South River FY 2009 Commercial Thinning Environmental Assessment

Bureau of Land Management
Roseburg District Office
South River Field Office
DOI-BLM-OR-R050-2009-0005-EA

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 commercial thinning designed in conformance with management direction provided in the 1995 Roseburg Record of Decision and Resource Management Plan (ROD/RMP), as amended prior to December 30, 2008.

The BLM is providing a 30-day period for public review and comment on the documents, and will accept comments until the close of business (4:30 PM, PDT) on August 12, 2010.

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. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so. If you choose to submit any written comments, they should be directed to Ralph Thomas, South River Field Manager, at the above address.

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 **Plans & Projects** at www.blm.gov/or/districts/roseburg, on the same day in which legal notices of availability for public review and notices of decision are published in *The News-Review*, Roseburg, Oregon. 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.

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Chapter One
Purpose and Need for Action

This chapter provides a description of the purpose and need for the proposed action.

I. Background

The analysis area encompasses lands managed by the South River Field Office of the Roseburg District, Bureau of Land Management (BLM) in the Middle South Umpqua River and Olalla Creek-Lookingglass Creek fifth-field watersheds.

Approximately 8,000 acres of forest stands 40 and 80-years of age were initially screened for thinning suitability. Examination of aerial photographs and field reconnaissance reduced the area under consideration to 1,740 acres by initiation of this environmental assessment. Additional areas were eliminated where stand exams projected insufficient timber volume for a commercial entry, stands are not developmentally ready for thinning, or some stands in Late-Successional Reserves are already on a desired growth trajectory.

A description of the historic condition of natural resources is provided in the Middle South Umpqua Watershed Analysis (USDI, BLM 1999) and Olalla-Lookingglass Watershed Analysis (USDI BLM 1998). Except for forest seral stages which can be rapidly changed by timber harvest and natural events such as wildfire and windstorms, the characterization of resources contained in the watershed analyses is generally representative of present conditions.

The *South Coast-Northern Klamath Late-Successional Reserve Assessment* (USDI and USDA 1998 (LSRA)) describes habitat objectives and provides additional guidance for determining which forest stands warrant silvicultural treatments to achieve desired stand conditions, and appropriate treatments. Revisions to silvicultural criteria for thinning treatments in Late-Successional Reserve 259, which encompasses a portion of the analysis area south of State Highway 42, were proposed and adopted. In May, 2004, the Regional Ecosystem Office found the revisions consistent with Standards and Guidelines of the Northwest Forest Plan for managing Late-Successional Reserves.

Late-Successional Reserves 259 and 261, which overlap portions of analysis area, are identified as high priorities for management actions based on large size, key links to the Late-Successional Reserve network, and land ownership pattern. Management priorities include enlarging existing blocks of interior late-successional habitat, maintaining and improving habitat connections between and within Late-Successional Reserves, and creating late-successional habitat where absent (LSRA, pp. 63-66 and Maps 6 and 8).

II. The Proposed Action

The proposed action is thinning of approximately 866 acres in the Matrix and associated Riparian Reserves, and 306 acres allocated to Late-Successional Reserves. The locations of units being considered in this analysis are as follows:

Matrix and Riparian Reserves - Sections 21, T. 28 S., R. 8 W.; Sections 19, 29, 31 and 33, T. 29 S., R. 6 W.; Sections 11, 13, 15, 25, and 31, T. 29 S., R. 7 W.; Section 33, T. 29 S. R. 8 W.; and Sections 5 and 7, T. 30 S., R. 6 W., W.M. The units in Sections 29 and 31, T. 29 S., R. 6 W. are on lands allocated as Connectivity/Diversity Block. The remaining 26 units are on lands allocated to the General Forest Management Area.

Fourteen units allocated to the General Forest Management Area by the Roseburg District *Record of Decision and Resource Management Plan* ((ROD/RMP) USDI, BLM 1995a) are in critical habitat for the northern spotted owl as designated in 2008. These fourteen units, comprising 485 acres, are all located in T. 29 S., R. 7 W.

Late-Successional Reserves - Section 8, 21 and 33, T. 28 S., R. 8 W.; and Section 9, T. 30 S., R. 7 W., W.M.

Appendix A of this environmental assessment provides maps illustrating location and tentative configuration of proposed thinning units. The maps also identify proposed haul routes, and location of proposed road construction, road renovation, and decommissioning. If a decision is made to implement all or portions of the proposed action, it is anticipated that minor changes may occur in unit acreage and configuration, and in miles, location and types of road treatments.

III. Objectives

The proposed thinning of developing stands is needed to promote tree survival and growth to achieve a balance between wood volume production, quality of wood, and timber value at harvest, by implementation of actions such as commercial thinning designed to reduce competition among remaining trees (ROD/RMP p. 60).

The ROD/RMP (p. 62) also directs that thinning be practiced in the Matrix allocations where practical and where research indicates increased gains in timber production are likely. Target stand conditions described in the ROD/RMP (p. 150 and 152) include creation of a variety of structures, stands with trees of varying age and size, and an assortment of canopy configurations.

Timber volume generated from thinning in the General Forest Management Area and Connectivity/Diversity Block allocations would contribute toward the Roseburg District declared annual allowable sale quantity in support of the socio-economic benefits envisioned in the *Roseburg District Proposed Resource Management Plan/Environmental Impact Statement* (USDI BLM 1994 (PRMP/EIS Vol. 1, p. xii).

In Riparian Reserves, thinning is to be applied to control stocking levels, establish and manage non-conifer vegetation, and acquire vegetation characteristics consistent with Aquatic Conservation Strategy objectives (ROD/RMP, pp. 153-154).

Activities beneficial to the creation of late-successional habitat will be planned and implemented in the Late-Successional Reserves, including thinning in forest stands up to 80 years old, if needed to create and maintain late-successional forest conditions (ROD/RMP, p. 29).

Objectives identified in the LSRA include:

- Protecting and enhancing conditions of late-successional forest ecosystems, which serve as habitat for late-successional and old-growth forest related species;
- Promoting development of old-growth forest characteristics that include snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition;
- Maintaining the health and vigor of the stands, and promoting the growth of the remaining trees;
- Retaining hardwoods as stand components;
- Maintaining native species diversity and structural composition of the forest stands; and
- Decreasing the risk of large scale disturbance from fire, wind, insects, and diseases that would destroy or limit the ability of the reserves to sustain viable species populations.

While timber volume generated from treatments in Riparian Reserves and Late-Successional Reserves would not be chargeable against the annual ASQ, it would further contribute to the socio-economic benefits envisioned in the PRMP/EIS.

IV. Decision Factors

Factors to be considered in deciding between the alternatives will include:

- The manner in which the described objectives would be achieved, including harvest prescription, yarding methods, seasons of operation, and manner of access.
- The nature and intensity of environmental impacts that would result from thinning, and the nature and effectiveness of measures to minimize impacts to resources present.
- Compliance with ROD/RMP management direction, terms of consultation on species listed and critical habitat designated under the Endangered Species Act, BLM programs such as Special Status Species, and laws that include the Clean Water Act and O&C Act.
- How to provide timber resources in support of local industry, and provide revenue to the Federal and County governments from the sale of those resources while reducing short and long-term costs of managing the lands in the project area.
- How to enhance habitat structure and conditions for the Federally-threatened northern spotted owl and marbled murrelet, and improve habitat conditions in spotted owl critical habitat.

V. Conformance

The effects of resource management, including timber management, were analyzed in the Roseburg District PRMP/EIS. This EA will consider the environmental consequences of no action and the proposed action alternatives in order to provide sufficient evidence for determining whether there would be impacts exceeding those already considered in the PRMP/EIS which would preclude issuance of a Finding of No Significant Impact and require preparation of a Supplemental Environmental Impact Statement. Additional information and analysis provided by the following documents is incorporated by reference.

- The *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* (USDA and USDI 1994a),
- The 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* (USDA and USDI 2000),
- The FSEIS *to Remove or Modify the Survey and Manage Mitigation Measures Standards and Guidelines* (USDA and USDI 2004b);
- The FSEIS *for Management of Port-Orford-Cedar in Southwest Oregon* (USDA and USDI 2004a),
- The *Final Supplement to the 2004 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measures Standards and Guidelines* (USDA and USDI 2007), and
- The *Final Environmental Impact Statement for the Revision of the Resource Management Plans for the Western Oregon Bureau of Land Management* (USDI BLM 2008a (2008 FEIS)).

Implementation of actions proposed in this analysis would conform to management direction from the Roseburg District *Record of Decision and Resource Management Plan* ((USDI, BLM 1995a (ROD/RMP)) as amended by the following:

- The *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (USDA and USDI 1994b),
- The *Record of Decision and Standards and Guidelines 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* (USDA and USDI 2001), and
- The *Record of Decision and Resource Management Plan Amendment for Management of Port-Orford-Cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg Districts* (USDI, BLM 2004b).

Chapter Two
Discussion of Alternatives

This chapter describes the basic features of the alternatives being analyzed.

I. Alternative One - No Action

Thinning would not be undertaken. 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 of trees in the suppressed and intermediate canopy classes would increase and overall stand growth could stagnate unless growth trajectories were altered by a natural disturbance such as wind or fire.

There would be no road construction to provide access for yarding and timber hauling. Road renovation or improvements 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 maintenance would be conducted, on an as needed basis, to provide resource protection, accommodate reciprocal users, and protect the government's infrastructure investments.

II. Alternatives Two and Three – The Proposed Actions

A. Features Common to Alternatives Two and Three

Thinning would be applied to approximately 1,172 acres of mid-seral forest stands.

Table 2-1 provides a general description of units proposed for treatment in the Late-Successional Reserves.

Table 2-1 Proposed LSR Thinning Units

Unit ID Number	LSR	Acres	Yarding Method	Potential Suitable Habitat Removal	Seasonal Restrictions*
28-8-8A	261	19	Cable	Tailhold trees	2, 3,4, 5, 6 and 7
			Ground-based		1, 2, 4 and 5
28-8-21A	261	39	Cable	Guyline trees	2. 3, 4, 5 and 7
			Ground-based		1, 2, 4 and 5
28-8-21B	261	39	Ground-based	None	1, 2, 4 and 5
28-8-21D	261	40	Cable	Tailhold trees	2, 3, 4, 5 and 7
			Ground-based		1, 2, 4 and 5
28-8-33A	261	20	Cable	Guyline and tailhold trees and road right-of-way	2, 3, 4, 5 and 7
28-8-33B	261	51	Cable	Guyline and tailhold trees and road right-of-way	2, 3, 4, 5 and 7
30-7-9A	259	48	Cable	None	2
30-7-9B	259	37	Cable	Tailhold trees	2, 3, 4, 5 and 7
30-7-9C	259	13	Cable	None	2 and 6

* *See pages 12-13 for discussion*

Table 2-2 provides a corresponding description of units in the Matrix and Riparian Reserves.

Table 2-2 Proposed Matrix Commercial Thinning Units

Unit ID Number	Acres	Yarding Method	Potential Suitable Habitat Removal	Seasonal Restrictions*
28-8-21C	30	Cable	Guyline trees and road right-of-way	2, 3, 4, 6 and 7
		Ground-based		1, 2, 4 and 6
29-6-19A	60	Cable	Guyline and tailhold trees, and road right-of-way	2, 3, 4, 6 and 7
29-6-29A	39	Cable	None	2 and 4
		Ground-based		1, 2 and 4
29-6-31B	29	Cable	None	2, 5 and 6
29-6-33C	9	Cable	None	2
29-7-11A	11	Cable	None	2, 4, 5 and 6
29-7-11B	56	Cable	Guyline trees	2, 3, 4, 6 and 7
29-7-11C	37	Cable	None	2, 4, and 6
29-7-13B	16	Cable	Guyline trees	2, 4, 6 and 7
29-7-13C	59	Cable	Guyline trees	2, 4, 6 and 7
29-7-13D	48	Cable	Guyline trees and road right-of-way	2, 4, 6 and 7
29-7-13E	23	Cable	Guyline trees	2, 3, 4, 6 and 7
29-7-15A	47	Cable	Guyline trees	2, 3, 4, 5 and 7
29-7-15B	30	Cable	Tailhold trees and road right-of-way	2, 3, 4, 5 and 7
29-7-25A	26	Cable	None	1 and 2
29-7-25B	14	Cable	None	2
29-7-25C	32	Cable	None	2, 4, and 6
29-7-25D	47	Cable	None	2
29-7-31A	39	Cable	Tailhold trees	2, 3, 4, 5 and 7
		Ground-based		1, 2 and 5
29-8-33A	28	Cable	Guyline trees	2, 3, 4, 5 and 7
30-6-5A	28	Cable	None	2
30-6-5B	24	Cable	None	2 and 4
30-6-5C	23	Cable	None	2
30-6-5D	33	Cable	None	2
30-6-7A	18	Cable	None	2
30-6-7C	22	Cable	Tailhold trees	2, 3 and 4
30-6-7D	24	Cable	Guyline trees	2, 3 and 4
30-6-7E	13	Cable	Tailhold trees	2, 3 and 4

* *See pages 12-13 for discussion*

1. Marking Prescriptions

In both action alternatives, marking prescriptions for the Connectivity/Diversity Block units, Riparian Reserves, and nine Late-Successional Reserve units would be the same.

Connectivity/Diversity Block

A variable density prescription would be applied based on a combination of basal area and number of trees per acre to encourage development of structural diversity. The healthiest, best-formed trees would be favored for retention. Minor conifer species would be retained in numbers reflecting current percentages of stand composition. Hardwoods greater than ten inches diameter breast height, would be retained where available.

Trees would primarily be removed from suppressed and intermediate canopy classes, though some co-dominant and dominant trees could be removed to meet specific density and spacing objectives. Trees selected for retention would generally have a live crown ratio of at least 30 percent so that live crown expansion and accelerated diameter growth would be more likely following thinning (Daniel, et. al. 1979).

Where the percentage of grand fir far exceeds levels present in natural stands in the project watersheds, conifers other than grand fir would be selected where present and considered likely to release in response to thinning. On average, relative density would be reduced to 25[1], approximately 75 trees per acre would be retained, residual basal area would be approximately 95 square feet, and post-thinning canopy cover would be about 60 percent.

Older remnant trees present in some of the proposed units are not the focus of treatments and would be retained to the greatest degree practicable. Circumstances under which these trees would be cut would be limited to the clearing road rights-of-way and landings, and providing for safe operations. Snags would also be retained where practicable, subject to these same exceptions.

The stands would be evaluated, post-thinning, for under-planting to help create a secondary canopy layer. A combination of ponderosa pine, sugar pine, cedars and Douglas-fir would be planted based on specific site conditions.

Riparian Reserves

Riparian Reserves would be established in the Matrix land use allocations with comparable measures employed along streams in the Late-Successional Reserves. The width would be based on a site-potential tree height, calculated as 160-feet for the project watersheds.

On non-fish-bearing streams, Riparian Reserves and stream-side buffers would be 160-feet wide, slope-distance, measured from the ordinary high water line. On fish-bearing streams, intermittent or perennial, Riparian Reserves would be 320-feet wide.

“No-treatment areas” would be established adjacent to all streams within or adjacent to the thinning units. These areas would be 35-feet in width, slope-distance, on intermittent, non-fish-bearing streams. On all other streams they would be 60-feet wide.

Small areas of slope instability that are not associated with streams would also receive protection in the form of retention of trees around the slumps or scarps and prohibition on yarding through these areas to avoid creating conditions that could trigger slope failure.

[1] Relative density is the level of competition among trees or site occupancy in a stand relative to some theoretical maximum based on tree size and species composition. The values in this document are based on Curtis relative density. (Curtis 1982)

Portions of Riparian Reserves and stream-side buffers outside of the "no-treatment areas" would be thinned to a relative density of approximately 25, maintaining a minimum of 50 percent canopy cover. The prescription would mirror the variable density prescription for units in the Connectivity/Diversity Block land use allocation.

If application of a unique marking prescription is not practical because of small acreages involved, the marking prescription would reflect the prescription for the adjoining upland stands, subject to the minimum 50-percent canopy cover constraint.

Trees with broken or deformed boles and crowns may be selected for retention. Conifers such as western hemlock, western redcedar and incense cedar would be retained in sufficient numbers to maintain them as stand components. Grand fir would not be favored under circumstances described above. Hardwoods greater than 10 inches diameter breast height and reasonably likely to survive thinning operations would also be retained. Snags felled for safety or operational reasons would be left on site.

Forwarded crossings may be needed on intermittent streams in Units 28-8-8A, 28-8-21B, 28-8-21D, and 29-6-29A. To minimize soil disturbance and displacement that could result in sedimentation, operation of ground-based equipment would be restricted in "no-treatment areas" to the highest extent practicable. Cable yarding corridors through "no-treatment areas" would be cleared where needed. These corridors would be a maximum of 20-feet wide and as near perpendicular to stream channels as practicable, at locations approved by the contract administrator.

Trees cut in "no-treatment areas" to facilitate forwarder crossings or cable-yarding corridors would remain on site as sources of wood for potential in-stream recruitment.

Late-Successional Reserves

Development of late-successional and old-growth forests in southwest Oregon largely resulted from fires of varying intensities, including fires set by indigenous peoples for managing vegetation to suit their needs. Present day, the extent to which fire can be used as a tool for vegetation management is limited by potential impacts to adjoining private property and air quality. Mechanical treatment is the most effective means for managing forest stands for development of late-successional and old-growth forest habitat.

Variable density thinning treatments would be designed to mimic natural disturbances that reduce stand density and move stand development toward late-successional conditions described in the *South Coast-Northern Klamath LSRA* (pp. 28 and 82). Treatments would employ variable density thinning, creation of canopy gaps and openings, and retention of at least ten percent of the acreage of individual units in unthinned areas to: maintain areas of thermal and visual cover; natural suppression and mortality; natural size differentiation among trees, including small trees; and undisturbed coarse woody debris. Post-treatment relative density would average approximately 25 across the units with an average canopy cover of approximately 60 percent.

Selection of trees would mirror retention criteria for Riparian Reserves, and not be based solely on the healthiest and best formed trees. Trees greater than 20 inches in diameter breast height and trees with broken or deformed tops that could provide future roosting and nesting structure would generally be favored for retention. Large hardwoods would also be reserved where available and reasonably likely to survive thinning operations.

Three levels of thinning intensity would be applied individually or in combination consisting of light, moderate and heavy treatments. Light thinning would retain 90 to 100 trees per acre, with moderate thinning retaining 60 to 80 trees per acre, and heavy thinning retaining approximately 50 trees per acre. Across entire unit areas, 75 trees per acre would be retained and residual basal area would be 95 square feet, on average.

Canopy gaps and openings would be created in conjunction with the thinning treatments and retention of unthinned areas. In LSR 261 openings and gaps would be limited to a maximum size of one-quarter of an acre, and in combination with heavily thinned areas would not exceed ten percent of the total treated acres.

In LSR 259, openings may be up to 1.5 acres in size and constitute up to two percent of the total treated acres. Heavily thinned areas, with 25 to 50 trees per acre, may constitute up to 50 percent of the treated acres.

In the application of heavy thinning and the creation of gaps and openings it is expected that some dominant and co-dominant trees, possibly greater than 20 inches diameter breast height, would be removed. A combination of ponderosa pine, sugar pine, cedars and Douglas-fir would be planted in the openings and heavy thinning areas, based on an evaluation of specific site conditions.

For Douglas-fir stands 40 to 80 years old the target volume for down wood is 1,102 cubic feet per acre. Target numbers for snags per acre are: seven, 20 inches or greater diameter breast height, all heights; two, 20 inches or greater diameter breast height and 16 feet tall; and 48 under 20 inches diameter breast height, all heights. (LSRA, p. 30)

For the Coast Range Province, which contains LSR 261, the LSRA (p. 90) recommends that at 80 years of age riparian stands have 3,600 to 9,400 cubic feet of coarse woody debris per acre, at least four inches in diameter and at least one meter in length, within the first site-potential tree height of perennial streams . Within the second site-potential tree height of perennial streams or the first site potential tree height of intermittent streams 1,600 to 2,300 cubic feet per acre is recommended.

For the Klamath Province, which contains LSR 259, at 80 years of age riparian stands should have 650 to 1,300 cubic feet of coarse woody debris per acre, at least four inch diameter and three feet long, within two site-potential tree heights of any perennial stream and within the first site-potential tree height of intermittent streams.

It is expected that coarse woody debris would be adequately provided by the following:

- Contract provisions stipulate reservation of existing coarse woody debris.
- Snags felled for safety or operational reasons would be retained on site.
- Non-merchantable materials generated during thinning operations, including broken-out tree tops would largely be left in place.
- Natural events such as windthrow, wind break, snow break, and suppression mortality would provide additional coarse woody debris.

Snag objectives would be met through:

- Reservation of snags in unthinned areas where operationally practical.
- Mechanical damage or individual tree mortality.
- Wind and snow break.

The potential need for additional trees to meet snag and coarse wood requirements would be factored into the marking prescriptions. Transect surveys would be conducted by BLM personnel or under service contract following the first winter after completion of thinning to assess the amount of coarse wood and numbers of snags present. If there are deficiencies identified, selected trees reserved under the marking prescription would be felled or girdled to meet coarse wood and/or snag objectives within five years of completion of thinning. Felling and/or girdling would be accomplished under a service contract or by qualified District personnel.

2. Yarding Methods

For ground-based yarding, the following project design features would apply:

- Restricted to the dry season when soils are least susceptible to compaction.
- Generally be limited to slopes of 35 percent or less, on pre-designated trails, using existing trails to the greatest degree practicable. Operations on steeper pitches between gentler benches could be authorized where appropriate.
- Conducted with harvester/forwarder equipment.

For cable yarding the following project design features would apply:

- Equipment capable of maintaining a minimum one-end log suspension. If necessary, contract requirements may specify the type of logging carriage used.
- Equipment with a minimum of 100 feet of lateral yarding capability, and pre-designated yarding corridors.
- Location of landings at least 200 feet apart to the extent practicable.

Cable yarding typically requires use of trees outside of unit boundaries for tailholds and guyline anchors. Tailhold trees seldom require cutting, and contract provisions require that purchasers obtain written approval before attaching logging equipment to any tree in the timber reserve and take appropriate measures to protect against undue damage. Protection measures could include the use of tree plates, straps or cribbing. Guyline trees are generally cut because they are located in the guyline radius of cable yarding equipment and subject to state safety regulations.

3. Access

Primary access would be provided by roads under BLM control and/or private roads over which the BLM has rights of use under the terms of reciprocal rights-of-way agreements. In addition, construction of 3.36 miles of aggregate-surfaced road, renovation and surfacing of 3.99 miles of existing road, construction of 0.57 miles of unsurfaced road, and renovation of 0.15 miles of unsurfaced road are proposed for access to advantageous landing areas within units.

Table 2-3 identifies by unit, the proposed road construction/renovation, and disposition post-thinning. Where no additional unit access is necessary, no entry for the unit is made.

Table 2-3 Proposed Road Renovation and Construction

Unit ID	Proposed Road Construction and/or Renovation	Road Length (miles)	Disposition Post-Harvest
28-8-8A	Renovate unsurfaced road	0.15	Block/Decommission
28-8-21C	Construct surfaced road	0.37	Retain
28-8-21D	Construct surfaced road	0.51	Block/Decommission
28-8-33A	Construct surfaced roads (2)	0.14	Retain
28-8-33B	Construct surfaced roads (2)	0.40	Retain
29-6-19A	Construct surfaced road	0.40	Retain
29-7-11B	Construct surfaced road	0.16	Block/Decommission
29-7-13C	Construct surfaced roads (2)	0.19	Block/Decommission
	Renovate and surface road	0.49	Retain
29-7-13D	Construct unsurfaced road	0.21	Block/Decommission
29-7-13E	Construct surfaced road	0.05	Block/Decommission
	Renovate and surface road	0.10	Retain
29-7-25A	Construct unsurfaced road (2)	0.36	Block/Decommission
29-7-25B	Construct surfaced road	0.02	Retain
29-7-25C	Construct surfaced roads (2)	0.34	Retain
29-7-25D	Construct surfaced road	0.19	Retain
29-7-31A	Construct surfaced road	0.18	Block/Decommission
	Renovate and surface road	0.14	Block/Decommission
29-8-33A	Construct surfaced road	0.13	Block/Decommission
30-6-5A	Construct surfaced roads (2)	0.05	Retain
	Renovate and surface road	0.12	Retain
30-6-5C	Construct surfaced roads (2)	0.15	Retain
	Renovate and surface road	0.11	Retain
30-6-7D	Construct surfaced roads (2)	0.06	Retain
30-7-9A	Renovate and surface road	2.21	Retain
30-7-9B	Construct surfaced road	0.02	Retain
	Renovate and surface road	0.82	Retain

New roads would be sited on ridge tops and stable side slope locations and disconnected from the road drainage network to the greatest extent practicable. Where road gradients are less than six or seven percent, roads would be out-sloped for drainage in lieu of ditches and cross drains. Otherwise, road surfaces would be crowned and culverts installed at short intervals to quickly and evenly disperse run-off to the forest floor.

Cleared rights-of-way would be a minimum of 25-feet wide under the most favorable of circumstances because they must provide a minimum of five feet of horizontal clearance on either side of the road, and a minimum of ten feet of overhead clearance. Factors requiring wider rights-of-way would include slope steepness, turnouts, and a safe line-of-sight on approaches to curves.

The intent is to construct, use and decommission unsurfaced temporary roads in the same operating season. If not possible because of events such as extended fire closure, the roads would be winterized prior to the onset of autumn rains for use the following year.

At a minimum, road decommissioning would consist of removing temporary drainage structures, constructing water bars, seeding and mulching disturbed areas, and blocking roads to vehicular use. The running surface may be covered with logging debris to discourage off-highway vehicle use, and may also be subsoiled dependent on individual site circumstances. Landings on temporary roads may be subsoiled in conjunction with road decommissioning.

4. Seasonal Operational Restrictions on Thinning Operations and Timber Hauling

Operations would be allowed throughout the year subject to any of the following seasonal restrictions that apply.

1) Ground-based operations or cable yarding to roads not suitable for all-weather hauling would be restricted to the period of May 15th to October 15th, but may be extended beyond October 15th if weather conditions and soil moisture warrant.
2) Felling and yarding, other than for the clearing of road rights-of-way would generally be prohibited during the bark-slip period, from April 15th to July 15th.
3) Removal of suitable nesting, roosting and foraging habitat within one-quarter mile of known northern spotted owl sites, estimated sites, or unsurveyed suitable habitat would be prohibited from March 1st to September 30th. This restriction could be waived until March 1st of the following year if surveys indicate owls are not present, not nesting, or have failed in a nesting attempt. If two years of protocol surveys do not detect owl presence or activity, restrictions may be waived the following two years (USDI, USFWS 1992 p. 2).
4) Operations within applicable disruption threshold distances of known northern spotted owl sites or unsurveyed suitable habitat would be prohibited from March 1st to July 15th. This restriction could be waived until March 1st of the following year if surveys indicate owls are not present, not nesting, or have failed in a nesting attempt. If two years of protocol surveys do not detect owl presence or activity, restrictions may be waived the following two years.
5) Thinning within 100 yards of occupied marbled murrelet sites or unsurveyed suitable nesting habitat in Zone 1 or the Zone 2 restriction corridor would be prohibited April 1st to August 5th and subject to Daily Operating Restrictions (DOR) August 6th to September 15th to avoid disturbance during the nesting and fledging season. Daily Operating Restrictions prohibit commencement of operations until two hours after sunrise and require operations to cease two hours before sunset. These restrictions would be waived if two years of surveys indicate no murrelet occupancy.

6) Outside of the Zone 2 restriction corridor, operations would be subject to Daily Operating Restrictions from April 1st to August 5th. These restrictions would be waived if two years of surveys indicate there is no occupancy.
7) Areas where operations would remove suitable marbled murrelet nesting habitat would be surveyed for two years to determine occupation status. Operations that remove suitable habitat within one-quarter mile of an occupied site or unsurveyed habitat would be prohibited from April 1st to September 15th. The restrictions would be waived if two years of surveys indicate there is no occupancy.

5. Hazardous Fuels Treatments

In order to reduce the risk of fire and damage to the thinned forest stands, slash piles at landings would be burned to reduce roadside fuel concentrations. Within the Wildland Urban Interface and Late-Successional Reserves, post-thinning fuel load and arrangement would be evaluated in order to determine whether a need exists for limited hand-piling and burning, chipping, or pull back of fuels from adjacent roads and property lines.

6. Noxious Weeds and Invasive Non-Native Plants

Preventative measures would be implemented in conjunction with the proposed thinning that focus on minimizing or eliminating the risk of introducing new weed infestations or spreading existing ones. These measures would include:

- Steam cleaning or pressure washing equipment used in logging and road construction to remove soil and materials that could transport weed seed or root fragments.
- Scheduling work in uninfested areas prior to work in infested areas.
- Seeding and mulching disturbed areas with native grass seed; or revegetating with native plant species where natural regeneration is unlikely to prevent weed establishment.

B. Alternative Two – Even-Spaced Thinning in the General Forest Management Area

Under this alternative, all 798 acres in the General Forest Management Area proposed for thinning would be managed for full site occupancy to maximize future timber volume, by thinning on a generally even spacing, to a relative density of 35. Thinning would retain 80 and 130 trees per acre and basal area would be reduced to between 115 and 140 square feet per acre. Canopy cover would range from 70 to 80 percent.

The healthiest and best-formed conifers would be retained regardless of species, except in stands where the percentage of grand fir far exceeds what is present in natural stands in the project watersheds. In these instances, conifers other than grand fir would be selected where present and considered likely to release in response to thinning. Trees selected for retention would generally have a live crown ratio of at least 30 percent.

C. Alternative Three – Variable-Spaced Thinning of Stands in the General Forest Management Area Located in Spotted Owl Critical Habitat

Under this alternative, the 485 acres proposed for thinning in the General Forest Management Area that are located in critical habitat for the northern spotted owl (Figure 2-1) would be managed for the development and improvement of habitat conditions and structure that would provide nesting, roosting and foraging opportunities for northern spotted owls. The remaining 313 acres proposed for thinning in the General Forest Management Area, outside of spotted owl critical habitat, would be managed for full site occupancy and maximum future timber production, consistent with the objectives of Alternative Two.

The stands in critical habitat in Sections 11, 13, 15, 25 and 31, T. 29 S., R. 7 W. would be thinned using a variable density prescription that would mirror many of the components of the marking prescription for Late-Successional Reserves.

