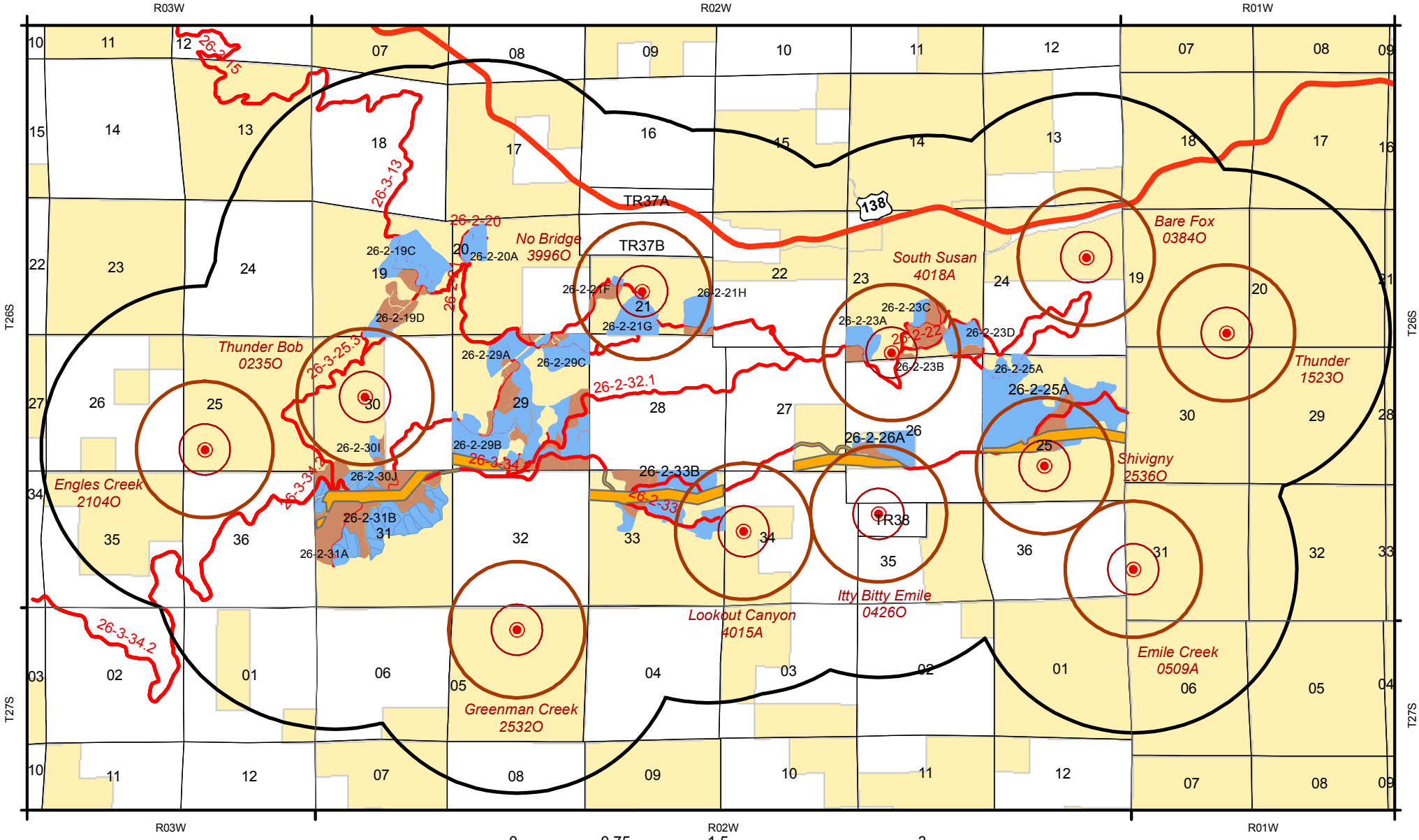


Figure 7. Northern Spotted Owl Analysis Area and Sites



Legend

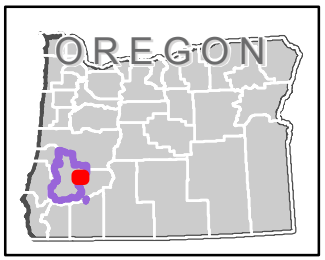
Thunderbolt Thinning Units

- Cable Yarding
- Ground-based Yarding
- Hazardous Fuels Treatment
- BLM ownership

Northern Spotted Owl

- NSO Activity Center
- Nest Patch (300 meters/ 70 acres)
- Core Area (0.5 miles/502 acres)
- Spotted Owl Action Analysis Area (1.2 mile Home Range Buffer off of NSO activity centers + Thunderbolt Units)

N W E S



Creation Date: 9/4/2013