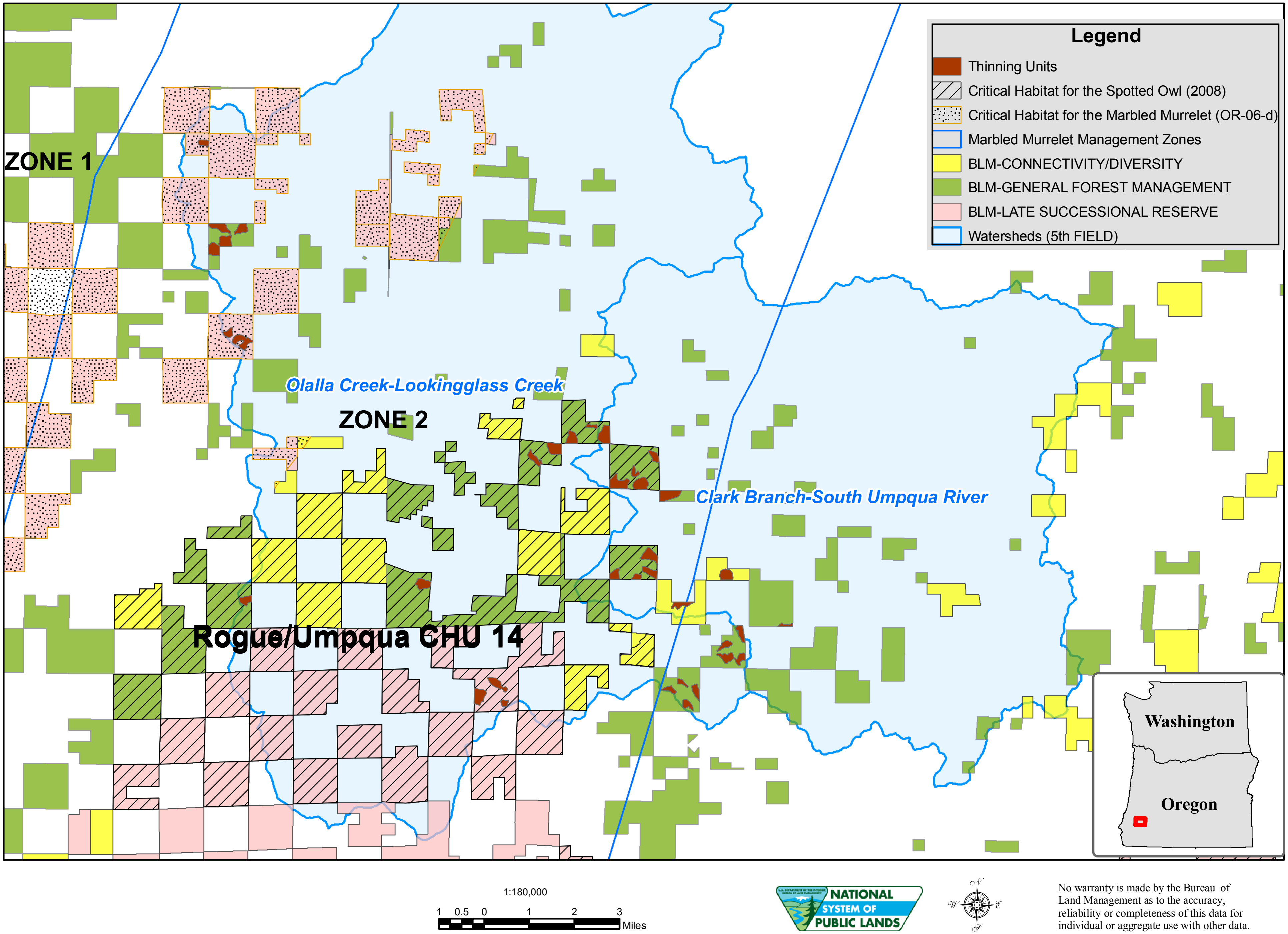
Thinning would primarily remove trees from the intermediate and suppressed canopy layers, while favoring retention of co-dominant and dominant trees. Thinning across all diameter classes could occur where necessary to achieve density objectives or where designed to release and accelerate growth of specific trees. Selection of trees for retention could also include deformed trees that possess physical characteristics that would provide nesting and roosting structure, and large hardwoods where available.

Light, moderate and heavy thinning would be applied in conjunction with creation of gaps and openings. The size of gaps and openings would be consistent with those described in the *South Coast-Northern Klamath LSRA.*

Unthinned areas may be designated around special habitat features such as concentrations of down wood, snags, or hardwood clumps. Marking prescriptions would not require retention of a minimum of ten percent of the area of individual units in unthinned areas, however. Equally, attainment of LSRA snag and coarse wood objectives within five years of thinning would not be required, and acquisition of snags and accumulation of coarse wood would occur through natural successional processes.

The following map identifies the entire thinning project area and relative location of the proposed thinning units. Units located within the cross-hatched portions of the map are those units located in the General Forest Management Area within northern spotted owl critical habitat.

Figure 2-1. South River Commercial Thinning EA-2009- Overlap of Northern Spotted Owl Critical Habitat and Matrix Land



No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of this data for individual or aggregate use with other data.

III. Alternatives and/or Actions Considered But Not Analyzed In Detail

A. Potential Units Dropped from Analysis

From the time of initiation of the interdisciplinary team analysis to the development of the proposed action, 16 units and portions of 10 other units totaling approximately 570 acres were eliminated from further consideration.

The principle reason for elimination was insufficient timber volume for an economically viable entry. Other factors leading to unit elimination included: erosive soils, excessive road construction requirements and costs, and stands already on a desired growth trajectory.

B. Reservation of Large Trees to Provide Large Wood and Snags

On previous occasions, during the preparation of environmental assessments for commercial thinning and density management, individuals and groups have often suggested that the BLM identify the "biggest and best" trees in the Riparian Reserves and Late-Successional Reserves and retain them for the creation of dead wood and snags. This was not considered to be an alternative requiring analysis, because it is already essentially a component of the proposed variable density thinning prescriptions.

As previously described on pages 6 through 9, with respect to the alternatives to the proposed action, thinning would thin primarily from below and favor the retention of dominant and co-dominant trees. Older remnant trees would be reserved from cutting, subject to the exceptions noted. Consequently, there would be ample large trees available in Riparian Reserves to provide large wood for in-stream recruitment.

Coarse woody debris and snags would be adequately provided for in the Late-Successional Reserves. Thinning operations and natural processes would be expected to create additional snags and coarse wood. Additional trees would also be marked for retention exceeding numbers necessary for the desired post-thinning relative density and felled or girdled to create coarse wood and snags if post-treatment assessment indicates a need.

C. Helicopter Yarding vs. Building or Reconstructing Roads

Comments on other environmental assessments for commercial thinning have suggested that the BLM should consider helicopter yarding as an alternative to any road construction or renovation. This is not considered a reasonable alternative and was not analyzed for the following reasons:

- Primary road access already exists to almost all of the units. Proposed roads would be principally located within unit boundaries allowing landings to be moved off of through-roads and/or placed in areas that provide adequate reach and deflection for environmentally responsible yarding.
- Using representative appraisal criteria for a comparison of costs indicates that helicopter yarding would be three to four times more expensive than traditional cable yarding or ground-based harvest methods, which would make thinning economically unviable.

- Helicopter yarding poses a risk of disruption to nesting northern spotted owls and marbled murrelets at distances much greater than cable or ground-based yarding, resulting in extended seasonal restrictions that would further limit season(s) of operations.

Past comments have also suggested that temporary roads have unacknowledged effects which may include: changing natural contours of the landscape, leaving clearcut strips, spreading disease if tilled, and compacting soil with a lasting effect on soil productivity. With respect to compaction, reference was made to a study[2] that purports to show that "sub-soiling, ripping or otherwise de-compacting the road after use" does not restore the soil to pre-road condition.

- As described on page 11, new roads would be located on ridge tops or gentle, stable side slopes wherever practicable, reducing the need for excavation and the level of modification to existing slopes, contours, and natural drainage patterns.
- As described on page 12, rights-of-way clearing limits for temporary roads are designed to the minimum necessary for safe vehicle operations.
- Root diseases are endemic in forest soils and spread by root grafts between living trees. Sub-soiling roads would not affect this process in either an adverse or beneficial manner.
- The BLM is aware of the research regarding the effectiveness of ripping in restoring the infiltration capacity of road surfaces. The study cited acknowledged limits to the degree of restoration achievable, but concluded (p. 269) that: "Ecological restoration of forest roads and watersheds requires improved vegetation cover and improved infiltration for forest road surfaces. These findings suggest that ripping can be a reasonably effective step in the restoration process."

IV. Resources not Present or Unaffected by the Alternatives

Areas of Critical Environmental Concern, prime or unique farmlands, floodplains, wilderness, and Wild and Scenic Rivers are absent from the project area.

Williams Pipeline Group has proposed construction of a natural gas delivery pipeline that would pass through project two watersheds. It would not approach any proposed thinning units or haul roads, however. There are no other energy production facilities, transmission facilities, or known sources of commercially developable energy present in the project area.

V. Issues Considered but not Analyzed in Detail

Environmental Justice

The proposed action is consistent with Executive Order 12898 which addresses Environmental Justice in minority and low-income populations. The BLM has not identified potential impacts to low-income or minority populations, internally or through the public involvement process.

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[2] Luce, Charles H. September 1996. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads. Intermountain Research Station, U.S. Department of Agriculture, U.S. Forest Service. Moscow, ID. Restoration Ecology, Vol. 5, No. 3.

Native American Religious or Ceremonial Sites

No Native American religious concerns have been identified by the interdisciplinary team or through correspondence with local tribal governments.

Visual Resources

All of the areas proposed for thinning are on lands classified as Visual Resource Management (VRM) Class IV. There are no specific visual constraints applicable to this VRM class.

Recreation

There are no developed recreational facilities or proposed developments in the timber sale areas. Recreational opportunities are limited to those of a dispersed nature, such as hiking, picnicking, wildlife observation, and hunting. Off-highway vehicle use is “limited” to existing roads and trail (ROD/RMP, p. 58). It is not anticipated that the proposed timber harvest would affect the relative abundance of these recreational opportunities.

Noxious Weeds and Invasive Non-Native Plants

There are infestations of noxious weeds in the proposed timber sale areas and along access roads. The most common species present are Himalayan blackberry and Scotch broom.

In the absence of the proposed thinning, weed control measures would still be undertaken. Actions taken to contain, control and eradicate existing infestations are implemented under the *Roseburg District Integrated Weed Control Plan* (USDI, BLM 1995b). These actions include inventory of infestations, assessment of risk for spread, and application of control measures in areas where other management actions are proposed or planned. Control measures may include release of biological agents, mowing, hand-pulling, and limited use of approved herbicides. Herbicide application treats individual plants. Application methods are limited to truck-mounted sprayers, backpack and hand sprayers, and wick wipers. Time and location of application is also restricted based upon forecast weather conditions, proximity to live water and riparian areas, and proximity to residences or other places of human occupation.

As discussed on page 13, if decisions are made to implement the proposed action are made there are preventative measures that would be implemented focused on minimizing or eliminating the risk of introducing new weed infestations or spreading existing ones. As a consequence, negligible changes in noxious weed populations would be expected under any of the alternatives.

Chapter Three
The Affected Environment and Environmental Consequences

This chapter summarizes the current condition of specific resources present or potentially present in the project watersheds that could be affected by the proposed project. It also addresses the anticipated short-term and long-term effects that may result from implementation of the alternatives, including those effects that are direct, indirect and cumulative.

The discussion is organized by resource, addressing the interaction of the effects of thinning with current baseline conditions of this environment. It describes potential effects, how they might occur, and the incremental result of those effects, focusing on direct and indirect effects with a realistic potential for cumulative effects, rather than those of a negligible or discountable nature.

The Council on Environmental Quality (CEQ) provided guidance on June 24, 2005, as to the extent to which agencies of the Federal government are required to analyze the environmental effects of past actions when describing the cumulative environmental effect of a proposed action in accordance with Section 102 of the National Environmental Policy Act (NEPA). CEQ noted the "[e]nvironmental analysis required under NEPA is forward-looking," and "[r]eview of past actions is only required to the extent that this review informs agency decisionmaking regarding the proposed action." This is because a description of the current state of the environment inherently includes effects of past actions. Guidance further states that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historic details of individual past actions."

The cumulative effects of the BLM timber management program on the Roseburg District have been described and analyzed in the PRMP/EIS (pp. 4-7 to 99), incorporated herein by reference.

I. Timber Resources

A. Affected Environment

Forest Conditions in the Middle South Umpqua River and Olalla Creek-Lookingglass Creek Fifth-Field Watersheds

The **Middle South Umpqua River** fifth-field watershed drains approximately 59,397 acres, an area of slightly less than 93 square miles (USDI, BLM 1999 p. viii). In 1936, approximately 20,900 acres or 35 percent of the watershed was characterized as nonforest. Early-seral conifer forest was almost non-existent. Woodlands constituted approximately 8,100 acres or 14 percent of the watershed. Acreages of mid-seral and late-seral conifer forest in all ownerships were approximately 16,160 acres and 14,100 acres, respectively (USDI, BLM 1999 p. 17).

In 1993, approximately 20,734 acres were unforested and managed primarily for agricultural purposes (USDI, BLM 1999 p. 24). Early-seral conifer forest constituted about 23,700 acres (~40 percent) of the watershed. Mid-seral and late-seral conifer forest in all ownerships were about 7,100 acres and 7,860 acres, respectively (USDI, BLM 1999 p. 24).

The most current information on the condition of privately-owned forest lands in the watershed dates from 1993. At that time, the age class distribution was approximately 20,540 acres of early-seral stands; 5,335 acres of mid-seral stands; and 5,404 acres of late-seral stands.

The BLM administers approximately 7,680 acres in the watershed, with 7,400 acres considered forest land (USDI, BLM 1999 p. 23). 1999 Forest Operation Inventory characterized forests on BLM-administered lands as approximately: 1,914 acres less than 30 years old (26 percent); 2,074 acres 30 to 80 years old (28 percent); and 3,105 acres over 80 years old (46 percent).

The BLM has conducted no regeneration harvest in the watershed since 1999. Since that time, forest stands less than 30 years old have declined by approximately 860 acres to an estimated 14 percent of BLM-administered forest land. Some small but unquantifiable increase in forest older than 80 years has also occurred. In the past five years the BLM has implemented 300 acres of thinning of mid-seral forest.

Two vegetation zones are present in the watershed, as characterized in a Natural Resources Conservation Service soil survey (Hickman 1994). Each zone exhibits a single characteristic set of dominant plant communities related to local landscape features such as aspect, soil types and landform. Vegetation zones are an approximate guide to complex local vegetation patterns, natural plant succession, and stand development processes.

- The **Interior Valleys and Foothills Zone** occupies the lower valleys and elevations, comprising about 87 percent of the watershed, including most of the agricultural lands noted above. Douglas-fir is the dominant conifer species on the most favorable sites with lesser numbers of ponderosa pine and incense-cedar. Hardwood associates include Pacific madrone, bigleaf maple, California black oak and occasionally Oregon white oak.
- The **Grand Fir Zone** transitions from the drier valleys to the moist hemlock forests at the upper elevations, comprising 13 percent of the watershed. Douglas-fir is dominant in older stands, but in the absence of disturbance, such as wildfire, insects, or diseases, the dominant tree regeneration would be grand fir. Incense-cedar is often present and western redcedar may be found in moister areas. Golden chinkapin is common on northern aspects. Pacific madrone and occasionally California black oak may occur on drier southern aspects. Bigleaf maple and red alder are typically limited to moister sites.

Port-Orford-cedar is susceptible to a root disease caused by the pathogen *Phytophthora lateralis,* which is highly adapted for spread in water and soil. Viable resting spores may survive in infected root systems for 7 years or more following death of the host tree (Hansen and Hamm 1996). The disease is spread by the transport of infested soil and overland flow of water, primarily in the fall, winter, and spring when the cool, moist conditions are most favorable for the pathogen. Port-Orford-cedar is not known to occur naturally in the watershed, although it was occasionally planted in harvested units in the past. It has not been identified in any proposed thinning units or along roads that access them.

The **Olalla Creek-Lookingglass Creek** fifth-field watershed drains approximately 103,109 acres, an area of slightly more than 161 square miles (USDI, BLM 1998 p. vii). In 1997, approximately 23,719 acres were identified as non-forested lands primarily dedicated to agricultural and residential uses (USDI, BLM 1998 p. 28).

In 1936, approximately 23,700 acres or 23 percent of the watershed was nonforest. Woodlands constituted approximately 5,500 acres or five percent of the watershed. Approximately 1,000 acres or one percent of the watershed was early seral conifer forest. Mid-seral and late-seral conifer forest in all ownerships constituted approximately 29,650 acres and 43,230 acres, respectively (USDI, BLM 1998 p. 18).

In 1997, satellite imagery was used to project land condition and forest age class distribution in the watershed. Nonforest land had declined by approximately 2,300 acres to 21 percent of the watershed area.

The condition of privately-owned forest lands in the watershed consisted of approximately 28,580 acres of early-seral stands; 16,400 acres of mid-seral stands; and 9,290 acres of late-seral stands (USDI, BLM 1998 p. 42).

The BLM manages approximately 27,390 acres in the watershed, roughly 26,000 in forested condition. 1997 Forest Operation Inventory characterized forests on BLM-administered lands as approximately: 7,033 acres (27 percent) less than 30 years old; 3,829 acres (15 percent) 30 to 80 years in age; and 15,116 acres (58 percent) greater than 80 years old (USDI, BLM 1998 p. 24).

As in the Middle South Umpqua River watershed, no regeneration harvest has been conducted by the BLM in more than a decade. Since 2005, the BLM has implemented 686 acres of thinning in mid-seral forest stands. Consequently, there has been a decline in the abundance of early-seral stages with a corresponding increase in mid-seral forest stands and a gradual increase in mature and late-seral forest stands.

There are four vegetation zones represented in the watershed. In addition to the Interior Valleys and Foothills zone and Grand Fir zone described above, the Cool Douglas-fir/Hemlock and Western Hemlock zones are represented at higher elevations (USDI, BLM 1998 pp. 32-33).

- The **Cool Douglas-fir/Hemlock Zone** is dominated by Douglas-fir. Where soil conditions are favorable western hemlock may also be present. The occurrence of other conifer species such as incense-cedar, western redcedar and sugar pine is sporadic. Competition from evergreen shrubs such as canyon live oak and rhododendron can impede conifer regeneration.
- The **Western Hemlock Zone** is also dominated by Douglas-fir but western hemlock is typically present in the understory, or as an overstory dominant in older stands on north aspects. Grand fir is also common as an understory and overstory component. Western redcedar, chinkapin, bigleaf maple and red alder may also be present.

Port-Orford-cedar occurs naturally in the watershed, and as a reforestation component of some previously harvested stands. Port-Orford-cedar root disease is present in the watershed but has not been identified in any of the proposed commercial thinning units. A plantation with planted Port-Orford-cedar adjacent to proposed Unit 30-6-7A does not exhibit any sign of infection. Infected and uninfected Port-Orford-cedar are present along Road Nos. 29-8-9.0 and 30-7-23.0 which would provide access to several units.

Conditions within the proposed thinning units

Stand exams were conducted in late-2008 and early-2009 using the BLM Ecosurvey Stand Exam Program. Organon Forest Growth and Yield Model version 8.2 (Hann et al. 2005) for southwest Oregon was used to estimate future stand growth, development, and stand characteristics. These include trees per acre, diameter breast height, relative density, canopy cover, and mortality.

All of the stands were established following regeneration harvest. They range in age from 33 to 59 years old. Most were broadcast burned and planted primarily to Douglas-fir, though some natural regeneration of other conifers also occurred.

The stands are dense and generally even-aged, with few remnant trees from the previous entry. Conifers other than Douglas-fir consist primarily of incense-cedar, sugar pine, ponderosa pine and grand fir with occasional occurrences of western hemlock and western redcedar. Pacific madrone, bigleaf maple, golden chinkapin, and red alder are the most common hardwoods. There are few residual snags, and little Decay Class 1 and 2 large down wood.

Relative stand densities range from about 40 to 65 (Curtis Relative Density), exceeding 50 in approximately 75 percent of the stands. Live crown ratios are still above 30 percent, a level important for maintaining or increasing the health and vigor of individual trees, and the stand as a whole. Ground cover and understory development is patchy and sparse as a result of 100 percent canopy cover. Hardwoods, which are generally shade intolerant, are being overtopped by conifers and gradually succumbing to suppression mortality, as are pine species. Table B-1 (Appendix B) provides a description of the current condition of individual units.

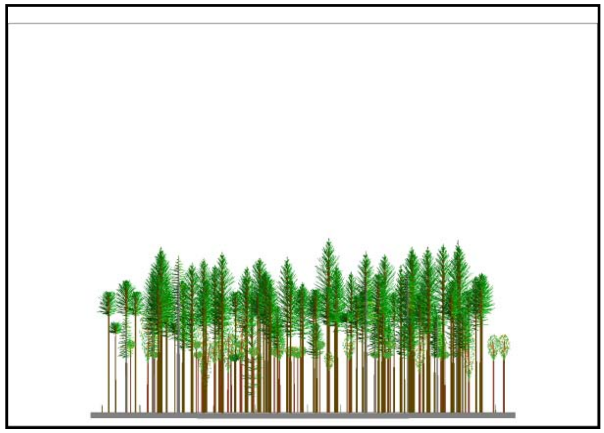
Trees per acre that are seven inches or larger diameter breast height range in number from about 110 to 250 per acre, with a mean of 200. Quadratic mean diameter[3] ranges from approximately 10 to 17 inches with a median of about 13 inches. Basal area[4] varies from approximately 140 to 235 square feet per acre with a mean of about 180 square feet.

Figure 3-1 is a photograph of conditions typical of those in the stands proposed for thinning. Figure 3-2 is a computer-generated depiction of the same stand modeled to display the effects of different silvicultural prescriptions and stand development through time. It was generated using Organon ver. 8.2 for Southern Oregon and depicted using Stand Visualization System ver. 3.36 (McGaughey 2002).

[3] Quadratic mean diameter is the mean diameter of all stems measured at breast height.
[4] Basal area is the sum of the cross-sectional area of all stems, including bark, measured at breast height and expressed in square feet.

Figure 3-1

Figure 3-2



B. Alternative One - Effects

Under this alternative, there would be no thinning. The stands would continue to develop as relatively homogeneous and even-aged stands that are primarily single-storied in nature and dominated by Douglas-fir. Forest canopies would remain fully closed and the percentage of live crown in individual trees would recede below 30 percent over the next 10 to 20 years. Diameter growth and live crown would continue to decline from competition among trees for water, nutrients, and sunlight. Height growth, which is less affected by stand density, would continue, but with little corresponding increase in diameter the trees would become unstable and more susceptible to wind damage (Wonn 2001, Wilson and Oliver 2000).

Suppression mortality and stagnation of tree growth would increase as live crowns recede. Hardwoods trees and shade intolerant conifers such as sugar pine and ponderosa pine would be gradually eliminated as stand components. Establishment and growth of shrubs and herbaceous plants would be largely precluded. Reduced tree vigor would result in slower-growing trees less capable of adapting to disturbance and more susceptible to damage and mortality from endemic populations of insects and root diseases present in the stands.

Table 3-1 provides a comparison and illustrates the structural changes that would occur in a representative stand over the next 20 and 40 years, absent thinning to reduce stand density.

Table 3-1 Reference Unit 28-8-8A Comparison of Current Stand Conditions with Conditions in 20 and 40 Years if Left Untreated (includes trees < seven inches diameter breast height)

Year	Trees per Acre	Basal Area (square feet per acre)	Quadratic Mean Diameter (inches)	Curtis Relative Density Index	Percent Canopy Cover	Percent Live Crown
2009	374	182	9.4	57	100	29
2029	301	237	12.0	68	100	23
2049	264	288	14.2	77	100	19

Figure 3-3 depicts the anticipated mortality and structural condition of the stand in the year 2029 in the absence of any thinning. Figure 3-4 depicts additional changes in stand conditions that would occur by the year 2049.

Figure 3-3

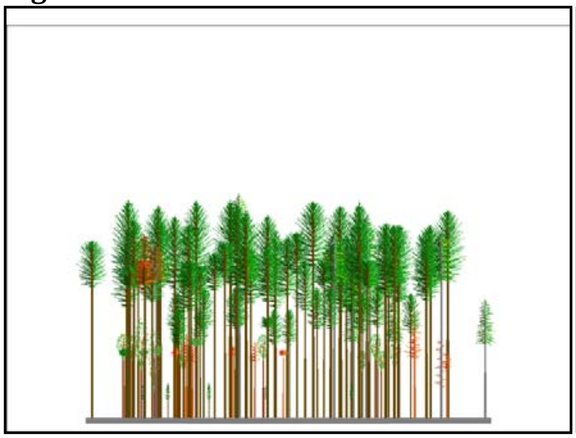
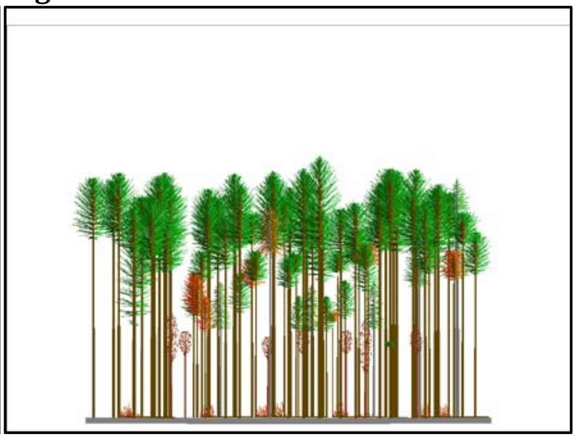


Figure 3-4



Canopy cover remains at 100 percent while stand relative density increases to more than 70, well beyond the threshold where suppression mortality increases, as illustrated by the declining number of trees per acre. There would be a corresponding decline in the health and vigor of individual live trees as crown ratios fall below 30 percent. Increased tree mortality would also substantially increase accumulated dead fuel on the forest floor.

This would not meet the objectives described in Chapter One of: managing developing stands in the General Forest Management Area and Connectivity/Diversity Block land use allocations to promote tree survival and growth to achieve a balance between wood volume production, quality of wood, and timber value at harvest; and creating of a variety of structures, stands with trees of varying age and size, and an assortment of canopy configurations..

Late-Successional Reserves and Riparian Reserves are managed for the development of late-successional forest conditions. Old-growth stands typically developed at low tree densities, while these young managed stands are developing at comparatively higher relative densities (Tappeiner et al. 1997).

Without silvicultural treatment or natural disturbance, individual tree growth will stagnate even as stand growth continues. This would likely result in stands with little structural complexity indicated by a lack of large overstory trees, decreased species diversity as hardwoods and shade intolerant conifers die from suppression, and maintenance of closed and single-layered canopy conditions. Level of sunlight reaching the forest floor would be insufficient to support establishment and survival of a robust community of shrubs, forbs, grasses and herbaceous plants in the understory.

Formation of canopy gaps and stratification of the canopy into multiple layers would generally not occur. Growth and development of large diameter trees would be delayed, creating a deficit of large snags and down wood which would need to be created by disturbance factors other than suppression mortality, such as windthrow, root disease, lightning or fire.

This alternative would not meet the objectives for Riparian Reserves of controlling stocking levels, and establishing and managing non-conifer vegetation to consistent with Aquatic Conservation Strategy objectives. It also would not meet management objectives, or objectives of the *South Coast-Northern Klamath Late-Successional Reserve Assessment*, because it would not: protect and enhance conditions of late-successional forest, promote development of old-growth forest characteristics, maintain the health and vigor of the stands, maintain native species diversity, and decrease the risk of large-scale disturbances.

Management of Private Forest Lands

Recent data on the harvest of privately-managed forest lands is not readily available, but an analysis of aerial photographs in 2004 of the Olalla Creek-Lookingglass Creek watershed projected an annual harvest of approximately 325 acres of mid-seral forest and 130 acres of late-seral forest.

As major private ownership is generally the same in the two watersheds, and their timber needs for operation of their mills would be generally constant or gradually increasing over the short term, these average rates would be representative of recent and reasonably foreseeable timber harvest over the next decade. Harvest at these rates would indicate a decline of approximately 20 percent per decade in the amount of mid-seral forest and 15 percent per decade in the amount of late-seral forest on privately-managed lands.

When harvest of late-seral forest under private ownership is complete, it is anticipated that these private lands will continue to be managed on rotations of 50 years or less, as illustrated by the present rate of harvest of mid-seral forest stands.

Common to all Land Use Allocations in the Project Watersheds

Port-Orford-cedar occurs individually or in scattered groups of trees rather than as continuous stands. Based on extensive roadside surveys in 1996, it was estimated to be present on approximately 6,163 acres or 24 percent of BLM-administered lands in the project watersheds.

One study (Jules et al. 2002) concluded that 72 percent of the infected sites in the landscape under examination were the result of vehicular dispersal of contaminated soil along roads. The disease may also be spread by game animals and casual forest visitors, by transport of infested soil on hooves and feet. For these reasons, it is expected that the spread of *Phytopthora lateralis* will continue at rates comparable to what has been observed and noted in the past.

One other Federal project is proposed that would affect the project watersheds. The Federal Energy Regulatory Commission is considering a proposal for construction of a natural gas pipeline, which would pass through the two watersheds.

Right-of-way construction for the Williams Connector Pipeline, if approved, would remove approximately 31 acres of late-seral forest and five acres of mid-seral forest from BLM-administered lands which would then be managed, for the foreseeable future, in non-forest or early-seral forest condition. This would represent a 0.17 percent decrease in late-seral forests and 0.09 percent of mid-seral forest stands managed by the BLM in the two watersheds.

C. Alternative Two - Effects

General Forest Management Area

As described in Chapter Two (p. 13), the entire 798 acres in the General Forest Management Area proposed for thinning would be managed for full site occupancy to maximize future timber volume: by thinning on a generally even spacing to a relative density of 35, retaining 80 to 130 trees, and 115 to 140 square feet of basal area per acre. Post-thinning canopy cover would range from 70 to 80 percent. These changes in relative stand density would reduce competition among remaining trees for available water, light and nutrients and result in increased growth rates expected to persist for 15 to 20 years.

Thinning would meet the objective of assuring high levels of timber productivity and quality wood production by increasing average stand diameter growth. Selecting the best formed co-dominant and dominant trees for retention, and promoting accelerated growth by releasing these trees from competition would aid in the maintenance of the health and vigor of the stands.

Table 3-2 compares post-thinning conditions for Unit 30-6-7A with conditions anticipated 20 years after thinning.

Table 3-2 Comparison of Pre-thinning Conditions and Average Stand Conditions for a Selected Unit post-thinning, 20 years out, and 40 years out (includes trees < seven inches diameter breast height)

	Trees per Acre	Basal Area (square feet per acre)	Quadratic Mean Diameter (inches)	Curtis Relative Density	Canopy Cover (percent)	Live Crown Ratio (percent)
Unthinned	353	163	9.2	52	100	37
Post Thinning	144	127	12.7	35	74	50
20 Years post thinning	135	213	17.0	53	83	36
40 Years post thinning	127	278	20.0	62	98	28

Figure 3-5 is a photograph of typical conditions in a stand following application of even-spacing thinning. Figure 3-6 is a computer-generated depiction of the same stand, using Organon ver. 8.2 for Southern Oregon and Stand Visualization System ver. 3.36 (McGaughey 2002). Figures 3-7 and 3-8 are representative of expected stand conditions 20 years after thinning. Figure 3-9 depicts expected stand conditions 40 years after thinning.

Figure 3-5

Figure 3-6

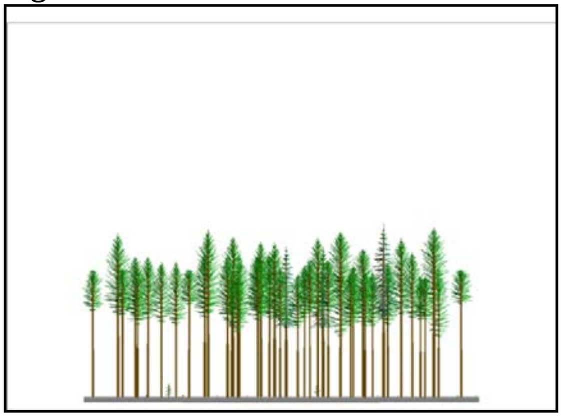


Figure 3-7

Figure 3-8

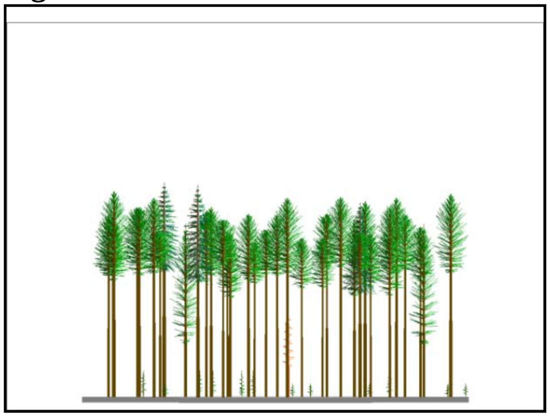
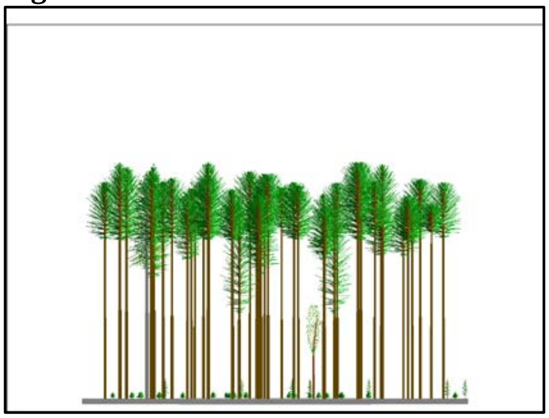


Figure 3-9



This alternative would meet the objectives, described on page 2, of managing developing stands to promote tree survival and growth to achieve a balance between wood volume production, quality of wood, and timber value at harvest.

Connectivity/Diversity Block and Riparian Reserves

As described in Chapter Two (pp. 6-8), in these two land use allocations a variable density prescription would be employed based on a combination of basal area and number of trees per acre.

Variable density thinning would create gaps and areas of greater canopy removal, allowing sufficient light for regeneration of more shade tolerant conifers, retention of hardwood species, and establishment of shrub, forbs, grass and herbaceous communities on the forest floor. The stands would also be evaluated, post-thinning, for under-planting gaps and openings with a combination of ponderosa pine, sugar pine, cedars and Douglas-fir to help create a secondary canopy layer.

This would help achieve the objective of creating stands with a variety of structures, trees of varying age and size, and an assortment of canopy configurations while still contributing to a sustainable supply of timber.

No-treatment areas within the Riparian Reserves would provide for natural differentiation in the size of trees. The lower stand densities in the thinned portions of the Riparian Reserves would allow sufficient light for regeneration of more shade tolerant conifers, retention of hardwood species, and establishment of shrub and forbs communities on the forest floor. This would eventually lead to the development of multiple canopy layers and conditions more akin to late-successional forest. Creating gaps and releasing selected trees would also allow for accelerated tree growth that would provide larger wood for future instream recruitment.

Late-Successional Reserves

Thinning initiates and promotes tree regeneration, shrub growth, and development of multi-storied stands even when the treatments focus on management of overstory tree density (Bailey and Tappeiner 1998). Thinning, in conjunction with gap creation and retention of unthinned areas would alter the current developmental trajectory of the managed stands to enhance the structural and biological diversity, and provide conditions favorable for development of late-successional characteristics.

In the Late-Successional Reserves, light and moderate variable density thinning from below would remove smaller trees that that would normally die from suppression. This would limit numbers of smaller diameter snags and abundance of coarse down wood, short term, and reduce numbers of trees available for snag recruitment and coarse down wood over the longer term. Smaller diameter snags and down wood created by suppression mortality would not persist for the long term, however.

Initially, the creation of gaps would allow sufficient light to reach the forest floor to allow for the natural regeneration of conifer and hardwood species that are less shade tolerant. This would also promote establishment and growth of herbaceous plants, forbs and shrubs that provide organic nutrients, and shelter and forage for birds, mammals, and invertebrate species.

Over the longer term, these gaps would allow for the growth of larger trees adjacent to the openings, with full crowns and large limbs that are more typical of trees that were open-grown when young. This would aid in development of tree sizes and crown characteristics associated with mature and late-successional forest more quickly than untreated forest stands in the area. This accelerated growth would be expected to persist for a period of 30-years or longer.

Table 3-3 Reference Unit 28-8-8A, Stand Condition for No Treatment Compared to Variable Density Thinning at Years 2009, 2029, and 2049 (includes trees < seven inches diameter breast height)

Stand Treatment	Year	Trees per Acre	Basal Area (square feet per acre)	Quadratic Mean Diameter (inches)	Curtis Relative Density	Canopy Cover (percent)	Live Crown Ratio (percent)
Unthinned	2009	374	182	9.4	57	100	29
Thinned		75	96	15.4	25	58	31
Unthinned	2029	301	237	12.0	68	100	23
Thinned		71	146	19.4	34	72	26
Unthinned	2049	264	288	14.2	77	100	19
Thinned		68	186	22.4	42	79	21

Thinned stands would eventually reach a level of stand density where mortality suppression would once again occur, resulting in the generation of snags and large down wood that would persist for longer periods of time. Future entries, which would be subject to future analysis, may be needed to maintain or further enhance structural and horizontal diversity.

Figure 3-10 is a photograph of typical conditions expected following the manner of variable density thinning that would be applied in the Late-Successional Reserves. Figure 3-11 is a computer-generated depiction of the same stand, generated using Organon ver. 8.2 for Southern Oregon. Figures 3-12 and 3-13 are representative of expected stand conditions after 20 years. Figures 3-14 depicts expected stand conditions 40 years after thinning.

Figure 3-10

Figure 3-11

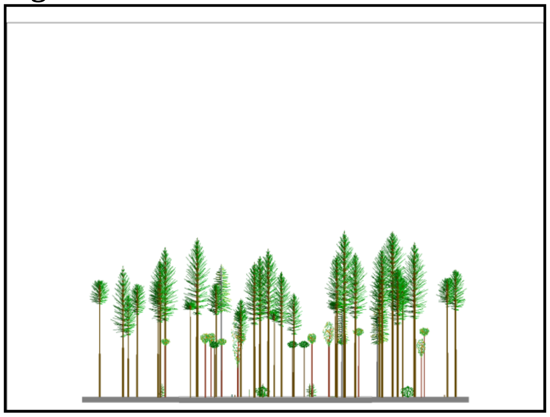


Figure 3-12

Figure 3-13

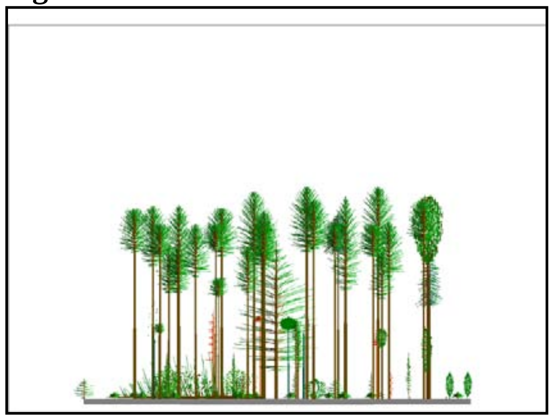
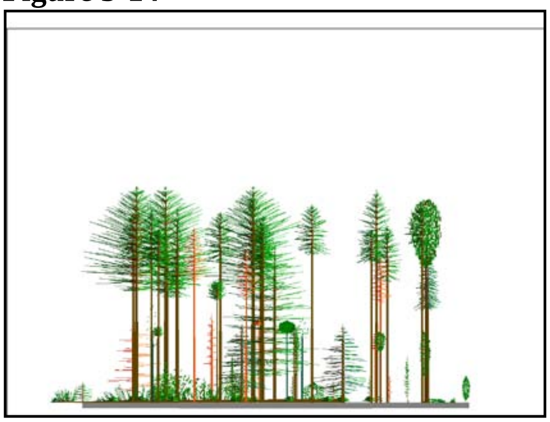


Figure 3-14



Regardless of the land use allocation, while thinning would reduce tree densities in individual stands, it would not alter the seral stage of the stands, or the seral stage distribution of BLM-managed lands within the two watersheds, nor preclude future development of the stands along trajectories consistent with the objectives of the specific land use allocations. Removal of approximately three acres of late-seral forest associated with road and landing construction represents less than 0.02 percent of the late-seral forest managed by the BLM in the projects watersheds and would not measurably change current abundance and distribution.

Common to All Land Use Allocations in the Watersheds

The *Record of Decision and Resource Management Plan Amendment for Management of Port-Orford-cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg Districts* (USDI, BLM 2004) provides direction for assessing risk and controlling spread of Port-Orford-cedar root disease in order to maintain Port-Orford-cedar as an integral component of the vegetative communities of which it is a part.

The risk key is used for site-specific assessment of the need for application of additional management practices. An assessment of the project area indicates no special mitigation is required, because:

- There are no uninfected Port-Orford-cedar within, near or downstream of any of the proposed commercial thinning units or anticipated haul routes whose ecological, Tribal, or product use or function measurably contributes to meeting resource management objectives.
- There are no uninfected Port-Orford-cedar within, near or downstream of any of the proposed commercial thinning units or anticipated haul routes that, were they to become infected, would likely spread infections to trees whose ecological, Tribal, or product use or function measurably contribute to meeting land and resource management plan objectives.
- None of the proposed commercial thinning units are located in uninfested 7^{th}-field watersheds (drainages).

Although no mitigation is indicated, measures to reduce the risk of further spread of Port-Orford-cedar root disease would be implemented, including: equipment washing, restricting road construction and renovation to May 15^{th} through October 15^{th}, restricting hauling on unsurfaced roads to the dry season, scheduling operations in uninfested areas prior to work in infested areas, and decommissioning and blocking unsurfaced roads to vehicular access upon completion of thinning operations.

D. Alternative Three Effects

Effects of thinning in the Connectivity/Diversity Block, Riparian Reserve, and Late-Successional Reserve land use allocations would be identical to those described under Alternative Two, as the marking prescriptions would be the same. The same would apply to units in the General Forest Management Area that are outside of critical habitat designated for the survival and recovery of the northern spotted owl. The application of a modified Late-Successional Reserve variable density thinning to units in the General Forest Management Area that are within critical habitat would achieve results similar to those described on pages 28 and 29 and illustrated on page 30.

This treatment would reduce stand densities on these 485 acres below full site-occupancy, resulting in a small increase in the timber volume generated from the thinning, with a corresponding reduction in total stand volume at such time as the stands may be scheduled and prepared for a final harvest. It would also place the stands on a growth trajectory that would move them toward the development of forest structure that would provide nesting, roosting and foraging habitat for northern spotted owls, consistent with long-term objectives of critical habitat.

This alternative would also meet the objectives identified in Chapter One. It would contribute toward the Roseburg District declared annual allowable sale quantity provide timber. It would also create a variety of structures, stands with trees of varying age and size, and an assortment of canopy configurations to support the needs of wildlife species. The cumulative effects would not differ from those of Alternative Two, as it would not measurably alter the seral stage of the stands, or the seral-stage distribution of BLM-managed lands within the two watersheds.

II. Wildlife

A. Affected Environment

BLM Manual 6840 establishes management direction for two groups of special status species; those that are listed or proposed for listing under the Endangered Species Act of 1973, as amended, and those designated as Bureau Sensitive by the Bureau of Land Management. Twenty-four special status wildlife species are known or suspected to occur on the Roseburg District. The proposed action alternatives would have no effect on 16 of these species because the project area is outside their recognized range, suitable habitat is absent in the project area, or Riparian Reserves would provide adequate protection (Table C-1, Appendix C). The remaining eight special status species that may be affected are addressed below.

A third group of species designated as Survey and Manage species, also referred to as Special Attention species, were designated under the Northwest Forest Plan. The Survey and Manage standards and guidelines were amended by the *2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl*, and incorporated into the Roseburg District ROD/RMP. These species are not considered special status species, unless also designated as such under Manual 6840 authority. Further amendments to the Survey and Manage program were implemented in 2004 and 2007.

In 2006, Judge Pechman in the U.S. District Court for the Western District of Washington invalidated the agencies' 2004 Record of Decision eliminating Survey and Manage, based on a finding of violations of the National Environmental Policy Act. Following the ruling, parties to the litigation entered into a stipulated agreement which exempted certain categories of activities from the Survey and Manage standard, hereinafter referred to as the "Pechman exemptions".

Judge Pechman's Order directed that: "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 2001 ROD 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."

On December 17, 2009, Judge Coughenour in the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Rey, et al.*, No. 08-1067, granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the 2007 Record of Decision eliminating the Survey and Manage mitigation measure. Judge Coughenour deferred issuing a remedy until further proceedings, did not set aside the Pechman exemptions, or enjoin the BLM from proceeding with projects.

1. Threatened and Endangered Species

The **northern spotted owl** (*Strix occidentalis caurina*) is present throughout the Roseburg District, generally inhabiting forests older than 80 years of age that provide habitat for nesting, roosting and foraging, which is commonly referred to as suitable habitat. Stands typically have a multi-layered, multi-species canopy dominated by large overstory trees greater than 20 inches diameter breast height. Canopy cover is typically 60-to-80 percent, with open spaces within and below the dominant overstory. Trees with large cavities and other deformities, large snags, and large down wood are typically abundant (Thomas *et al.* 1990; Hershey et al. 1997; USDI USFWS 1990; USDI USFWS 2008a).

Younger conifer-dominated forest stands 40 to79-years old generally do not function as nesting habitat, but provide dispersal habitat, instead. Canopy cover exceeds 40 percent, and average tree diameter breast height is 11 inches or greater (Thomas et al. 1990). Dispersal habitat may contain snags, coarse woody debris, and prey sources that allow mature owls to move between blocks of suitable habitat, and juveniles to disperse from their natal territories (USDI USFWS 2009).

Because of relatively small tree size (quadratic mean diameter 10 to 17 inches), high stand density, and lack of suitable habitat components, conditions in the proposed thinning units, the stands are considered primarily dispersal habitat. A part of Unit 29-07-11B contains a mix of madrone and conifers that provides some suitable habitat structure. In 2009, a barred owl (*Strix varia*) was observed in this stand multiple times, indicating regular use.

In southwest Oregon, particularly in drier forests, woodrats (*Neotoma* ssp.) are the primary prey for northern spotted owls. This terrestrial species inhabits earlier seral forest stages and accounts for 45 to 70 percent of the prey biomass consumed (Forsman et al. 1984, Carey et al. 1992, Forsman et al. 2004). Other prey, both terrestrial and arboreal, include northern flying squirrels (*Glaucomys sabrinus*, ~ 14 percent of prey biomass), Oregon red tree voles (*Arborimus longicaudus*, one to two percent of prey biomass), brush rabbits (*Sylvilagus bachmani*, 6 to 22 percent of prey biomass), deer mice (*Peromyscus maniculatus*, ~ one percent of prey biomass), and Western red-backed voles (*Clethrionomys occidentalis*, one to three percent of prey biomass) (Forsman et al. 1984, Carey et al. 1992, Forsman et al. 2004).

Data from the 2008 Roseburg District northern spotted owl database identifies 18 original and 15 alternate spotted owl home ranges that overlap the project watersheds. Twenty-five sites are in the Klamath Province, and the remaining eight are in the Coast Range Province. Approximately 813 acres proposed for thinning are located within home ranges that overlap the project area (Table C-2, Appendix C).

A known site is defined as a location with evidence of continued use by northern spotted owls. Evidence can be in the form of repeated location of single or paired birds in a single season and/or over a period of several years, presence of a breeding owl pair, and presence of young owls prior to dispersal. Known sites may include alternate nest trees outside the existing nest patch. Known sites are identified with a unique four-digit number plus a letter, called the IDNO. The original site is given the letter O for 'Original,' while alternate sites are assigned consecutive letters (USDI USFWS 2009). For example, the original Burnt Mountain site is 0513O, and three alternate sites are 0513A, 0513B and 0513C.

Effects to known sites are generally assessed by evaluating the amount of suitable and dispersal habitat within the home range, a core area, and a nest patch, described below.

- A "home range" is a circle centered on a northern spotted owl nest site that represents the area northern spotted owls are assumed to use for nesting, roosting, and foraging when occupying that site. Home ranges frequently overlap, and habitat within them may be shared by adjacent resident spotted owls and dispersing owls (USDI USFWS 2009). Home range radii and acreages vary by physiographic province. In the Coast Range a home range is represented by a circle 1.5 miles in radius or an area of approximately 4,524 acres, while a home range in the Klamath province is 1.3 miles in radius an 3,340 acres (USDI USFWS 2008a). Because northern spotted owls may use multiple nest sites from year to year, the combined acreage used by a given owl pair may exceed those described above.
- The "core area" is an area 500-acres in size, represented by a 0.5-mile radius circle centered on the nest tree. It describes the area most heavily used during the nesting season and defended by territorial owls (USDI USFWS 2008a). Core areas generally do not overlap. The U.S. Fish and Wildlife Service considers any timber harvest in a core area containing less than 50 percent suitable habitat as likely to affect the reproductive success of nesting spotted owls.
- The "nest patch", located within the core area, is represented by a 300-meter radius circle, approximately 70-acres in area, centered on the nest tree (USDI USFWS 2008a). The U.S. Fish and Wildlife Service considers any timber harvest within a nest patch, including thinning, likely to affect the reproductive success of nesting spotted owls.

The relationship of individual thinning units with respect to home ranges, core areas and nest patches overlapping the project area is displayed in Table C-2 of Appendix C, which also identifies proximity of units to suitable habitat. Eleven units are located partially or entirely within a core area, and three of these units overlap nests patches (Table C-3, Appendix C).

Access to Units 28-08-21C, 28-08-33A and B, 29-06-19A, and 29-07-13D, would require road construction through suitable spotted owl habitat. Road lengths would vary from approximately 300 to 800, and total approximately 2,400 feet. Construction would modify approximately two and a half acres of suitable habitat.

Critical habitat is defined as the habitat on which the physical and biological features essential to the conservation of the species are found. For spotted owls, this includes forest land that is currently unsuitable habitat, but capable of becoming suitable habitat in the future.

Critical Habitat Unit OR-62, designated in 1992 designated for spotted owl recovery (USDI USFWS 1992), contains 49,562 acres. There are 32,489 acres of dispersal habitat, which include 25,864 acres deemed suitable habitat.

CHU OR-62 overlaps five proposed thinning units, totaling 117 acres in area. Units 28-08-8A and 30-07-9A, B, and C are within Late-Successional Reserves, and Unit 29-08-33A is in the Matrix. Access to these units would involve renovation of existing roads or road construction exclusively within the thinning units. No suitable habitat would be removed in association with these activities.

Revision of critical habitat was completed by the U.S. Fish and Wildlife Service in 2008 (USDI USFWS. 2008b). Eighteen of the proposed thinning units, totaling approximately 611 acres, are in the Rogue Umpqua critical habitat unit (OR CHU 14 in Table C-2, Appendix C), a Managed Owl Conservation Area (MOCA) identified as OMOCA No. 27 in the 2008 recovery plan for the spotted owl (USDI USFWS. 2008a). Of the five units described above that are overlapped by 1992 critical habitat, only Unit 28-8-8A is not in 2008 critical habitat.

Marbled murrelets (*Brachyramphus marmoratus*) nest in forests with canopies dominated by large overstory trees. Large diameter mossy branches, dwarf mistletoe brooms, branch overcrowding, natural depressions on large limbs, damaged limbs, or old stick nests can serve as platforms for egg laying (Lank et. al. 2003, Hamer and Nelson 1995).

Availability of trees with platforms is critical for nesting (McShane et al. 2004). Forest stands with trees greater than 80-years-old may provide platforms, but the quality and abundance of trees with platforms and the number of platforms per tree is more apparent in stands over 150-years-old. Some proposed thinning units have large residual trees that pre-date the existing stands, but overall lack suitable nesting habitat.

In Oregon, there are two marbled murrelet management zones. Zone 1 extends 35 miles from the Oregon coast and Zone 2 continues from 35 miles to 50 miles inland. Murrelets generally nest within 28 miles of the coast (Lank et. al. 2003), but multiple occupied sites and a nesting tree have been documented 29 to 49 miles inland on the Roseburg District.

Proposed units 29-06-29A; 29-06-33C; 30-06-5A, B, C, and D; and 30-06-7A, C, D, and E are located entirely outside of the two management zones, as is the eastern half of proposed unit 29-06-31B. The remaining units and western portion of 29-06-31B are in Zone 2.

No suitable habitat exists within 100 yards of proposed units: 29-06-33C; 30-06-5A, B, C, and D; 30-06-7C, D, and E; 29-07-25A, B, and D; and 30-07-9A. Where suitable habitat is present within 100-yards of proposed units, or isolated groups of suitable nest trees exist within proposed units, the units are being surveyed in accordance with established protocol (Mack et al. 2003). Proposed Unit 28-08-21B is adjacent to an occupied forest stand, and occupancy has also been documented in an older stand adjacent to proposed Unit 28-08-8A.

Proposed access to Units 28-08-21C, 28-08-33A and B would require construction of roads that would pass through or skirt adjacent suitable nesting habitat for murrelets.

The U.S. Fish and Wildlife Service has designated critical habitat for the marbled murrelet (USDI USFWS 1996). Proposed units 28-08-8A, 28-08-33A and B are located in Critical Habitat Unit OR-06-d illustrated in Figure 2-1.

2. Bureau Sensitive Species

BLM Manual section 6840, states that Bureau actions must not contribute to the need to list BLM Special Status Species under the Endangered Species Act. The species list was last updated in January 2008 (USDI BLM 2008b). Five species that could be affected by the proposed thinning are discussed below.

The **Chace sideband snail** (*Monadenia chaceana*) and **Oregon shoulderband snail** (*Helminthoglypta hertleini*) are endemic to northwestern California and southwestern Oregon. These snails may use interstices in rock-on-rock habitat, soil fissures, or the interior of large woody debris as refugia from desiccation during dry periods (Weasma 1998a, 1998b; Duncan et al. 2003, Frest and Johannes 2000).

Both species have been found in watersheds throughout the South River Resource Area. While most often associated with older forest habitat, these snails have been found in mid-seral stands, though less frequently. In the Klamath Province, they most often inhabit rock-on-rock habitat. Forage is believed to consist of leaf litter, fungus, and/or detritus. When active they are most often found on herbaceous vegetation, ferns, leaf litter, or moss mats in moist and shaded areas near refugia.

Surveys of suitable habitat for these two species were conducted with negative results. Consequently, they will not be discussed further in this analysis.

The **spotted tail-dropper** (*Prophysaon vanattae pardalis*) is a large slug that is generally found in leaf litter beneath shrubs, in mature conifer forests east of the Coast Range. It is also found in moist mature forested habitat with a diversity of deciduous trees and shrubs, and other mollusk species (USDA Forest Service and USDI BLM 2000). The species is present in the Coast Range Province on the Roseburg District, in the western portion of the South River Resource Area situated north of Highway 42. Proposed Units 28-08-8A; 29-08-21A, B, C; and 28-08-33A and B are within this area.

Proposed roads for access to Units 29-08-21C and 28-08-33B would pass through forest that are suitable habitat for the spotted tail-dropper. The results of surveys of the proposed right-of-way into Unit 28-08-33B were negative. Surveys of the proposed right-of-way that would access Unit 28-08-21C are ongoing.

Fringed myotis (*Myotis thysanodes*) are insectivorous bats found throughout the western U.S., in a range of habitats that include Douglas-fir forest (reviewed in Verts and Carraway 1998). Hibernacula and roost sites are known to include caves, mines, buildings, and large snags (Weller and Zabel 2001).

The **Pacific pallid bat** (*Antrozous pallidus pacificus*) is another insectivore found in the Pacific Northwest, often in forest edge habitat (reviewed in Verts and Carraway 1998). Hibernacula and roost sites include caves, mines, rock crevices, bridges, buildings, hollow trees and snags (Lewis 1994).

Townsend's big-eared bats (*Corynorhinus townsendii*) are also found in the western U.S. in habitats that include conifer forest (reviewed in Verts and Carraway 1998). They typically roost and hibernate in mines and caves, but have also been found roosting in hollow trees (Fellers and Pierson 2002).

All three are documented on the Roseburg District, but the numbers and location of these bats in relations to the proposed thinning units is unknown.

3. Survey and Manage Species

In the project area, there are four Survey and Manage wildlife species whose presence might be reasonably expected. The Oregon shoulderband snail and Chace sideband snail are addressed above as Bureau Sensitive species.

The **great gray owl** (*Strix nebulosa*) is documented in the South River Resource Area at a single nesting location (BLM owl survey data). Like other owls the great gray owl does not construct nests or carry nesting material (USDA Forest Service, USDI BLM 2004c). It typically depends on abandoned nests built by the common raven, hawks, and squirrels. Other suitable nesting structures are provided by broken–top snags, dwarf-mistletoe brooms, and branch/tree bole deformities.

The stands proposed for thinning generally lack nesting habitat but some of the proposed road locations pass through older forest stands with nesting potential. These areas include proposed roads to Units 29-06-19A, 29-07-25C and D, 29-08-21C, 28-08-33A and B, and 29-07-13D. In conjunction with red tree vole evaluations, the proposed road rights-of-way and adjoining forest 180-feet either side of centerline were examined for possible great gray owl occupancy. No obvious nests built by hawks or ravens were observed, but squirrel nests were present and tree deformities were noted. No great gray owls were observed, though.

None of the proposed road locations are within 200 meters of natural openings greater than 10 acres in size that would provide areas for foraging. Man-made openings in various stages of forest development are adjacent to the forest stands.

Clearance surveys were not conducted because the survey protocol (USDA Forest Service and USDI BLM 2004c) states pre-disturbance surveys are not necessary to provide for a reasonable assurance of persistence in the following conditions:

- Surveys of suitable nesting habitat adjacent to natural openings smaller than 10 acres is not necessary, and
- Pre-disturbance surveys are not suggested in suitable nesting habitat adjacent to man-made openings at this time.

Road construction would not substantially change concerns for persistence of the great gray owl in the South River Resource Area. Given the lack of large natural openings in the immediate vicinity of road rights-of-way, great gray owls are not expected in the project area.

The **Oregon red tree vole** (*Arborimus longicaudus*) is an arboreal rodent endemic to moist coniferous forests of western Oregon and extreme northwest California. It that nests, forages, and travels through the canopies of conifers (Forsman and Swingle 2007, Carey 1991). Red tree voles primarily feed on the needles and bark of Douglas-fir, and use materials such as twigs, needles, and lichens for nest building (Maser 1998).

Mature and old-growth forests appear to provide optimum habitat. Tall, multi-layered forest canopies retain humidity and intercept fog, which moderates climate and provides a source of free water. Large branches provide stable support for nests, protection from storms, and travel routes (Gillesberg and Carey 1991)".

The "Survey Protocol for the Red Tree Vole (Arborimus longicaudus). Version 2.1" (USDI BLM 2002, p. 6) identifies conditions under which pre-disturbance surveys are required. In the "Mesic Forest Distribution" pre-disturbance surveys are required where stand quadratic mean diameter is equal to or greater than 18 inches. As illustrated in Table B-1, *Appendix B – Silviculture*, none of the stands proposed for thinning have a quadratic mean diameter sufficient to trigger survey requirements.

Proposed road rights-of-way to Units 29-06-19A, 29-07-25C and D, 29-08-21C, 28-08-33A and B, and 29-07-13D are routed through forest stands that are suitable for red tree vole occupancy. Ground evaluation was conducted of the proposed rights-of-way and adjacent forest 180 feet on either side. Trees with potential nests are present in all of the road locations. Evidence of older nests and more current nests were found in some locations. Further evaluation through physical inspection of the suspected nests is ongoing to determine the level of activity present, and the appropriate application of the management recommendations.

4. Landbirds

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" and "Birds of Conservation Concern" to be addressed during environmental analysis of agency actions and plans.

"*Game Birds Below Desired Condition*" documented or suspected on the Roseburg District include the harlequin duck (*Histrionicus histrionicus*), wood duck (*Aix sponsa*), band-tailed pigeon (*Columba fasciata*) and mourning dove (*Zeneida macroura*).

As described in Table C-1 (Appendix C), nesting habitat for the **harlequin duck**, also a Bureau Sensitive species, is absent in the proposed thinning units and presence of the species is not expected.

Wood ducks nest in tree cavities (Lewis and Kraege 1999) in the vicinity of wooded swamps, flooded forest, marsh, or ponds (Ehrlich et. al.1988). Although small wet areas, less than 0.1 acres in size, are present in some proposed units, nesting habitat is not.

In western Oregon, **band-tailed pigeons** nest primarily in closed Douglas-fir stands with canopy cover above 70 percent (Leonard 1998). Presence of the species has been linked to the existence of mineral springs (Altman 1999). More recent work by Sanders and Jarvis (2003) indicates reduced availability of food sources such as red elder and cascara, rather than nesting habitat and proximity to mineral sites, may be more directly related to declining abundance of band-tailed pigeons in Oregon.

Mourning doves (*Zeneida macroura*) range across North and Central America, inhabiting forest, desert, shrub/scrub, suburban areas and agricultural lands. They forage in areas with little ground cover and nest in edge-habitats between forest/shrubs and open areas. They are frequently seen on the Roseburg District along roadsides and forest openings.

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.

Eight species: the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus anatum*), marbled murrelet (*Brachyramphus marmoratus*), rufous hummingbird (*Selasphorus rufus*), Allen's hummingbird (*Selasphorus sasin*), olive-sided flycatcher (*Contopus cooperi*), willow flycatcher (*Empidonax traillii*) and purple finch (*Carpodacus purpureus*)) are documented in the Roseburg District.

The marbled murrelet has been discussed under Threatened and Endangered Species. Habitat for the bald eagle, peregrine falcon, willow flycatcher, and Allen's hummingbird would not be affected and these species will not be discussed further.

The remaining species; the olive-sided flycatcher, purple finch, and rufous hummingbird could be indirectly affected by the proposed thinning and are discussed below.

The **olive-sided flycatcher** is associated with natural or man-made openings with tall trees or snags available for perching and singing (Altman 1999). In the Oregon Coast Range, it is closely associated with edges of older stands with tall trees and snags greater than 21 inches diameter breast height and broken canopy (Carey et al. 1991). These conditions are generally absent within the proposed thinning units but often present in adjacent or nearby older stands.

Purple finches are common the west coast of North America, including southwestern Oregon (Wootton 1996, Csuti et al. 1997). They prefer open areas or edges of low to mid-elevation mixed coniferous-deciduous forests (Csuti et al. 1997), 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 (Wootton, J. T. 1996). They primarily nest in Douglas-fir, pine or spruce but may use oak, maple, and fruit trees, and feed on seeds, buds, blossoms, nectar, fruit of trees and occasionally insects (Wootton 1996). They have been documented in some of the proposed thinning units or adjoining stands.

Rufous hummingbirds are present throughout the Roseburg District, primarily associated with forest edges and openings with a diversity of flowering plants for feeding and open space for aerial displays of courtship behavior. This most 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 (e.g., treefall gaps, wind throw, blowdown) that naturally occur in these forests (Altman 1999).

Early nests (April/May) are placed near the ground and late nests (June), higher up to maintain a desired microclimate. Food, primarily nectar, is a limiting factor and territory size is a function of the number of flowering plants present. Shrubs and trees are needed for nesting, and insects for feeding young and dispersing juveniles (Altman 1999). Flowers and shrubs are generally limited to road edges and small openings in the proposed thinning units.

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. The species below were identified as focal species to consider during forest management actions.

Wilson's warbler (*Wilsonia pusilla*) is an insectivorous species that uses deciduous shrub and sub-canopy layers in a wide range of forest age classes. Other species with similar habitat needs include Swainson's thrush and warbling vireo. Data indicates a declining trend in populations of Wilson's warbler. Although the proposed thinning units generally do not provide habitat, existing gaps may provide some early-seral shrub habitat for foraging.

The **winter wren** (*Troglodytes troglodytes*) forages on the ground and low understory. It is most commonly found in older and more in structurally complex areas in the forest and is thought to be sensitive to fragmentation of interior habitat. It forages for insects on shrubs, rootwads, down logs, ferns, and herbaceous vegetation (Altman 1999). The winter wren is generally absent from units with high levels of canopy closure; a lack of shrubs, ferns, and down wood; or where there are not adjacent older forest stands. In contrast, the winter wren is present in units where these habitat components exist, as in Units 28-08-21D, 29-07 11B, and 29-07-13D.

The **hermit warbler** (*Dendroica occidentalis*) inhabits 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 (reviewed by Altman 1999). Hermit warblers are known to be present in many of the forest stands proposed for thinning.

B. Alternative One - Effects

There would be no direct effects to wildlife on BLM-managed lands if thinning was not undertaken. In the short term, habitat conditions at the unit scale would be generally unchanged.

In the long term, habitat conditions would be most affected by competition mortality of overstory trees. Overstocked stand conditions would result in relatively slow growth rates that would prolong crown differentiation until some trees eventually become dominant and shade out suppressed trees. Dead suppressed trees would stand as small-diameter snags and ultimately fall, but would not create openings as in late-seral stands because of the small size of the snags. The remaining dominant trees would soon 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 reinitiation. This growth trajectory would be unfavorable to the development of mature and late-successional forest attributes, particularly large-diameter trees, high crown volume, large branches, cavities, large snags, and large woody debris.

1. Threatened and Endangered Species

As illustrated in Table 3-3 (p. 29), stand densities would continue to increase, high canopy cover would persist and live crown percent would decrease over the next 40 years. While trees would continue to increase in size, they would do so slowly, as illustrated by the quadratic mean diameter for the model stand which would still be below 16 inches.

For **northern spotted owls** dispersal habitat in core areas below the 50 percent suitable habitat threshold and in nest patches would remain intact and its function for foraging and movement by the spotted owl would be unaffected.

Where long-term development of suitable habitat is a concern, as in the Late-Successional Reserves and designated critical habitat, stands would not develop the 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. This would also delay habitat development in proximity to or within northern spotted owl home ranges, core areas, or nest patches in the other land use allocations.

Development of trees providing nesting habitat for **marbled murrelets** would be delayed or would not occur at all. Under conditions of high relative density, tree canopies would remain confined and develop more cylindrically than conically. Large limbs that provide nesting platforms would not develop and tree crowns would continue to recede.

2. BLM Bureau Sensitive Species

If **spotted tail-droppers** are present, they would be unaffected in the short term. In the long term, however, as forest canopy remains closed and deciduous trees and shrubs that provide forage are shaded out and decline in numbers, forage would become less abundant which could lead to a decline in habitat suitability.

Townsend's big-eared bats, Pacific pallid bats, and fringed myotis would not be affected in the short term as large remnant trees would continue to provide roosting opportunities during foraging. In the longer term, however, stagnated growth would not lead to growth and development of larger trees and snags to replace current roosting opportunities that would decline through time. A lack of a developed understory with shrubs and flowering plants that support abundant insect populations could also reduce the utility of the stands for foraging.

3. Survey and Manage Species

If red tree voles in older forest stands through which road rights-of-way are proposed, they would be unaffected as the roads would not be constructed in the absence of thinning.

4. Land Birds

Hermit warblers would continue to use the dense young forests for nesting and occupy the stands through subsequent successional stages.

In contrast, habitat conditions for species that use early-seral forest and shrubs habitat, such as mourning doves and Wilson's warbler, or species dependent on an abundance of flowering plants, such as rufous hummingbirds, would be unsuitable because of the lack of understory development.

Winter wrens may persist in units with newly recruited or remnant down woody material and shrub habitat, but would not be likely occupy the stands over the long term as 100 percent canopy cover would preclude growth of herbs and forbs, shrubs, and trees in the understory. Where these understory layers presently exist, they would likely die out as the canopy remains closed and prevents understory reinitiation of these plant communities.

C. Alternative Two - Effects

1. Threatened and Endangered Species

Northern spotted owl

Disruption/Disturbance

Effects associated with noise arising from thinning activities are expected to be discountable because all activities would be conducted outside of the minimum disruption thresholds established by the U.S. Fish and Wildlife Service (chainsaw: 65 yards, heavy equipment: 35 yards), from any known spotted owl site or unsurveyed suitable habitat, or be subject to a seasonal restriction from March 1st to July 15th, both dates inclusive. This would ensure that noise disruption would not cause spotted owls to abandon nests or fledge prematurely.

Effects on Habitat

Effects of thinning dispersal habitat are discussed at three spatial scales; within a nest patch, within a core area, and at the scale of the home range. Thinning would reduce vertical and horizontal cover regardless of the location. Yarding would damage shrubs and ground cover, and damage or destroy woody debris and snags.

Even-spaced thinning in the General Forest Management Area would more or less yield single-storied stands without size differentiation between trees and stratification of canopy layers. Maintenance of a higher relative density would result in higher canopy cover, post-thinning. This may largely preclude establishment and growth of a robust understory with shrubs, grasses, and forbs that would provide shelter and forage for species such as woodrats and brush hares that constitute important prey for spotted owls.

Variable density thinning in the other land use allocations would favor size differentiation between trees and canopy stratification. Increased availability of light would foster understory establishment which would persist for a longer period of time before canopy cover returned to pre-thinning levels.

General Effects to Individual Spotted Owl Sites

Literature is mixed on the actual effects of thinning on the spotted owl. Meiman et al. (2003) suggested that heavy thinning reduces stand use by spotted owls. 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. Generally, research data supports the notion that spotted owls will continue to use thinned stands for foraging when overall canopy cover remains above 50 to 60 percent (Forsman 1994, 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 of the owls to treatments. Because the proposed thinning would retain average canopy cover at levels exceeding 50 percent it is expected that those thinning units adjacent to suitable habitat or having remnant habitat components may continue to provide foraging and dispersal opportunities.

Variable density thinning, in contrast to even-spaced thinning, may accelerate development of suitable habitat and denser prey populations (Carey 1995, 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).

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.

Cable yarding requires use of trees tailholds and guyline anchors, outside the unit boundaries, that provide suitable habitat. Guyline tree are generally cut and could result in loss of suitable nest trees, but the potential number of trees is not known. To ensure that tree removal does not directly affect spotted owls, seasonal restrictions would be implemented unless clearance surveys have been conducted and the probability of spotted owl presence has been determined as unlikely.

Removal or modification of suitable or dispersal habitat within a 300 meters nest patch may result in incidental take (USDI USFWS 2008a p. 13). Where thinning is conducted in a core area with less than 50 percent suitable habitat, or in a nest patch, owl use of the stands would be expected to decline in the near term. In these circumstances, where the dispersal habitat plays a critical role in supporting dispersal and foraging, take of owls may result (USDI USFWS 2009-p34.)

Given the location and historic use of owl site 0513 and the 1914 complex of original and alternate sites, thinning is likely to cause changes in the function of the dispersal habitat. The known nest trees are very near thinning units and altering current conditions could increase risk of predation, or cause owls to move away from the nest trees and not use these areas until canopy cover reaches pre-thinning levels.

Thinning Unit 29-06-29A, located in the nest patch of site 3850O, represents a different situation. The site has very little suitable habitat within the home range (160 acres), the core area (58 acres), and the nest patch (30 acres). The spotted owl pair that was detected in 2006 did not nest at that time and has not been located at the site since that time.

The remaining thinning units are generally located toward the periphery of the affected home ranges. Thinning may reduce use of the dispersal habitat within the home ranges but would not limit movement into other suitable habitat in the home ranges or threaten the continued persistence of spotted owl in the watersheds.

Spotted owl prey species would also be affected by the proposed thinning. Species such as brush rabbits, woodrats, 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), and could benefit from increased understory and shrub development. This could indirectly benefit spotted owls if increasing numbers of prey move into forest stands where they are available for capture.

General Effects to Critical Habitat

As described above in the discussion of general habitat effects, the function of 306 acres of dispersal habitat on lands allocated as Late-Successional Reserves within critical habitat may be modified as a result of thinning, but with average canopy closure expected to remain in excess of 50 percent the stands in critical habitat would continue to provide foraging and dispersal opportunities, especially in those locations where suitable habitat is present adjacent to thinning units, or where older remnant trees are present within units.

Road construction would modify or remove up to 1.5 acres of suitable habitat and create linear openings at scattered locations. Under either critical habitat designation, this would represent less than 0.01 percent of the available suitable habitat within critical habitat.

This low level of modification/removal of suitable habitat, combined with the dispersed nature of the activity is not expected to prevent the critical habitat from fulfilling its intended role in recovery of spotted owls. In a biological opinion (USDI USFWS 2010 -p72) the U.S. Fish and Wildlife Service concluded that the amount of road construction "is not likely to destroy or adversely modify spotted owl critical habitat" because "the proposed action will have insignificant effects on a very small extent of spotted owl critical habitat

Marbled murrelets

Disruption/Disturbance

The potential for effects to marbled murrelets from noise arising from thinning activities are expected to be discountable because all activities would be conducted outside of the minimum disruption thresholds established by the U.S. Fish and Wildlife Service (chainsaw: 100 yards, heavy equipment: 100 yards), from any known murrelet site or unsurveyed suitable habitat. Otherwise; operations would be subject to seasonal and/or daily operating restrictions as described in Chapter Two. This would ensure that noise disruption would not cause marbled murrelet to abandon nests, abort feeding attempts, or fledge prematurely.

Effects on Habitat

Thinning would not have a direct impact on the marbled murrelet. Although some units have individual or small groups of older trees that may provide nesting platforms, most are not considered suitable habitat. Thinning in General Forest Management Area would release trees and foster accelerated growth in the short term. In the long term, however, as stand canopies reclose crown expansion would cease, canopy stratification would not occur, and development of large trees with suitable nest platforms would be largely precluded.

In contrast, forest stands in Connectivity/Diversity Blocks, Riparian Reserves and Late-Successional Reserves are more likely to release and develop larger diameter trees with multiple platforms given the heavier thinning treatment.

Construction of roads to access units may remove a number of trees on the edge of suitable habitat. Direct impacts would be minimized by completing surveys following accepted protocols (Mack et al.2003) to determine if murrelets are present in the adjacent forests. Negative survey results indicate a low probability that a specific forest stand is occupied, so any action such road construction, tailhold tree use, or guyline tree removal that removes trees is unlikely to directly affect murrelets.

General Effects to Marbled Murrelets

Cable yarding requires use of trees outside the unit boundaries for tailholds and guyline anchors. Trees in adjacent stands that provide suitable nesting habitat may be used for such. Guyline trees are generally cut and could result in loss of suitable nest trees, but the potential number of trees is not known.

To ensure that tree removal does not directly affect marbled murrelets seasonal and/or daily operational restrictions described in Chapter Two (p. 12) and above would be implemented unless clearance surveys have been conducted and the probability of murrelet presence has been determined as unlikely.

2. BLM Bureau Sensitive Species

If spotted tail droppers are located in the remaining survey of the proposed right-of-way accessing Unit 28-08-21C, the site(s) would be managed by establishment of a buffer, one site-potential tree height in radius in diameter. This would maintain forage and climate conditions for persistence of the species at the site(s).

Townsend's big-eared bats, Pacific pallid bats, and fringed myotis all are known to utilize caves, mines, or rock outcrops for roosts, maternity colonies, or hibernacula. None of these potential habitats exist in the proposed thinning. Larger remnant trees present in some of the units which could used by these species for roosting, would be reserved from harvest. Consequently, the proposed thinning would not be expected to negatively impact these species and could indirectly benefit them by accelerating development of large trees and future snags suitable for roosting.

3. Survey and Manage Species

If surveys document red tree vole occupancy in rights-of-way proposed for accessing thinning units, sites would be protected in accordance with the most recent management recommendations for maintaining persistence of the population(s).

4. Landbirds

The proposed thinning could have direct and indirect effects on migratory birds. Potential benefits of thinning vary with the objectives; thinning for timber production is different than thinning to increase diversity (Hagar et al. 2004). Thinning would reduce canopy cover and volume, and remove or damage understory vegetation, snags, and coarse woody debris. Thinning would stimulate growth of remaining trees and allow for the establishment of shrubs, forbs, and grasses in the understory.

Band-tailed pigeons could be indirectly affected but there is little information on the actual effects. Decreased canopy cover in more heavily thinned areas may allow establishment of shrubs such as red elder and cascara that are key forage for band-tailed pigeons (Sanders and Jarvis 2003).

Mourning doves could be affected by removal of suitable nest trees. Nests, eggs, and/or nestlings could be destroyed if mourning doves are present and units are thinned during the breeding season.

The **olive-sided flycatcher** may benefit, more so from thinning in Late-Successional Reserves, Riparian Reserves and Connectivity/Diversity Blocks than in the General Forest Management Area. Variable density thinning creates 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 foraging opportunities (Hagar et al. 2004).

Although the olive-sided flycatcher is declining in Oregon, there is little information on the effect of timber management on the species (Altman 1999). Gaps created by thinnings may allow foraging until the canopy eventually closes again and these opportunities are lost.

Like the olive-sided flycatcher, in Oregon, there is little information on the effect of management activities on the **rufous hummingbird** (Altman 1999). The proposed thinnings are not expected to have long-term effects on local or geographic populations given that the stands would continue to provide for nesting and perching. Tree removal would also create openings where flowering vegetation important for foraging would persist until the canopy cover increases and closes in 10 to 20 years.

Thinning would modify and partially remove stand overstory, reducing foraging and nesting opportunities for the **hermit warbler** over the short term, until forest canopy closes in 10 to 20 years. "No-treatment areas" along streams would help maintain habitat for this species until canopy closure in treated portions of the stands returns to pre-thinning levels.

Nesting opportunities for **Wilson's warbler** would be reduced by partial overstory removal. Secondary canopy layers and shrubs could be damaged and/or removed, decreasing foraging opportunities. "No-treatment areas" and retention of untreated clumps in Late-Successional Reserves would maintain some useable habitat in the interim. Hagar et al. (2004) noted that thinning was relatively neutral in impact to the Wilson's warbler.

In the short term, it is expected that the **winter wren** would respond negatively to thinning, especially heavy thinning (Hagar et al. 2004. Thinning would reduce foraging opportunities by decreasing structural complexity near the forest floor as large down wood, shrubs, and understory trees are damaged or removed. "No-treatment areas" and retention of untreated clumps in Late-Successional Reserves may aid in retaining some of these components. In the long-term, as canopy closure increases and structural diversity develops with accumulation of down wood and understory development winter wrens would be expected to return.

D. Alternative Three Effects

1. Threatened and Endangered Species

Disruption/Disturbance

Effects to **northern spotted owls** under this alternative would be consistent with those under Alternative Two. Where any activities associated with thinning occur within minimum disruption thresholds established by the U.S. Fish and Wildlife Service, they would be subject to a seasonal restriction of operations.

Effects on Habitat

The effects of thinning units in the Connectivity/Diversity Block, Riparian Reserves, Late-Successional Reserves, and those units in the General Forest Management Area that are outside of critical habitat would be identical to those described for Alternative Two.

Variable density thinning of units in the General Forest Management Area that are also in critical habitat would be expected to result in changes in the dynamics of the forest stands which would enhance future development of critical habitat for the northern spotted owl, and meet specific recovery actions identified in the Recovery Plan for the Northern Spotted Owl (USDI-USFWS 2008a).

Removing trees from the intermediate and suppressed canopy layers, favoring dominant and co-dominant trees for retention, thinning across all diameters, retaining hardwoods, creating canopy gaps creation, differing thinning intensities, and retaining patches of unthinned areas would move stand development away from even-aged symmetrical development. There would be a short-term loss of suppressed trees that presently function as a source of down wood and snags for spotted owl prey species.

Over the next 20-to-50 years these forest stands would begin developing habitat components contributing to the development of suitable nesting, roosting and foraging habitat in the Rogue/Umpqua critical habitat unit. Additional benefits provided would include enhanced tree growth, understory development, increases in understory flower and fruit production to support abundant spotted owl prey, while maintaining more canopy connectivity, woody plant diversity, and spatial variability (Carey in Courtney et al. 2004; Carey 2000). This would also increase development of suitable habitat throughout the Critical Habitat Unit rather than limiting it only to those areas where LSR 259 overlaps Critical Habitat Unit 14 (Figure 2-1).

Variable density thinning of the proposed General Forest Management Area units within CHU 14 would also aid in meeting objectives to produce the highest amount and quality of spotted owl habitat through activities that demonstrate long-term benefits for spotted owls (USDI-USFWS 2008a). The treatments proposed would begin a process that would contribute toward meeting these long-term objectives even though some short-term negative effects such as reduced canopy closure in dispersal habitat would occur.

General Effects and Effects to Individual Spotted Owl Sites

Effects of this alternative on individual owl sites would be effectively the same as those described in Alternative Two. Where thinning is conducted in a core area with less than 50 percent suitable habitat, or in a nest patch, owl use of the stands would be expected to decline. In these circumstances, where the dispersal habitat plays a critical role in supporting dispersal and foraging, take of owls would be likely.

General Effects to Critical Habitat

The function of 791 acres of dispersal habitat may be modified as a result of thinning, but with average canopy closure expected to remain in excess of 50 percent the stands in critical habitat would continue to provide foraging and dispersal opportunities, especially in those locations where suitable habitat is present adjacent to thinning units, or where older remnant trees are present within units.

Effects from road construction on suitable habitat would be the same as those described under Alternative Two as there are no differences in the location or lengths of proposed rights-of-way. Road construction would modify or remove up to 1.5 acres of suitable habitat and create linear openings at scattered locations. This would represent modification or removal of less than 0.01 percent of the available suitable habitat within critical habitat.

This low level of modification/removal of suitable habitat, combined with the dispersed nature of the activity is not expected to prevent the critical habitat from fulfilling its intended role in recovery of spotted owls.

For **marbled murrelets**, the sole difference in effects from those described under Alternative Two would be the variable density management of 485 acres in the General Forest Management Area.

Disruption/Disturbance

Protocol surveys of suitable nesting habitat within or adjacent to proposed thinning units would be conducted, as in Alternative Two. If murrelets are located and the behavior indicates regular use or occupancy, operations would be subject to seasonal or daily operational restrictions as they would under Alternative Two.

Effects on Habitat

Effects would be generally consistent with those described under Alternative Two, except that the application of variable density thinning to 485 acre in the General Forest Management Area would establish a growth trajectory that could eventually produce larger trees with abundant platforms that would provide additional nesting opportunities.

Effects to Marbled Murrelets

As described above, seasonal and/or daily operational restrictions would be implemented unless clearance surveys have been conducted and the probability of murrelet presence has been determined as unlikely, thus reducing the probability of harm to a discountable level during the critical breeding season.

2. BLM Bureau Sensitive Species

As is the case under Alternative Two, if spotted tail droppers are located in the remaining survey of the proposed right-of-way accessing Unit 28-08-21C, the site(s) would be managed by establishment of a buffer, one site-potential tree height in radius in diameter. This would maintain forage and climate conditions for persistence of the species at the site(s).

Since thinning prescriptions would only vary with respect to the portion of stands in the General Forest Management Area that are in critical habitat, and all large remnant trees that may provide roosting habitat would be reserved from cutting in general, potential effects to **Townsend's big-eared bats, Pacific pallid bats, and fringed myotis** would not differ from those under Alternative Two.

3. Survey and Manage Species

Effects would not differ from those in Alternative Two. If surveys document red tree vole occupancy in rights-of-way proposed for accessing thinning units, sites would be managed in accordance with the most recent management recommendations for maintaining persistence of the population(s).

4. Landbirds

Effects to bird species would be commensurate with those under Alternative Two. Potential loss of nesting and foraging habitat for some species would occur. Species that flourish in more open forest stands with a well-developed understory would benefit, while those species dependent on more closed stand conditions would see a reduction in habitat suitability for 10-to-20 years.

III. Botany

A. Affected Environment

1. Threatened and Endangered Species

Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) is an herbaceous perennial native to the prairies of the Willamette Valley and southwestern Washington. It has been found in forest openings, meadow gaps, and along forest edges in Douglas County, Oregon (Menke and Kaye 2003).

A single population has been located in association with the proposed South River FY 2009 Commercial Thinning project. The population, approximately one-tenth of an acre in area, is located on the west side of proposed Unit 29-7-11C and above Road No. 29-7-3.0 in Section 11, T. 29 S., R. 7 W., W.M.

2. BLM Bureau Sensitive Species

Vascular Plants, Lichens and Bryophytes

Tall bugbane (*Cimicifuga elata*) is a temperate herbaceous perennial found in wooded areas, primarily on north-facing aspects. On the South River Resource Area, populations have been identified in successional stages ranging from recent clear-cuts to mature forest. Frequent association with deciduous trees suggests the species may respond to gaps created in conifer forest (Kaye and Kirkland 1993). No occurrences of tall bugbane have been located in any of the proposed thinning units.

Wayside aster (*Eucephalis vialis*) is most commonly found in canopy gaps, on edges where forest and meadows meet, and in clearcuts. Known populations in the resource area occur in all stages of stages of forest succession (Gammon 1986.). No occurrences of wayside aster have been located in any of the proposed thinning units.

There are 60 additional Bureau Sensitive vascular plant, lichen and bryophyte species known or suspected on the Roseburg District (*Appendix D – Botany*). Habitat for 16 of these species is not present in the project area and they are not discussed further.

Surveys of potential habitat for the remaining 44 species were conducted in the spring and summer of 2009 with negative results.

Fungi

There are 12 Bureau Sensitive fungi species documented on the Roseburg District, consisting of: *Cudonia monticola*, *Dermocybe humboldtensis*, *Gomphus kuffmanii*, *Leucogaster citrinus*, *Otidea smithii*, *Phaeocollybia californica*, *P. spadicea*, *P. olivacea*, *Ramaria largentii*, *R. spinulasa* var. *diminutive*, *R. rubella* var. *blanda*, and *Sowerbyella rhenana*.

Twelve additional species are suspected on the Roseburg District based on habitat conditions and host species present. These are: *Helvella crassitunicata*, *Phaeocollybi dissilens*, *P. gregaria*, *P. oregonensis*, *P. pseudofestiva*, *P. scatesiae*, *P. sipei*, *Pseudorhizina californica*, *Ramaria amyloidea*, *R. gelatiniaurantia*, *Rhizopogon chamaleontinus*, and *R. exiguus*,

These fungi are primarily associated with species of the *Pinaceae* family, principally Douglas-fir and western hemlock. Important habitat components include: dead wood; dead trees; live, mature trees; many shrub species; a broad range of microhabitats; and for many, a well-distributed network of late-seral forest with moist, shaded conditions. None of these fungi have been identified in either of the project watersheds.

Most of these fungi species are highly isolated in occurrence, producing short-lived, ephemeral sporocarps or fruiting structures that are seasonal and annually variable in occurrence (USDA and USDI 2007 p. 191). Richardson (1970) estimated that sampling every two weeks would fail to detect about 50 percent of macrofungal species fruiting in any given season. In another study (O'Dell 1999) less than ten percent of species were detected in each of two consecutive years at any one of eight sites.

3. Survey and Manage Species

The following species were identified as Survey and Manage botanical species that could be present in the project area, more specifically, in proposed road rights-of-way that would provide access to a number of thinning units.

Vascular Plants

Botrychium minganense
Botrychium montanum
Coptis aspleniifolia
Coptis trifolia
Corydalis aquae-gelidae
Cypripedium fasciculatum
Cypripedium montanum
Galium kamtschaticum
Platanthera orbiculata

Lichens

Bryoria tortuosa
Hypogymnia duplicata
Leptogium burnetiae var. *hirsutum*
Leptogium cyanescens
Lobaria linita
Platismatia lacunosa
Pseudocyphellaria rainierensis
Ramalina thrausta

Bryophytes
Schistostega pennata
Tetraphis geniculata

Surveys were conducted in April of 2010, with the following results. *Chaenotheca furfuracea*, a (Category F pin lichen) was located approximately in an old-growth stand approximately 150 feet south of a proposed road to Unit 28-8-21C.

B. Alternative One - Effects

1. Threatened and Endangered Species

In the absence of any commercial thinning, there would be no direct effects to the known Kincaid's lupine population in Section 11, T. 29 S., R. 7 W., W.M. Over time, however, cause without timber harvest or other vegetation management to create and maintain gap and edge habitat, available light would decline to levels insufficient to trigger flowering and reproduction, which could result in the population dying out..

2. BLM Bureau Sensitive Species

Vascular Plants, Lichens and Bryophytes

No effects, direct or indirect, to any Bureau Sensitive vascular plants, lichens or bryophytes would be expected as none are known to occur in any of the proposed thinning units or road rights-of-way.

Fungi

Absent any road construction and commercial thinning, there would be no modification of existing habitat conditions. The availability of host trees for ectomycorrhizal fungi would remain unchanged, and existing forest canopy would continue to provide shade and maintain cooler temperatures and higher humidity on the forest floor. Forest litter, soil organic matter and large woody debris would be undisturbed and continue to provide reservoirs of moisture and nutrients. Consequently, there would be no effect on Bureau Sensitive fungi that may occur in any of the proposed thinning units or road rights-of-way.

3. Survey and Manage Species

Absent any road construction, there would be no effect on the *Chaenotheca furfuracea* found south of the proposed road to Unit 28-8-21C.

C. Alternative Two Effects

1. Threatened and Endangered Species

There would be no direct effect to the Kincaid's lupine population described above. The site has been clearly marked and disturbance of the area would be prohibited. If timber hauling occurs between April 1 and July 31, dust abatement measures would be applied to prevent possible interference with plant pollination.

Thinning adjacent to the site may indirectly benefit the population by increasing available light. Menke and Kaye (2003) found a correlation between canopy openness and plant vigor with increased availability of sunlight resulting in greater growth, flowering, and seed production.

2. BLM Bureau Sensitive Species

Vascular Plants, Lichens and Bryophytes

No effects, direct or indirect, to any Bureau Sensitive vascular plants, lichens or bryophytes would be expected as none are known to occur in any of the proposed thinning units or road rights-of-way.

Fungi

Surveys for these species are not considered practical so their presence is unknown. If fungi are present in the proposed thinning units, loss of sites could result from disturbance or removal of substrate, and modification of microclimate.

3. Survey and Manage Species

There would be no direct or indirect effects on the *Chaenotheca furfuracea* found south of the proposed road to Unit 28-8-21C, because the 150-foot distance from the site to the edge of the right-of-way provides a buffer sufficient to maintain the microclimatic conditions essential to survival of the pin lichen.

D. Alternative Three Effects

1. Threatened and Endangered Species

As the location and boundaries of proposed thinning units would be the same as in Alternative Two, and given that surveys would be conducted for special status botanical species, there would be no difference in effects from those described for Alternative Two. If special status species are located, the sites would be managed to maintain the integrity and persistence of the population(s).

2. BLM Bureau Sensitive Species

Vascular Plants, Lichens and Bryophytes

No effects, direct or indirect, to any Bureau Sensitive vascular plants, lichens or bryophytes would be expected as none are known to occur in any of the proposed thinning units or road rights-of-way.

Fungi

Surveys for these species are not considered practical so their presence is unknown. If fungi are present in the proposed thinning units, loss of sites could result from disturbance or removal of substrate, and modification of microclimate.

3. Survey and Manage Species

Effects would not differ from those for Alternative Two. The distance from the pin lichen (*Chaenotheca furfuracea*) to the edge of the proposed right-of-way to Unit 28-8-21C will sufficiently buffer the lichen from changes in microclimate.

IV. Fish, Aquatic Resources and Water Resources

A. Affected Environment

As all proposed thinning units are located in the Middle South Umpqua River and Olalla Creek-Lookingglass Creek fifth-field watersheds, discussion is appropriately limited to conditions within the two watersheds.

Both watersheds have a Mediterranean-type climate characterized by cool, wet winters and hot, dry summers. Most precipitation is in the form of rain; though in most years some snow is likely at higher elevations. Annual precipitation varies with elevation and averages approximately 42 inches a year within the project areas, about 85 percent occurring between October and April. Stream flow volumes closely follow the annual precipitation patterns, with peak stream flows November to March, and low stream flows July to October.

Streams within proposed thinning units are generally intermittent first and second order headwater streams which typically have no surface flow in the dry season. Proposed units 28-8-8A, 28-8-33B, 29-7-15A, 29-7-11C and 29-7-25A contain perennial streams.

Downslope of some proposed thinning units and along portions of the access route are larger perennial and fish-bearing streams. Aquatic habitat conditions and fish presence or absence were noted during site visits.

1. Fish Species, Coho Critical Habitat, and Essential Fish Habitat

Salmonids found in the project watersheds include winter-run Oregon Coast steelhead trout and resident rainbow trout (*Oncorhynchus mykiss*), resident and sea-run Coastal cutthroat trout (*O. clarki clarki*), fall and spring Oregon Coast Chinook salmon (*O. tshawytscha*), and Oregon Coast coho salmon (*O. kisutch*). Current fish distribution is based on historical surveys, Aquatic Habitat Inventory surveys conducted by the Oregon Department of Fish and Wildlife, Streamnet data, and surveys by BLM fisheries biologists.

Federally-Threatened Species

Oregon Coast coho salmon are listed as a threatened species under the Endangered Species Act (Federal Register 2008). Critical habitat was designated concurrent with the Endangered Species Act listing.

Coho salmon are present in the South Umpqua River and major tributaries in the project area. Portions of proposed Units 29-7-13C and 29-7-25A located within Riparian Reserves are adjacent to coho-bearing streams (Kent Creek and Rice Creek). All other proposed thinning units are greater than one-tenth of a mile, slope distance, from coho-bearing streams, with most units located near ridges more than one mile upstream from occupied reaches.

Bureau Sensitive Species

The Umpqua chub (*Oregonichthys kalawatseti*) is found in larger order streams and rivers throughout the Umpqua River Basin (Markle et al. 1991). They are present in the main-stem of the South Umpqua River where it passes through the project watersheds. Historic distribution of Umpqua chub is greater than two miles from any proposed thinning units.

Steelhead trout are located throughout the Umpqua Basin, in all stream reaches occupied by coho salmon and in higher gradient streams not used by coho salmon. Distribution is similar to resident trout where habitat access is not blocked by manmade barriers.

Critical Habitat

Streams in the project watersheds adjacent to proposed thinning units that are designated as Critical Habitat for coho salmon include Rice Creek in Section 25, T. 29 S., R. 7 W., and Kent Creek in Section 13, T. 29 S., R. 7 W.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act of 1996 (Federal Register 2002) designated Essential Fish Habitat for fish species of commercial importance. Essential Fish Habitat consists of streams and habitat currently or historically accessible to Chinook and coho salmon. Essential Fish Habitat for coho salmon in the project watersheds is coincident with coho salmon distribution and critical habitat.

2. Aquatic Habitat and Water Quality

Based on surveys conducted on reference stream reaches, the Oregon Department of Fish and Wildlife has set benchmarks for aquatic habitat conditions (Foster et al. 2001).

Water quality standards are determined for each water body by the Oregon Department of Environmental Quality (ODEQ). Water bodies that do not meet water quality standards are placed on the state's 303(d) list as Water Quality Limited (ODEQ 2008).

<u>Substrate/Sediment</u>

Spawning substrate condition

Quality spawning substrate is important to the productivity of resident and anadromous salmonids. Suitability of spawning habitat varies with the amount, size and quality of the spawning substrate. Gravels and small cobbles relatively free of embedded fine sediment is ideal spawning substrate.

Fines (silt, sand and organic material) may limit substrate quality. During egg incubation and alevin emergence, fine sediment can fill interstitial spaces in spawning substrates reducing oxygen flow and smothering eggs, or forming an armor layer that prevents alevin emergence (Waters 1995).

Riffles are considered in "desirable" condition when they contain less than 10 percent fines and more than 35 percent gravel (Foster et al. 2001). The Oregon Department of Fish and Wildlife (ODFW 1994, 1995 and 1996) inventoried over 84 miles of streams, covering 79 reaches in the two watersheds. Most had moderate amounts of gravel. Some exhibited high levels of sediment and embeddedness. Forty-five reaches met "desirable" criteria for fines in riffle units, and 53 reaches met "desirable" criteria for amount of gravel in riffle units.

More recent visual surveys of project area streams indicate that the availability of spawning substrate is moderate to high and embeddedness, though present, was not prevalent in many reaches. Overall, the condition of spawning habitat for salmonids was considered fair.

Sediment Sources

Rashin et al. (2006) found that timber yarding, post-harvest site preparation, forest road construction and forest road use all have the potential to generate sediment and cause a decrease in water quality. Studies by Reid (1981) and Reid and Dunne (1984) found that forest roads can be major contributors of additional fine sediment to streams, with the potential to reduce water quality for domestic use and cause detrimental changes to streams and their inhabitants (Castro and Reckendorf 1995).

Roads may increase erosion and sedimentation, which in turn may alter stream channel morphology (Furniss, et al. 1991). Roads hydrologically connected to stream channels at road crossings can act as a link between sediment sources and streams, often accounting for most sediment problems within a watershed.

When timber hauling occurs on unsurfaced roads during the wet season, precipitation can mobilize sediments that may be routed to streams and increase turbidity. Excepting Road No. 30-7-18.1, proposed for renovation as part of the thinning project, all roads proposed for use are stable, do not exhibit erosion, are effectively ditched and have sufficient cross drains to disperse run-off. All roads proposed for haul during the wet season are either surfaced or would be surfaced in conjunction with the proposed thinning.

Large Woody Debris

Large wood facilitates sediment storage and controls channel morphology in headwater streams. It is also important in the formation of deep scour pools and retention of gravel substrate (Bilby and Ward 1989). In higher order fish-bearing streams, it retains gravel substrate suitable for spawning and creates backwater and pool habitat during a range of stream flows (May and Gresswell 2003).

Wood can be delivered to streams by mass wasting and bank erosion, or from episodic events such as landslides and blow-down (Hassan et al. 2005). Adjacent riparian stands and hill slopes in steeper, confined valleys astride headwater streams contribute greater amounts of large wood (Reeves et al. 2003). Absent large episodic debris flows, wood is retained for longer periods of time in headwater streams (May and Gresswell 2003).

Fish-bearing reaches downstream of proposed thinning units generally lack large wood and small functional wood capable of trapping and storing gravel and creating deep pool habitat suitable for rearing juvenile fish. ODFW considers more than 30 cubic meters of large wood per 100 meters of stream reach "desirable." Only twelve of the 79 surveyed reaches met the criteria. The benchmark for number of "key" pieces, defined as greater than 33-feet long and 24 inches in diameter, is three per 100 meters. None of the surveyed reaches met the criteria.

High-gradient intermittent and perennial headwater streams adjacent to the proposed thinning units generally had a higher volume and number of pieces of large wood and small functional wood than lower reaches surveyed by ODFW. Habitat forming large wood ranged from large logs greater than 24 inches in diameter to smaller hardwoods.

Pool Quality

Pools are important habitat features for juvenile rearing, both during low-flow months when high stream temperatures add to stress and during high flow events when off-channel pools provide refuge habitat. Salmonids are generally found in greater densities (Roni 2002) and larger size (Rosenfeld et al. 2000) in deep pool habitats.

ODFW considers stream reaches to be in a "desirable" condition when they contain greater than 35 percent pool habitat by area and have greater than 2.5 complex pools (those having a large wood component) per kilometer or stream. Forty-two of 79 surveyed reaches met the "desirable" criteria for pool area. Only two reaches met the "desirable" criteria for frequency of complex pools (ODFW 1994, 1995 and 1996).

Habitat Access

Access for migrating fish can be restricted at stream crossings where culvert outlet jumps exceed six inches or the outlet pool depth is less than 1.5 times the height of the jump. Adults are capable of jumping in excess of four feet, but upstream migration by juveniles is often prevented by jumps exceeding six inches. Culverts sized less than bank-full width or installed on gradients over one-half percent can also limit fish passage by accelerating water velocities within the pipes (Watershed Professionals Network 1999).

Throughout both watersheds, there are culverts on private and federally-controlled roads that continue to block access by resident and anadromous fish to historically occupied habitat.

Shade/Water Temperature

Water temperature is a key factor affecting growth and survival of aquatic organisms. Effects on fish, amphibians, and macroinvertebrates vary between species and within the life cycle of a given species (Lantz, 1971). Factors influencing water temperature include elevation, slope, aspect, local topography, flow patterns, channel geometry, vegetation, stream shading, and distance from the headwaters. The most common cause of elevated stream temperatures associated with timber harvest is a reduction in streamside shade that may render stream surfaces more susceptible to solar radiation (Moore and Miner 1997).

Within the analysis area, Olalla Creek, Thompson Creek, Rice Creek and the South Umpqua River are listed Water Quality Limited for temperature (ODEQ 2008). Streams within or adjacent to the proposed thinning units were determined, by ocular estimates, to be well-shaded, though, with dense stands of conifers and hardwoods.

Peak Flows

Rain-on-Snow Area and Rain-Dominated Area

In the project watersheds, the Rain-on-Snow Area (Transient Snow Zone), an area which may alternately receive snow or rain during the winter months, lies at approximately 2,500 to 5,000-feet in elevation. Higher than normal peak flows can result from timber harvest which creates openings which allows more snow accumulates than non-harvested areas (Harr and Coffin, 1992). Warm rain-on-snow events can melt this increased snow pack at a higher rate than normal which can result in higher than normal flows. Only 92 acres proposed for thinning are in the Rain-on-Snow Area.

The 2008 FEIS (pgs. 753-759) analyzed sixth-field subwatersheds in the Rain-on-Snow Area and the Rain-Dominated Area for susceptibility to peak flow effects from regeneration harvest on public and private lands. No six subwatersheds (Berry Creek, Thompson Creek, Olalla Creek, Tenmile Creek, Willis Creek and Rice Creek) where thinning is proposed were found to be susceptible. The portion of the Willis Creek subwatershed located in the Rain-Dominated Area is considered susceptible, due to the preponderance of agricultural lands.

Roads

Roads may modify hydrology through interception of precipitation on road surfaces and interception of subsurface flow. Intercepted subsurface flow routed to ditch lines may enter streams in a more direct manner than via natural subsurface flow patterns. Once the water is directed toward streams through ditch lines, the timing of water delivery is altered causing a peak in flow and an increase in drainage density (Wemple & Jones 2003). This can decrease the volume of water that infiltrates into the ground for soil water storage (Furniss et al. 1991).

Increased drainage density increases the rate at which runoff leaves a basin, resulting in higher peak flows in times of snow melt or rainfall and reduced stream flows in late summer. The magnitude of peak flow enhancement also depends on whether or not road segments drain directly into stream channels. Roads not connected to stream channels, or those that efficiently direct surface flow to the forest floor where it can infiltrate, have a negligible effect on flow magnitude and timing.

Peak flows have been shown to increase substantially when roads occupy more than 12 percent of the land area in a watershed (Watershed Professionals Network 1999, IV-15). Roads occupy no more than three percent of the land base in either the Middle South Umpqua River watershed or the Olalla Creek-Lookingglass Creek watershed; making it unlikely that peak flows are being measurably affected by current road densities.

3. Water Rights

Five registered surface water rights for domestic use exist within one mile downstream of some of the proposed commercial thinning units. Table 3-4 identifies location of the points of diversion (P.O.D.), permit numbers and distance downstream of the proposed commercial thinning units.

Table 3-4 Registered Surface Water Rights for Domestic Use

Unit	Location of P.O.D.	Permit #	Distance of P.O.D. from unit (miles)
29-6-29A	NW¼SE¼, Section 29, T. 29 S. R. 6 W.	S 50193	0.1
29-7-13B	NE¼NE¼, Section 13, T. 29 S., R. 7 W.	S 31327	0.8
29-6-31B	SW¼SE¼, Section 30, T. 29 S., R. 6 W.	S 39134	0.7
29-6-31B	SW¼SW¼, Section 30, T. 29 S., R. 6 W.	S 42556	0.6
29-7-31A	NE¼SW¼, Section 32, T. 29 S., R. 7 W.-	S 35590	0.8

B. Alternative One - Effects

1. Fish Species, Coho Critical Habitat, and Essential Fish Habitat

Under this alternative, the BLM would not authorize any road construction, renovation, decommissioning; commercial thinning; or log hauling. Absent any of these activities, there would be no potential for direct effects to aquatic habitat, anadromous or resident fish, critical habitat for coho salmon, or Essential Fish Habitat for coho and chinook salmon located adjacent to or downstream from the proposed thinning units.

Anadromous and resident fish species, including the Federally-threatened Oregon Coast coho salmon, and aquatic habitat that includes critical habitat and Essential Fish Habitat for coho salmon would continue to be indirectly affected by existing watershed conditions and management activities on private lands, though.

2. Aquatic Habitat and Water Quality

Spawning Substrate/Sediment

Absent the proposed commercial thinning, there would be no road construction or renovation, or log hauling. Aquatic habitat would continue to be affected, however, as run-off from unsurfaced or poorly surfaced forest roads, particularly those heavily used during periods of wet weather would continue to contribute sediment to streams, as would erosion and sediment from roads with inadequate or improperly functioning drainage.

Fine road sediment is generally quickly washed from larger streams (Bilby 1985), but elevated inputs of sediment may become embedded in stream substrates and impair its function as spawning and rearing habitat.

Large Woody Debris

There would be no thinning in Riparian Reserves in the Matrix, or streamside areas in Late-Successional Reserves. Stands would continue to provide some functional small wood, but overstocked stand conditions would retard the growth of large conifers and contribute to a continuing decline in the amount of large woody debris recruited into streams. Over time, there would be a gradual decline in available pool habitat as existing in-stream wood decays and is flushed through the stream system. This would reduce capacity of streams to store spawning gravel. The trend would continue for several decades unless natural disturbance reduced stand densities sufficient to allow growth of larger trees.

Where timber harvest occurs in riparian areas on private lands, loss of existing large wood coupled with decreased recruitment of large wood into streams would limit replacement of existing complex pool habitat and creation of new pool habitat.

Pool Quality

Pool quality would remain generally unaffected in the near term. Existing pool habitat in streams adjacent to the proposed thinning units would alternately develop and dissipate in the absence of large wood recruitment from adjacent stands. Smaller trees and logs that enter stream channels would provide temporary pool habitat and slow-water refugia, but generally would not create deep and complex pool habitat that would persist for long periods of time. This cycle would persist until trees of large size are available for development of more complex and persistent in-stream habitat.

Where timber harvest occurs in riparian areas on private lands, decreased recruitment of large wood into streams would limit replacement of existing complex pool habitat and creation of new pool habitat.

Shade/Water Temperature

Water temperatures in streams and stream reaches located within or adjacent to the proposed thinning units would be maintained. As previously noted, these areas were determined, by ocular estimates, to be well shaded with dense stands of conifers and hardwoods.

At the watershed scale, water temperatures in many larger streams exceed water quality standards. Factors contributing to these conditions include agricultural clearing in valley bottoms, single seral-stage riparian vegetation, and reduction/removal of riparian canopy cover on privately-managed timber lands. These conditions are unlikely to change.

Sediment Sources

Absent thinning of BLM-administered forest stands there would be no soil disturbance and displacement that would create conditions favorable for erosion and potential sedimentation. Natural stream bank failures would result in additional sediment inputs, but this would be due to current stream conditions.

No discernible change in sediment inputs from the network of roads under BLM-administration would be expected. There would be no road construction, renovation or decommissioning with the potential for generating sediments. There is the possibility that roads in need of repair and maintenance would contribute sediment to streams, but this would be addressed through maintenance and repair.

Peak Flows

Rain-on-Snow Area and Rain-Dominated Area

Timber harvest on privately-managed lands in the project watersheds is expected to continue at rates comparable to those of the past decade, with timber managed on rotations of 50 years or less. If harvest in the Rain-on-Snow Area is concentrated in the same areas in the near future, short-term increases in peak flows could occur.

Roads

In the absence of any action by the BLM, there would be no change in the length or location of the transportation system managed and maintained by the BLM. Road and drainage densities would be unchanged and the present potential for the network of existing roads to contribute to water routing and peak flows would be unchanged.

3. Water Rights

Absent any thinning on BLM lands, there would be no direct effect on the interception of precipitation or rates of evapotranspiration that could affect the quality, rate or timing of water delivery to registered water rights downstream of proposed thinning units.

B. Alternative Two - Effects

1. Fish Species, Coho Critical Habitat, and Essential Fish Habitat

Direct effects to fish species from timber harvest and log hauling can result from the addition of fine sediment to streams resulting in a temporary increase in turbidity. Fine sediment that becomes embedded in spawning substrate can hinder survival of eggs and alevin still buried in gravel. Turbidity can reduce foraging ability, impair breathing by clogging gill membranes, and increase overall stress levels (Waters 1995). No direct effects would be expected to fish in streams adjacent to or downstream of any of the proposed thinning units as described in the following discussion of effects on aquatic habitat and water quality.

Indirect effects could include a reduction in spawning success and egg and alevin survival if fine sediments generated by road work thinning operations and timber hauling reaches streams and accumulate in gravels. The application of project design features and Best Management Practices described below (Aquatic Habitat and Water Quality, pp. 60-61) would arrest the mechanism for sediment transport or minimize the risk for delivery of fine sediment so that any effects would be expected to be short-term and so small as to not be measurable at the project level scale.

Critical Habitat

As described below, (Aquatic Habitat and Water Quality, pp. 59-61) there would be no adverse effects anticipated from the thinning project and associated activities. “No-treatment areas” along streams would prevent transmission of sediment, help maintain stream bank and channel integrity, provide sources for recruitment of functional small wood and large wood, and maintain streamside shade.

Project design features and Best Management Practices would be employed to effectively eliminate the transmission of road derived sediment to live stream channels. Vegetation would be left in ditch lines, where practical, and sediment traps such as hay bales could be deployed to slow runoff and trap sediment in ditches. Timber hauling would be suspended ahead of forecast periods of heavy precipitation or if sediment laden water is running in ditch lines. Where sediment could reach streams designated as critical habitat, the amount is expected to be negligible and the effect would be short term in nature.

Essential Fish Habitat

The following components were analyzed to assess potential effects of the proposed thinning on Essential Fish Habitat, with citations to appropriate sections of this assessment.

- *Water quality/Water quantity* – There would be no affect to water quality and/or quantity as a result of the proposed commercial thinning. “No-treatment areas” within the Riparian Reserves would prevent delivery of sediment to streams and preserve streamside shading essential to the maintenance of water temperatures (Aquatic Habitat and Water Quality, pp. 59 and 61).
- *Substrate characteristics* – “No-treatment areas” adjacent to streams would provide a sufficient buffer strip to prevent any sediment laden runoff reaching streams or transmitting sediment to reaches containing coho salmon. Haul of timber during dry season would have no mechanism to contribute sediment to stream channels. During wet season operations, implementation of appropriate project design criteria would serve to arrest any mechanism for sediment to be washed off of road surfaces and into coho salmon bearing reaches (Aquatic Habitat and Water Quality, pp. 59-61).
- *Large woody debris within the channel and large woody debris source areas* – There would be no effect on existing large woody debris as it would be reserved and left on site. Thinning would not affect short-term recruitment of large woody debris. While thinning would reduce the number of trees available for future recruitment, the trees removed would principally come from the suppressed and intermediate canopy layers. These smaller diameter trees would not persist over time. By thinning and releasing the dominant and co-dominant trees in the areas adjacent to streams, accelerated growth would result and provide larger diameter trees for future recruitment as large wood (Aquatic Habitat and Water Quality, p. 61).
- *Channel geometry* – Stream channels are stable and have riparian vegetation sufficient to prevent erosion caused by high stream flow. There would be no measurable increase in peak stream flows that would affect channel geometry (Aquatic Habitat and Water Quality, p. 59).

- *Fish passage* – There would be no effect on fish passage as the proposed thinning would not include construction or replacement of stream crossings on any fish-bearing streams where the potential for creating a barrier to fish passage would exist (Aquatic Habitat and Water Quality, p. 61).
- *Forage species (aquatic and terrestrial invertebrates)* – Forage for coho and Chinook salmon would remain unaffected. Streamside riparian vegetation, protected within Riparian Reserves and "no-treatment areas" would continue to provide sources of terrestrial invertebrates. Aquatic invertebrate populations would be unaffected by discountable and negligible increases in sediment.

2. Aquatic Habitat and Water Quality

Activities that could affect aquatic habitat conditions would include: road construction, renovation and decommissioning; thinning operations; and timber hauling.

<u>Substrate/sediment</u>

Spawning substrate condition

"No-treatment areas" would remain vegetated and non-compacted. Non-compacted forest soils in the Pacific Northwest have very high infiltration capacities and are not effective in transporting sediment overland by rain splash or sheet erosion (Dietrich et al. 1982). "No-treatment areas" on streams would provide root strength sufficient to maintain bank stability (FEMAT 1993, 2008 FEIS), protect stream banks and filter out sediment before it could enter streams and accumulate in spawning gravels (Fischer & Fischenich, 2000).

"No-treatment areas" would also be established on perennially wet areas, small wetlands, swales and sag ponds. Absent surface disturbance or removal of vegetation providing for soil cohesion, risk of slope movement or failure would be low. If an event occurred, it would be low magnitude and not travel sufficient distance to affect streams or aquatic inhabitants.

If yarding corridors through "no-treatment areas" are needed, they would be limited to the minimum needed in locations approved of the contract administrator. Corridors would be as nearly perpendicular to stream channels as possible and trees felled to clear corridors would remain in place to armor stream banks. Full log suspension would be required where feasible, with one-end suspension required at a minimum. These measures would maintain stream bank integrity and reduce the risk of sediment to negligible levels.

Potential effects on aquatic systems would come primarily from road related activities, which can contribute sediment to streams that can affect spawning substrate (Furniss et al. 1991). Construction of new roads would include clearing of vegetation, grubbing of stumps, excavation, road shaping, and in some instances surfacing. Renovation of existing roads would include application of rock lifts where needed, grading and brushing to make roads more accessible. All these activities would occur during the dry season and absent any substantial precipitation would not generate sediment that could create the potential for affecting spawning substrate in downstream reaches.

No perennial streams would be crossed by any new construction, and intermittent streams that would be crossed are generally more than one-quarter of a mile upstream of fish-bearing reaches. These channels have adequate sediment storage capacity and installing crossings would not increase sediment delivery to fish bearing reaches.

In addition to several perennial non-fish-bearing streams, the proposed haul routes cross or closely parallel a number of fish-bearing streams including Rice Creek, Kent Creek, Bar Creek and Olalla Creek. Timber hauling could occur during both the dry and wet seasons.

Haul during the dry season would not generate or deliver sediment to streams, because absent substantial precipitation no mechanism exists for moving fine sediment from road surfaces into ditch lines and potentially into nearby streams. Absent surface flow in intermittent stream channels there would be no mechanism for transport of sediment downstream to fish bearing reaches.

Hauling during the wet season can contribute fine sediment to streams where roads cross streams (Waters 1995). Haul routes open for any season of operation cross or closely parallel fish bearing portions of Kent Creek, Rice Creek, Bar Creek, Olalla Creek and Doe Creek. There are eleven stream crossings over fish-bearing streams, including seven coho-bearing streams. All of these crossings are on flat road sections with moderate approach grades. Renovation at these crossings would include application of a rock lift where needed and installation of additional cross drains to remove water from ditch lines before it enters streams at crossings and route water toward the forest floor.

Intermittent stream channels along the haul route generally have steep gradients with high sediment storage capacity sufficient to retain any small amount of sediment generated in the local area (Montgomery and Buffington 1997). Most stream reaches also have large woody and small functional wood sufficient to trap and store sediment in headwater reaches well upstream of fish bearing reaches.

To further reduce the potential for sediment delivery, the following project design features and Best Management Practices could be implemented at the time of operation:

- New roads, whether temporary or permanent, would be located on stable slopes or ridge-tops and disconnected from the drainage network to the extent practicable, to prevent sediment delivery to live streams and intermittent channels.
- Temporary roads would be built, used and decommissioned in the same operating season so that there would be no increase in drainage density or potential for future erosion and delivery of fine sediment to streams.
- Stream crossings on principal haul roads would be surfaced with adequate rock. Cross drains located approximately 50-feet from crossings on steep approaches would prevent concentrated ditch drainage from entering live stream channels.
- Ditch lines would be left vegetated to capture and retain sediment from road runoff.
- Timber hauling would be suspended during or prior to forecast periods of substantial precipitation, or when sediment laden water appears in ditch lines.
- Water bars may be installed to further route water off road surfaces to the forest floor.

Large woody debris

Removal of smaller suppressed and intermediate trees from areas near stream channels but outside of the "No-treatment areas" could have a short- term effect on instream habitat, by reducing the short-term availability of small functional wood for in-stream recruitment, as small woody material can create pool habitat in smaller stream systems (Bilby and Ward 1989). However, smaller diameter wood does not persist in the stream channel for the long term due to higher rates of decay (Naiman et al. 2002) and is more easily flushed from the system than large pieces (Keim et al. 2002).

Most instream wood comes from within a site potential tree height from the channel (Naiman et al. 2002), although large wood can also come from distances greater than 90 meters in steeply confined channels (Reeves et al. 2003). In the long term, the availability of large trees for in-stream recruitment from areas close to streams would increase as thinning would accelerate the growth and development of larger trees closer to the stream channels.

Road renovation and construction would not affect large wood contribution to streams, as there are no roads proposed for construction that would cross over streams or be located within Riparian Reserves and streamside areas in the Late-Successional Reserves.

Pool quality

Pool habitat availability would remain unaffected by thinning in the short term as all existing large wood that presently provides pool habitat would be reserved.

"No-treatment areas" adjacent to streams would maintain the larger percentage of functional small wood available for stream recruitment. Thinning outside of these areas would principally remove smaller trees from the suppressed and intermediate canopy layers, but would not reduce availability of larger trees for instream recruitment. Over a period of decades, thinning would accelerate growth of the remaining trees providing larger wood that could enter streams to enhance existing pool habitat and creating additional pool habitat.

There would be no change in pool availability resulting from road renovation, construction, and decommissioning for reasons described above.

Habitat Access

There would be no stream crossing construction on fish-bearing streams associated with proposed roads. Consequently, the potential for limiting fish passage would not exist.

Shade/Water Temperature

Shade from trees adjacent to streams is important in reducing direct solar radiation and preventing increases in stream temperatures. "No-treatment areas" adjacent to streams and minimum canopy cover requirements outside of these "no-treatment areas" would conserve the vegetation and streamside trees that provide effective shade and microclimate for stream channels (2008 FEIS pp. 759-761).

Water Yield

Peak Flows

Peak flow increases can occur in forested basins due to the creation of openings in the Rain-on-Snow Area caused by timber harvest and road construction. These effects primarily occur in areas with less than 30 percent canopy cover where snow may accumulate in openings and be subject to rapid melt from warm rain-on-snow events, creating higher than normal flows (Watershed Professionals Network 1999, IV-11).

Post-thinning canopy cover would remain above 50 percent, not creating openings sufficient to allow abnormal accumulations of snow. Poggi et al. (2004) found forest thinning maintains normal patterns of snow accumulation and has little effect on melt rates during rain on snow events within the Rain-on-Snow Area (2008 FEIS p. 355). Since the proposed action is thinning in which the projected canopy cover would remain above the 30 percent threshold and only 2.2 percent of the Rain-on-Snow Area would be treated, no expected potential exists for alteration of snow capture or snow melt.

No measurable effect to stream flow would be expected as a result of thinning since it would only involve partial removal of vegetation over areas constituting no more than 2 percent of any affected drainage. In a review of several studies Satterlund and Adams (1992, p. 253) found that "lesser or nonsignificant responses occur (to streamflow) …where partial cutting systems remove only a small portion of the cover at any time." Where individual trees or small groups of trees are harvested, the remaining trees will generally use any increased soil moisture that becomes available following timber harvest.

The only other action with the potential to decrease canopy cover within the Rain-on-Snow Area would be the addition of approximately one-half mile of new roads which would creation of an additional three to four acres of openings. These openings would have minimal potential for localized changes in snow capture, however, because they would be dispersed and account for less than a 0.04 percent of the Rain-on-Snow Area.

Low Flows and Annual Yield

No measurable effect to stream flow would be anticipated as a result of commercial thinning because it would involve only partial removal of vegetation from no more than three percent of the surface area in either of the affected watersheds.

3. Water Rights

Surface water rights for domestic use located within one mile downstream of proposed commercial thinning units would not be affected. As previously discussed, there would be a negligible risk to increased peak flows from the proposed thinning and no effects from sediment or increases in water temperature would be expected. Consequently, there would be no anticipated impacts to water quantity, timing or quality.

D. Alternative Three Effects

1. Fish Species, Coho Critical Habitat, and Essential Fish Habitat

The affected environment would remain unchanged across all alternatives. There are no additional special status fish species, critical habitat for coho salmon or Essential Fish Habitat for coho and chinook salmon that could be affected.

Measures that would be implemented under Alternative Two to prevent direct effects to fish, critical habitat and Essential Fish Habitat would also apply under Alternative Three, and no difference in effects would be expected.

2. Aquatic Habitat and Water Quality

The proposed thinning units, and streams and aquatic habitat would be the same under Alternatives Two and Three. Measures described under Alternative Two, such as establishment of "no-treatment areas", minimum retention thresholds for canopy cover in areas outside of the "no-treatment areas", and implementation of other measures to protect water quality and aquatic habitat would equally apply under Alternative Three such that no difference in effects would be expected.

3. Water Rights

The marking prescription for stands in spotted owl critical habitat would remove more canopy cover but maintain average levels above 40 percent. The remaining trees would utilize additional soil moisture that becomes available. The length and location of proposed roads would not change, so road densities and effects on drainage would not differ. Consequently, the sediment potential, risk for increased water temperature, or changes in the quantity or timing of water yield would be the same between Alternatives Two and Three.

V. Soils

A. Affected Environment

Soils in the project area are primarily derived from sedimentary rock of sandstone, siltstone and mudstone, and from metamorphosed sedimentary rock (Johnson et al. 2004, Walker and MacLeod 1991, and Wells et al. 2000), with some small areas derived from conglomerate rock.

Shallow to moderately deep soils, up to 40 inches in depth, are found on steep slopes of 60 to more than 90 percent. These soils have lower amounts of clay and higher amounts of gravel. In some areas, soils over loosely consolidated conglomerate bedrock are overlain with up to 3 inches of loose gravelly material.

Deep soils, 40 to more than 60 inches in depth, are found on concave and convex slopes or benched and undulating terrain ranging from flat up to 65 percent. These soils contain moderate to high amounts of clay, and low gravel content. These soils are more susceptible to compaction by ground-based yarding then cable yarding operations.

Old slope failures, two to eight feet in depth, exist in some proposed thinning units where soils are moderately deep to deep. The failures are generally in transition zones between different bedrock materials on moderate to steep slopes, in highly weathered and fractured bedrock with sharp topographical breaks, or in loosely consolidated conglomerate material. They are of two general types: debris slides that are rapid failures of shallow to moderate depth; and soil slumps representing moderately deep to deep, slower slope movement, with concave failure surfaces.

These slope failures are all less than one-quarter acre in size, with roughly half no larger than a twentieth of an acre. The total area involved constitutes approximately two acres of the 1,172 acres proposed for thinning treatment. The failed material generally traveled from 50 to 200 feet down slope, where it settled out, or entered nearby intermittent stream channels. The slope failures and run-out areas constitute less than one percent of the proposed project acres.

Most of the slope failures areas have revegetated and are moderately stable. Six of the areas, located in proposed units 28-8-33B, 29-7-13C, 29-7-13D and 30-6-7E, continue to have a moderate to high risk for soil movement and/or erosion, though. These areas include soil scarps, which are the nearly vertical and exposed failure surfaces, scoured side-slopes, and areas immediately upslope of the failures. The risk is primarily associated with soil sloughing of scarps and side-slopes, erosion of areas with little stabilizing vegetation, and in well-vegetated but gullied areas.

One additional area of concern is a deep-seated slump in proposed unit 28-8-21A. This deep-seated slump lies 50 to 80 feet below BLM Road 28-8-21. It is approximately 250 feet in length with a four to five foot high scarp. It is approximately 0.83 acres in size and is exhibiting soil scarp, showing soil creep movement and land flow undulations.

Old skid trails are present in most of the proposed thinning units, many with cut banks three to five feet in height. Running surfaces, fill slopes, and cut banks of the skid trails are generally well-vegetated and exhibit little or no signs of active erosion. The running surfaces of the skid trails are moderately to highly compacted, however.

B. Alternative One – Effects

Under this alternative, there would be no direct effect on the soils in the project area, because absent any road and landing construction, cable yarding or ground-based yarding there would be no soil disturbance, displacement, compaction or erosion commonly associated with these activities.

Soil movement, such as sloughing of bare soil scarps and scoured side-slopes would continue within some previous slope failures, but as these areas continue to revegetate they will become more stable and soil erosion will gradually cease. The deep-seated slump below BLM Road 28-8-21 would likely continue to move slowly, regardless.

Absent amelioration such as tilling, compacted soils on the old skid trails and skid roads would recover slowly, especially at depths below 6 inches (Amaranthus et al 1996; Powers et al 2005).

The duff layer and soil organic matter would continue to increase slowly with the accumulation of needles, twigs and small branches, and decomposing larger woody material, absent a fire of sufficient intensity to consume the material.

C. Alternative Two – Effects

The ROD/RMP (p. 37) directs that silvicultural systems capable of maintaining or improving the long-term site productivity of soils be used, and that logging systems are to be designed to avoid or minimize adverse soil impacts. Best Management Practices identified in the ROD/RMP (Appendix D, pp. 130-131) are intended to achieve these objectives.

Soil disturbance, displacement, erosion and compaction would be expected to result from road and landing construction, cable yarding or ground-based yarding. Providing for long-term soil productivity can be achieved by minimizing the areal extent of disturbance and by reducing the degree of impacts. Surface erosion in disturbed areas can be controlled by applying erosion control measures.

The degree of soil disturbance from cable yarding varies with topography (convex vs. concave slope), slope steepness, angle of yarding with respect to the face of the slope (perpendicular vs. side slope), and the number of logs yarded. Cable yarding can result in localized areas of soil disturbance along the yarding corridors, especially within 100 feet of the landings. Downhill yarding can produce more soil disturbance than uphill yarding. Both uphill and downhill yarding are proposed in the cable harvest units.

On the moderate to steep slopes, yarding would be accomplished with cable systems that are capable of maintaining a minimum of one-end log suspension at all times, reducing the degree of soil displacement and compaction within yarding corridors. Requiring a minimum of 100-feet of lateral yarding capability and locating landings at 200-foot intervals, where practicable, would reduce the areal extent of disturbance and compaction.

Monitoring of commercial thinning activities conducted with cable-yarding equipment under similar site conditions has resulted in less than two percent soil disturbance, including landing areas. Effects in yarding corridors varied from little to no disturbance, to partial duff removal, to displacement of the top one to three inches of soil. Low to moderate compaction occurred but this was typically shallow and concentrated in the center of the corridors. This is not considered sufficient to affect long-term soil productivity.

For ground based yarding systems, the areal extent of ground affected depends on the type of equipment used, number of passes over the skid trails, the terrain, access routes, climatic conditions and operator skill. In some cases, logs can be processed partially or totally in the woods, so there would be smaller and/or fewer landings.

As described in Chapter Two, ground-based thinning would utilize harvester/forwarder equipment. Monitoring has shown that harvest with tractors, rubber tired skidders, shovel loaders, and harvester/forwarders affected three to nine percent of ground-based harvest areas. On average the figure was less than six percent, including landings and major skid trails. The amount of displacement and depth of compaction was generally least with harvester/forwarders.

Operations would be restricted to the dry season when soils are least susceptible to compaction, and the harvester/forwarder equipment would operate on top of limbs, tree tops, and other logging residues to minimize soil displacement and reduce ground pressure and potential compaction. Operations on designated trails and on slopes generally less than 35 percent would further reduce soil displacement and compaction. If a need is identified, forwarder trails would be mapped for subsoiling.

Impacts of landings are primarily associated with the road prism where yarding, log sorting, decking, loading, and hauling occur. Temporary spur roads and associated landings would be subsoiled with several offset passes of tilling equipment to reduce compaction. These areas would then be covered with tree limbs and tops, generated by the thinning, to reduce the risk of erosion and unauthorized vehicular use. Although it would not remedy soil displacement or bring about 100 percent recovery from soil compaction, tilling can bring about greater than 80 percent soil fracturing, and is an important step in soil recovery (Luce 1997). Tillage also helps prevent runoff and erosion by reducing compaction and increasing water infiltration.

If the six slope failures and slumps identified as having a moderate to high potential for soil movement and surface erosion were commercially thinned, there would be some soil disturbance from felling and yarding, and removal of some trees that are key to slope stability along and above the scarps. The disturbance could increase soil sloughing and erosion above current levels, and result in eroded material entering nearby intermittent or perennial stream channels.

Where these areas are in immediate proximity to streams, they would be incorporated into no-treatment areas of 35 or 60 feet in width, commensurate with the nature of the stream. No yarding would occur through these no-treatment areas. Key trees would also be left on site along and above the soil scarps and scoured side-slopes to help maintain stability provided by their rooting network. These measures would reduce the chance for increased surface soil erosion and soil sloughing from the exposed soil banks, and no large scale changes in slope stability would be expected.

Because the rate of soil movement of the deep-seated slump below BLM Road No. 28-8-21 is slow, management practices such as commercial thinning are considered feasible (USDI, BLM 1986). This area would be cable yarded to minimize the scope and extent of soil disturbance.

As discussed above, the proposed thinning would result in two percent or less of the cable-yarded area being subjected to soil disturbance and displacement, and less than nine percent of the ground-based areas similarly affected. These effects would not extend beyond the immediate unit areas or road rights-of-way, and are not anticipated to have any cumulative effects at the scale of the project watersheds.

D. Alternative Three Effects

The direct, indirect and cumulative effects of implementation of Alternative Three would not differ from the effects identified for Alternative Two, because the action area would be unchanged. Only the marking prescription for a portion of the project would vary and all areas identified as a concern would receive protections under this alternative equivalent to those under Alternative Two.

The same objective of maintaining soil productivity would apply. To this end, the same project design features and Best Management Practices intended to minimize soil disturbance, displacement and compaction would be applied. These would include harvest systems and the types of equipment used, spacing of landing and skid roads, and seasons of operations.

VI. Fuels Management/Fire Risk and Air Quality

Affected Environment

Fuels Management/Fire Risk

Fine fuels are most susceptible to ignition and most responsible for rate of fire spread. These are referred to as 1-hour (< ¼-inch diameter), 10-hour (¼ to 1-inch in diameter) and 100-hour (1 to 3-inches in diameter) fuels. The hours correspond to the length of time it takes the moisture content of individual fuels to reach equilibrium with changes in relative humidity. Large fuels are those greater than 3 inches in diameter and are most responsible for fire intensity, duration and difficulty of control. Larger fuels are typically described as 1000-hour or 10,000- hour fuels because of the lengthy time required to reach equilibrium with changes in relative humidity.

Existing fuel conditions in wildland urban interface units 28-8-21B, 28-8-23A and B, 29-7-11C, 29-7-15A, and 29-7-25D are best depicted by descriptive code 1-MC-3 of *Photo Series for Quantifying Natural Residues in Common Vegetation Types of the Pacific Northwest* (Maxwell and Ward, 1980). Total fuel loading is estimated at 11.1 tons/acre, distributed as follows: 1-hour, 0.7 tons/acre; 10-hour, 1.1 tons/acre; 100-hour, 1.5 tons/acre; and large fuels, 7.8 tons/acre. Fuels cover approximately 55 percent of the unit surface area, to an average depth of approximately one inch.

In unit 29-7-25A descriptive code 2-MC-3 is typical of existing conditions with a total fuel load of approximately 20.4 tons/acre, distributed as follows: 1-hour, 0.5 tons/acre; 10-hour, 1.8 tons/acre; 100-hour, 3.5 tons/acre; and large fuels, 14.6 tons/acre. Fuels cover approximately 73 percent of unit surface area, to an average depth of approximately 1.9 inches.

In units 28-8-21C and D, 29-6-29A, 29-7-11B, and 29-7-13C and D descriptive code 1-MC-2 is typical of existing conditions. Total fuel load is approximately 6.8 tons/acre and distributed as follows: 1-hour, 0.6 tons/acre; 10-hour, 2.3 tons/acre; 100-hour, 1.9 tons/acre; and large fuels, 2 tons/acre. Fuels cover approximately 99 percent of the unit surface area, to an average depth of approximately 2 inches.

In units 28-8-21A, 29-6-19A, 29-7-11A, 29-7-13B and E, 29-7-15B, 29-7-25B and C, and 29-7-31A descriptive code 2-MC-2 is typical of existing conditions. Total fuel load is approximately 10.8 tons/acre and distributed as follows: 1-hour, 0.5 tons/acre; 10-hour, 1.3 tons/acre; 100-hour, 3 tons/acre; and large fuels, 6 tons/acre. Fuels cover approximately 76 percent of unit surface area, to an average depth of approximately 2 inches.

The present risk for wildfire in the wildland urban interface of the project area is considered low to moderate based on existing fuels load, stand characteristics, and understory vegetation that could contribute to fire spread.

Air Quality

The Oregon Smoke Management Plan identified areas of air quality concern and established Designated Areas where smoke intrusion should be avoided. The only Designated Area in proximity to the proposed commercial thinning areas is Roseburg, Oregon.

B. Alternative One - Effects

Fuels Management/Fire Risk

Lightning has historically been the primary cause of wildfires, but wildfire occurrence has increased due to increases in dispersed recreation in forested settings, debris burning on private residences located within the Wildland/Urban Interface, and timber management activities on private and public lands. Under this alternative, there would be no increase in fuel load on BLM-managed lands. Short term, the fire risk would remain low to moderate. Over the long term, however, fuel load would steadily increase, primarily as a consequence of increased suppression mortality.

The effects of suppression mortality on future fuel loads were modeled in Organon Stand Growth and Yield Model, Version 8.2, Southwest Oregon. For proposed unit 29-7-11C representative of a stand with fuel load of 11 tons per acre, modeling indicates that in the absence of thinning approximately 49 trees per acre greater than six inches diameter breast height would die over the next ten years. An additional 40 trees per acre greater than six inches diameter breast height would die in the following decade.

Accumulated bole wood resulting from this additional mortality would be approximately 358 cubic feet per acre the first decade and 421 cubic feet per acre in the second decade. Douglas-fir has a density of 35 pounds per cubic foot (2008 FEIS, Appendix C, p. 28). This translates to an increase in fuel load of approximately 6.3 tons per acre in the first decade, to 17.1 tons per acre. Mortality in the second decade mortality would contribute another 7.4 tons per acre, increasing fuel load to 24.5 tons per acre. These figures are approximations and could be as much as ten percent more, as the model does not account for smaller diameter trees, limb wood, branches and needles.

Private timber harvest would generate activity fuels that may elevate fire risk in the project watersheds. The extent is difficult to gauge, however, because there is no way to project the extent of harvest in the near term, level of utilization, or fuels treatments that would be applied.

Air Quality

Absent any commercial thinning, there would be no need to apply prescribed fire for hazard reduction on BLM-managed lands, and consequently no effects to air quality. Prescribed burning may occur on private timber lands in conjunction with post-harvest site preparation. As such activities would be subject to State of Oregon smoke management restrictions, no long term degradation of air quality should occur.

C. Alternative Two - Effects

Fuels Management/Fire Risk

Due to the fragmented ownership pattern that is typical in the project areas and common throughout the South River Resource Area, wildfire potential is not dependent on BLM management activities alone. The majority of large, stand replacing wildfires have involved multiple ownerships and either started in or intensified by untreated activity fuels. Fire intensity and severity has also increased by the exclusion of fires from fire-dependent ecosystems allowing for an unnatural buildup of naturally occurring fuels.

Short-term increases in fire risk would exist associated with increases in dead woody fuels, estimated at 14.9 tons of woody residue per acre for the unit discussed above. This is depicted by 2-DF-3-PC from *Photo Series for Quantifying Forest Residues in the Coastal Douglas-Fir – Hemlock Type* (Maxwell and Ward, 1976, pp. 54-55).

Fine fuels less than 3-inches in diameter would total approximately 4.1 tons/acre or slightly less than one-third of the total fuel load. Fuels 3.1 to 9-inches in diameter would account for the remaining 10.8 tons/acre.

Various types of fuels and vegetative management applied in the Wildland Urban Interface and Late-Successional Reserves would reduce this risk. Landing disposal would eliminate large concentrations of combustible material. Hand piling and burning, chipping, and/or lopping and scattering material within 50 feet of property lines or selected road segments would create discontinuous fuels less capable of carrying fire over larger areas. Thinning, brushing and pruning young stands would facilitate hazard mitigation by reducing bulk crown density, altering the spatial arrangement of fuels, and removing ladder fuels. In the event of a fire start, this would allow for quicker suppression and less resource damage.

Air Quality

State of Oregon smoke management restrictions limit or prohibit burning during periods of stable atmospheric conditions when residual smoke from previously burned units may become trapped by a surface inversion. Where surface inversions develop within 24 hours of unit ignitions, aggressive mop-up would be conducted to minimize the potential for residual smoke affecting the local airshed.

Where hand piling and burning is proposed for hazard reduction and/or site preparation, piles would be burned in the autumn or winter months during unstable fall and winter weather conditions when winds and atmospheric instability favor rapid smoke dispersion, and precipitation washes particulates from the air. Potential impacts to air quality within one-quarter to one mile of units would persist for 1 to 3-days and would be characterized by some haziness.

With the application of Oregon smoke management restriction, previously discussed, prescribed burning would not have cumulative and long-term effects to local air quality.

D. Alternative Three Effects

Fuels Management/Fire Risk

As in Alternative Two, woody residues from thinning operations would result in short-term increases in fire risk that would not differ notably from those for Alternative Two. The same risk reduction measures would be applied with the same expected results.

Air Quality

No difference in effects to air quality would be expected as prescribed fire treatments would still be governed by State of Oregon smoke management regulations, and burning would be conducted under conditions designed to minimize potential impacts to air quality.

VII. Carbon Storage and Release

Climate change and greenhouse gas emissions have been identified as an emerging resource concern by the Secretary of the Interior (Secretarial Order No. 3226; January 16, 2009), the OR/WA BLM State Director (Instruction Memorandum OR-2010-012, January 13, 2010), and by the general public through comments on recent project analyses.

Forster et al. 2007 (pp. 129-234), incorporated here by reference, reviewed scientific information on greenhouse gas emissions and climate change and concluded that human-caused increases in greenhouse gas emissions are extremely likely to have exerted a substantial warming effect on global climate. Literature, however, has not yet defined any specifics on the nature or magnitude of any cause and effect relationship between greenhouse gases and climate change.

The U.S. Geological Survey, in a May 14, 2008 memorandum (USDI USGS 2008) to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gas emissions and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location. Given this uncertainty, this analysis is focused on calculating gas emissions and storage, in the context of carbon release and sequestration.

Forests store carbon through the process of photosynthesis and release carbon through respiration and decay, affecting atmospheric concentrations of carbon dioxide which thereby affecting global climate. Forest management can be a source of carbon emissions through deforestation and conversion of lands to non-forest condition, or means of carbon storage through forest growth or afforestation (2008 FEIS, p. 220).

Values in this analysis, in terms of carbon stored and released, are generally expressed as tonnes, the unit of measure most commonly used in scientific literature to express carbon storage and release. One tonne of carbon is equivalent to 3.67 tons of carbon dioxide (U.S. EPA 2005).

The 2008 FEIS (pp. 488-490), incorporated by reference, described current information on predicted changes in regional climate, concluding that the regional climate has become warmer and wetter with reduced snowpack, and that continued change is likely.

Changes in resource impacts as a result of climate change would be highly sensitive to specific changes in the amount and timing of precipitation which are presently too uncertain to predict. Because of this uncertainty, it is not possible to predict changes in vegetation types and condition, wildfire frequency and intensity, streamflow, and wildlife habitat.

Even though a causal link between the South River 2009 Commercial Thinning project and specific climate change effects cannot be assigned, the amount of carbon released or stored under the various alternatives being analyzed can be estimated. Site specific data from stand exams was input into the ORGANON Growth Model (Hann et al. 2005). The outputs from the model were then used to calculate amounts of carbon that would be released or sequestered, and the resulting net carbon balance that would result under the alternatives. The modeled results are displayed in Table 3-5 Effects of the Alternatives on Carbon Release and Storage.

Modeling was conducted out for intervals extending out100 years from the present as was done for carbon analysis in the 2008 FEIS. The net carbon balance for the South River 2009 Commercial Thinning project was analyzed by calculating: the amount of carbon held in live trees and other components of the forest stands (snags, down wood, soil carbon, etc.), the amount of carbon held in wood products and logging slash that gradually release that carbon over time, and the amount of carbon released by the burning of fossil fuels and slash under the proposed action alternatives. The methodology used to estimate the net carbon balance is described in *Appendix F - Calculation Assumptions for Carbon Sequestration and Release*.

A. Affected Environment

Total global emissions of carbon dioxide are estimated at 25 billion tonnes (Denman et al. 2007), with estimated U.S. emissions of 6.9 billion tonnes carbon dioxide (EPA, 2010; Table 2-3). Within the United States, fossil fuel combustion accounted for 94.1 percent of CO2 emissions in 2008 (EPA, 2010; Executive Summary p. 6).

Land use, land use change and forestry, such as the proposed action, nationally resulted in a net sequestration of carbon dioxide of 940 million tons in 2008 (EPA, 2010; Table 2-3). Forest management, alone, resulted in net carbon dioxide sequestration of 792 million tonnes (EPA, 2010; Table 2-9), an offset of approximately 11 percent of total U.S. carbon dioxide emissions.

On lands managed by the Salem, Eugene, Roseburg, Coos Bay, and Medford districts of western Oregon and on the Klamath Falls Resource Area of the Lakeview District there are 222 million tonnes of carbon currently stored in live trees (2008 FEIS p. 221). For this same area, the amount of carbon stored in other than live trees (includes shrubs, brush, snags, woody debris, and organic carbon in the soil) is calculated at 195 million tonnes (2008 FEIS p. 222).

The South River 2009 Commercial Thinning project area consists of 1,172 acres of mid-seral forest stands. Under Alternatives Two and Three, there are 74 acres designated as unthinned areas in units located within the Late-Successional Reserves. Consequently, carbon calculations for all alternatives, including No Action, are based on 1,098 acres for comparative consistency.

Modeling projects that there are currently 167,374 tonnes of carbon held by the stands comprising the South River 2009 Commercial Thinning project, indicated as the "Current Condition" Table 3-5. This carbon is held in either the pool of "standing, live trees" (90,228 tonnes) or in the pool of "other than live trees" (77,119 tonnes). The total amount of carbon currently held in proposed South River 2009 Commercial Thinning project represents approximately 0.04 percent of the estimated 417 million tonnes of carbon stored on BLM administered lands in western Oregon.

B. Alternative One – Effects

Under this alternative, there would be no direct release of carbon as fossil fuels would not be consumed in conjunction with road construction and renovation, timber harvest operations, and timber hauling. Direct release of carbon from the cutting live trees would not occur. No slash would be generated and no carbon would be release in association with its burning and decomposition. No wood products would be produced which would release carbon over time.

Forest stands comprising the South River 2009 Commercial Thinning project would continue to grow and develop along a trajectory described under **Timber Resources/Alternative One Effects** (pp. 23-26). Carbon would be released through the decay of snags, woody debris and dead vegetation. At the same time, carbon would be sequestered as live, growing trees and other vegetation remove carbon dioxide from the atmosphere through the process of photosynthesis. As illustrated in Table 3-5, in 100 years time the total carbon stored on-site would increase by approximately 445,000 tonnes, or 366 percent compared to current conditions.

The average annual sequestration of 4,450 tonnes of carbon would represent an offset of approximately 0.000018 percent of current annual global emissions of carbon dioxide and 0.000065 percent of current U.S. emissions of carbon dioxide. In terms of the total carbon sequestered in the U.S. in 2008, it represents approximately 0.00047 percent of carbon sequestration by land use, land use change and forestry described above, and 0.00056 percent of carbon sequestered by forestry alone.

C. Alternative Two – Effects

Table 3-5 displays the current levels of carbon storage on-site, and the changes to these carbon pools that would result from implementation of this alternative, in terms of direct (immediate) and indirect (long-term) releases of carbon.

Based on ORGANON modeling, thinning under this alternative would reduce the pool of carbon stored in live trees by 30,175 tonnes. Some of this carbon would be directly released, while the remainder would be gradually released through time.

Based on (Smith et al., 2006), 13.5 percent of the gross saw log carbon and 14.8 percent of the gross pulpwood carbon (2,322 tonnes) would be immediately released into the atmosphere following harvest. Other direct carbon release would be carbon released by the consumption of approximately 89,700 gallons of gasoline and diesel (245 tonnes), and carbon released by burning of landings and large concentrations of woody residues (987 tonnes). As illustrated in Table 3-5, net sequestration of direct carbon release would occur in just over one year.

While an estimated 3,555 tonnes would be directly released by thinning, the estimated annual carbon released in the United States is 1.6 billion tonnes (U.S. EPA, 2009; pgs. 2-3) and 6.8 billion tonnes globally (IPCC, 2007; pg. 513). Carbon released by implementation of this alternative would represent only 0.00022 percent of annual emissions in the United States, and only 0.000032 percent of annual global emissions.

Approximately 14,800 tonnes of carbon would be stored in wood products, and another 13,000 tonnes in untreated logging slash. As illustrated by Table 3-5, both of these carbon pools would gradually release carbon over time, through processes of decay and combustion. This release, modeled out 100 years, would average 134 tonnes annually.

While there would be a direct release of 3,555 tonnes of carbon, and an indirect release of 134 tonnes annually from wood products and unburned slash, growth of remaining trees would sequester atmospheric carbon and store it on site in the form of additional standing volume.

Over the first 50 years following thinning, carbon stored in live trees would increase at an average rate of about 37,000 tonnes per decade from post-thinning levels. In 100 years time, the total of all total carbon stored on-site, compared with post-thinning levels, would increase by approximately 345,000 tonnes. This would represent a 313 percent increase from current conditions and a 319 percent increase over post-thinning conditions.

D. Alternative Three Effects

As illustrated by Table 3-5, thinning under this alternative would reduce the pool of carbon stored in live trees by 35,111 tonnes.

Based on Smith et al. (2006), 2,703 tonnes of carbon would be immediately released into the atmosphere following harvest. More fossil fuel would be burned, mainly because more truck loads of logs would be transported to sawmills or other processing facilities. Fuel consumption would total an estimated 91,500 gallons, and release 250 tonnes of carbon. The estimated amount of carbon released by burning would remain at 987 tonnes. As illustrated in Table 3-5, net sequestration of direct carbon release would occur in less than a year-and-a-half.

While an estimated 3,939 tonnes would be directly released by thinning, this would not be measurably different from Alternative Two direct carbon release in the context of annual carbon release nationally and globally.

Approximately 17,225 tonnes of carbon would be stored in wood products, and another 15,180 tonnes in untreated logging slash. As illustrated by Table 3-5, both of these carbon pools would gradually release carbon over time, through processes of decay and combustion. This release, modeled out 100 years, would average 166 tonnes annually.

Over the first 50 years following thinning, carbon storage would increase an average of 35,000 tonnes per decade from post-thinning levels, reflecting the higher reduction in future growing stock from heavier thinning. In 100 years time, the total of all total carbon stored on-site, compared to post-thinning levels, would increase approximately 337,000 tonnes, representing a 301 percent increase from current conditions and a 318 percent increase post-thinning.

Table 3-5 Effects of the Alternatives on Carbon Release and Storage

Alternative One - No Action

Timestep	Standing, Live Trees (tonnes)	Wood Products (tonnes)	Logging Slash (tonnes)	Other Than Live Trees (tonnes)	Carbon Released by Fossil Fuel Consumption (tonnes)	Carbon Released by Slash Burning (tonnes)	Carbon Balance (tonnes)	Net Change (+/-) for the Time Interval (tonnes)
Current Condition	90,228	0	0	77,119	0	0	167,347	
10 years	136,899	0	0	77,119	0	0	214,018	46,671
20 years	186,476	0	0	77,119	0	0	263,595	49,576
50 years	328,991	0	0	77,119	0	0	406,110	142,516
100 years	509,403	0	0	103,996	0	0	613,399	207,288

Alternative Two

Timestep	Standing, Live Trees (tonnes)	Wood Products (tonnes)	Logging Slash* (tonnes)	Other Than Live Trees (tonnes)	Carbon Released by Fossil Fuel Consumption (tonnes)	Carbon Released by Slash Burning (tonnes)	Carbon Balance (tonnes)	Net Change (+/-) for the Time Interval (tonnes)
Current Condition	90,228	0	0	77,119	0	0	167,347	
At Harvest	60,053	14,804	13,049	77,119	(245)	(987)	163,792	(3,555)
10 years	93,764	13,579	10,276	77,119	0	0	194,738	30,946
20 years	130,985	12,976	8,757	77,119	0	0	229,837	35,099
50 years	246,698	11,984	5,416	77,119	0	0	341,217	111,380
100 years	405,592	11,144	2,346	103,996	0	0	523,168	181,951

Carbon Neutral Time = 1.15 years

Alternative Three

Timestep	Standing, Live Trees (tonnes)	Wood Products (tonnes)	Logging Slash* (tonnes)	Other Than Live Trees (tonnes)	Carbon Released by Fossil Fuel Consumption (tonnes)	Carbon Released by Slash Burning (tonnes)	Carbon Balance (tonnes)	Net Change (+/-)for the Time Interval (tonnes)
Current Condition	90,228	0	0	77,199	0	0	167,347	
At Harvest	55,117	17,225	15,183	77,199	(249)	(987)	163,408	(3,939)
10 years	86,803	15,800	12,095	77,199	0	0	191,817	28,410
20 years	121,873	15,099	10,306	77,199	0	0	224,397	32,580
50 years	231,764	13,945	6,374	77,199	0	0	329,202	104,805
100 years	383,950	12,967	2,868	103,996	0	0	503,781	174,579

Carbon Neutral Time = 1.39 years

*** “**Logging Slash” is woody residue created by harvest operations.

VIII. Cultural/Historical Resources

A. Affected Environment

To date, the following units proposed for commercial thinning have been surveyed. No resources of significant[5] cultural or historical value were identified.

28-8-21A, B, C and D
29-6-19A
29-6-33C
29-7-11A, B and C
29-7-13B, C, D and E
29-7-15A and B
29-7-31A
30-6-5A, B, C and D
30-7-9A, B and C

Surveys of the remaining 14 units proposed for commercial thinning are ongoing.

B. Alternative One – Effects

In the absence of any ground disturbance associated with road construction or timber harvest activities, there would be no potential for affecting resources of cultural or historical value that may be present in units that have not yet been surveyed.

C. Alternative Two – Effects

If surveys of the remaining proposed commercial thinning units identify any cultural or historical resources, several options would be available to address them. The first option would be to avoid the resources by reconfiguring unit boundaries or moving road locations. If that option is not viable the resources would be evaluated to determine their significance.

If a determination were made that the resources were not significant, the project could proceed as proposed. If resources were found to be significant, they would need to be avoided or mitigated by recovering a portion of the information that they contain. Development of a mitigation or treatment plan would require consultation with interested Tribal governments and the State Historic Preservation Office to determine appropriate measures to be implemented.

D. Alternative Three Effects

The effects of this alternative would be the same as in Alternative Two. Clearance surveys would be conducted, and where resources of significant cultural or historical value were located they would be avoided by reconfiguration of unit boundaries or relocation of roads. If project modification and avoidance was not practical, mitigation would be developed.

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[5] Significance refers to the value of the resource as defined in the National Historic Preservation Act and its implementing regulations, rather than effects as described in the National Environmental Policy Act and the implementing regulations of the Council on Environmental Quality.

IX. Monitoring

Monitoring of the effects of the proposed action, if implemented, would be done in accordance with provisions contained in the ROD/RMP, Appendix I (p. 84-86 and 190-199), focusing on the effects of thinning on: Riparian Reserves; Late-Successional Reserves; Matrix; Air Quality; Water and Soils; Wildlife Habitat; Fish Habitat; and Special Status Species Habitat.

Chapter Four
List of Agencies and Individuals Contacted; Preparers; and Literature Cited

A notice of initiation of the analysis was published in the Spring 2009 Quarterly Planning Update. Upon completion and release of the EA, a Notice of Availability for public review and comment will be published in *The News-Review*, Roseburg, Oregon.

I. Agencies & Persons Contacted:

Adjacent Landowners & Down-stream Water Users
Cow Creek Band of Umpqua Tribe of Indians
NOAA Fisheries
U.S. Fish and Wildlife Service

II. Agencies, organizations, and individuals to be notified of the completion of the EA:

Cascadia Wildlands Project
Douglas Timber Operators, Robert Ragon - Executive Director
Klamath Siskiyou Wildlands Center
National Marine Fisheries Service
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Wild
Pacific Northwest 4-Wheel Drive Association
U.S. Fish and Wildlife Service
Umpqua Valley Audubon Society
Umpqua Watersheds, Inc.
Ronald S. Yockim, Attorney-at-Law

III. List of Preparers:

Paul Ausbeck	Environmental Coordinator	Writer/Editor
Terrie King	Engineer	Transportation
Gary Basham	Botanist	Special Status Plants and Noxious Weeds
Rolando Espinosa	Wildlife Biologist	Special Status Wildlife
Abe Wheeler	Forester	Timber
Ryan Johnson	Forester	Silviculture
Ward Fong	Soil Scientist	Soils
Krisann Kosel	Fire Ecologist	Hazardous Fuels/Air Quality
Cory Sipher	Fisheries Biologist	Fisheries and Aquatic Habitat
Keith Karoglania	Hydrology Technician	Water Quality/Resources
Jay Besson	Supervisory Forester	Management Representative

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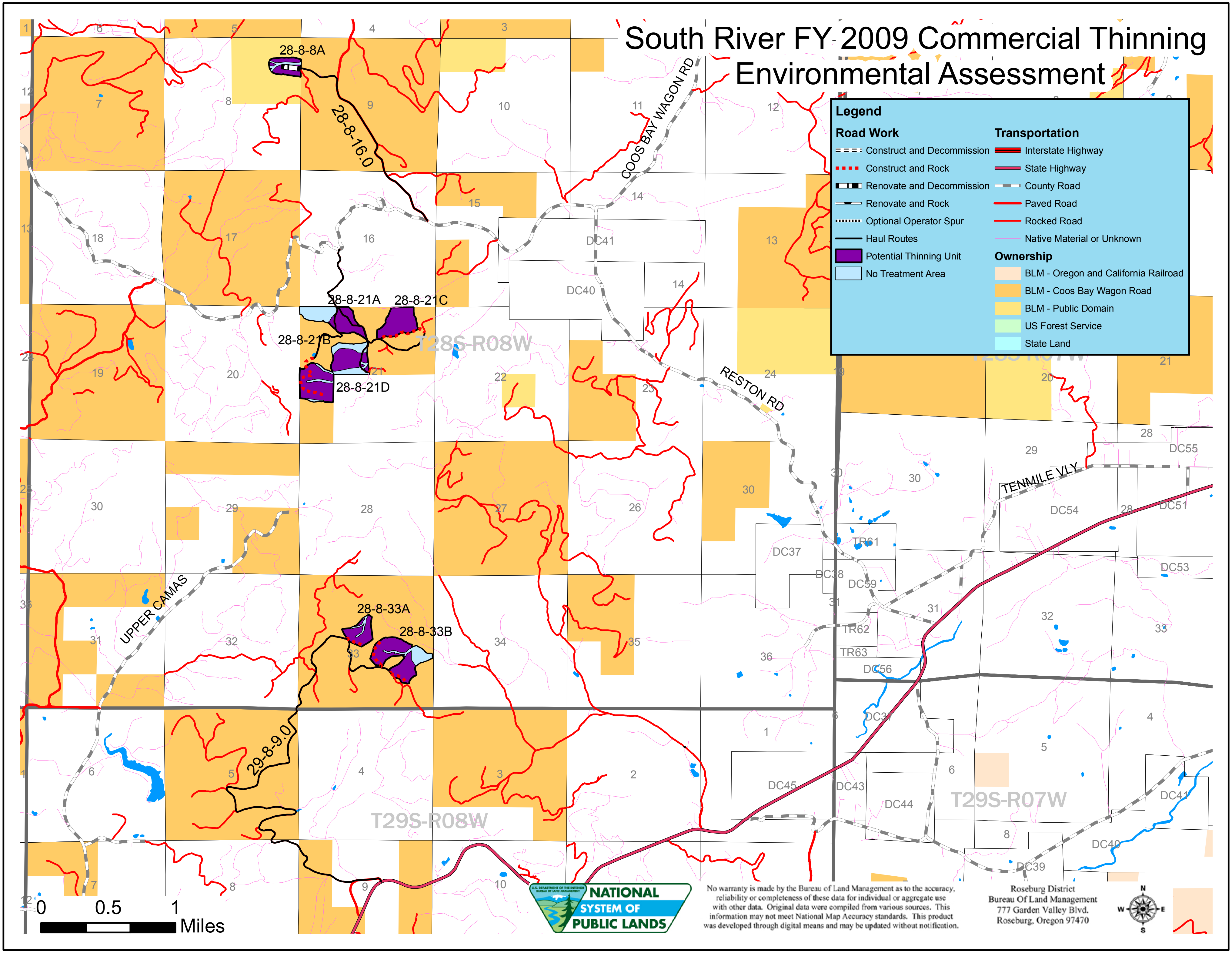
Appendix A - Vicinity Maps and Maps of the Proposed Commercial Thinning Units


South River FY 2009 Commercial Thinning
Environmental Assessment
Legend
Road Work
Construct and Decommission
Construct and Rock
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Renovate and Rock
Optional Operator Spur
Haul Routes
Potential Thinning Unit
No Treatment Area
Transportation
Interstate Highway
State Highway
County Road
Paved Road
Rocked Road
Native Material or Unknown
Ownership
BLM - Oregon and California Railroad
BLM - Coos Bay Wagon Road
BLM - Public Domain
US Forest Service
State Land
28-8-8A
28-8-16.0
28-8-21A
28-8-21B
28-8-21C
28-8-21D
28-8-33A
28-8-33B
29-8-9.0
COOS BAY WAGON RD
RESTON RD
UPPER CAMAS
TENMILE VLY
T28S-R08W
T29S-R08W
T29S-R07W
DC41
DC40
DC37
DC38
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DC54
DC55
DC51
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NATIONAL SYSTEM OF PUBLIC LANDS
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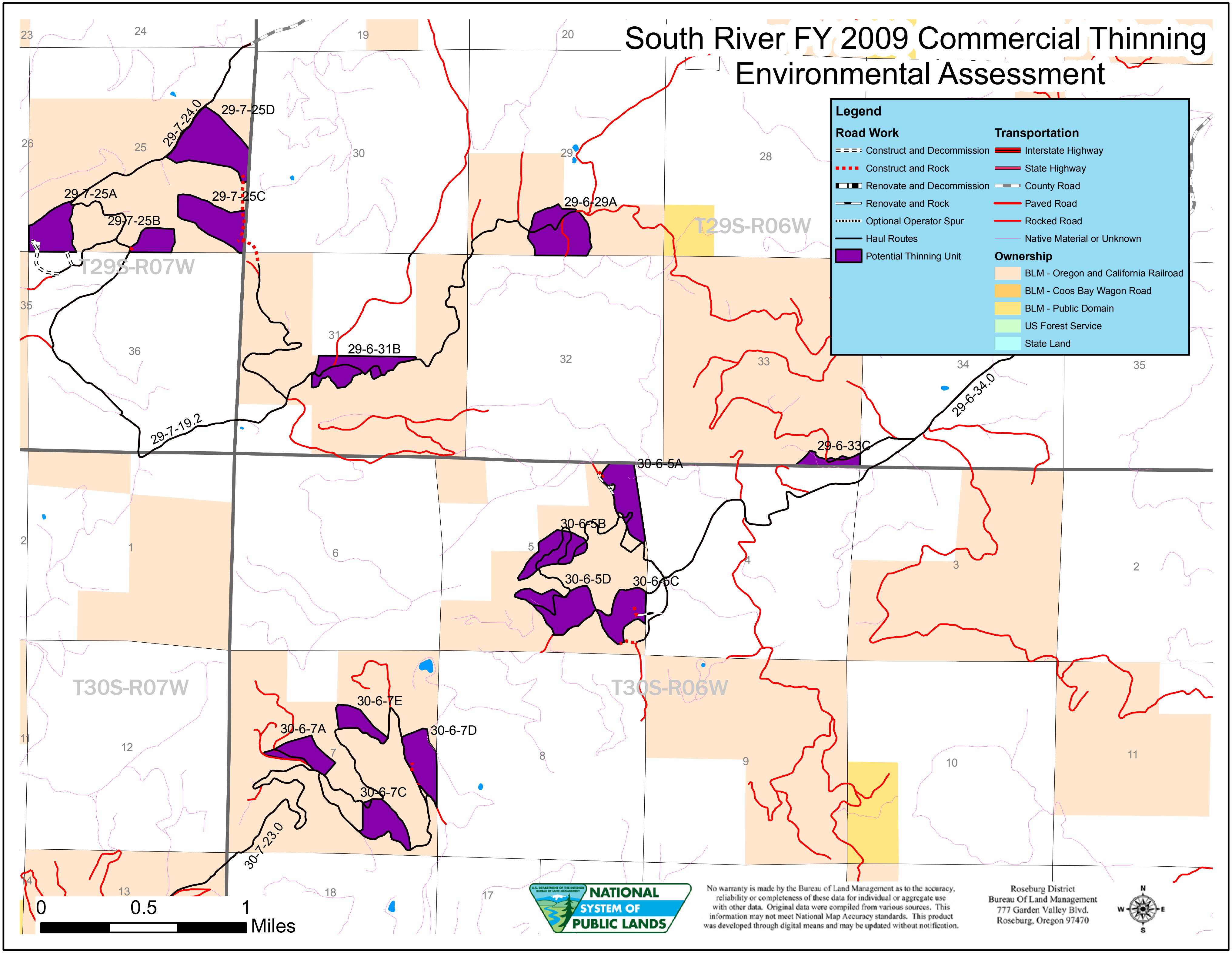

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Construct and Rock
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Optional Operator Spur
Haul Routes
Potential Thinning Unit
Transportation
Interstate Highway
State Highway
County Road
Paved Road
Rocked Road
Native Material or Unknown
Ownership
BLM - Oregon and California Railroad
BLM - Coos Bay Wagon Road
BLM - Public Domain
US Forest Service
State Land
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T29S-R06W
T30S-R07W
T30S-R06W
29-7-25D
29-7-24.0
29-7-25A
29-7-25B
29-7-25C
29-6-29A
29-6-31B
29-7-19.2
29-6-33C
29-6-34.0
30-6-5A
30-6-5B
30-6-5D
30-6-5C
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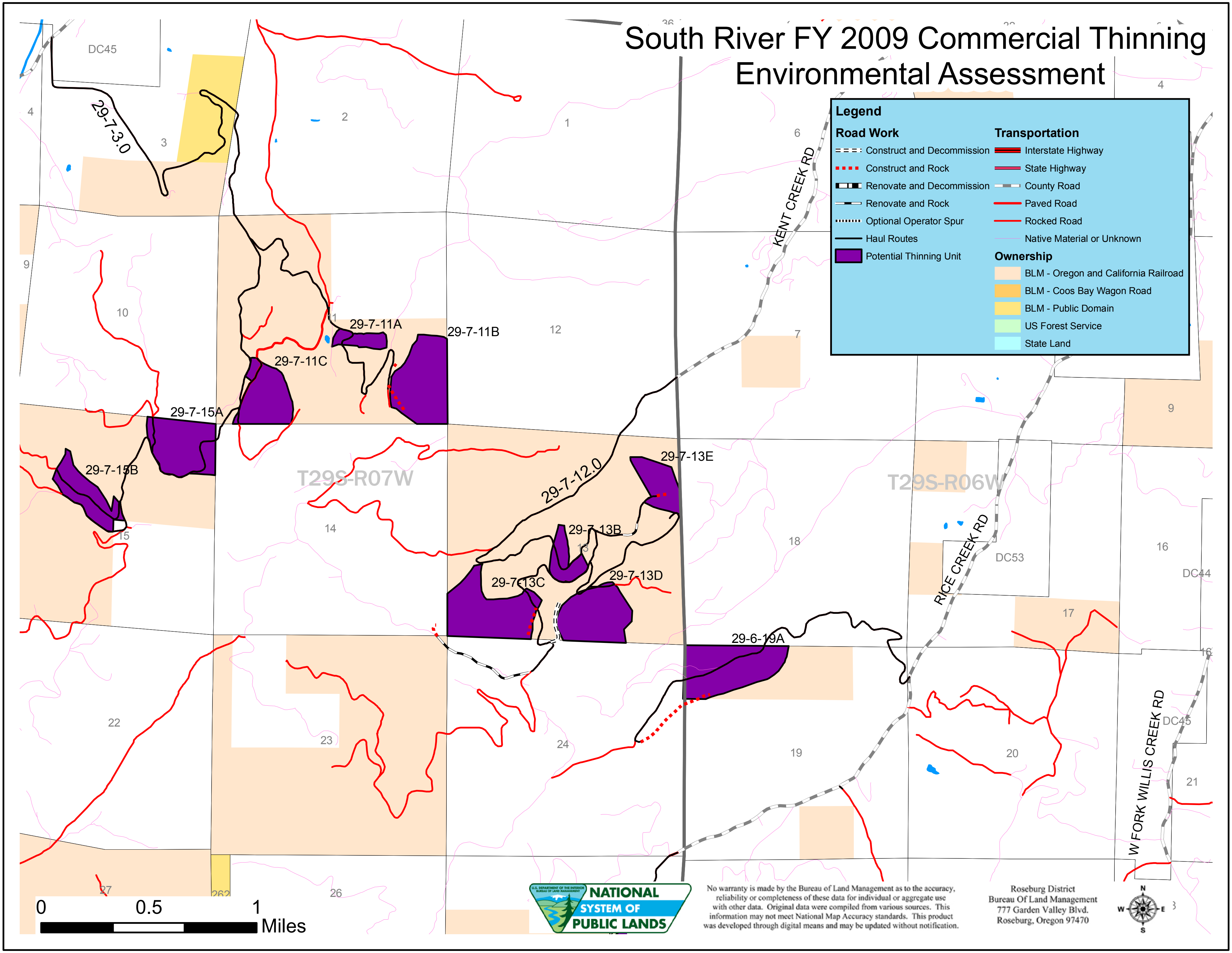
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Legend
Road Work
Construct and Decommission
Construct and Rock
Renovate and Decommission
Renovate and Rock
Optional Operator Spur
Haul Routes
Potential Thinning Unit
Transportation
Interstate Highway
State Highway
County Road
Paved Road
Rocked Road
Native Material or Unknown
Ownership
BLM - Oregon and California Railroad
BLM - Coos Bay Wagon Road
BLM - Public Domain
US Forest Service
State Land
DC45
29-7-3.0
29-7-11A
29-7-11B
29-7-11C
29-7-15A
29-7-15B
29-7-12.0
29-7-13E
29-7-13B
29-7-13C
29-7-13D
29-6-19A
T29S-R07W
T29S-R06W
KENT CREEK RD
RICE CREEK RD
W FORK WILLIS CREEK RD
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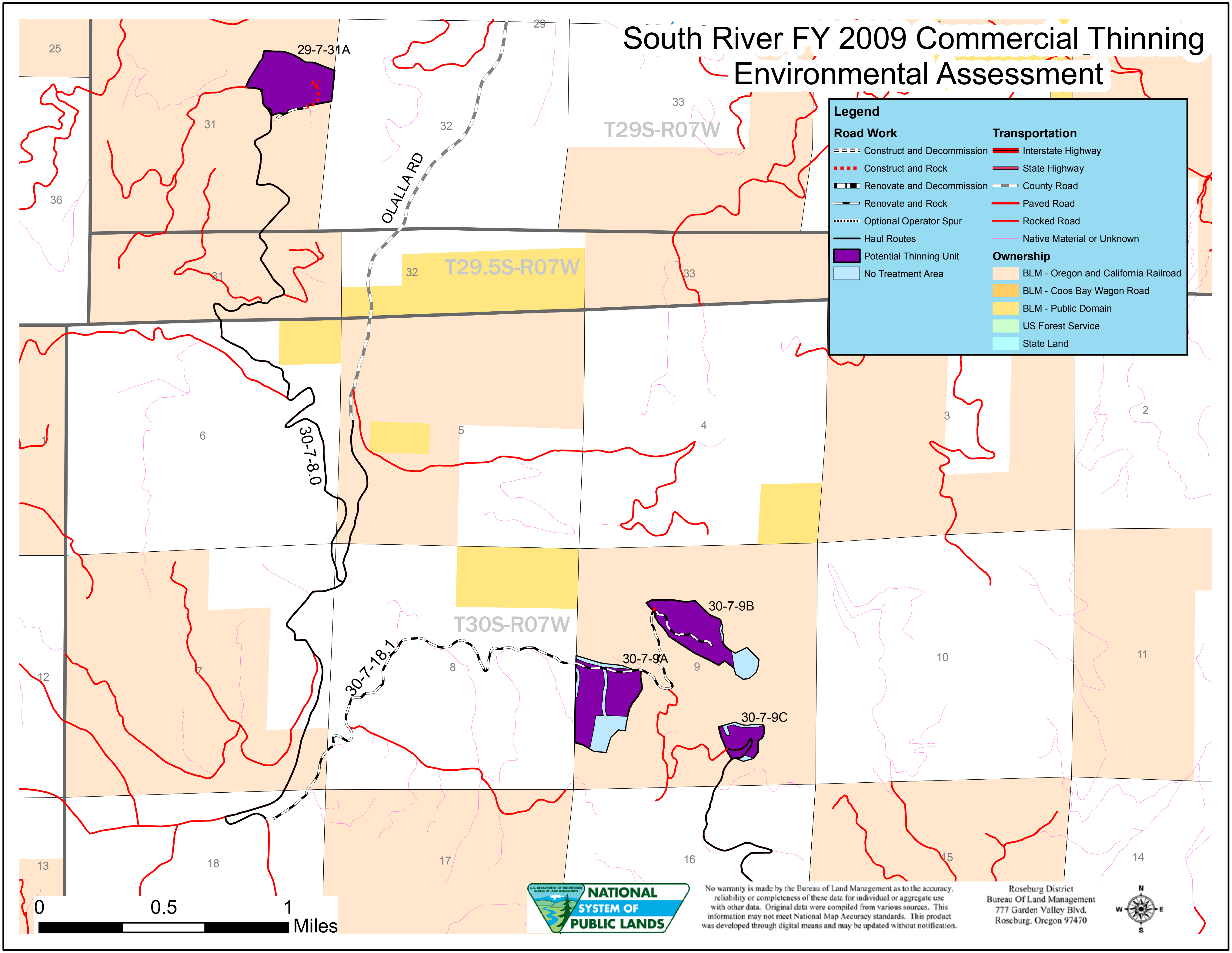
South River FY 2009 Commercial Thinning
Environmental Assessment
Legend
Road Work
Construct and Decommission
Construct and Rock
Renovate and Decommission
Renovate and Rock
Optional Operator Spur
Haul Routes
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Interstate Highway
State Highway
County Road
Paved Road
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Native Material or Unknown
Ownership
BLM - Oregon and California Railroad
BLM - Coos Bay Wagon Road
BLM - Public Domain
US Forest Service
State Land
29-7-31A
30-7-9B
30-7-9A
30-7-9C
30-7-8.0
30-7-18.1
OLALLA RD
T29S-R07W
T29.5S-R07W
T30S-R07W
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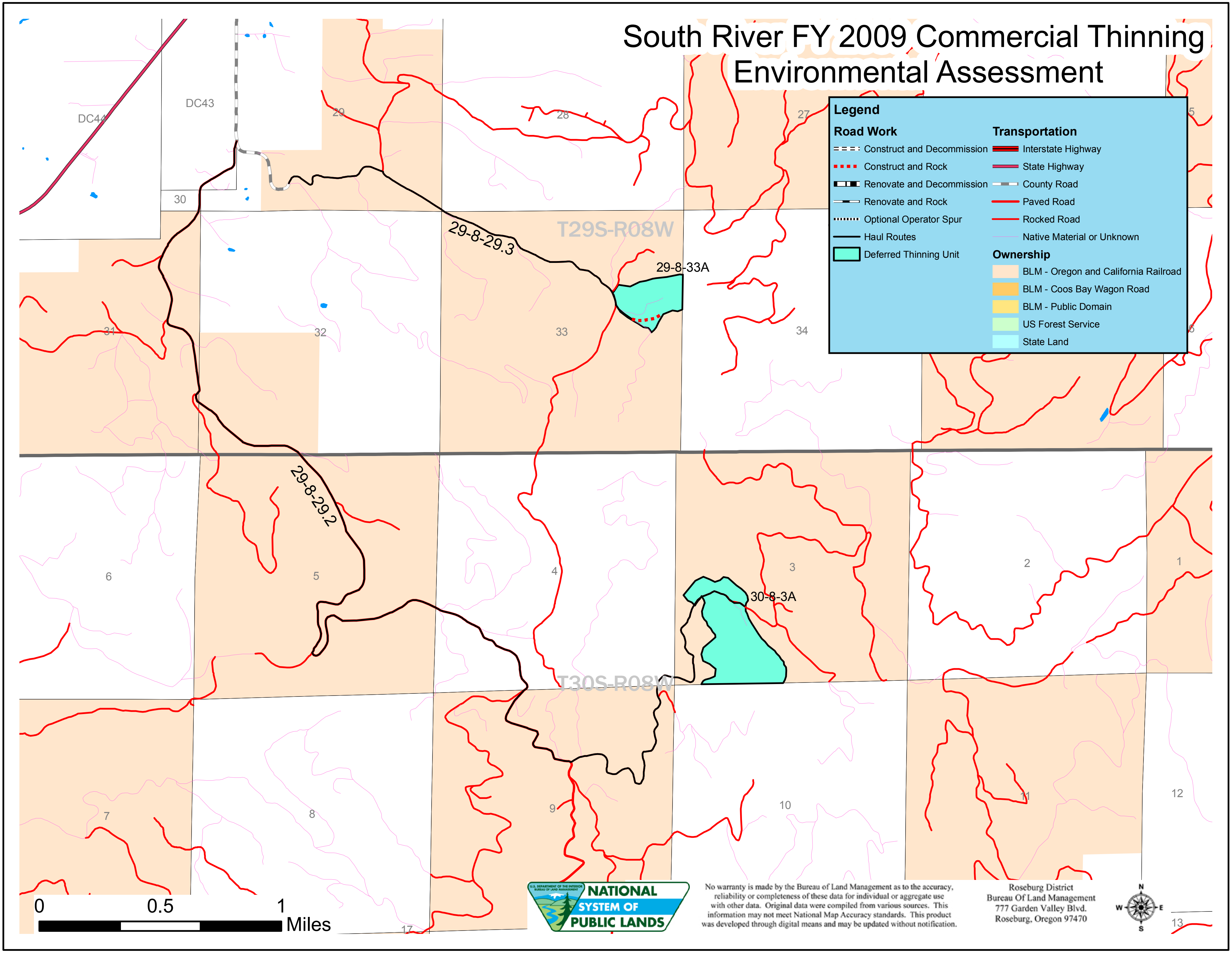
South River FY 2009 Commercial Thinning
Environmental Assessment
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Road Work
Construct and Decommission
Construct and Rock
Renovate and Decommission
Renovate and Rock
Optional Operator Spur
Haul Routes
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Transportation
Interstate Highway
State Highway
County Road
Paved Road
Rocked Road
Native Material or Unknown
Ownership
BLM - Oregon and California Railroad
BLM - Coos Bay Wagon Road
BLM - Public Domain
US Forest Service
State Land
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Appendix B – Silviculture

Table B-1 Average current conditions of the forest stands proposed for treatment*

Unit	Age	Curtis Relative Density	Basal Area (sq.ft./ac)	QMD (trees >7" DBH)	Tree per acre (>7" DBH)
28-8-8A	41	57	182	12.3	215
28-8-21A	49	63	214	12.8	238
28-8-21B	49	63	230	15	185
28-8-21C	49	66	234	13.1	245
28-8-21D	49	48	138	19	69.1
28-8-21D	44	52	180	17.1	113
28-8-33A	49	54	200	13.6	198
28-8-33B	49	48	181	14.4	160
29-6-19A	49	62	219	13.1	228
29-6-29A	49	69	218	12.5	242
29-6-31B	49	62	200	11.6	267
29-6-33C	49	69	243	15	195
29-7-11A	39	56	181	10.3	307
29-7-11B	49	48	164	11.1	245
29-7-11C	42	56	176	10.8	257
29-7-13B	39	52	163	11.5	213
29-7-13C	49	48	160	12.8	169
29-7-13D	≈49	≈60	≈190	≈12.0	≈245
29-7-13E	49	44	140	11.5	182
29-7-15A	39	38	133	13.7	130
29-7-15B	35	42	149	12.4	177
29-7-25A	59	53	185	13.9	171
29-7-25B	55	60	215	15.8	155
29-7-25C	49	45	163	13.6	159
29-7-25D	49	49	172	12.9	186
29-7-31A	49	63	196	11.7	248
29-8-33A	44	50	157	11.8	197
30-6-5A	46	62	223	15.2	174
30-6-5B	46	58	211	14.2	188
30-6-5C	46	53	184	12.6	212
30-6-5D	46	55	205	14.7	175
30-6-7A	33	57	204	13.3	211
30-6-7C	44	53	191	13.1	204
30-6-7D	44	57	213	14.3	190
30-6-7E	49	47	165	12.1	208
30-7-9A	49	48	156	11.7	207
30-7-9B	39	50	173	12.5	190
30-7-9C	39	54	190	12.8	210

* All values expressed are approximations of conditions throughout individual units.

Appendix C – Wildlife

Table C-1 Special status species eliminated from further analysis.

Status	Common Name	Scientific Name	Key Habitat Features	Reason Eliminated
Bureau Sensitive	American peregrine falcon	*Falco peregrinus*	Cliffs and rocky outcrops with shear vertical structure often near water (White et al. 2002)	Habitat not present
Bureau Sensitive	bald eagle	*Haliaeetus leucocephalus*	Large trees near large bodies of water (Buehler 2000, Anthony and Isaacs 1989)	Habitat not present
Bureau Sensitive	Columbian White-tailed deer	*Odocoileus virginianus leucurus*	Oak woodland habitats near and north of Roseburg, OR	Out of species' range
Bureau Sensitive	Fisher	*Martes pennanti*	Large contiguous blocks of mature forest with structural complexity (Verts and Carraway 1998)	Habitat not present
Bureau Sensitive	Foothill yellow-legged frog	*Rana boylii*	Low-gradient streams with bedrock or gravel substrate (Corkran and Thoms 1996)	Habitat not present
Bureau Sensitive	Green sideband snail	*Monadenia fidelis beryllica*	Deciduous trees and brush in wet forest, low elevation; strong riparian associate (USDA/USDI 1994, Frest and Johannes 2000)	Out of species' range
Bureau Sensitive	Crater Lake tightcoil snail	*Pristiloma articum crateris*	Wet habitats such as springs, seeps, and wetlands. Habitat features include large coarse woody debris, rocks, surface vegetation, moss, and uncompacted soil (Duncan et al. 2003).	Out of species' range
Bureau Sensitive	Harlequin duck	*Histrionicus histrionicus*	Larger fast-flowing streams and riparian areas (Thompson et al. 1993, Robertson and Goudie 1999)	Habitat not present
Bureau Sensitive	Lewis' woodpecker	*Melanerpes lewis*	Open woodland with ground cover and snags (Tobalske 1997)	Out of species' range
Bureau Sensitive	Northwestern pond turtle	*Actinemys marmorata marmorata*	Marshes, ponds, lakes, streams, and rivers with emergent structure (Csuti et al. 1997).	Habitat not present
Bureau Sensitive	Oregon Vesper sparrow	*Pooecetes gramineus affinis*	Grassland, farmland, sage. Dry, open habitat with moderate herb and shrub cover (Jones and Cornely 2002)	Habitat not present
Bureau Sensitive	Purple Martin	*Progne subis*	Snags, woodpecker cavities; typically found in open areas near water (Brown 1997, Horvath 2003).	Habitat not present
Bureau Sensitive	Round Lanx snail	*Lanx subrotunda*	Umpqua River and major tributaries (USDA/USDI 1994)	Habitat not present
Bureau Sensitive	Scott's Apatanian caddisfly	*Allomyia scotti*	Low-gradient streams with gravel and cobble substrates (Wiggins 1977)	Habitat not affected by action
Bureau Sensitive	Western ridged mussel	*Gonidea angulata*	Low to mid-elevation streams with cobble, gravel, or mud substrates (Nedeau et al 2005)	Habitat not present
Bureau Sensitive	White-tailed kite	*Elanus leucurus*	Low-elevation grassland, farmland or savannah and nearby riparian areas (Dunk 1995)	Habitat not present

Table C-2 Location of proposed units relative to spotted owl suitable habitat, evaluation areas, and critical habitat.

Unit ID	Within 65 yards of Suitable Habitat	Within 1.3 or 1.5-mile Home Range Radius	Within 0.5 Miles of Core Area	Within 300 Meters of Nest Patch	Within Critical Habitat
28-8-8A	Yes	Yes	Yes	Yes	No
28-8-21C	Yes	Yes	No	No	No
28-8-33A	Yes	Yes	No	No	No
28-8-33B	Yes	Yes	No	No	No
29-6-19A	Yes	No	No	No	No
29-6-29A	Yes	Yes	Yes	Yes	No
29-6-31B	Yes	Yes	Yes	No	No
29-6-33C	No	No	No	No	No
30-6-5A	No	Partially	No	No	No
30-6-5B	No	No	No	No	No
30-6-5C	No	No	No	No	No
30-6-5D	No	No	No	No	No
30-6-7A	Yes	Yes	No	No	No
30-6-7C	No	Yes	No	No	No
30-6-7D	No	Yes	No	No	No
30-6-7E	No	Yes	No	No	No
28-8-21A	Yes	Yes	No	No	No
28-8-21B	No	Yes	No	No	No
28-8-21D	Yes	Yes	No	No	No
29-7-11A	Yes	Yes	No	No	Yes
29-7-11B	Partially	Yes	No	No	Yes
29-7-11C	Yes	Yes	Yes	No	Yes
29-7-13B	Yes	No	No	No	Yes
29-7-13C	Yes	Partially	No	No	Yes
29-7-13D	Yes	No	No	No	Yes
29-7-13E	Yes	No	No	No	Yes
29-7-15A	Yes	Yes	Yes	No	Yes
29-7-15B	Yes	Yes	No	No	Yes
29-7-25A	No	Yes	No	No	Yes
29-7-25B	No	Yes	Yes	No	Yes
29-7-25C	Yes	Yes	Yes	No	Yes
29-7-25D	No	Yes	No	No	Yes
29-7-31A	Yes	Yes	No	No	Yes
29-8-33A	Yes	Yes	Yes	No	Yes
30-7-9A	No	Yes	Yes	No	Yes
30-7-9B	Yes	Yes	Yes	Yes	Yes
30-7-9C	No	Yes	No	No	Yes

Table C-3. Distribution of proposed units that overlap spotted owl core areas and nest patches.

UNIT ID	OWL SITE IDNO	CORE AREA[1]				NEST PATCH[2]			
		SUITABLE HABITAT ACRES	DISPERSAL HABITAT ACRES	THINNING ACRES IN DISPERSAL HABITAT	PERCENT[3] TREATED	SUITABLE HABITAT ACRES	DISPERSAL HABITAT ACRES	THINNING ACRES IN DISPERSAL HABITAT	PERCENT TREATED
29-07-11C; 29-07-15A	0239O	77	43	34	79	0	3.6	0	0
NA	0241O	69	21	0	0	16	0.0	0	0
NA	0378O	85	0	0	0	5	0.0	0	0
28-08-8A	0513O	361	5	5	100	70	0	0	0
	0513A	344	19	19	100	60	1.3	1.3	100
	0513B	410	2.3	2.3	100	64	0	0	0
	0513C	310	19	19	100	59	9.2	9.2	100
NA	0540B	81	106	0	0	30	12	0	0
NA	1362O	28	15	0	0	5	7	0	0
NA	1807O	251	0	0	0	68	0	0	0
NA	1807A	121	0	0	0	0	0	0	0
NA	1807B	202	0	0	0	56	0	0	0
NA	1807C	238	0	0	0	41	0	0	0
30-07-09A 30-07-09B	1914O	114	57	30	52	44	3.4	2.4	70
	1914A	190	44	31	70	48	20	15	75
NA	1978O	21	0	0	0	0	0	0	0
NA	2039O	63	0	0	0	7	0	0	0
NA	2039A	250	0	0	0	37	0	0	0
NA	2039B	228	2.5	0	0	58	0	0	0
29-07-25B 29-07-25A 29-07-25C 29-06-31B	2097O	115	54	26	49	40	0	0	0
	2097A	87	49	38	77	0	0	0	0
	2097B	76	107	46	43	0	0	0	0
NA	2100O	86	85	0	0	28	20	0	0
NA	2100A	104	32	0	0	34	17	0	0
NA	2747O	104	26	0	0	42	7	0	0
NA	3268O	211	3	0	0	46	0	0	0
NA	3268A	180	0	0	0	44	0	0	0
NA	3268B	179	0	0	0	45	0	0	0
29-06-29A	3850O	58	134	39	29	0	45	19	42
NA	3907O	240	0	0	0	56	0	0	0
NA	3907A	293	0	0	0	60	0	0	0
NA	4508O	57	149	0	0	30	13	0	0
29-08-33A	4588B	180	38	0.15	1.5	35	0	0	0

1-Core area-within 0.5 miles; 2-Nest patch-within 300 meters;

Appendix D - Botany

Scientific Name	Taxon	Status	Habitat Present
Plagiobothrys hirtus	Vascular Plant	Federally Endangered	No
Adiantum jordanii	Vascular Plant	Bureau Sensitive	Yes
Arabis koehleri var. koehleri	Vascular Plant	Bureau Sensitive	No
Arctostaphylos hispidula	Vascular Plant	Bureau Sensitive	Yes
Asplenium septentrionale	Vascular Plant	Bureau Sensitive	Yes
Bensoniella oregana	Vascular Plant	Bureau Sensitive	Yes
Botrychium minganense	Vascular Plant	Bureau Sensitive	No
Calochortus coxii	Vascular Plant	Bureau Sensitive	No
Calochortus umpquaensis	Vascular Plant	Bureau Sensitive	No
Camassia howellii	Vascular Plant	Bureau Sensitive	Yes
Carex comosa	Vascular Plant	Bureau Sensitive	Yes
Carex gynodynama	Vascular Plant	Bureau Sensitive	Yes
Carex serratodens	Vascular Plant	Bureau Sensitive	Yes
Cicendia quadrangularis	Vascular Plant	Bureau Sensitive	No
Cypripedium fasciculatum	Vascular Plant	Bureau Sensitive	Yes
Delphinum nudicaule	Vascular Plant	Bureau Sensitive	Yes
Epilobium oreganum	Vascular Plant	Bureau Sensitive	Yes
Eschscholzia caespitosa	Vascular Plant	Bureau Sensitive	Yes
Horkelia congesta ssp. congesta	Vascular Plant	Bureau Sensitive	Yes
Horkelia tridentata ssp. tridentata	Vascular plant	Bureau Sensitive	Yes
Iliamna latibracteata	Vascular Plant	Bureau Sensitive	Yes
Kalmiopsis fragans	Vascular Plant	Bureau Sensitive	No
Lathyrus holochlorus	Vascular Plant	Bureau Sensitive	Yes
Lewisia leana	Vascular Plant	Bureau Sensitive	Yes
Limnanthes gracilis var. gracilis	Vascular Plant	Bureau Sensitive	Yes
Lotus stipularis	Vascular Plant	Bureau Sensitive	Yes
Meconella oregana	Vascular Plant	Bureau Sensitive	Yes
Pellaea andromedaefolia	Vascular Plant	Bureau Sensitive	Yes
Perideridia erythrorhiza	Vascular Plant	Bureau Sensitive	Yes
Polystichum californicum	Vascular Plant	Bureau Sensitive	Yes
Romanzoffia thompsonii	Vascular Plant	Bureau Sensitive	Yes
Schoenopectus subterminalis	Vascular Plant	Bureau Sensitive	Yes
Scirpus pendulus	Vascular Plant	Bureau Sensitive	Yes
Sisyrinchium hitchcockii	Vascular Plant	Bureau Sensitive	No
Utricularia gibba	Vascular Plant	Bureau Sensitive	No
Utricularia minor	Vascular Plant	Bureau Sensitive	No
Wolffia borealis	Vascular Plant	Bureau Sensitive	No
Wolffia columbiana	Vascular Plant	Bureau Sensitive	No
Chiloscyphus gemmiparus	Bryophyte	Bureau Sensitive	No
Diplophyllum plicatum	Bryophyte	Bureau Sensitive	Yes
Entosthodon fascicularis	Bryophyte	Bureau Sensitive	Yes
Gymnomitrion concinnatum	Bryophyte	Bureau Sensitive	Yes
Helodium blandowii	Bryophyte	Bureau Sensitive	Yes
Meesia uliginosa	Bryophyte	Bureau Sensitive	Yes
Schistostega pennata	Bryophyte	Bureau Sensitive	Yes
Tayloria serrata	Bryophyte	Bureau Sensitive	Yes
Tetraphis geniculata	Bryophyte	Bureau Sensitive	Yes
Tetraplodon mnioides	Bryophyte	Bureau Sensitive	Yes

Scientific Name	Taxon	Status	Habitat Present
Tomentypnum nitens	Bryophyte	Bureau Sensitive	Yes
Tortula mucronifolia	Bryophyte	Bureau Sensitive	Yes
Trematodon boasii	Bryophyte	Bureau Sensitive	Yes
Bryoria subcana	Lichen	Bureau Sensitive	No
Calicium adspersum	Lichen	Bureau Sensitive	No
Chaenotheca subroscida	Lichen	Bureau Sensitive	Yes
Dermatocarpon meiophyllizum	Lichen	Bureau Sensitive	Yes
Hypogymnia duplicata	Lichen	Bureau Sensitive	Yes
Lobaria linita	Lichen	Bureau Sensitive	Yes
Pannaria rubiginosa	Lichen	Bureau Sensitive	Yes
Pilophorus nigricaulis	Lichen	Bureau Sensitive	No
Stereocaulon spathuliferum	Lichen	Bureau Sensitive	Yes

Appendix E
Aquatic Conservation Strategy Consistency

The Aquatic Conservation Strategy (ACS) was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems 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:

Riparian Reserves (ACS Component #1)

The 1995 ROD/RMP (pg. 24) specifies Riparian Reserve widths equal to the height of two site potential trees on each side of fish-bearing streams and one site-potential tree on each side of perennial or intermittent non-fish bearing streams, wetlands greater than an acre, and constructed ponds and reservoirs. The height of a site-potential tree for the Olalla Creek - Lookingglass Creek and Middle South Umpqua River Watersheds has been determined to be 160 feet (USDI BLM 1998, 1999). Approximately 138 acres within Riparian Reserves would be treated to accelerate development and attainment of late-seral characteristics.

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 Olalla Creek - Lookingglass Creek and Middle South Umpqua River watersheds.

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

In developing the project, the Olalla Lookingglass and Middle South Umpqua River Watershed Analyses were 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 www.blm.gov/or/districts/roseburg/index.htm.

Existing watershed conditions are described in the Fish, Aquatic Resources and Water Resources section of the EA (pp. 51-56) and in the Olalla Lookingglass and Middle South Umpqua River Watershed Analyses. The short-term, long-term and cumulative effects to aquatic resources are also described in this section of the EA (pp. 59-65).

Watershed Restoration (ACS Component #4)

One of the primary purposes of this project is to accelerate tree growth in Riparian Reserves to speed attainment of late seral forest conditions. The thinning prescriptions are considered to be a watershed restoration project and are therefore consistent with the Watershed Restoration component of the ACS.

In addition, separate restorative actions have been ongoing in the watershed. In 2002, logs were placed in about one mile of Thompson Creek to improve spawning and rearing habitat. These structures were designed to capture and retain gravel substrate for spawning and during high flows, provide winter rearing habitat for salmon and trout.

Two culverts in the Olalla Creek-Lookingglass Creek watershed and one in the Middle South Umpqua River watershed have been replaced with stream crossings that allow passage for adult and juvenile fish at a range of flows. Crossings were designed to pass a 100 year flood and prevent road failure that would contribute sediment to streams. Access to over three miles of fish habitat has been improved or restored. Three additional culverts on Rice Creek are scheduled for replacement in the Middle South Umpqua River watershed over the next three years.

Range of Natural Variability within the Watershed:

Natural disturbance events to aquatic systems in the Pacific Northwest include wildfires, floods, and landslides. Because of 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 to look at ecological processes assessed at scales equal to or greater than the 5^{th} 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.

Habitat for fish and other aquatic species in the watershed is variable over time and sensitive to a range of disturbance events. Large scale disturbance events (e.g. fire, debris torrents, wind throw, etc), can reduce the quality of aquatic habitat in the short term (less than 5 years) but are important to the long-term diversity of habitat components such as substrate, large woody debris and pool complexity (Reeves et al. 1995).

Landslides

The watersheds are located predominantly in the Klamath Mountain Province. The geology is both sedimentary and volcanic. Landslides typically occur on steeper slopes ranging from 60 to 100 percent (USDI BLM 1998, 1999). These slides, when they occur near streams, have the potential to influence fish habitat and water quality in the short term by contributing fine sediment and increasing stream turbidity. Over the course of decades, large wood contributed by landslides stabilizes stream networks and creates high quality fish habitat as streams recover. In any watershed only a small percentage is affected at any given time.

Fire regime

Both watersheds have a high-severity fire regime, meaning that fires occur across the landscape at intervals greater than 100 years. Though small and short in duration, fires are typically high severity and intensity (USDI BLM 1998, pg. 15-19). These fires would have resulted in a large contribution of wood and sediment over a short period of time to adjacent stream channels (Gresswell 1999). Over decades, stream channels recover and aquatic habitat complexity returns to pre-fire levels.

Over the past 75 years, aggressive fire suppression has reduced the size and intensity of fires in the watersheds, resulting in an accumulation of fuels in highly stocked forest stands can result in infrequent but very high-intensity, stand altering fires (USDI BLM 1999, pg. 19).

Watershed disturbance

Both watersheds are primarily located in the Klamath Province. Headwater tributaries are located in often steep and confined valleys where large woody components would be recruited to the stream from adjacent hillslopes and upland stands (Reeves et al. 2003). Harvest of riparian and upland stands where debris flows would have occurred has reduced the amount of large wood entering streams. Agricultural development of low lying floodplains areas has impacted stream channels by eliminating sources of large wood, reducing riparian vegetation and stream shade and limiting access to tributaries through the installation of road crossings.

Table 1 – Individual ACS Objective Assessment

ACS Objective	Site/Project Scale Assessment	5th Field Watershed Scale Assessment
	Scale Description: This project is located in multiple 7th field drainages in the two watersheds. The drainages range from 2,057 to 9,165 acres in area. The BLM manages approximately 17,970 acres or 31 percent of the land base in the project drainages. Proposed thinning represents from 0.8 to 3.3 percent of drainage areas, and 6.72 percent of BLM-managed lands in the drainages.	Scale Description: This project is located in the Olalla Creek - Lookingglass Creek and Middle South Umpqua River Watersheds 5th field watershed. These watersheds total roughly 162,506 acres in area. The BLM manages approximately 35,070 acres or 21.6 percent of the lands within the two watersheds. Units proposed for treatment represent 0.04 to 0.43 percent of the total watershed area, and 3.3 percent 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.	The proposed action would thin about 138 acres in Riparian Reserves. Trees selected for retention would attain larger heights and diameters in a shorter period of time. Reducing canopy cover outside of no-treatment areas would allow conifer regeneration, hardwood retention, and understory establishment that would increase stand complexity and diversity in attainment of this objective.	This proposed thinning would also speed attainment of this objective at the individual watershed scales.

2. Maintain and restore spatial and temporal connectivity within and between watersheds	Absent the construction of any additional stream crossings, the project would have no influence on aquatic connectivity. Therefore this treatment would maintain the existing connectivity condition at the site scale.	Within the project watersheds, the proposed project would have no influence on aquatic connectivity. Therefore this treatment would maintain the existing connectivity condition at the individual watershed scales.
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations	As discussed on pages 63-64 of the EA, thinning treatments would not reduce canopy closure to an extent that could potentially influence in-stream flows. In addition, "no-treatment" areas adjacent to streams would prevent disturbance to stream channels and stream banks (EA, pg. 60). Therefore, this treatment would maintain the physical integrity of the aquatic system at the site scale.	This treatment would aid in maintaining the physical integrity of the aquatic system at the individual watershed scales.
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	As previously mentioned, no treatment areas would protect stream banks from erosion that could contribute sediment to adjacent streams and capture any sediment laden overland flow from thinned upland stands. Sufficient canopy would be retained to provide shade, preventing any increases in stream temperatures. Additional project design features described in the EA (pp. 60-64) would ensure that water quality would not be adversely impacted by the proposed action. Road renovation, seasonal restrictions on haul and sediment traps in ditches close to live streams remove the mechanism for sediment transport to streams.	Based on the information discussed at the site scale, this project would also aid in maintaining water quality at the individual watershed scales.
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved.	As noted above, "no-treatment" areas established on streams in or adjacent to proposed units would prevent disturbance to stream channels and banks and intercept surface run-off allowing sediment to precipitate out before reaching active waterways. Therefore, this project would maintain the existing sediment regime.	This project would assist in maintaining the existing sediment regime at the individual watershed scales 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.	As discussed on pages 63-64 of the EA, thinning treatments would not reduce canopy closure to an extent that could potentially influence in-stream flows. The project would involve partial removal of vegetation on areas constituting 3.3	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.

	percent or less of each affected catchment (7th HUC). 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. Therefore, this treatment would maintain stream flows within the range of natural variability at the site scale.	
7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and woodlands.	As discussed in Objective 6 above, this project would maintain stream flows within the range of natural variability at the site scale. Therefore, it would also maintain stream interactions with the floodplain and respective water tables at the site scale.	At the watershed scale, this project would also maintain stream interactions with the floodplain and respective water tables within the range of natural variability.
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 allowing a mix of conifer and hardwood development in riparian stands. 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 individual watershed scales as well.
9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	As mentioned previously, the intent of this project is to set riparian stand conditions in the proposed treatment areas a trajectory towards historical conditions. Implementation of riparian restoration projects will 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 will help restore adequate habitat to support riparian-dependent species at the site and individual watershed scales.

Summary:

Based upon the information listed above, the proposed action would meet Aquatic Conservation Strategy 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 Aquatic Conservation Strategy, and its objectives at the site and watershed scales.

Appendix F
Carbon Storage/Release
Analytical Methodology

Project: South River FY 2009 Commercial Thinning – Alternative 2
Prepared By: Rex McGraw, Ryan Johnson, Abe Wheeler
Date: April 13, 2010

This appendix lays out the analytical methodology for calculating carbon storage and release for Alternative 2. It is intended to show the reader what assumptions were used and how the calculations were done. The same assumptions and methodology shown below have been applied to Alternatives 1 and 3 and the results are described in Table 3-5.

Analysis of Carbon Storage

It is recognized that a variety of scientific literature exists regarding quantitative measures (e.g. slash decay rates, fire consumption of slash, fuel use and efficiency, haul distances, etc.) and other factors that may be used in calculating carbon storage which may influence the outcome of this analysis. However, the methodology described here provides a consistent means to compare the relative effects of the alternatives considered in South River FY 2009 Commercial Thinning and not necessarily the absolute amount of carbon that would be stored or released under the alternatives.

The analysis of carbon storage modeled amounts of carbon stored in the forest and harvested wood products, and carbon released into the atmosphere through harvest operations. The analysis divided carbon storage/release into six pools:

- Standing, Live Trees
- Other Than Live Trees
- Wood Products
- Slash Burning
- Logging Slash
- Fossil Fuels

The carbon in these six pools was summed at each time step to calculate the Net Carbon Balance by alternative.

Carbon Storage in Standing, Live Trees

The carbon pool of "Standing, Live Trees" represents the live trees that are developing currently and would develop in the future within the proposed units.

1. Standing, live tree carbon was derived in this analysis using the outputs from the ORGANON model (Hann et al., 2005) for standing tree volume in the proposed units over time for each alternative. Due to the large number of units in this sale, representative units were used to calculate carbon storage and release. The units were grouped by thinning intensity in different land use allocations. A stand out of each group was selected that had average stand attributes and average predicted harvest volume.

2. Standing tree volumes measured in board feet per acre were converted to cubic feet using a conversion factor of 6.00 board feet/cubic foot (2008 Final EIS, Appendices-28).

3. The cubic foot tree volumes per acre were converted to pounds of biomass using a conversion factor of 35 pounds of biomass/cubic foot (2008 Final EIS, Appendices-28, Table C-1). Biomass was assumed to be Douglas-fir in this analysis.

4. The pounds of biomass per acre derived from tree volumes were expanded to a total biomass for entire trees (including branches, bark, and roots) per acre by multiplying by 1.85 (2008 Final EIS, Appendices-28).

5. The expanded biomass for entire trees per acre was converted to pounds of carbon per acre by multiplying by 0.50 (2008 Final EIS, Appendices-28).

6. Pounds of carbon in whole trees per acre were converted to tonnes of carbon in whole trees per acre by dividing by 2200 (2008 Final EIS, Appendices-28).

7. The tonnes of carbon in whole trees per acre were converted to tonnes of carbon in whole trees within each proposed unit by multiplying by the size of the unit in acres.

8. The tonnes of carbon in whole trees within the project area were derived by summing the tonnes of carbon in whole trees within each unit, shown in Table 3-5 as "Standing, Live Trees".

Carbon Storage in Forests Other than Live Trees

The carbon pool of "Other than Live Trees" represents shrubs, brush, snags, woody debris, and organic carbon in the soil within the proposed units.

1. Carbon in other than live trees for each unit was derived by multiplying the unit acreage by the tonnes of carbon per acre shown in Table E-1 (which was adapted from Table C-2 in the 2008 Final EIS, Appendices-29). The stands in South River FY 2009 Commercial Thinning were aged based on the time steps used in the analysis (i.e. 10, 20, 50, and 100 years after the current condition) and the corresponding tonnes of carbon per acre was used in the calculations of other than live tree carbon. Under the "current condition", stands in South River FY 2009 Commercial Thinning were 33-59 years old.

Table F-1. Forest Ecosystem Carbon (Excluding Live Trees) By Structural Stage*.

Age of Stand(s)	Structural Stage	Tonnes of Carbon per Acre
5-34 years	Stand Establishment	67.8
35-94 years	Young	70.3
95-124 years	Mature	88.2
$\geq$ 125 years	Developed Structurally Complex	94.8

* adapted from 2008 Final EIS, Appendices-29.

2. Tonnes of carbon in the project area were derived by summing tonnes of carbon within each unit, presented in Table 3-5 as "Other Than Live Trees".

Carbon Storage in Wood Products

The "Wood Products" carbon pool represents the amount of carbon that would be converted from standing, live trees into either saw logs or pulpwood, collectively referred to as wood products under the proposed action. There would be no carbon pool of wood products under the No Action Alternative since wood products would not be generated.

1. Tonnes of carbon in whole trees were previously derived in Steps 1-7 under "Standing, Live Trees" for the time steps used in this analysis. The difference between the tonnes of carbon in whole trees at "current condition" and at "harvest time" would be the tonnes of carbon in harvested whole trees.

2. Tonnes of carbon in whole trees that would be harvested per unit were summed to provide the total for the alternative.

3. Tonnes of carbon in whole trees that would be harvested were converted to tonnes of carbon in saw logs by dividing by 1.85 (2008 Final EIS, Appendices-28). *Note:* this reverses the previous calculation that expanded biomass of harvested logs into the biomass of whole trees (derived in Step 4 of "Standing, Live Trees").

4. At harvest time, 13.5 percent of the carbon in saw logs carbon would be immediately released (Smith et al. 2006); with the remainder gradually released over time. The remaining tonnes of carbon held in saw logs were then decayed over time by multiplying the tonnes of carbon in saw logs harvested by the values shown in Table E-2 which were adapted from the 2008 Final EIS, Appendices-30 and Smith et al. (2006).

Table F-2.
Fraction of Carbon Remaining or Captured as an Alternative Energy Source*.

Timestep	Saw Logs	Pulpwood
Harvest Time (0 years)	0.865	0.852
+10 years	0.796	0.730
+20 years	0.761	0.691
+50 years	0.702	0.655
+100 years	0.651	0.645

*These fractions include; wood products in use, wood products in the landfill, and wood products emitted as energy in lieu of fossil fuels (adapted from 2008 Final EIS, Appendices-30 and Smith et al. 2006)

5. Additional tonnes of carbon held in pulpwood (e.g. chips) were derived by multiplying the tonnes of carbon in saw logs (derived in Step 3 above) by five percent (2008 Final EIS, Appendices-30). *Note*: Pulpwood tonnage is five percent *in addition to* the saw logs not five percent *of* the saw logs.

6. At harvest time, 14.8 percent of the pulpwood's carbon would immediately be released Smith et al. (2006); but afterwards the carbon in pulpwood would be gradually released over time. The tonnes of carbon held in pulpwood were then decayed over time by multiplying the tonnes of carbon in pulpwood by the values shown in Table E-2 which were adapted from the 2008 Final EIS, Appendices-30 and Smith et al. (2006).

7. The sum total of the tonnes of carbon immediately released from saw logs (derived in Step 4 above) and from pulpwood (derived in Step 6 above) represent the total amount of carbon released by “Wood Products” at harvest time. The sum total of the tonnes of carbon held in saw logs (derived in Step 4 above) and held in pulpwood (derived in Step 6 above) at each time step represent the amount of carbon stored in “Wood Products” as shown in Table 3-5.

Carbon Release in Slash Burning

The carbon pool of “Slash Burning” represents the amount of slash generated by the proposed timber harvest that is consumed through prescribed pile burning. There would be no carbon pool of slash burning under the No Action Alternative since logging slash would not be generated and therefore not burned.

1. The amount of slash burned was calculated by averaging slash burned in recently implemented sales under similar conditions in the South River Area and was found to be 2.0 tonnes of biomass per acre. Total tonnes of slash biomass to be burned were calculated by multiplying 2.0 tonnes times the total number of acres in the project area (A. Wheeler, pers. comm., 2009).

2. It was assumed that prescribed fire would consume 90 percent of the slash scheduled for burning (K.Kosel, pers. comm., 2009); thereby releasing carbon. The tonnes of slash biomass per acre consumed were derived by multiplying the tonnes of slash biomass per acre by 0.90.

3. The tonnes of slash biomass consumed per acre were converted to tonnes of carbon released per acre by using a conversion factor of 0.50 tonnes of biomass/tonne of carbon.

4. Within the South River Resource Area, it was calculated that an average of 0.9 tonnes of carbon would be released per acre of commercial thinning and/or density management unit scheduled for piling and burning using prescribed fire.

5. The tonnes of carbon that would be released under the proposed action were derived by multiplying the project acreage by 0.9 tonnes per acre (derived in Step 4 above) and are shown in Table 3-5 as “Slash Burning” at harvest time.

Carbon Storage in Logging Slash

The carbon pool of “Logging Slash” represents the limbs, fine branches, leaves/needles, stumps, and roots of harvested trees that remain on site following thinning and density management operations that are not consumed during slash burning. There would be no carbon pool of logging slash under the No Action Alternative since logging slash would not be generated.

1. Tonnes of logging slash remaining on-site was calculated by subtracting the following three amounts of carbon from the total tonnes of carbon in whole trees harvested under the alternative (derived in Step 2 under “Wood Products”):
    - tonnes of carbon immediately released from wood products (derived in Step 7 of “Wood Products”),

8. The sum total of the tonnes of carbon immediately released from saw logs (derived in Step 4 above) and from pulpwood (derived in Step 6 above) represent the total amount of carbon released by “Wood Products” at harvest time. The sum total of the tonnes of carbon held in saw logs (derived in Step 4 above) and held in pulpwood (derived in Step 6 above) at each time step represent the amount of carbon stored in “Wood Products” as shown in Table 3-5.

Carbon Release in Slash Burning

The carbon pool of “Slash Burning” represents the amount of slash generated by the proposed timber harvest that is consumed through prescribed pile burning. There would be no carbon pool of slash burning under the No Action Alternative since logging slash would not be generated and therefore not burned.

6. The amount of slash burned was calculated by averaging slash burned in recently implemented sales under similar conditions in the South River Area and was found to be 2.0 tonnes of biomass per acre. Total tonnes of slash biomass to be burned were calculated by multiplying 2.0 tonnes times the total number of acres in the project area (A. Wheeler, pers. comm., 2009).

7. It was assumed that prescribed fire would consume 90 percent of the slash scheduled for burning (K.Kosel, pers. comm., 2009); thereby releasing carbon. The tonnes of slash biomass per acre consumed were derived by multiplying the tonnes of slash biomass per acre by 0.90.

8. The tonnes of slash biomass consumed per acre were converted to tonnes of carbon released per acre by using a conversion factor of 0.50 tonnes of biomass/tonne of carbon.

9. Within the South River Resource Area, it was calculated that an average of 0.9 tonnes of carbon would be released per acre of commercial thinning and/or density management unit scheduled for piling and burning using prescribed fire.

10. The tonnes of carbon that would be released under the proposed action were derived by multiplying the project acreage by 0.9 tonnes per acre (derived in Step 4 above) and are shown in Table 3-5 as “Slash Burning” at harvest time.

Carbon Storage in Logging Slash

The carbon pool of “Logging Slash” represents the limbs, fine branches, leaves/needles, stumps, and roots of harvested trees that remain on site following thinning and density management operations that are not consumed during slash burning. There would be no carbon pool of logging slash under the No Action Alternative since logging slash would not be generated.

2. Tonnes of logging slash remaining on-site was calculated by subtracting the following three amounts of carbon from the total tonnes of carbon in whole trees harvested under the alternative (derived in Step 2 under “Wood Products”):
    - tonnes of carbon immediately released from wood products (derived in Step 7 of “Wood Products”),

- tonnes of carbon stored in wood products at harvest time (derived in Step 7 of "Wood Products"), and
- tonnes of carbon released from slash burning (derived in Step 5 under "Slash Burning").

3. The tonnes of logging slash on-site were then multiplied by the fraction of Douglas-fir slash remaining at each time step as shown in Table E-3 (based on Janisch et al. 2005). This represents the amount of carbon stored in "Logging Slash" as it decayed and released carbon over time as shown in Table 3-5.

Table F-3. Decay Rates of Carbon from Douglas-fir Slash*.

Timestep	Fraction of Carbon Remaining in Douglas-fir Slash
Harvest Time (0 years)	1.000
+10 years	0.852
+20 years	0.726
+50 years	0.449
+100 years	0.202

* based on Janisch et al. 2005.

Carbon Release in Fossil Fuels

The carbon pool of "Fossil Fuels" represents the amount of carbon that would be released through consumption of gasoline and diesel in various harvest-related activities such as: timber falling and yarding, log hauling, and road construction and renovation. There would be no carbon pool of fossil fuels under the No Action Alternative since no harvest-related activities would occur.

1. Fuel consumption for harvest operations (i.e. timber felling and yarding) was estimated based on the production rates and fuel efficiencies shown in Table E-4. For analysis purposes, it was assumed that the 1,097 acre project would be harvested using chainsaws, motorized carriage, cable/skyline yarder, and a loader.

Table E-4. Fossil Fuel Consumption during Harvest Operations.

Equipment	Production Rate[a]	Fuel Efficiency[b]		Fuel Consumed
	(acres/day)	(gallons/hour)	(gallons)	(gallons)
Chainsaw (gasoline)	0.4	-	1	2,743
Motorized Carriage (gasoline)	1	-	3	3,291
Cable/Skyline Yarder (diesel)	1	2.3	19.55	21,446
Loader (diesel)	1	4.5	38.25	41,960
rubber tire skidder (diesel)	2	4.8	40.8	-
tracked tire skidder (diesel)	2	3.6	30.6	-
Harvester (diesel)	3	4.7	42.3	-
Forwarder (diesel)	3	4.3	38.7	-

[a] based on experience of BLM Contract Administrators and Crusier/Appraisers.
[b] based on World Forestry Institute (1997).

2. For log hauling, this analysis assumed an average log-truck load of 4,000 board feet (BF) (based on experience of BLM Contract Administrators and Cruiser/Appraisers) and a fuel efficiency of 6 miles/gallon. Total timber volume in South River FY 2009 Commercial Thinning was 12,303.5 thousand board feet (MBF) (based on ORGANON modeling) and the length of haul (round-trip) was 20 miles. It was estimated that 10,252.5 gallons of diesel would be consumed during log hauling under this alternative.

3. For road construction it was assumed that 588 gallons of diesel would be consumed per mile (5,280 feet) of road constructed and 73 gallons per mile of road renovated (Loeffler et al., 2009). There would be 3.93 miles of road construction (p. 10 and Table 2-3)corresponding to 2,311 gallons of diesel consumed and 4.14 miles of road renovation (p. 10 and Table 2-3) corresponding to 302 gallons of diesel consumed.

4. For road rocking it was assumed that for every station (100 ft.) 57.5 yards of rock would be used (USDI, BLM, 1970). It was also assumed that a truck would hold 10 yards and the average miles per load would be 20. Fuel mileage was assumed to be 6 miles/gallon. There would be 7.35 miles of rocking for the South River FY 2009 Commercial Thinning or 388 stations. It was estimated that 7,437 gallons of diesel would be consumed during the rocking.

5. The gallons of fuel that would be consumed by harvest operations (derived in Step 1), log hauling (derived in Step 2), road construction and renovation (derived in Step 3), and road rocking (derived in step 4) were summed to provide the total fuel consumption for this alternative (Table E-5). Total gallons of fuel that would be consumed were converted to tonnes of carbon released using conversion factors shown in Table E-5. Total tonnes of carbon that would be released is shown in as “Fossil Fuels” in Table 3-5.

Table E-5. Total Fossil Fuel Consumption and Associated Carbon Release.

Fuel Use	**Fuel Consumption** (gallons)	**Pounds CO_2 per Gallon**[a]	**CO_2 Released**[b] (tonnes)	**Carbon Released**[c] (tonnes)
Harvest Operations (gasoline)	6,034	19.4	53	15
Harvest Operations (diesel)	63,406	22.2	640	175
Log Hauling (diesel)	10,253	22.2	103	28
Road Construction & Renovation (diesel)	2,613	22.2	26	7
Road Rocking (diesel)	7,437	22.2	75	20
Total	-	-	**897**	**245**

[a] based on experience of BLM Contract Administrators and Crusier/Appraisers.
[b] conversion rate of 2,200 pounds per tonne (2008 Final EIS, Appendices-28).
[c] One tonne of carbon is equivalent to 3.67 tons of carbon dioxide (U.S. EPA, 2005).